United States
Department of
Agriculture

Forest Service

Northeastern Forest
Experiment Station

General Technical
Report NE-119

Publications of the Northeastern Forest Experiment Station— 1985 and 1986

Publications—1985

Most Station publications (Research Papers, Notes, General Technical Reports, and Resource Bulletins) are available from USDA Forest Service, 359 Main Road, Delaware, OH 43015, Attn: Publications Group. For copies of articles not published by the Station, contact a university library or the Northeastern Forest Experiment Station author or co-author. A list of Station authors by locations follows the citations. Full mailing addresses for headquarters and field locations are located on the inside back cover.

Adams, Edward L. **Computer simulation used for modifying hardwood sawmills.** In: Massey, Joseph G.; Greber, Brian J.; Cooney, Timothy M., eds. Software solutions: Proceedings of a symposium; 1985 April 21-24; Clarksville, IN. Madison, WI: Forest Products Research Society; 1985: 193-196.

The DESIM (DEsign SIMulator) system for designing and simulating the operation of hardwood sawmills can help managers modify hardwood sawmills. The system was used on a sawmill for which modifications were being considered. Data collected at the mill were used to simulate the operation of the existing mill to assure that the DESIM outputs were realistic. Then, modifications by the manager were considered, the mill was changed in the DESIM system, and its operation simulated to show what might be expected. The manager was expecting an increase in daily production, however, the simulation showed a reduction in yield of 6,000 board feet (Mbf) below the 32 Mbf per 10-hour shift presently being produced.

Adams, Edward L. **DESIM data manual: a procedural guide for developing equipment processing and down time data.** Gen. Tech. Rep. NE-102. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 23 p.

A procedural guide for developing the equipment processing and down time information required by the DESIM computerized system for designing and simulating hardwood sawmills. Instructions are provided for collecting and processing the data for the different types of sawmill equipment that can be considered when using the system.

Allen, P. G.; Stevens, T.; More, T. **Measuring the economic value of urban parks: a caution.** Leisure Science. 8(4): 467-477; 1985.

Andersen, J. L.; Campana, R. J.; Shigo, A. L.; Shortle, W. C. **Wound response of Ulmus americana. I: Results of a chemical injection in attempts to control Dutch elm disease.** Journal of Arboriculture. 11(5): 137-142; 1985.

Anderson, R. Bruce. **Analyzing production costs through computer.** Furniture Manufacturing Management. 31(2): 12-14; 1985.

A crosscut-first furniture rough mill is simulated to evaluate processing and raw material costs on an individual-part basis. The results from the simulation provide benchwork costs that can be compared with other rough-mill production sequences. The relationships between part length and part cost and between degree of processing and part cost are discussed.

Anderson, R. Bruce. **Computerization in the rough mill.** Furniture Manufacturing Management. 31(2): 12-14; 1985.

Anderson, R. Bruce. **Programs for computer simulation of a crosscut-first furniture rough mill.** Gen. Tech. Rep. NE-97. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 11 p.

Computer programs for simulating a crosscut-first furniture rough mill were developed to include all operations from the lumber breakdown hoist through the crosscut saws to the final machining-to-width on ripsaws. The programs allow the user to measure the effects of changes in the factors affecting production costs and to determine total

processing costs for individual parts leaving the furniture rough mill. A combined continuous/discrete FORTRAN-based simulation language, GASP IV, was used.

Anderson, R. Bruce; Luppold, William G. **An econometric analysis of pallet demand and supply and raw material usage by the pallet industry in southern regions.** In: Trends in growing and marketing southern timber: 1985 Southern Forest Economics Workshop; 1985 March 13-15; Athens, GA. Raleigh, NC: Southern Forest Economics Workers; 1985: 142-149.

Araman, Philip A. **Current trends and developments in hardwood exports and hardwood dimension export opportunities.** In: A comprehensive diagnostic analysis of the U.S. hardwood dimension industry; 1984 October 29; Kansas City, MO. Marietta, GA: National Dimension Manufacturers Association; 1985: 232-245. In cooperation with: U.S. Department of Commerce, International Trade Administration.

Araman, Philip A.; Hansen, Bruce G. **Prospective world demand for hardwoods.** In: Proceedings of 13th annual hardwood symposium of the Hardwood Research Council; 1985 May 22-24; High Point, NC. Asheville, NC: Hardwood Research Council; 1985: 110-125.

Araman, Philip A.; Reynolds, Hugh W. **Computer programs provide evaluation of standard blanks.** Furniture Manufacturing Management. 31(6): 22-24; 1985.

Araman, Philip A.; Reynolds, Hugh W. **Computer programs for analyzing furniture rough part needs in standard-size blanks.** In: Proceedings of 2nd Annual Computer Symposium of the Forest Resources Systems Institute; 1985 April 22-24; Louisville, KY. Florence, AL: Forest Resources Systems Institute; 1985: 204-210.

Ashby, W. Clark; Vogel, Willis G.; Rogers, Nelson F. **Black locust in the reclamation equation.** Gen. Tech. Rep. NE-105. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 12 p.

Black locust has been planted and seeded more than any other tree species on lands surface-mined for coal in the Eastern United States. Benefits from planting black locust are: it provides quick cover for stabilization and esthetics; it supplies nitrogen and nutrient-rich litter to soil; it improves site for establishment of other higher quality trees; it grows in a wide range of minesoil conditions, including extremely acid soils; it grows better than most trees in soils compacted by grading and topsoiling practices; it can be established by seeding; and it is useful for posts, fuel, and biomass production.

Auchmoody, L. R. **Evaluating growth responses to fertilization.** Canadian Journal of Forest Research. 15(5): 877-880; 1985.

Auchmoody, L. R. **Response of young black cherry to thinning and fertilization.** In: 5th Central Hardwood Forest Conference; 1985 April 15-17; Urbana-Champaign, IL. Urbana-Champaign, IL: University of Illinois; 1985: 53-61.

Auchmoody, L. R.; Walters, R. S. **Recovery of forest vegetation after saturation with oil well brine water.** In: Agronomy Abstracts: 77th annual meeting of the American Society of Agronomy; 1985 December 1-6; Chicago, IL. Madison, WI: American Society of Agronomy; 1985. 215 p.

Baird, Fay; Buso, Donald C.; Hornbeck, James W. **Access pipes for multiple sampling under ice.** Limnology and Oceanography. 30(5): 1129-1130; 1985.

Barger, Jack H. **Elm bark beetle control on American elm, 1979, 1980.** Insecticide and Acaricide Tests. 10: 286-287; 1985.

Barger, Jack H. **Control of elm bark beetle on American elm, bioassay tests, Cuyahoga, Co., Ohio, 1983.** Insecticide and Acaricide Tests. 10: 287-288; 1985.

Barger, Jack H. **Residues of insecticides on American elm, Cuyahoga Co., Ohio, 1983.** Insecticide and Acaricide Tests. 10: 288; 1985.

Baumgras, John E. **Cost and production analysis of the Bitterroot Miniyarder on an Appalachian hardwood site.** Res. Pap. NE-557. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 13 p.
An 18-horsepower skyline yarder was studied on a steep slope clearcut, yarding small hardwood trees uphill for fuelwood. Yarding cycle characteristics sampled include: total cycle time including delays, 5.20 minutes; yarding distance, 208 feet (350 feet maximum); turn volume, 11.6 cubic feet (24 cubic feet maximum); pieces per turn, 2.3. Cost analysis shows yarding costs will range from $18.00 to $36.00 per cunit, depending upon crew efficiency and yarding conditions.

Beckjord, P. R.; Melhuish, J. H., Jr.; Kundt, J. F. **Survival and growth of Paulownia seedlings are enhanced through weed control.** Journal of Environmental Horticulture. 3(3): 115-117; 1985.
Four treatments of preemergence herbicide and a water control were compared in circular plots around cut off stumps of 1-year-old field-grown Paulownia tomentosa seedlings. Tree survival and growth were significantly increased with the use of Princep (simazine), 0.45 and 0.90 kg/ha (0.40 and 0.80 lb active ingredient/acre (ai/A)), and Velpar (hexazinone), 0.50 and 1.00 kg/ha (0.45 and 0.90 lb ai/A) for weed control. Velpar at the high rate significantly reduced weed cover over all other herbicide treatments.

Beckjord, P.; Melhuish, J., Jr.; McIntosh, M. **Influence of nitrogen and phosphorus fertilization on ectomycorrhizal formation of Quercus alba and Q. rubra seedlings by Pisolithus tinctorius and Scleroderma auranteum.** In: Proceedings, 6th North American conference on mycorrhizae; 1984 June 25-29; Bend, OR. Corvallis, Or: Oregon State University; 1985: 221.

Beckjord, P. R.; Melhuish, John H., Jr.; McIntosh, Marla S. **Effects of nitrogen and phosphorus on growth and formation of ectomycorrhizae of Quercus alba and Q. rubra seedlings by Pisolithus tinctorius and Scleroderma auranteum.** Canadian Journal of Botany. 63(10): 1677-1680; 1985.

Berry, Frederick H. **Anthracnose diseases of eastern hardwoods.** For. Insect & Dis. Leafl. 133. Washington, DC: U.S. Department of Agriculture, Forest Service; 1985: 8 p.
Describes the hosts, symptoms, and control of anthracnose diseases of eastern hardwoods.

Berry, Frederick H. **Reducing decay losses in high-value hardwoods - a guide for woodland owners and managers.** Agric. Handb. 595. Washington, DC: U.S. Department of Agriculture, Forest Service; 1985. 23 p.

Biller, Cleveland J. **Forest harvesting patents.** NE-INF-60-85. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 5 p.

Biller, Cleveland J.; Peters, Penn A. **Harvesting hardwoods with a fellow-buncher.** In: Proceedings, 8th Annual Council on Forest Engineering Meeting; 1985 August 18-22; Tahoe City, CA. [Place of publication unknown]: [Publisher unknown]; 1985: 140-145.
A National Hydro-Ax 511 with a Morbark 20-inch accumulating head felled and bunched 8-inch-diameter hardwoods for $0.40 per green ton. The average number of trees per cycle was 1.6, with a felling rate of 118 trees per scheduled hour. The harvest unit was a 6-acre clearcut bounded by property lines that could not be crossed. Boundary

restrictions and oversize trees that could not be felled by the Hydro-Ax 511 resulted in an unusual felling pattern that reduced the potential efficiency of the felling operation.

Blum, Barton M. **Appropriate silviculture.** In: Schmitt, Daniel, ed. Spruce-fir management and spruce budworm; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 185-191.
Silvicultural options suitable for reducing the vulnerability of spruce-fir forests to spruce budworm damage are discussed. The concepts of susceptibility and vulnerability are outlined, and a comprehensive list of selected references for further study is presented.

Blum, B. M.; MacLean, D. A. **Potential silviculture, harvesting and salvage practices in Eastern North America.** In: Recent advances in spruce budworms research: Proceedings of the CANUSA Spruce Budworms Research Symposium; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 264-300.
Silvicultural techniques coupled with forest management offer some potential for reducing susceptibility of spruce-fir forests to budworm attack, over large areas, although recent research in infestation dynamics may alter present approaches. Implementation of silvicultural techniques in U.S. and Canadian forests is well-documented in a few instances, but up-to-date data are difficult to obtain for some areas. Implementation has not been extensive in those areas where documentation exists.

Blyth, James E.; Widmann, Richard H. **Pulpwood production up in 1983.** Northern Logger. 33(8): 12-13; 1985.

Briese, D. T.; Podgwaite, J. D. **Development of viral resistance in insect populations.** In: Maramorosch, Karl; Sherman, K. E., eds. Viral insecticides for biological control. New York: Academic Press; 1985: 361-398.

Brock, Samuel M.; Kingsley, Neal P.; DeBald, Paul S.; Grafton, William N. **A focus on West Virginia's retired forest landowners.** Circ. No. 135. Morgantown, WV: West Virginia University, Agricultural and Forestry Experiment Station; 1985. 36 p.
This study was initiated to test the use of focus group interviewing to gain a deeper understanding of the interests and objectives of key segments of the nonindustrial private forest owning population. A target audience of owners who were over 55 years of age and retired was selected and seven focus group interviews were conducted. The results show that this group of owners displays a strong sense of stewardship toward their land, a concern for their families, society as a whole, and for future generations. Confusion about inheritance and estate taxes causes them special concern. They tend to down play the financial aspects of timber production. A land ethic is clearly implied by their comments. They derive a sense of security and well-being from the ownership of forest land and evince a deep feeling for nature. Few seem aware that forestry assistance is available to them. Others, while aware that assistance is available, do not know from which agencies it is available.

Brooks, Robert T.; Barnard, Joseph E. **Kentucky's fourth forest inventory: information for wildlife habitat evaluations.** In: McComb, William C., ed. Proceedings, Workshop on management of nongame species and ecological communities; 1984 June 11-12; Lexington, KY. Lexington: University of Kentucky; 1985: 53-58.

Buso, Donald C.; Bailey, Scott W.; Baird, S. Fay; Hornbeck, James W.; Martin, C. Wayne. **Watershed interactions affecting pond acidification.** Res. Rep. No. 62. Durham: Water Resource Research Center, University of New Hampshire; 1985. 61 p.

Cannon, William N., Jr. **Effects of female size on gallery construction and oviposition of Scolytus**

multistriatus in relation to adult density. In: Mayo, Z. B., compiler. Proceedings, 40th annual meeting, North Central Branch of Entomological Society of America; 1985 March 11-14; Lexington, KY. College Park, MD: North Central Branch of Entomological Society of America; 1985. Abstract 42.

Factors that affect gallery construction and oviposition are important in understanding the dynamics of smaller European elm bark beetle populations in American elm. The interactions of female size and adult density on maternal gallery parameters were studied in the laboratory.

Cannon, William N., Jr. **Gallery construction and oviposition of Scolytus multistriatus (Coleoptera: Scolytidae) in relation to temperature and adult density.** Environmental Entomology. 14(5): 641-643; 1985.

Laboratory studies of effects of temperature and adult density (10 females or 50 females per 250 cm^2 phloem of Ulmus americana L.) on maternal gallery construction and oviposition by Scolytus multistriatus (Marsham) indicated that response of adult beetles at 25 and 30°C was similar. At the higher density, maternal galleries were shorter (20 mm) and there were fewer egg niches per unit length of gallery (1.8/mm); at the lower density, maternal galleries averaged 23 mm and there were 2.5 egg niches per mm of gallery. Length of the egg-free portion of the maternal gallery was similar at both densities.

Cannon, William N., Jr. **Social feeding behavior of Hyphantria cunea larvae (Lepidoptera: Arctiidae) in multiple choice experiments.** The Great Lakes Entomologist. 18(2): 79-81; 1985.

The response of fall webworm larvae to identical feeding stimuli presented in a series of multiple choice tests was studied in the laboratory. Instead of responding independently, all larvae in 61 percent of the trials were observed to aggregate at one of two identical feeding stations.

Cannon, William N., Jr.; Barger, Jack H.; Groth, Laurie L. **Seasonal detection of visible Dutch elm disease symptoms.** Journal of Arboriculture. 11(8): 233-235; 1985.

Most of the lightly diseased American elms (10% or less crown wilt) that were suitable candidates for fungicide injection and/or pruning therapy for Dutch elm disease were discovered in surveys during June and early July. More treatable elms were found in areas where diseased trees were removed promptly (up to 20 work days after discovery) than where removal was delayed until fall and winter. There were also more treatable elms in areas where the smaller European elm bark beetle was the primary vector of Dutch elm disease rather than where the native elm bark beetle was the primary vector.

Cannon, William N., Jr.; Schroeder, Herbert W. **Street trees in Ohio communities.** Cities and Villages. 33(4): 33-34; 1985.

Casey, Lloyd R.; Kingsley, Neal P. **The effects of landowner tenure on the management of nonindustrial private forest land.** In: Forest resources management--the influence of policy and law; International Forest Congress; [Date of symposium unknown]; Quebec City, PQ. [Place of publication unknown]: [Publisher unknown]; 1985: 236-239.

Corbett, Edward S. **Municipal watershed concerns.** In: Forest management and water quality. Proceedings, 1984 Penn State Forestry Issues Conference; 1984 March 13-14; University Park, PA. University Park, PA: The Pennsylvania State University; 1985: 120-127.

In many areas, well-managed forested watersheds are virtually the last remaining sources of high-quality water. Municipal watershed managers are trying to balance the supply and quality of water against the demands for products and services. Management concerns discussed include forest defoliation, water-transmitted disease, stream temperature and turbidity, organics, acidic deposition, water-yield considerations, and recreation.

Corbett, E. S. **Frequency of episodic pH depressions on a forested watershed in Pennsylvania.** In: NADP Technical Committee Meeting--Abstracts of Papers; 1985 October 8-11; [Location of meeting unknown]. In cooperation with the State Agricultural Experiment Stations, R-7, Federal Interagency Task Force on Acid Precipitation, State Agencies, and Private Research Organizations; 1985. 24.

The potential impacts of episodic pH depressions on aquatic biota have been recognized, but there is a lack of information on their frequency, magnitude, and seasonality. A 122.6-ha (303 acre) forested experimental watershed in central Pennsylvania was instrumented for a 4-year period to obtain such information. Most of the watershed soils are residual, having developed in place through weathering of the underlying strata which are the Rose Hill shale (lower slope), Castanea sandstone (middle slope), and Tuscarora quartzite (ridge top) formations. Over the 4-year period an average of 33 episodic stream pH depressions of 0.3 pH units or greater occurred per year. The maximum storm-caused stream pH depression was 2.37 pH units (7.32 to 4.95) occurring in October following a dry period. A similar pH depression (2.10 pH units) occurred in August under similar antecedent conditions. The frequency of occurrence of stream pH depressions increased from January (lowest) to June (highest) and then decreased through December. During the study period, storm-caused pH depressions of 1.26 pH units or greater occurred at least once for all months except January and September.

Corbett, Edward S.; Lynch, James A. **Management of streamside zones on municipal watersheds.** In: Riparian ecosystems and their management: Reconciling conflicting uses: Proceedings of the symposium; 1985 April 16-18; Tucson, AZ. Gen. Tech. Rep. RM-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service; Rocky Mountain Forest and Range Experiment Station; 1985: 187-190.

Riparian zones play a major role in water-quality management. Water supply considerations and maintenance of streamside zones from the municipal watershed manager's viewpoint are detailed. Management impacts affecting water quality and quantity on forested municipal watersheds are discussed in relation to the structure of the riparian zone.

Corbett, E. S.; Lynch, J. A.; Wagner, T. M. **Spatial variation in stream water pH as related to soils and geology.** Abstracts of IUFRO Water-nutrient Symposium. Hampton Beach, New Hampshire. 1985: 3-4.

The potential impacts of episodic stream pH depressions on aquatic biota have been recognized but there is a lack of information on their frequency, magnitude, seasonality, and intra-watershed variation. A 4-year study examining the spatial variability of stream pH has shown that the intra-watershed variation is strongly influenced by soils and geology.

Crang, Richard E.; McQuattie, Carolyn J. **Effects of acid mist and air pollutants on foliar structure.** In: Air pollutants effects on forest ecosystems; 1985 May 8-9; St. Paul, MN. St. Paul, MN: The Acid Rain Foundation: 1985: 385-386.

Crawford, H. S. **Effects of silvicultural practice on bird predation.** In: Schmitt, Daniel, ed. Spruce-fir management and spruce budworm; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 173-175.

Several species of birds were effective predators on endemic spruce budworm populations. Populations of these birds can be improved by silvicultural practices that increase: (1) the degree of hardwood admixture with softwoods, (2) the proportion of spruce to fir, and (3) the diversity in horizontal and vertical habitat structure. Group selection and shelterwood cuts were favored.

Crawford, Hewlette S. **Forest land use regulation for wildlife and fish.** In: Forest resources management--the influence of policy and law; International Forest Congress; [Date of symposium unknown]; Quebec City, PQ. [Place of publication unknown]: [Publisher unknown]; 1985: 343, 357.

Crawford, H. S.; Jennings, D. T. **Effects of bird predation on spruce budworm: pilot study.** In: Recent advances in spruce budworms research: Proceedings of the CANUSA Spruce Budworms Research Symposium; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 98-99.

The spruce budworm is a serious pest of spruce-fir forests in the United States and Canada. Enhancing its natural enemies is desirable for integrated pest management. Forest birds are effective predators; they consume substantial numbers of spruce budworm larvae and pupae. With proper habitat management, bird populations can be increased. For example, stand diversity can be increased by group selection or by shelterwood harvesting methods, and this will increase populations of effective bird predators and enhance their role in integrated pest management.

Creek, Robert; Wade, Gary L. **Excretion of phenolic compounds from the roots of Festuca arundinacea, Eragrostis curvula, and Lespedeza striata.** Transactions of the Kentucky Academy of Science. 46(1-2): 51-55; 1985.

Festuca arundinacea, Eragrostis curvula, and Lespedeza striata were grown hydroponically using a continuous circulating system in which root exudates were collected in columns containing XAD-4 resin. The exudates were separated into neutral, acidic, and basic fractions. Lettuce radicle bioassay showed only the neutral fractions to be inhibitory. Analysis of the neutral fractions by paper chromatography, TLC, and gas chromatography indicated the presence of five inhibitory compounds, which were tentatively identified as the phenolic compounds cinnamic acid, ferulic acid, gallic acid, gentisic acid, and syringic acid.

Curtis, Willie R. **Impoundments on mined mountaintops in eastern Kentucky.** In: Reclamation of lands disturbed by surface mining: A cornerstone for communication and understanding: 1984 National Meeting American Society for Surface Mining and Reclamation; 1984 July 10-13; Owensboro, KY. Wilmington, DE: Science Reviews, Inc.; 1985: 249-274.

Impoundments on surface-mined lands date to the beginning of surface mining and usually were unplanned. Such impoundments on contour-type mining often failed, contributing to slides and excessive stream sedimentation. In some states, legislation was planned to prohibit impoundments. In 1973, two impoundments were constructed and instrumented on a mountaintop mine in eastern Kentucky to study effects on mined-land hydrology. A number of wells, drilled in lines four directions from the ponds, were used to keep track of water table development. Rainfall on and runoff from the drainage areas of the ponds have been maintained by automatic recorders. The relationship of water level in the ponds to water table elevations in the wells is described. Ground water recharge has resulted in the formation of a perched aquifer with its phreatic surface mounded under the ponds. Data show that impoundments control runoff, contribute to ground water recharge, and, perhaps most important, mitigate flood flows.

Cutler, Bruce; Jennings, Daniel T. **A revision of the Metaphidippus arizonensis group (Araneae, Salticidae).** Journal of Arachnology. 13: 1-8; 1985.

Czapowskyj, M. M.; Robison, D. J.; Briggs, R. D.; White, E. H. **Component biomass equations for black spruce in Maine.** Res. Pap. NE-564. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 7 p.

Component biomass prediction equations are presented for young black spruce in northern Maine. A weighted least-

squares model was used to construct the equations for small trees from 1 to 15 cm d.b.h., and an ordinary least-squares model for trees less than 2 m in height. A linearized allometric model was also tested but was not used. Equations were developed for oven-dry needle, branch, bolewood, bolebark, aboveground, root, and complete tree biomass components. Aboveground components accounted for approximately 80 percent, and stump (less than 6 cm in height) plus roots accounted for 20 percent of the complete tree oven-dry biomass accumulation.

Dale, Martin E.; Brisbin, Robert L. **Butt log quality of trees in Pennsylvania oak stands.** Res. Pap. NE-568. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 8 p.

Describes the distribution of sawtimber trees by d.b.h. and grade for eight hardwood species in upland oak stands of Pennsylvania. The proportion of trees by d.b.h. and grade revealed differences between species. The quality of northern red oak, white oak, and yellow-poplar appeared inherently better than that of red maple, chestnut oak, and a group of other hardwoods. Grade predictions by size and species allow more precise timber appraisals and enable managers to evaluate alternative management strategies more accurately.

DeBald, Paul S.; Birch, Thomas W. **Who owns Ohio's woodlands?** The Ohio Farmer. October 1985: 22.

DeByle, Norbert V.; Winokur, Robert P., eds. **Aspen: ecology and management in the Western United States.** Gen. Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1985: 283 p.

DeGraaf, Richard M. **Breeding bird assemblages in New England northern hardwoods.** In: Regan, Ronald J.; Capen, David E., eds. The impact of timber management practices on nongame birds in Vermont; 1982 August 7; Johnson, VT. Montpelier, VT: Vermont Fish and Wildlife Department; 1985: 5-22.

DeGraaf, Richard M. **Residential forest structure in urban and suburban environments: some wildlife implications in New England.** Journal of Arboriculture. 11(8): 236-241; 1985.

Tree populations were compared in residential areas of urban Springfield and suburban Amherst, Massachusetts. The urban environment contains significantly fewer tree species, lower total tree density, no large conifers, a narrower range of tree diameters, and a more park-like condition because the lower margins of tree crowns are positioned higher. Both environments are dominated by relatively few tree species, and contain many exotic species and many species native to the country or region but not occurring locally. The latter compose the majority of metropolitan trees. These differences in residential forest structure contribute to dramatic differences in the composition of breeding birds between the two environments.

DeGraaf, Richard M.; Shigo, Alex L. **Managing cavity trees for wildlife in the Northeast.** Gen. Tech. Rep. NE-101. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 21 p.

This paper is a guide for woodland owners, managers, or arborists who want to provide key habitat components for northeastern cavity-nesting birds and mammals that use tree dens. Methods for creating and maintaining cavity trees, snags, and den trees are described.

DeGraaf, Richard M.; Tilghman, Nancy G.; Anderson, Stanley H., **Foraging guilds of North American birds.** Environmental Management. 9(6): 493-536; 1985.

Proposes a foraging guild classification for North American inland, coastal, and pelagic birds. This classification uses a three-part identification for each guild--major food, feeding substrate, and foraging technique--to classify 672 species of birds in both the breeding

and nonbreeding seasons. We have attempted to group species that use similar resources in similar ways.

Demeritt, Maurice E., Jr. **Sap-sugar content of grafted sugar maple trees.** Res. Note NE-328. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 4 p.

In March and April 1983, 289 and 196 young grafted sugar maple trees were tapped and evaluated for sap-sugar content. In April, sap was collected from taps both above and below the graft union. Diameter of all tapped trees at 18 inches above the ground was measured. Analysis of the data revealed that: (1) trees selected for high sugar yield cannot be reproduced by grafting on rootstock of unknown but varying sugar content without encountering large fluctuations in sap sweetness of the trees produced; (2) diameter is not correlated with sap sweetness of young grafted trees; (3) numerous sap-sugar readings over time may be necessary to identify the sap-sugar characteristics of a candidate sweet tree; and (4) the cause of the variation in sap-sugar content of trees over time needs to be investigated more fully.

Demeritt, Maurice E., Jr. **Survival of hybrid poplar at Camp Edwards, Cape Cod, MA.** In: Proceedings, 29th Northeastern Forest Tree Improvement Conference; 1984 July 18-20; Morgantown, WV. [Place of publication unknown]. Northeastern Forest Tree Improvement Conference; 1985: 1-4.

There were significant differences in survival among 11 hybrid poplar clones planted at Camp Edwards, Cape Cod, MA, after 2 years. The best survivor, clone NE-388 at 33.75 percent, barely reached the lower limit of stocking necessary for revegetation purposes. Hybrid poplar have difficulty growing on this coarse, harsh site.

Demeritt, Maurice E., Jr.; Gerhold, Henry D. **Genetic evaluation of rapid growth in pot- and nursery-grown Scotch pine.** Res. Pap. NE-554. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 11 p.

Genetic and environmental components of variance for 2-year pot and nursery heights of offspring from inter- and intra-provenance matings in Scotch pine were studied to determine which provenances and selection methods should be used in an ornamental and Christmas tree improvement program. Nursery evaluation was preferred to pot evaluation because heritability estimates were larger and error variances were smaller for the experiments evaluated. Simple recurrent selection would be a good method for improving traits important to the Christmas tree industry.

Denig, Joseph; Wengert, Eugene M.; Brisbin, Robert; Schroeder, James. **Structural lumber grade and yield estimates for yellow-poplar sawlogs.** Forest Products Journal. 35(1): 26-32; 1985.

Yellow-poplar is an accepted species for structural light framing in the National Grading Rule as adopted by the Northern Hardwood and Pine Manufacturers Association. If utilization of yellow-poplar as a framing lumber species is to be realized, lumber-yield and residue information is needed to allow sawmill operators to evaluate the economic feasibility of producing structural lumber from yellow-poplar logs.

Dennis, Donald F. **Capital gains treatment of timber income: An economic assessment.** Res. Pap. NE-556. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 5 p.

Treating timber income as capital gains meets the criteria used to evaluate tax systems better than treating it as ordinary income. Social welfare implications and impact on timber supply also favor such treatment.

Dennis, Donald F.; Dresser, Shelley J. **Wood generation suits Vermont.** Public Power. 1985 July-August: 14-15.

The Burlington Electric Department must procure 500,000 green tons of wood chips annually to fuel its 50-megawatt power

plant. Wood supply in the region appears more than adequate without disrupting existing markets. It is hoped that removal of low-quality wood will improve timber production and quality in the region.

Dennis, Donald F.; Dresser, Shelley J. **Burlington's wood-burning utility company.** Journal of Forestry. 83(2): 100-104; 1985.
Construction of the 50-megawatt, wood-fueled McNeil Plant represents an innovative step for Burlington Electric and the people of Vermont. This paper examines issues concerning wood supply, esthetic and ecological impacts of harvesting, pollution, location, and need for the plant. Costs and local economic benefits of this venture are also discussed.

Dennis, Donald F.; Remington, Susan B. **The influence of price expectations on forestry decisions.** Northern Journal of Applied Forestry. 2(3): 81-83; 1985.
Expectations of future stumpage prices influence many forestry decisions. Real price trends are presented for 1964 to 1983 for selected species and products in New Hampshire. The data indicate much variation in trends among species and products. This paper presents data useful in developing price expectations and analyzes how rotation age and soil rent change with expectations of advancing or declining real stumpage prices.

DeWalle, D. R.; Ribblett, G. C.; Helvey, J. D.; Kochenderfer, J. **Laboratory investigation of leachate chemistry from six Appalachian forest floor types subjected to simulated acid rain.** Journal of Environmental Quality. 14(2): 234-240; 1985.
In order to determine the role of the forest floor in neutralization of strong acidity in acid rain, simulated acid rain at pH 4.0 was applied under laboratory conditions to forest floor samples from six Appalachian forest types. Effects of forest type, storm size, and repeated storm applications on leachate chemistry were investigated.

Dochinger, Leon S.; Jensen, Keith F. **Effect of acid mist and air pollutants on yellow-poplar seedling height and leaf growth.** Res. Pap. NE-572. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 4 p.
One-year-old yellow-poplar seedlings were treated with acid mist at pH 2.5, 3.5, 4.5, and 5.5 either alone or in combination with 0.1 ppm O_3, SO_2, and NO_2 or NO_2 plus SO_2. After 4 and 8 weeks of treatment, height, leaf area, and leaf and new shoot weight were determined and growth analysis variables calculated. Height, leaf area, and dry weight decreased with increasing acidity in seedlings treated with SO_2 and acid mist, but no differences were found in seedlings fumigated with NO_2, NO_2 plus SO_2, or ozone and acid mist. Further studies using different combinations of pollutants and acid mist must be conducted before their apparent interactions can be more accurately assessed.

Donley, David E.; Feicht, David L. **Oak sawtimber losses in stands defoliated by gypsy moth.** In: Dawson, J. O.; Majerus, K. A., eds. Fifth central hardwood forest conference proceedings; 1985 April 15-17; Urbana-Champaign, IL. SAF Publ. 85-05, Urbana-Champaign, IL: University of Illinois; 1985: 275-279.
Between 1978 and 1982, the "front" of defoliation by the gypsy moth swept over central Pennsylvania. In the 5-year period, defoliation of individual stands was neither complete nor continuous but most of the study areas were defoliated at a level of over 50 percent for at least 2 years. In 1983, more than half the trees on some 6,000 acres died. Oak volume and value estimates were obtained from salvage sale data and a series of prism point samples collected in 1983 and 1984. Dead oak volume ranged from 3.5 to 11.0 Mbf per acre. Values ranged from a low of $281 an acre to a high of $914. Dead oak trees averaged 246 board feet per tree. Timber buyers are biased against dead trees, which appears

justified because trees dead more than 2 years are riddled with galleries of the oak timberworm.

Donnelly, John R.; Shane, John B.; Bergdahl, Dale R.; Clausen, John C.; Gregory, Robert A.; Wong, Betty L. **A preliminary assessment of red spruce vigor as related to physiographic characteristics in Vermont.** Northeastern Environmental Science. 4(1): 18-22; 1985.

Dubois, N. R. **Field use of Bacillus thuringiensis to control the gypsy moth.** In: Proceedings of Symposium: Understanding the gypsy moth threat: Control options with Bacillus thuringiensis; 1985 November 5-6; Vancouver, BC. Vancouver, BC: Canadian Deptartment of Agriculture; 1985: 5-6.

Dubois, Normand R. **Recent field studies on the use of Bacillis thuringiensis to control the gypsy moth (Lymantria dispar L.).** In: Microbial control of spruce budworms and gypsy moths: Proceedings of the symposium; 1984 April 10-12; Windsor Locks, CT. Gen. Tech. Rep. NE-100. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 83-85.

Dubois, Normand R. **Selection of new more potent strains of Bacillus thuringiensis for use against gypsy moth and spruce budworm.** In: Microbial control of spruce budworms and gypsy moths: Proceedings of the symposium; 1984 April 10-12; Windsor Locks, CT. Gen. Tech. Rep. NE-100. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 99-102.

Dulmage, H. T.; Beagle, C. C.; Dubois, N. R. **Bioassays of formulations of Bacillus thuringiensis for use in forestry: panel discussion of the role of the bioassay in standardizing formulations of B. thuringiensis.** In: Microbial control of spruce budworms and gypsy moths: Proceedings of the symposium; 1984 April 10-12; Windsor Locks, CT. Gen. Tech. Rep. NE-100. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 161-168.

Dyer, Kenneth L.; Sencindiver, John C. **Bark mulch promotes establishment of vegetation on minesoils with south and west exposures.** In: Proceedings, 1985 Symposium on Surface Mining, Hydrology, Sedimentology, and Reclamation; 1985 December 9-13; Lexington, KY. Lexington, KY: University of Kentucky; 1985: 151-156.

In early July 1976, a non-topsoiled head-of-hollow fill in Breathitt County, Kentucky, was seeded to grasses and legumes. From July 12 to July 16, a hardwood bark mulch was applied in a band around this fill. After late August 1976, the mulched areas were nearly fully sodded, regardless of aspect. South- and west-facing unmulched slopes were nearly void of vegetation. At this time, the north-facing slope had the best vegetative cover even though no mulch had been applied. By the end of the second growing season, nearly the entire head-of-hollow fill was well vegetated, regardless of aspect or whether mulch had been applied. The mulch protected the exposed minesoil from erosion during the first year and speeded the establishment of vegetative cover on the south- and west-facing slopes.

Echelberger, H. E. **Commercial facility X-C skiers: a profile.** Ski Area Management. 24(5): 29-32; 1985.

Echelberger, Herbert E. **Nascent trends in the private campground industry.** In: Outdoor Recreation Trends Symposium II; 1985 February 25-27; Myrtle Beach, SC. Clemson, SC: Clemson University and USDI National Park Service; 1985: 185-192.

Edwards, Pamela J.; Helvey, J. David. **Variability of rainfall chemistry within a 40 ha field in north central West Virginia.** In: Hutchison, B. A.; Hicks, B. B., eds. The Forest-Atmosphere Interaction, 1983 October

23-28; Oak Ridge, TN. Dordrecht, Holland: D. Reidel Publishing Company; 1985: 309-318.
Precipitation chemistry variations were studied at five points in a level field using Aerochem Metrics 301 automatic wet/dry collectors. Precipitation samples collected for 11 weeks were analyzed for pH, specific conductance, cold acidity, and concentrations of NO_3-N, SO_4, Ca, Mg, K, Na, and NH_3-N. No significant variations in chemical concentrations among gage sites were found for any of the constituents. Although concentrations were poorly correlated with total weekly precipitation, some evidence of greater chemical dilution with larger storm sizes was shown.

Edwards, Pamela J.; Phillips, James D. **The Black Fork.** Wonderful West Virginia. 49(7): 2-4; 1985.
The Black Fork River at Hendricks, West Virginia, is very important ecologically. It is formed by the confluence of two rivers, Blackwater River and Dry Fork River. Blackwater is very polluted by bog acids and acid mine drainage; Dry Fork is clean. When these two waters converge and form Black Fork River, they struggle to mix. However, mixing only occurs after the waters enter a natural mixing hole. Upon emerging from the hole, the water quality is fairly good. Consequently Black Fork River acts to dilute and neutralize acidic inputs.

Ernst, Richard L.; Knapp, Walter. **Forest stand density and stocking: Concepts, terms, and the use of stocking guides.** Gen. Tech. Rep. WO-44. Washington, DC: U.S. Department of Agriculture, Forest Service; 1985: 8 p.
Consistent application of silvicultural guidelines requires a common understanding of stocking concepts and terminology. We present standardized definitions and the display format adopted by the National Forest System. The concepts of absolute density, relative density, and stocking levels are defined.

Federer, C. Anthony; Hornbeck, James W. **The buffer capacity of forest soils in New England.** Water, Air and Soil Pollution. 26: 163-173; 1985.

Fege, Anne S. **Research evaluation techniques applied to a case study of short-rotation forestry.** In: Proceedings, Forestry Research Evaluation: Current Progress, Future Directions; 1984 August 20-21; St. Paul, MN. Gen. Tech. Rep. NC-104. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1985: 82-90.
The forestry community has planned and conducted forestry research for well over 100 years, and continues to provide new information and technologies for managing and using forest resources. Yet, we have only a shallow understanding of the decisionmaking processes within forestry research and the organizational structure of researchers within the broader forestry community. We also lack systematic methods for evaluating the effectiveness and efficiency of forestry research.

Feicht, David L.; Acciavatti, Robert. **Pilot test of red oak borer silvicultural control in commercial forest stands.** In: Dawson, J. O.; and Majerus, K. A., eds. Proceedings Fifth Central Hardwood Forestry Conference; 1985 April 15-17; Urbana-Champaign, IL. SAF Publ. 85-05. Urbana-Champaign, IL: University of Illinois; 1985: 280-284.

Feicht, David L.; Ehlers, Lawrence J.; Donley, David E. **The No. 1 pest of Ohio's oak.** Ohio Woodlands. 22(3): 4-5; 1985.

Feicht, David L.; Wright, Susan L.; Donley, David E. **Let's knock off Ohio's No. 1 oak pest.** Ohio Woodlands. 22(4): 21-24; 1985.

Fernandez, Ivan J.; Czapowskyj, Miroslaw M. **Levels of trace metals in the forest floors of low elevation, commercial spruce-fir sites in Maine.** Northeastern Environmental Science. 4(1): 1-7; 1985.

Frank, R. M. **Building new spruce-fir stands--a long-term localized strategy for reducing spruce budworm impact.** In: Recent advances in spruce budworms research: Proceedings of the CANUSA Spruce Budworms Research Symposium; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 365-366.
Discussion of silvicultural strategies to reduce susceptibility/vulnerability within the forest stands and budworms workshop III.

Frank, R. M. **The shelterwood simulator.** In: Sanders, C. J.; Stark, R. W.; Mullins, E. J.; Murphy, J., eds. Recent advances in spruce budworms research; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 503.

Frank, Robert M. **The Penobscot Experimental Forest--a unique laboratory.** Forest Technique. Orono, ME: University of Maine; 1985; 85(3): 20.

Fridley, J. L.; Garbini, J. L.; Jorgensen, J. E.; Peters, P. A. **An interactive simulation for studying the design of feller-bunchers for forest thinning.** Transactions of the American Society of Agricultural Engineers. 28(3): 680-686; 1985.

Friedland, Andrew J.; Hawley, Gary J.; Gregory, Robert A. **Investigations of nitrogen as a possible contributor to red spruce (Picea rubens Sarg.) decline.** In: Proceedings of the effects of air pollutants on forest ecosystems; 1985 May 8-9; Minneapolis, MN. St. Paul, MN: University of Minnesota Press; 1985: 95-105.

Frieswyk, Thomas S.; Malley, Anne M. **Forest Statistics for New Hampshire--1973 and 1983.** Resour. Bull. NE-88. Broomall, PA: U.S. Department of Agriculture, Forest Service; 1985: 100 p.
A statistical report on the fourth forest survey of New Hampshire (1983). Findings are displayed in 81 tables containing estimates of forest area, numbers of trees, timber volume, tree biomass, and timber products output. Data is presented at three levels: state, geographic unit, and county.

Frieswyk, Thomas S.; Malley, Anne M. **Forest Statistics for Vermont--1973 and 1983.** Resour. Bull. NE-87. Broomall, PA: U.S. Department of Agriculture, Forest Service; 1985: 102 p.
A statistical report on the fourth forest survey of Vermont (1983). Findings are displayed in 81 tables containing estimates of forest area, numbers of trees, timber volume, tree biomass, and timber products output. Data are presented at three levels: state, geographic unit, and county.

Galford, Jimmy R. Enaphalodes rufulus. In: Singh, Pritam; Moore, R. F., eds. Handbook of insect rearing, Vol. 1. Amsterdam: Elsevier Science Publishers B.V.; 1985: 255-264.
Presents the diet and system presently used for rearing red oak borers.

Galford, Jimmy R. **Role of predators on an artificially planted red oak borer population.** Res. Note NE-331. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 2 p.
Adult survival of first-instar red oak borer larvae implanted into red oak trees was 4 times greater when the larvae were protected from predators. Nitidulids, ants, and woodpeckers accounted for 40 to 60 percent of the mortality in unprotected larvae. Most mortality in protected larvae occurred from unknown causes during the first overwintering period.

Gansner, David A. **Ten years after gypsy moth and still no regeneration.** Pennsylvania Forests. 75(4): 6, 12; 1985.
Having identified a high-risk situation, the forest manager has many effective and safe defensive alternatives to choose from. Local foresters, who have become seasoned veterans in the war against gypsy moth, are the best source for help in making the right decision.

Hansen, Bruce G.; Araman, Philip A. **Hardwood blanks expand export opportunities.** Forest Industries. 112(11): 33-35; 1985.

Hansen, Bruce G.; Araman, Philip A. **Low-cost opportunity for small-scale manufacture of hardwood blanks.** Res. Pap. NE-559. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 6 p.
Discusses the economics associated with the small-scale manufacture of blanks from four species--red oak, black cherry, hard maple, and yellow-poplar. Assuming a tax rate of 46 percent, returns ranged from 31 percent for hard maple to 38 percent for yellow-poplar. Plots were developed relating raw material input cost to blank prices necessary to achieve specified levels of return.

Hassler, Curt C.; Araman, Philip A.; Sinclair, Steven A.; Reynolds, Hugh W. **A normative analysis of a System-6 mill.** Forest Products Journal. 35(11/12): 43-48; 1985.
A computer simulation of the cutting process of a System-6 mill was developed for exploring the yield potential under various system parameter specifications. For this study, 382 red oak, 6-foot boards, in four grades, two board widths, and four quality classifications were processed by the simulation program using two different sets of system parameter specifications. A four-way analysis of variance of cutting yields showed significant differences in mean yields for grades, widths, and quality classifications, but failed to show any differences for the two sets of system parameters. A contingency table analysis of cutting lengths produced showed that choice of system parameters can have an effect on the distribution of cutting lengths. A similar analysis of cutting widths produced showed no statistical differences due to changes in system parameters.

Hawley, Gary J.; DeHayes, Donald H. **Hybridization among several North American firs. I. Crossability.** Canadian Journal of Research. 15: 42-49; 1985.
Controlled pollinations were conducted in spring of 1980, 1981, and 1982 to determine crossability among five species and varieties of Abies in the Balsameae section and white fir from section Grandes. Trees representing an eastern balsam fir population, Fraser fir, and bracted balsam fir were used as female parents and were control-pollinated with pollen from eastern and western balsam fir populations, Fraser fir, bracted balsam fir, subalpine fir, and white fir.

Hawley, Gary J.; DeHayes, Donald H. **Hybridization among several North American firs. II. Hybrid verification.** Canadian Journal of Forest Research. 15: 50-55; 1985.
Seedlings resulting from 1980 controlled pollinations of balsam fir, bracted balsam fir, Fraser fir, and white fir were evaluated to prove hybridity and to measure the expression of parental traits in the hybrids. Seedlings from inter- and intra-taxon crosses were grown indoors in replicated tests for 7 months and were subsequently transplanted into an outdoor nursery. Hybrids from all combinations were verified using growth, morphological and phenological characteristics. Hybrids generally resembled their paternal parent or were intermediate between parents. Some hybrids exhibited a heterotic expression of a few characteristics. Fraser X eastern balsam fir and Fraser X white fir seedlings were fastest growing and exhibited a more desirable combination of morphological and phenological characteristics than other seedlings in this study.

Hayslett, Homer T., Jr.; Solomon, Dale S. **Predicting foliage production after spruce budworm attack.** Forest Technique. Orono, ME: University of Maine; 1985; 84(10): 15.
The authors have constructed a mathematical model that predicts the weight of foliage by age class on a

given balsam fir tree. The model is applicable for nondefoliated trees and defoliated trees. It takes into account attack by spruce budworm and can operate at any level of defoliation.

Healy, William M. **Turkey poult feeding activity, invertebrate abundance, and vegetation structure.** Journal of Wildlife Management. 49(2): 466-472.
Wild turkey broods use a variety of permanent openings and forest types, but there are few descriptions of the ground cover that is most suitable within a particular plant community. In West Virginia, feeding activity of poults up to 4 weeks old and abundance of invertebrates increased across a gradient of ground cover abundance. Oak stands on dry sites produced little herbaceous vegetation and few invertebrates. Mixed hardwood stands on mesic sites produced intermediate levels of herbaceous vegetation and invertebrates. These stands provided adequate brood range, and management could enhance their value for poults. Herbaceous vegetation and invertebrates were most abundant in clearings maintained for wildlife, but poult feeding decreased where vegetation was most abundant because poults could not move through it. Life form, percent cover, and height of ground cover can be used to define early brood range in forested and open sites.

Healy, William M.; Nenno, Edward S. **Effect of weather on wild turkey poult survival.** In: Earl, James; Kennamer, Mary C., eds. Fifth national wild turkey symposium proceedings; 1985 June 17-21; Des Moines, IA. Edgefield, SC: National Wild Turkey Federation; 1985: 91-102.
Weather conditions are partly responsible for annual variations in poult production, but the specific effects of weather on the survival of eastern wild turkey poults are not well documented. Understanding the relationships between weather and poult survival might permit predicting fall populations from the preceding spring weather. Weather conditions and poult survival were monitored daily during two breeding seasons. The impact of weather on poult mortality included both age-specific and random effects. Rain and low temperatures (3.8 cm, 7-8°C) over an 18-hour period produced mortality in 12- and 15-day-old broods, but not in 4- and 6-day-old broods. One hen abandoned her nest during this storm. The disappearance of 8 of 11 poults in another brood coincided with a heavy thunderstorm that occurred about 1 hour after the birds left the nest. Predation and accidents were additional causes of poult mortality. Systematic brood counts provide the best means for predicting fall populations because spring weather accounts for only part of the annual variation in productivity.

Heiligmann, Randall, B.; Norland, Eric R.; Hilt, Donald E. **28-year-old reproduction on five cutting practices in upland oak.** Northern Journal of Applied Forestry. (2): 17-22; 1985.
Knowledge of composition and development of stands following harvesting is prerequisite to forest management decisions. Conventional harvesting in mature upland oaks stands resulted in stands substantially different from the original. Twenty-eight-year-old reproduction following complete clearcutting, commercial clearcutting, diameter-limit cutting, selection cutting, and selection cutting with timber stand improvement indicated that the higher the residual overstory density the lower the frequency, diameter, and basal area of reproduction. Generally the proportion of oak and hickory in reproduction was significantly lower than in the original stand, though enough oak was present to potentially comprise a substantial portion of the final stand. Increased amounts of red maple, particularly on north-facing slopes, were primarily responsible for this change in composition. Reproduction stem quality did not differ between treatments. This information provides a more accurate basis for predicting future stand character and potential products, and for developing alternative management strategies.

Heisler, Gordon M. **Measurements of solar radiation on vertical surfaces in the shade of individual trees.** In: Hutchison, B. A.; Hicks, B. B., eds. The Forest-Atmosphere Interaction: Proceedings of the Forest Environmental Measurements Conference; 1983 October 23-28; Oak Ridge, TN. Dordrecht, Holland: Reidel; 1985: 319-335.

Shortwave radiation, measured by pyranometers at six sample points on an imaginary one story south-facing wall tangent to the north edge of deciduous tree crowns, was compared to radiation on a parallel vertical surface in the open. Sampling periods were up to 8 hours long on 22 days, some of which were partly cloudy.

Helvey, J. D.; Tiedemann, A. R.; Anderson, T. D. **Plant nutrient losses by soil erosion and mass movement after wildfire.** Journal of Soil and Water Conservation. 40: 168-173; 1985.

Henson, Steven L.; Rowntree, Rowan A. **Influence of urban forest cover on radiation, temperature, and runoff in the Salt Lake Basin, Utah.** In: Foresters' Future: Leaders or followers?: 1985 Society of American Foresters. National Convention Proceedings; 1985 July 28-31; Fort Collins, CO. Bethesda, MD: Society of American Foresters; 1985: 412-416.

Herrick, Owen W.; Gansner, David A. **Forest-tree value growth rates.** Northern Journal of Applied Forestry. (2): 11-13; 1985.

Rates of growth in the value of standing timber can vary greatly from stand to stand and from tree to tree. Faced with this variation, forest managers need guidelines to help determine financial rates of return for their woodlots. In Pennsylvania, the average annual tree value growth rate between 1965 and 1978 was 1.6 percent. From analyses of the state's forest inventory data, we developed a general guide needing only a tree's commercial soundness (tree class), species, and diameter to assign average rates of value change ranging from -8.8 to 9.0 percent. The guide can be used to get a general indication of value growth potential for trees and woodlands.

Hilt, Donald E. **OAKSIM: An individual-tree growth and yield simulator for managed, even-aged, upland oak stands.** Res. Pap. NE-562. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 21 p.

OAKSIM is an individual-tree growth and yield simulator for managed, even-aged, upland oak stands. Growth and yield projections for various thinning alternatives can be made with OAKSIM for a period of up to 50 years. Simulator components include an individual-tree diameter growth model, a mortality model, height prediction equations, bark ratio equations, a taper-based volume system, and a mathematical thinning rule based on actual data. OAKSIM can be applied to a wide range of age, site, and stand conditions to develop management (thinning) guidelines.

Hilt, Donald E. **Species composition of young central hardwood stands that develop after clearcutting.** In: Dawson, Jeffrey O.; Majerus, Kimberly A., eds. 5th central hardwoods conference proceedings; 1985 April 15-17; Urbana, IL. Urbana-Champaign, IL: University of Illinois; 1985: 11-14.

Regeneration that developed after clearcutting mature upland oak stands was sampled on 29 clearcuts in Ohio, Kentucky, and Indiana. Clearcut ages ranged from 5 to 26 years. Site index ranged from 50 to 80. Statistical tests revealed that species composition depends on both age and site. Oaks dominate poor sites as stand age increases. Yellow-poplar, maple, and other commercial species such as black cherry, bigtooth aspen, and white ash eventually dominate the good sites.

Hilt, Donald E. **Where has all my yellow-poplar gone?** Northern Journal of Applied Forestry. 2: 67-69; 1985.

Hilt, Donald E. **User's guide to OAKSIM: an individual-tree growth and yield simulator for managed, even-aged, upland oak stands.** Gen. Tech. Rep. NE-104. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 22 p.

This user's guide presents operating instructions for OAKSIM, an individual-tree growth and yield simulator for managed, even-aged, upland oak stands. Growth and yield projections can be made with OAKSIM for various thinning alternatives for up to 50 years. The general structure and operation of OAKSIM, program control information, data formats, and program output are presented, with examples of thinned and unthinned projections.

Homola, Richard L.; Czapowskyj, Miroslaw M.; Blum, Barton, M. **Ectomycorrhizae of Maine, 3. A listing of hygrophorus with the associated hosts.** Bull. 810, 1985 July: 19 p.

Hygrophori have been collected and identified with their possible ectomycorrhizal associates in Maine. Most of the ectomycorrhizal relationships reported from Maine were confirmed by the work of others. The information on edibility is from authors' popular mushroom guides. Colored photos of 44 Hygrophori are included here.

Hornbeck, James W.; Federer, C. Anthony. **Estimating the buffer capacity of forest soils.** Journal of Forestry. 83(11): 690-691; 1985.

At four locations in New England, we measured buffer capacity of organic and mineral horizons for well-drained forest soils under second-growth forests and in new and regrowing clearcuts. The sites included a spruce-fir forest in central Maine, two northern hardwood forests in northern New Hampshire, and a central hardwood forest in southern Connecticut. Soil materials were titrated by adding known amounts of HCl of NaOH and measuring the pH after 24 hours.

Hornbeck, James W.; Martin, C. Wayne. **Whole-tree harvesting and water quality.** 1984 Penn State Forestry Issues Conference. Forest Management and Water Quality; 1985 March 13-14; University Park, PA. University Park, PA: The Pennsylvania State University; 1985: 808-891.

Presents information from studies on whole-tree harvesting at sites in Maine, New Hampshire, and Connecticut regarding the potential effects on quality of forest streams.

Hornbeck, James W.; Pierce, Robert S. **Comparative impacts of forest harvest and acid precipitation.** Bulletin of the Ecological Society of America. 66(2): 1917; 1985.

Forest harvest can change acidity of streamwater. Recent literature has suggested that such changes may occur gradually over several decades, and could be misinterpreted as an effect of acid precipitation. We examine this possibility by comparing pH and concentrations of HCO_3, NO_3, SO_4, and DOC of streams draining six forest cuttings in New England. Results showed that cutting of northern hardwoods in New Hampshire caused stream pH to decrease initially, and then increase above pre-cutting values. Stream pH showed little change after a whole-tree harvest of spruce-fir in central Maine, and increased after a whole-tree harvest of central hardwoods in Connecticut. Decreases in stream pH were the result of increased nitric acid arising from accelerated nitrification after harvest. Increases in stream pH were accompanied by increased HCO_3 concentrations. Both increases and decreases in stream pH were relatively small, but some of the increases have persisted for at least a decade.

Hornbeck, James W.; Smith, Robert B. **Documentation of red spruce growth decline.** Canadian Journal of Forest Research. 15(6): 1199-1201; 1985.

Data from a study of 3,001 dominant or codominant red spruces across New England and the Adirondacks showed that their annual growth in basal area increased consistently from 1910-20 to about 1960. It then fluctuated around a generally declining trend and by the early 1980's was 13 to 40 percent below

its peak. Defoliation by the spruce budworm, climate change, maturation of the forest, and acid deposition are all possible explanations.

Horsley, Stephen B. **Reforestation of orchard stands and savannahs on Pennsylvania's Allegheny Plateau.** Northern Journal of Applied Forestry. 2: 22-26; 1985.

Horsley, Stephen B. **Allelopathy as a stress for urban trees.** In: 19th annual meeting Society of Municipal Arborists; 1983 September 25-28; East Lansing, MI. Dayton, OH: Society of Municipal Arborists; 1985: 73-87.

Horsley, Stephen B. **Review of allelopathy, Second Edition by Elroy Rice.** Forest Science. 31(3): 799-800; 1985.

Horsley, Stephen B. **Reforestation of orchard stands and savannahs on Pennsylvania's Allegheny plateau.** Northern Journal of Applied Forestry. 2(1): 22-26; 1985.
Orchard stands and savannahs are forest openings that failed to regenerate after turn-of-the-century logging and have been dominated by dense herbaceous plant growth for 50 or more years. The effectiveness of herbicide application, mechanical site preparation, and fertilization on survival and growth of five species of seedlings was tested over a 6-year period. Neither site preparation nor fertilization significantly increased survival of any species above the control during the first 2 years after planting. Residues of picloram, one of the herbicides used during site preparation, reduced survival of all species, except white ash, below that of the control of species. Black cherry was the only species that grew better as a result of the treatments. Weed removal significantly increased black cherry seedling growth, but much of this increased growth was in branches, rather than the terminal shoot. Mechanical site preparation plus herbicide did not increase growth of black cherry seedlings above that of herbicide alone during the first 2 years and have the disadvantage of stimulating reinvasion by grass. Deer which penetrated the protective fence interfered with evaluation of growth after the second year.

Houseweart, M. W. **Trichogramma vs. the spruce budworm.** In: Sanders, C. J.; Stark, R. W.; Mullins, E. J.; Murphy, J.; eds. Recent advances in spruce budworms research; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 395-396.

Houston, David R. **Dieback and declines of urban trees.** Journal of Arboriculture. 11(3): 65-72; 1985.
Dieback-decline diseases occur when trees, stressed and altered by abiotic or biotic agents, are attacked by organisms of secondary action. The primary stress factors in forests are insect defoliation and extremes of moisture and temperature. In urban situations, drought is probably the most important stress factor. Most organisms of secondary action are native opportunists which often are more successful in urban than in forest situations--perhaps because urban trees are more frequently subjected to prolonged or intense stress. Attempts to control these diseases usually should be focused on preventing or reducing stress effects rather than on direct actions against the secondary organisms.

Houston, D. R. **Spread and increase of Ceratocystis ulmi with cultural characteristics of the aggressive strain in northeastern North America.** Plant Disease. 69(8): 677-680; 1985.
Elm trees with Dutch elm disease in the state of Vermont and in the town of Millinocket, ME, were systematically sampled for infection by Ceratosystis ulmi in 1980 and 1983. Isolates of C. ulmi were classified as either the aggressive or nonaggressive strain on the basis of growth rate and cultural morphology. Results indicated that these two subgroups are isolated in nature. Compared with an earlier survey in 1977, the relative number of nonaggressive isolates declined with each successive survey in both areas,

suggesting that this strain will soon disappear from these areas.

Houston, David R. **Sapstreak of sugar maple: How serious is it?** Maple Syrup Digest. 25(2): 24-27; 1985.

Hughes, Garrett A.; Sendak, Paul E. **Key algorithms used in GRO2: A computer simulation model for predicting tree and stand growth.** Res. Pap. NE-570. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 17 p.
GRO2 is an individual tree, distance-independent simulation model for predicting tree and stand growth over time. It performs five major functions during each run: (1) updates diameter at breast height, (2) updates total height, (3) estimates mortality, (4) determines regeneration, and (5) updates crown class.

Huyler, Neil K. **The production potential and cost of the Vermont cable yarder.** In: Proceedings, The Seventh International FPRS Industrial Wood Energy Forum '83; 1983 September 19-21; Nashville, TN. Madison, WI: Forest Products Research Society; 1985: 84-91.
The purpose of the Vermont cable yarder project was to build and demonstrate to private landowners and loggers a cable yarding system capable of handling fuelwood and small commercial-size timber economically with minimal environmental impact. Time studies were conducted during 1982 to determine the production capability and estimated operating cost of the system. The results indicate that the operation is marginal in production rate and cost. The advantages of the system, such as low level of environmental effects, operation on slopes too steep for conventional logging, and low initial investment may more than offset the high operating costs. However, more testing is needed before final recommendations can be made.

Jennings, D. T. **Prototype II detector-counter for egg masses of spruce budworm.** In: Sanders, C. J.; Stark, R. W.; Mullins, E. J.; Murphy, J., eds. Recent advances in spruce budworms research; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 237.
Discussion of determining insect numbers within the population and impact assessment workshop II.

Jennings, Daniel T. **Automated counter for detecting and counting egg masses of the spruce budworm.** In: Spruce-fir management and spruce budworm; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 143-145.
An optical-electronic counter (prototypes I and II) was designed and developed for detecting and counting egg masses of the spruce budworm and the western spruce budworm. The counter scans foliage samples, detects the presence of egg masses based on their characteristic fluorescing properties, and counts masses electronically.

Jennings, Daniel T.; Crawford, Hewlette S., Jr. **Predators of the spruce budworm.** Agric. Handb. 644. Washington, DC: U.S. Department of Agriculture; 1985: 77 p.
Reviews available information on invertebrate and vertebrate predators of the spruce budworm. Predators of each life stage--eggs, small larvae, large larvae, pupae, and adults--are discussed. Other topics include the importance of predators in regulating endemic and epidemic budworm populations; problems of identifying and measuring predation; methods of studying predation; conservation and enhancement of predators; and general references and guides for identifying predators.

Jennings, D. R.; Houseweart, M. W.; Dimond, J. B. **Strip clearcutting contributes to dispersal losses of early-instar spruce budworm larvae.** In: Sanders, C. J.; Stark, R. W.; Mullins, E. J.; Murphy, J., eds. Recent advances in spruce budworms research; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 115.

Discussion of budworms behavior within the spruce budworms population dynamics workshop I.

Jensen, Keith F. **Response of yellow-poplar seedlings to intermittent fumigation.** Environmental Pollution. 38: 183-191; 1985.
Yellow-poplar seedlings were treated with either clean air, 0.1 ml litre^{-1} O_3, 0.1 ml litre^{-1} O_3 plus 0.2 ml litre^{-1} SO_2, or 0.1 ml litre^{-1} O_3 plus 0.2 ml litre^{-1} NO_2 for one or two 12-h fumigation periods per week. Ten seedlings were harvested from each treatment every 4 weeks throughout the growing season and growth curves for height, leaf area, leaf dry weight, new growth dry weight, and total dry weight were constructed. Height, leaf area, leaf dry weight, new growth dry weight, and total dry weight differed by fumigation treatments. Relative growth rate and net assimilation rate of the yellow-poplar seedlings were reduced by fumigation. Seedlings moved twice a week from the glasshouse to the fumigation chambers were significantly shorter than seedlings moved only once a week.

Jensen, Keith F. **Interactive effects of sulfur dioxide, ozone and simulated acid rain on growth of Liriodendron tulipifera L. seedlings.** American Journal of Botany. 72(6): 906; 1985. Abstract No. 31.
Presents procedures and results for a study of 1-year-old yellow-poplar seedlings that were watered with simulated acid rain solutions and fumigated with sulfur dioxide and ozone in greenhouse fumigation chambers.

Jensen, Keith F. **Summary and evaluation of research on native vegetation.** In: Lee, Si Duk., ed. Evaluation of the scientific basis for ozone/oxidants standards; 1984 November; Houston, TX. Pittsburgh, PA: Air Pollution Control Association; 1985: 127-131.

Ketchledge, E. H.; Leonard, R. E.; Richards, N. A.; Craul, P. F.; Eschner, A. R. **Rehabilitation of alpine vegetation in the Adirondack Mountains of New York State.** Res. Pap. NE-553. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 6 p.
This paper describes field experiments in using sod-forming grasses from lower elevations as soil stabilizers, and discusses the effects of fertilizing and transplanting native vegetation as part of an integrated management plan for rehabilitating alpine plant communities in the Adirondacks. Results show that it is possible to stabilize severely degraded alpine communities by seeding exposed humus and detritus with bluegrass or red fescue and fertilizing with a complete fertilizer and lime. When the treated areas are protected from further hiker impact, native vegetation returns; first a mat of mosses develops under the grasses, then seedlings of rhizomes of vascular plants slowly invade the site.

Kingsley, Neal P. **A forester's atlas of the Northeast.** Gen. Tech. Rep. NE-95. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experimental Station: 1985: 96 p.
A reference atlas for the professional forester, geographer, student, and the general public. Contains 37 maps with accompanying text. Subject areas covered include: land resource areas, physical subdivisions, soils, water resources, forest resources, climate, population, income, labor, transportation, and timber products output.

Kingsley, Neal P.; Dale, Martin E. **Thirty years at Vinton Furnace Experimental Forest, Part 2.** Ohio Woodlands, 22(3): 21-23, 1985.
Discusses a number of significant forestry research studies conducted on the Vinton Furnace Experimental Forest since it was established in 1952.

Knezick, Donald R.; Kuser, John E.; Sacalis, John N. **Single clone orchard production of pitch X loblolly hybrids.** In: Proceedings, 29th Northeastern Forest Tree Improvement Conference; 1984 July 18-20; Morgantown, WV. [Place of publication unknown]: Northeastern Forest Tree Improvement Conference; 1985: 23-31.
Inbreeding depression tests with four clones of pitch pine indicate that select clones may be sufficiently self sterile to make supplemental mass pollination of isolated single-clone seed orchards with loblolly pollen an effective and economical means of producing superior pitch x loblolly hybrids.

Knezick, Donald R.; Kuser, John E.; Garrett, Peter W. **Supplemental mass pollination of single clone orchards for the production of southern pine hybrids.** In: 18th Southern Forest Tree Improvement Conference; 1985 May 21-23; Long Beach, MS. Long Beach, MS: Southern Forest Tree Improvement Committee; 1985: 187-193.

Kochenderfer, J. N.; Helvey, J. D. **Some effects of forest harvesting on water quality: Fernow Experimental Forest, West Virginia.** In: Proceedings, 1984 Penn State Forestry Issues Conference; Forest Management and Water Quality; 1985 March 13-14; University Park, PA. University Park, PA: The Pennsylvania State University; 1985: 44-52.
Review of 25 years of research at the Fernow Experimental Forest, assessing the impacts of road construction and timber harvest on sediment yield, stream temperature, and nutrient export.

Kostelnik, K. M.; Lynch, J. A.; Corbett, E. S. **Spatial variability of throughfall chemistry.** Abstracts of IUFRO Water-Nutrient Symposium, Hampton Beach, New Hampshire, [Place of publication unknown]: [Publisher Unknown]; 1985: 19.
The variability of throughfall chemistry associated with a mixed hardwood forest canopy and acid precipitation during an episodic event was determined for a 2.33 cm storm. This study utilized 32 throughfall chemistry collectors and 24 throughfall volume collectors.

Koten, Donald E.; Peters, Penn A. **Cable yarding on environmentally sensitive areas in New York state.** In: Proceedings of the 8th Annual Council on Forest Engineering Meeting; 1985 August 18-22; Tahoe City, CA. Davis, CA: University of California; 1985: 79-83.

Laing, Frederick M.; Sendak, Paul E.; Aleong, John. **Species trials for biomass production on abandoned farmland.** Northern Journal of Applied Forestry. (2): 43-47; 1985.
As part of a nationwide study of the potential for woody crops to supply biomass for energy use, we evaluated seven hardwood tree species and six hybrid poplar clones on four different sites in Vermont, with three fertilizer treatments on some sites. Not all species were evaluated on all sites. Plots containing 25 trees were replicated three or four times at each site. Trees were planted at a spacing of 0.6 x 0.6 m or 0.9 x 0.9 m and grown for 3 years. The application of fertilizer did have significant effect on height, diameter, and stem weight. Species with high yields (about 16 oven-dry t/ha/year) included four of the hybrid poplars. Silver maple, black locust, and the other two hybrid poplars yielded about 10 oven-dry t/ha/year. These species and clones were recommended for short-rotation intensive culture in areas with similar climate and growing sites.

Lamson, Neil I. **Thinning increases growth of 60-year-old cherry-maple stands in West Virginia.** Res. Pap. NE-571. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 8 p.
In north-central West Virginia, previously unmanaged 60-year-old cherry maple stands were thinned to 60 percent relative stand density. Thinning reduced mortality, redistributed growth onto fewer, larger stems, and increased individual tree growth. Five-year periodic basal-area growth per acre was

1.2 times greater in thinned stands than in unthinned stands. Periodic basal-area growth of individual trees was greater in thinned stands than in controls: 2.0 times for all stems and 1.3 times for dominants and codominants. Relative stand density in the thinned stands increased 1.6 percent annually.

Lamson, Neil I.; Smith, H. Clay; Miller, Gary W. **Logging damage using an individual-tree selection practice in Appalachian hardwood stands.** Northern Journal of Applied Forestry. 2(4): 117-120; 1985.

Four West Virginia hardwood stands, managed using individual-tree selection for the past 30 years, were examined after the third and, in one instance, the fourth periodic harvest to determine the severity of logging damage. On existing skid roads, trees were removed with a rubber-tired skidder or a crawler tractor with a rubber-tired arch. Logging damage reduced residual stand basal area by 6 percent, a total of 6.1 ft^2 per acre. Damage was concentrated in the saplings--85 percent of the stems lost to logging damage were less than 5.0 in d.b.h. An adequate number of undamaged stems in all diameter classes remained after logging to achieve individual-tree selection stand structure goals.

Lautenschlager, R. A.; Crawford, Hewlette S. **You can lead a moose to a study plot, but you have to finesse a deer.** American Forests. 91(3): 40-43; 1985.

The goal of the study was to determine what plants moose and deer eat from areas of various forest disturbances presently common in Maine. After watching deer take approximately 41,000 bites and moose take 144,000, we had a good idea of what they selected from the areas. Along the way we learned many things, ranging from how to tame moose and deer to the potential risks the animals pose to various tree species.

Lawrence, Robert K.; Houseweart, Mark W.; Jennings, Daniel T.; Southard, Susan G.; Halteman, William A. **Development rates of Trichogramma minutum (Hymenoptera: Trichogrammatidae) and implications for timing augmentative releases for suppression of egg populations of Choristoneura fumiferana (Lepidoptera: Tortricidae).** Canadian Entomologist. 117: 557-563; 1985.

Development rates and adult longevity of the parasitoid Trichogramma minutum Riley were studied to provide information for timing field releases of T. minutum to suppress spruce budworm. Development of T. minutum required the fewest degree days at 27°C. Within each temperature treatment, T. minutum developed more rapidly in Sitotroga cerealella eggs than in C. fumiferana eggs, and male T. minutum adults emerged before female adults from eggs of both host species. T. minutum from both parental-host groups had the greatest longevity at 21°C. Among those reared in S. cerealella eggs, mean adult longevity of females was significantly greater than that of males.

Leak, William B. **Relationships of tree age to diameter in old-growth northern hardwoods and spruce fir.** Res. Note NE-329. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 4 p.

Regressions are given for predicting age from diameter for 10 different species of trees or shrubs in old-growth northern hardwood and spruce-fir stands.

Leak, William B.; Gottsacker, James H. **New approaches to uneven-age management in New England.** Northern Journal of Applied Forestry. 2(1): 28-31; 1985.

Because of greater emphasis on nontimber values in New England, uneven-age management is drawing more interest among the larger ownerships. Uneven-age management approaches recommended in the past were both costly and biologically undesirable. However, recent findings are enabling the development of more feasible uneven-age guidelines for regenerating valuable species, conducting practical cutting operations, controlling marking, and keeping records.

LeDoux, Chris B. **Stump-to-mill timber production cost equations for cable logging eastern hardwoods.** Res. Pap. NE-566. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 6 p.

Logging cost simulators and data from logging cost studies have been assembled and converted into a series of equations that can be used to estimate the stump-to-mill cost of cable logging in mountainous terrain in the Eastern United States. These equations include the use of two small and four medium size cable yarders and are appropriate for harvested trees ranging in diameter from 6 to 24 inches. Cost components can be determined easily with a hand calculator. A program that can be used with many desktop computers also is available that calculates the total stump-to-mill logging for specific logging conditions.

LeDoux, Chris B. **When is hardwood cable logging economical?** Journal of Forestry. 83(5): 295-298; 1985.

Using cable logging to harvest eastern hardwood logs on steep terrain can result in low production rates and high costs per unit of wood produced. Logging managers can improve productivity and profitability by knowing how the interaction of site-specific variables and cable logging equipment affect costs and revenues. Data from selected field studies and forest model plots, as used in a simulation model, indicate that managers must consider cable logging technology, average slope distances required, volume and size of material cut, tree species and market price, and silvicultural treatment proposed.

LeDoux, Chris B.; Peters, Penn A. **Computer planning tools applied to a cable logging research study.** In: Proceedings, improving mountain logging planning, techniques and hardware: A joint symposium of the IUFRO mountain logging section and the 6th Pacific Northwest skyline logging symposium; 1985 May 8-11; Vancouver, BC. Vancouver, BC: Forest Engineering Research Institute of Canada; 1985: 51-54.

Leonard, R. E.; McMahon, J. L.; Kehoe, K. M. **Hiker trampling impacts on Eastern forest.** Res. Pap. NE-555. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 5 p.

Trampling impact studies were conducted in two eastern forest stands in the White Mountains, New Hampshire. Changes in plant mortality on simulated trails during a trampling period and a recovery period were monitored photographically. The extent of damage and rate of recovery varied among species. For most species, the greatest change in plant mortality occurred between 100 and 300 trampling passes.

Leonard, R. E.; Conkling, P. W.; McMahon, J. L. **The response of plant species to low-level trampling stress on Hurricane Island, Maine.** Res. Note NE-327. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 6 p.

In 1981, a study was initiated to measure the effects of low-level trampling (100 to 200 tramples) on selected vegetation on Hurricane Island, Maine. Low levels of trampling are representative of general recreational use patterns on most Maine islands. The study was designed to compare percent survival of common island species when subjected to low-level trampling, to observe treadway formation, and to monitor recovery. The quadropod photographic technique was used to monitor changes in area coverage of species. Climatic conditions on Hurricane Island appear to favor rapid plant recovery. Most species were able to withstand low levels of trampling stress if allowed a recovery period of 1 year. The most resistant species were Picea rubens and Cladina spp. The woody shrubs Empetrum nigrum, Myrica pensylvanica, and Juniperus horizontalis and the tall herbaceous species Solidago rugosa and Aralia nudicaulis were the least resistant to trampling stress.

Recovery of these species was relatively slow.

Lewis, F. B.; Dubois, N. R. **Bt strain and formulation research at the Center for Biological Control.** In: Spruce-fir management and spruce budworm; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 127-130.
One of the major objectives of the CANUSA program has been to bring microbial control into functional use in spruce budworm management and control programs. Bacillus thuringiensis (Bt) is the microbial agent with the greatest potential to meet this objective, but until recently has performed erratically in field operations. There are many reasons for this erratic performance--two reasons addressed in this paper are: (1) the strain of Bt being used and (2) the formulation-application-deposit of the material.

Likens, G. E.; Bormann, F. H.; Pierce, R. S.; Eaton, J. S. **The Hubbard Brook Valley.** In: Likens, G. E., ed. An ecosystem approach to aquatic ecology: Mirror Lake and its environment. New York: Springer-Verlag; 1985: 9-39.

Likens, G. E.; Eaton, J. S.; Johnson, N. M.; Pierce, R. S. **Flux and balance of water and chemicals.** In: Likens, G. E., ed. An ecosystem approach to aquatic ecology: Mirror Lake and its environment. New York: Springer-Verlag; 1985: 135-155.

Luppold, William G. **The causes of oak price variation.** National Hardwood Magazine. 59(5): 55, 78-80; June 1985.
The variability of oak lumber prices is a direct result of the variability of the national and international economies and the competitive nature of the oak lumber market. So long as the oak lumber market is composed of many buyers and sellers who as individuals cannot exert any major degree of influence on the market oak lumber prices will vary. Although government intervention or market dominance by a single firm or group of large firms will reduce price variability, neither of these situations is feasible or economically efficient. Therefore, the problem facing buyers and sellers of oak lumber is how to live with price variability and possibly how to reduce price variability. The best way to approach either of these problems is to understand and anticipate this economic fact of life.

Luppold, William G.; Anderson, R. Bruce. **Factors affecting pallet demand.** Pallet Enterprise. 5(1): 10-12; 1985.

Luppold, William G.; Jacobsen, Jennifer M. **The determinants of hardwood lumber price.** Res. Pap. NE-558. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 6 p.
Econometric equations were estimated to determine the effects of domestic foreign hardwood lumber demands on oak and hardwood lumber prices. Oak price seemed to be more sensitive to changes in exports than overall hardwood lumber price. However, the main determinants of hardwood lumber and oak lumber prices were found to be domestic demand and millstock levels.

Lynch, James A.; Corbett, Edward S. **Source area variability during peakflow: a function of antecedent soil moisture content.** In: Proceedings of Symposium Sponsored by Committee on Watershed Management; Irrigation and Drainage Division; 1985 April 30-May 1; Denver, CO. [Place of publication unknown]: [Publisher unknown]; 1985: 300-307.
An attempt was made to identify the source areas contributing to peakflow and to quantify the relative importance of each source area under various antecedent soil moisture (ASM) conditions. The variability of these source areas within and between storms was also investigated. This study was conducted on a first-order, 19.6-acre (7.9-ha) forested watershed in central Pennsylvania. An irrigation system was installed on this watershed that was capable of applying simulated rainstorms

to any or all portions of the basin under controlled antecedent conditions.

Lynch, James A.; Corbett, Edward S. **The significance of spatial and temporal variations in atmospheric wet deposition to effects research.** In: Conference Muskoka Conference '85. International Symposium on Acidic Precipitation; Sponsored by the Federal and Provincial Governments of Canada; 1985 September 15-20; [Place of meeting unknown]. [Place of publication unknown]: [Publisher unknown]; 1985. Abstract.
The results of this study indicate that the resolution of wet disposition maps can be improved by utilizing existing precipitation data that are available from federal and state agencies or by including in an atmospheric deposition monitoring network, additional automatic precipitation recorders.

Lynch, James A.; Corbett, Edward S.; Mussallem, Keith. **Best management practices for controlling nonpoint-source pollution on forest watersheds.** Journal of Soil and Water Conservation. 40(1): 164-167; 1985.
The Pennsylvania Department of Environmental Resources, Bureau of Forestry, developed a set of best management practices (BMPs) to limit and/or control nonpoint-source pollution from silvicultural activities. Nonpoint-source pollution in a forested watershed is characterized by changes in stream temperature, turbidity/sediment levels, and nutrient concentrations and export. A watershed study conducted on the Leading Ridge Experimental Watersheds in central Pennsylvania suggested that the BMPs were effective in controlling nonpoint-source pollution from a 44.5-hectare commercial clearcut. Slight increases in stream temperature, turbidity, and nitrate and potassium concentrations were observed, but these increases did not exceed drinking water standards.

Lynch, J. A.; Dann, M. S.; Corbett, E. S. **Variations in sulfate export as a function of time, methodology, and hydrologic conditions.** Abstracts of IUFRO Water-Nutrient Symposium, Hampton Beach, New Hampshire; 1985: 20-21.
Seven methods of estimating sulfate export from a forested watershed were compared. Three methods were based on regression models, two involved weighing individual concentrations and summing to an annual concentration; one used a simple unweighted average and one weighted export according to interval length. Annual and monthly fluctuations in sulfate export were also compared with wet sulfate deposition to determine the status of sulfate retention on the watershed. This study was conducted on the Leading Ridge Experimental in central Pennsylvania.

Mardon, David N.; Rothwell, Frederick M. **An Azosipirillum [sic] lipoferum isolate with high nitrogen-fixing capabilities from a coal surface-mined site.** Transactions of Kentucky Academy of Science. 46(1-2): 33-35; 1985.

Marquis, David A. **Silvicultural and forest management considerations.** In: Symposium II proceedings: NE petroleum-forest resource cooperative; 1985 April 3-4; Salamanca, NY. Syracuse: State University of New York; 1985: 79-88.

Martens, David G.; Nevel, Robert L., Jr. **OPTIGRAMI: Optimum lumber grade mix program for hardwood dimension parts.** Res. Pap. NE-563. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 10 p.
With rapidly increasing lumber prices and shortages of some grades and species, the furniture industry must find ways to use its hardwood lumber resource more efficiently. A computer program called OPTIGRAMI is designed to help managers determine the best lumber to use in producing furniture parts. OPTIGRAMI determines the least-cost grade mix of lumber required to produce a given cutting order of dimension parts. It the optimum grade mix is not available, the program can determine the best alternatives. It also can be useful in procurement and allocation

planning. A description of the program and examples of its use are included.

Martin, C. Wayne; Noel, Diane S.; Federer, C. Anthony. **Clearcutting and the biogeochemistry of streamwater in New England.** Journal of Forestry. 83(11): 686-689; 1985.
A survey shows that clearcutting in New England may increase stream nutrients, including nitrate-nitrogen, calcium, and potassium. The largest increases were found in northern hardwoods in New Hampshire. Stream insect populations, particularly mayflies and true flies, increased in clearcuts in response to increased stream temperature, algal populations, and organic matter. Changes in streamwater chemistry and biology indicate that clearcutting forest lands does affect streams throughout New England. However, the magnitude of differences is such that if erosion and sedimentation are controlled, clearcutting as practiced by foresters today, does not drastically change streamwater chemistry or biology.

Mastro, V. C.; Schwalbe, C. P., ODell, T. M. **An operationally feasible sterile insect technique.** Gypsy Moth News #10. Broomall, PA: U.S. Department of Agriculture; Forest Service; 1985: 13-15.

Mazzone, H. M. **Pathology associated with baculovirus infection.** In: Maramorosch, Karl; Sherman, K. E., eds. Viral insecticides for biological control. New York: Academic Press; 1985: 81-120.

Mazzone, H. M. **Receptors in the infection process.** In: Maramorosch, Karl; Sherman, K. E., eds. Viral insecticide for biological control. New York: Academic Press; 1985: 695-733.

Mazzone, H. M. **Isolation, electron microscopy, and computer processing of chromosomes.** In: Bailey, G. W., ed. Proceedings of the 43rd Annual Meeting of the Electron Microscopy Society of America; 1985 August 5-9; Lexington, KY. San Francisco: San Francisco Press, Inc.; 1985: 556-557.
The present study reports on the isolation of intact chromosomes from a mammalian cell culture and their examination in the transmission electron microscope. The images of the chromosomes were then enhanced by computer processing.

Mazzone, H. M.; Wray, G.; Engler, W. F. **The high voltage electron microscope in virology.** Advances in Virus Research. 30: 43-82; 1985.
The purpose of this review is to update the merits of high-voltage electron microscopy in virology. While most of our report centers about high-voltage transmission electron microscopy, we also discuss recent accomplishments in high-voltage scanning transmission microscopy. Lastly, the real considerations of cost and availability are discussed as well as the types of research in high-voltage electron microscopy taken on by virologists.

Mazzone, H. M. **The fungus of Dutch elm disease and antibiotics.** In: Underkofler, Leland A., ed. Developments in industrial microbiology. Vol. 26. Proceedings, 41st general meeting of the Society for Industrial Microbiology; 1984 August 12-17; Fort Collins, CO. Arlington, VA: Society for Industrial Microbiology; 1985: 471-477.
The Dutch elm disease fungus was screened against a number of antibiotics to measure their effectiveness. Plate and liquid cultures were used to determine at what concentration the antibiotics were fungicidal. Plate cultures consisted of potato dextrose agar as the growth medium, to which was added an agar overlay containing fungus and antibiotic. Liquid culture used to assay the effect of the antibiotics were potato dextrose broth or trypticase soy broth. Cerulenin, clotrimazole, polymyxin B, polyoxin D, stendomycin, and tropolone, each tested singly, were lethal to the fungus. Their efficiency, in terms of concentration required, was increased when used in combinations. This also was true for antibiotics, such as puromycin, which when tested singly were ineffective.

Mazzone, H. M.; Peacock, J. W. **Prospects for control of Dutch elm disease - biological considerations.** Journal of Arboriculture. 11(10): 285-292; 1985.

McClenahen, J. R.; Dochinger, L. S. **Tree ring response of white oak to climate and air pollution near the Ohio River Valley.** Journal of Environmental Quality. 14(2): 274-280; 1985.
White oak tree ring chronologies were compared among five sites representing an apparent gradient of industrial air pollution emitted from sources in a portion of the Ohio River Valley near the southern Ohio-northern Kentucky border. Response functions relating standardized ring-width indices with principal components of climate for sites nearest the industrial area exhibited a strong nonclimatic influence from 1930 to 1978, which did not appear at more remote sites or in the 30 years before 1930. Response functions for the entire 1900-78 period declined in reliability to predict indices from climate at sites near the pollution sources, as did the response function derived for the most remote site when used to predict indices at the other four sites. Evidence for nonclimatic influences on indices appeared at all sites between about 1950 and 1966. The altered patterns of tree ring response to climate add to a growing body of evidence for broad-scale changes in tree growth in the Northeast that may be associated with air pollution.

McClenahen, J. R.; Dochinger, L. S. **Tree ring response of white oak to climate and air pollution near the Ohio River Valley.** Journal of Environmental Quality. 14: 274-279; 1985.

McEwen, Douglas; Echelberger, Herbert; More, Thomas A. **Tent campers' druthers.** Woodall's Campground Management. 16(2): 6, 12, 13; 1985.

McPherson, E. Gregory; Brown, Roberto; Rowntree, Rowan A. **Simulating tree shadow patterns for building energy analysis.** In: Wilson, Alexander T.; Glennie, William, eds. Solar 85 Conference Proceedings, 1985 October 16-20; Raleigh, NC. Boulder, CO: American Solar Energy Society; 1985: 378-382.
Tree shade cast on buildings can reduce energy costs for mechanical cooling but also increase space heating costs and deter use of solar energy systems. This paper describes a microcomputer-based program that estimates percent irradiance reductions on building surfaces resulting from tree shade. Graphic output displays locations of tree shadows and percent of surface shaded at one-half hour intervals. Mathematical formulae used to simulate shadow projections are presented. This program is being interfaced with a commercially available building energy analysis program.

Mielke, M. E.; Houston, D. B.; Houston, D. R. **First report of Cryptococcus fagisuga, initiator of beech bark disease, in Virginia and Ohio.** Plant Disease. 69(10): 905; 1985.

Mohamed, M. A.; Coppel, H. C.; Podgwaite, J. D. **Temperature and crowding effects of virus manifestation in Neodiprion sertifer (Hymenoptera: Diprionidae) larvae.** The Great Lakes Entomologist. 18: 115-118; 1985.

Montgomery, Michael E. **Host plant nitrogen dynamics and the spruce budworm.** In: Recent advances in spruce budworms research: Proceedings of the CANUSA Spruce Budworms Research Symposium; 1984 Septemer 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 120-121.
Discussion of host-plant interactions within the spruce budworms population dynamics workshop I.

Moore, R. F.; ODell, T. M.; Calkins, C. O. **Quality assessment in laboratory-reared insects.** In: Singh, Pritam; Moore, R. F., eds. Handbook of insect rearing. Amsterdam: Elsevier Science Publishers B.V.; 1985: 107-135.

More, Thomas A. **Central City Parks: a behavioral perspective.** Burlington, VT: School of Natural Resources, University of Vermont; 1985: 74 p.
Although central city parks are a common feature of business districts in many American cities, we know surprisingly little about the role they play in city life. In this study, I monitored the use of two central city parks--one in Boston, one in Hartford--around the clock during summer 1978, recording the social characteristics and behaviors of the park users. Study results indicate that these parks are intensively used--together they produced over 300,000 visitor hours of use during the study period.

More, Thomas A. **Evaluating and interpreting use data in urban park settings.** In: Outdoor Recreation Trends Symposium II; 1985 February 25-27; Myrtle Beach, SC. Clemson, SC: Clemson University and USDI National Park Service; 1985: 103-108.

More, Thomas, A.; Echelberger, Herbert E. **Recreation education in U.S. Forestry schools.** In: Canadian Institute of Forestry and the Society of American Foresters Joint Convention; 1984 August 6-8; Quebec City, PQ. Bethesda, MD: Society of American Foresters; 1985: 185-187.

Morselli, Marie Franca; Whalen, Mary Lynn; Laing, Frederick M.; Sendak, Paul E.; Howard, Diantha B. **Changes in maple syrup from prolonged warm sap storage.** Burlington: University of Vermont, Agricultural Experiment Station; 1985. Res. Rep. 43. 12 p.

Nagpal, N. K. **Long-term phosphorus sorption in a brunisol in response to dosed-effluent loading.** Journal of Environmental Quality. 14: 280-285; 1985.
Phosphorus sorption characteristics of a major soil in the Shawnigal Lake area of Vancouver Island were studied in response to periodic secondary effluent loading. Five soil columns 0.60 m long and 0.139 m in diameter were prepared from the B horizon of the Shawnigan gravelly silt loam. Water table level was maintained at the base of the two partially saturated columns (PSC). The other three columns (USC) remained unsaturated at all times and were subjected to a tension of 6.0 kPa. A single, daily dose of 1 L (6.6 cm) of secondary effluent was applied to all columns except on weekends and holidays.

Nevel, Robert L., Jr.; Lammert, Peter R.; Widmann, Richard H. **Maine timber industries--a periodic assessment of timber output.** Resour. Bull. NE-83. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 42 p.
Reports the results of a survey of the timber industries in Maine; contains statistics on industrial timber production and receipts, and production and disposition of the manufacturing residues. Comparisons are made with the most recent data, and trends in industrial wood output are noted. Includes 25 statistical tables.

Northeastern Forest Experiment Station. **Publications of the Northeastern Forest Experiment Station--1983.** Gen. Tech. Rep. NE-103. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 41 p.
An annotated list of publications by Northeastern Forest Experiment Station scientists in 1983.

ODell, T. M. **Gypsy moth parasite research.** Gypsy Moth News #9. Broomall, PA: U.S. Department of Agriculture; Forest Service; 1985: 6-7.

ODell, Thomas M.; Butt, Carol A.; Bridgeforth, Arthur W. Lymantria dispar. In: Singh, Pritam; Moore, R. F., eds. Handbook of insect rearing. Amsterdam: Elsevier Science Publishers B.V.; 1985: 355-367.

Ossenbruggen, Sharon. **A properly placed cut is crucial to healthy pruning.** American Nurseryman. 161(6): 132-136; 1985.
Throughout the past century, myths and misconceptions have risen concerning

trees. All types of injurious treatments have been inflicted on them, mainly because no one took the time to learn what a tree is. Once people begin to understand how trees work, many seemingly complex treatments and subjects fall easily into place. One example is pruning.

Ossenbruggen, Sharon. **Tree wounds: To paint or not to paint.** Grounds Maintenance. 1985 June: 45, 50-52.

Peters, Penn A. **Cost-estimating programs for cable yarding.** In: ASAE Annual Winter Meeting; 1985 December 17-20; Chicago. ASAE Pap. No. 85-1590. St. Joseph, MI: American Society of Agricultural Engineers; 1985: 46 p.
Three basic language computer programs are described that estimate cable-yarding production and costs for fan, parallel, and reverse fan harvest units. Production and costs are determined as a function of load capacity, volume removed per acre, cable-yarder system characteristics, and harvest-unit geometry.

Peters, Penn A.; Biller, Cleveland J.; Johnson, David D., inventors; U.S. Department of Agriculture, assignee. **Transport carriage.** U.S. patent 4,500,004. 1985 February 19. Int. C13B66C 17/06.

Peters, M.; Ossenbruggen, S.; Shigo, A. **Cracking and failure behavior models of defective balsam fir trees.** Holzforschung. 39(3): 125-135; 1985.

Phillips, Ross A.; Powell, Douglas. **Timber volume relative to slope.** In: Proceedings, 8th Annual Council on Forest Engineering Meeting; 1985 August 18-22; Tahoe City, CA. [Place of publication unknown]: [Publisher unknown]; 1985: 41-45.
This work was to investigate a procedure for reporting effects of slope on available timber. Data were taken from two counties, Oxford and Franklin, in Maine, the most rugged terrain on which data were available; and slope and stand data were compared on a SAS system. Results showed no difference in timber size or volume with respect to slope for the limited area. Approximately 85 percent of this area was less than 25 percent slope. Further analysis needs to be done as data become available on other Appalachian areas. Steep forest land may be of little consequence if the total acreage is similar to the Maine sample.

Phillips, Ross A.; Perumpral, John V.; Swick, Christopher. **Forest management costs.** In: HP-41C Users' Library Software Catalog. Program No. 03255. Corvallis, OR: Hewlett-Packard; 1985.

Phillips, Ross A.; Perumpral, John V.; Swick, Christopher. **Log skidder loading predictions.** In: HP-41C Users' Library Software Catalog. Program No. 03265. Corvallis, OR: Hewlett-Packard; 1985.

Podgwaite, J. D. **Strategies for field use of baculoviruses.** In: Maramorosch, Karl; Sherman, K. E., eds. Viral insecticides for biological control. New York: Academic Press; 1985: 775-797.

Podgwaite, J. D. **Gypchek: Past and future strategies for use.** In: microbial control of spruce budworms and gypsy moths: Proceedings of the symposium 1984 April 10-12; Windsor Locks, CT. Gen. Tech. Rep. NE-100. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 91-93.

Powell, Douglas S. **Forest composition of Maine: An analysis using number of trees.** Resour. Bull. NE-85. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 40 p.
Number-of-trees data compiled by the USDA Forest Service from three periodic statewide inventories of Maine's forest resources are used to analyze the composition of the state's timberland in terms of species, tree class, and size. Conditions are compared and contrasted for periods from 1959 to 1974 to 1982 across different regions and counties of

the state. Twenty-three statistical tables containing 1982 estimates of number of trees, trees per acre, and average diameter are presented.

Powell, Douglas S. **The spruce-fir resource of Maine.** In: Spruce-fir management and spruce budworm; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 59-67.
Three statewide inventories (1959, 1971, and 1982) show trends in area, number of trees, and volume of the spruce-fir resource. In general, there are more sawtimber stands, overstocked stands, and sawtimber volume; fewer pole-sized trees; and less growing-stock volume. Relatively high mortality and removals levels have contributed toward the overall decline of the resource.

Rast, Everette D. **Predicted cubic-foot yields for green veneer and byproducts for northern red oak logs processed at a half-round slicing operation.** Forest Products Journal. 35(6): 26-30; 1985.
Mill managers or owners must have some benchmark with which to compare the efficiency of their operations. In this study, 169 northern red oak butt and upper logs, ranging from 13 to 26 inches were processed through a half-round slicing operation. Accurate measurements were made of the volumes of all byproducts and veneer. From this data, prediction equations were developed using diameter and log length as the independent variables. The accompanying tables show how the yields of both the veneer and byproducts vary with with the major variable, diameter. The equations are ideally suited for use with a computer. One of the major findings is that as the diameter of the log increases, the volume of veneer increases dramatically faster than does the volume of the byproducts.

Rast, Everette D.; Beaton, John A. **Photographic guide to selected external defect indicators and associated internal defects in black cherry.** Res. Pap. NE-560. Broomall, PA: U.S. Department of Agriculture, Forest Service Northeastern Forest Experiment Station; 1985: 22 p.
To properly classify or grade logs or trees, one must be able to correctly identify defect indicators and assess the effect of the underlying defect on possible end products. This guide aids the individual in identifying the surface defect indicator and also shows the progressive stages of the defect throughout its development for black cherry. It illustrates and describes seven types of external defect indicators and associated defects that are particularly difficult to evaluate.

Reiling, S. D.; Echelberger, H. E.; Cook, C. M. **Trends in the costs of providing public outdoor recreation opportunities.** In: Outdoor Recreation Trends Symposium II; 1985 February 25-27; Myrtle Beach, SC. Clemson, SC: Clemson University and USDI National Park Service; 1985: 257-270.

Remington, Susan B.; Sendak, Paul E.; Schumann, David R. **Connecticut's timber economy; a review of the statistics.** Burlington, VT: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; Durham, NH: U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry; 1985: 24 p.

Remington, Susan B.; Sendak, Paul E.; Schumann, David R. **Rhode Island's timber economy: a review of the statistics.** Burlington, VT: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; Durham, NH: U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry; 1985: 25 p.

Reynolds, Hugh W. **System 6: A new technology.** NE-INF-59-84. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 4 p.
Describes the System 6 technology with particular emphasis on the operation of a System 6 rough mill. Includes discussion of the concept and operation

of a gang crosscut saw, and a sample run of System 6 rough mill.

Reynolds, Hugh W. **System 6: Chips versus blanks program.** Gen. Tech. Rep. NE-106. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 12 p.
This paper gives a computer program to be used on the IBM-PC to evaluate the tradeoff between chips and boards. In System 6, bolts are sawed to cants, and cants are resawed to boards. All boards with a minimum clear area are stacked, dried, and processed to blanks. All other boards are chipped. When the bolts are of poor quality, many boards will have only the minimum clear area. By increasing the size of the minimum clear area used in sorting, only the better boards will be used for blanks and more chips will be made. Additional cants will have to be purchased to replace the boards chipped.

Roberts, B. R.; Jensen, K. F.; Cathey, H. M. **Modification of ozone sensitivity in seedlings by ethylenediurea: soil application vs. stem injection.** Journal of the American Society for Horticultural Science. 110(2): 178-180; 1985.
An anti-oxidant chemical, EDU, was applied in the greenhouse as a soil drench or by stem injection to 2-year-old containerized seedlings 7 days prior to fumigation with 0.35 to 0.95 ppm ozone (O_3) for 3 hours. EDU treatment reduced the appearance of O_3-induced symptoms (surface bleaching, bifacial necrosis, and chlorosis) on the foliage of red maple, honeylocust, sweetgum, and pin oak. Stem injection of EDU was significantly more effective than soil drench at the same concentration, although both treatments afforded some protection at the low O_3 level (0.35 ppm). About 50 times more EDU was required for comparable levels of O_3 protection using soil application as opposed to stem injection. Honeylocust showed the greatest physiological response to EDU as evidenced by changes in root, stem, and leaf dry weight of stem-injected seedlings. All four species showed some sensitivity to O_3 at 0.95 ppm in the absence of EDU. Chemical name used: N-[2-(2-oxo-1-imidazolidinyl)ethyl]-N'-phenylurea (EDU).

Robison, Daniel J.; Abrahamson, Lawrence P.; Czapowskyj, Miroslaw M.; White, Edwin H.; Allen, Douglas C. **Overwintering spruce budworm on black spruce: sample-unit size and population distribution.** Canadian Entomologist. 117(4): 395-399; 1985.

Rothwell, Frederick M.; Eagleston, Don. **Microbial relationships in surface-mine revegetation.** In: Symposium on the reclamation of lands disturbed by surface mining: A cornerstone for communication and understanding: 1984 national meeting of the American Society for Surface Mining and Reclamation; 1984 July 10-13; Owensboro, KY. Ser. Rev. 94-113. Wilmington, DE: [Publisher unknown]; 1985.
The establishment and interrelationships of microorganisms with soil and plant processes during reclamation are greatly influenced by the composition of the planting medium and vegetation practices. While in some instances the parent material may be used as the vegetation medium, the practice of topsoiling, particularly the direct haul method, may be beneficial in introducing microorganisms and improving the quality of the plant growth medium of spoils that are chemically or physically less desirable than the native soils. The influence of different vegetation types on soil development on surface mines may be a reflection of physiological differences that affect microbial development in the rhizosphere. Such differences include levels of carbohydrate translocated to the root system and/or released into the surrounding soil; the plant's effectiveness as a mycorrhizal host; and the rate of degradation of plant residues. It has become apparent that microbial interactions are an important part of plant and soil processes in reclamation. While some of the

microorganisms important in plant growth and soil development can be introduced readily by management practices, the majority usually are disseminated by natural means and only gradually become a part of the microbial population. More research is needed on developing new methods or refining current procedures for early introduction of these microorganisms in reclamation practices.

Sarles, Raymond L. **Thinning mountain hardwoods with a truck-mounted crane.** Northern Journal of Applied Forestry. 2(3): 87-90; 1985.

The truck-mounted crane (TMC) is a cable yarder that shows promise for logging thinnings on moderate to steep slopes. A commercial thinning using the TMC yarder on moderate slopes in an overstocked stand of 60-year-old cherry-maple poletimber and small sawtimber showed that a three-man crew could harvest about 50 tons (19.4 cunits) of tree-length logs per 8-hour day when extracting stems averaging 10 inches d.b.h. The cost to fell, yard, and deck stems of this size averaged $6.65 per ton ($17.13 per cunit), including cost of road construction. Truck-mounted crane yarding results in minimum damage to the residual stand, thus ensuring increased value of future crop trees. The environmental impact is light because fewer roads are required, and forest soils and stream courses are disturbed less with the TMC system than with conventional logging methods.

Sarles, Raymond L. **Production and costs: chain saw felling in hardwood thinnings.** The Northern Logger and Timber Processor. 34(2): 24-25, 50, 56-57; 1985.

Overstocked hardwood stands are common throughout the mountains of Appalachia. These second-growth stands contain fine commercial species that could be improved by thinning. At present the scarcity of markets for small roundwood in the mountain region makes thinning economically unfeasible at best. In addition, most logging contractors are hesitant to take on thinning operations because they are unfamiliar with the costs of thinning poletimber and small sawtimber stands, even where small wood markets are available. To give logging contractors and forest managers a better concept of harvesting costs in thinning operations, the USDA Forest Service's Forestry Sciences Laboratory at Princeton, West Virginia, researched harvesting operations on several thinning jobs. This paper reports what we learned about chain-saw felling production and costs in mountain hardwoods.

Schier, G. A. **Aspen reproduction.** In: Foresters' future: leaders or followers?: 1985 Society of American Foresters National Convention proceedings; 1985 July 28-31; Fort Collins, CO. Bethesda, MD: Society of American Foresters; 1985: 92-95.

Aspen commonly is found in clones produced vegetatively by root suckering. Rocky mountain aspen is unique because of the large size of the clones. Seedling establishment is rare due to short-lived seed and intolerance of the tiny seedlings to moisture stress and high temperature. Root suckering is inhibited by auxin translocated from crowns (apical dominance), so cutting or killing stems stimulates regeneration. Clearcutting is the most effective way to obtain aspen regeneration. It reduces apical dominance to a minimum and enables shoots of this shade-intolerant species to grow in full sunlight. Injury by livestock and big game may seriously impede the survival and growth of aspen suckers. Obtaining adequate regeneration is difficult in understocked, overmature, deteriorating stands.

Schier, G. A. **Response of red spruce and balsam fir seedlings to aluminum oxicity in nutrient solutions.** Canadian Journal of Forestry Research. 15(1): 29-33; 1985.

Red spruce and balsam fir were grown in nutrient solutions containing 0.25, 50, 100, and 200 mg/L aluminum (Al) at pH 3.8. Seedlings died only when placed directly in solutions containing Al without first being conditioned to growth in a hydroponic system. In preconditioned seedlings, no evidence of Al injury was noted in the tops of

seedlings at any level of Al, except for small reductions in shoot growth. Aluminum toxicity symptoms in roots, however, were well developed, though spruce showed less tolerance than fir. Inhibition of root growth in both species was first evident at 50 mg/L Al, root lengths decreasing with increasing concentrations of Al. Spruce seedlings at Al concentrations of 100 mg/L and higher were characterized by thickened, stunted, dark brown roots. Root deterioration was caused by Al-induced destruction of epidermal and cortical cells. Although root elongation was severely restricted in spruce and fir, root dry weight was not significantly reduced. Aluminum decreased seedling uptake of most mineral elements: manganese, magnesium, and zinc were affected most and boron and phosphorus least.

Schmitt, Daniel, ed. **Spruce-fir management and spruce budworm**; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 217 p.
Presents a technical update of the management of spruce-fir forests. Integrated management of eastern spruce budworm is not yet a reality. The ecological, social, and economic knowledge needed to develop an integrated management system is not available. The conference was designed to move individuals to a higher level of spruce budworm management in the eastern spruce-fir forests.

Sendak, Paul E. **Maple syrup production costs up.** New England Farmer. 1985 January: 4-5.
An annual maple syrup production cost index was estimated for the period 1972 to 1984 and compared to an index of maple syrup farm price. Cost increased more than 2.5 times from 1972 to 1984 while price almost doubled from 1973 to 1984. However, adjustment for inflation showed that there has been little, if any, change in cost or price measured in dollars of constant value over the entire period.

Sendak, Paul E. **Syrup cost relationships.** New England Farmer--The Sugarmaker. 1985 March: B6-B7.

Sendak, Paul E.; Bennink, John P. **The cost of maple sugaring in Vermont.** Res. Pap. NE-565. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 14 p.
An annual maple syrup production cost series was developed for the period 1972 to 1984. Comparisons were made between plastic tubing and metal bucket technology and wood- and oil-fired evaporation. The effects of sapsugar content and size of operation were examined together with the relationships among major cost items. The information will be useful to maple syrup producers and lenders needing financial analyses, equipment developers and manufacturers, and public policy analysts and planners.

Sendak, Paul E.; Laing, Frederick M. **The forced-draft wood grate.** Maple Sugar Digest. 26(3): 19-22; 1986.
Many maple syrup operations are too small to use the high-cost/high-tech innovations, such as reverse osmosis, that have been applied by the maple syrup industry. The forced-draft wood grate is a low-cost alternative designed to increase the thermal efficiency of the standard open-pan maple syrup evaporator. We installed a forced-draft grate on an evaporator to compare its effect on thermal efficiency with that of standard wood grates. The results indicated a statistically significant increase in thermal efficiency of 8.1 percent, attributable to the forced-draft grate. An economic analysis showed a 12.4 percent before-tax rate of return on the extra investment required to purchase a new forced-draft grate instead of a standard wood grate.

Seymour, R. S.; Grace, J. R.; Hannah, P. R.; Marquis, D. A. **Silviculture in the Northeastern United States--The past 30 years and the next 30 years Summary).** In: Foresters' future: Leaders or followers?: 1985 Society of American Foresters National Convention Proceedings; 1985 July 28-31; Fort

Collins, CO. Bethesda, MD: Society of American Foresters; 1985: 247-251.
Silvicultural practice in the Northeastern United States, which includes New England and the Middle-Atlantic States, is reviewed. Present forests are mostly in private ownership, have unbalanced age structure, and are dominated by mature, even-aged, largely unmanaged stands. Although intensive management practices requiring major investments are increasing on industrial timberlands, most of the region is still managed extensively through harvest cutting and natural regeneration, often with unsatisfactory results. Challenges for the next 30 years include improving management of the present growing stock, regenerating the forests of the 21st century, developing better forest development forecasting methods, and expanding public awareness and support for silviculture.

Seymour, Robert S.; Mott, D. Gordon; Kleinschmidt, Steven M.; Triandafillou, Peter; Keane, Robert. **Green woods model: a forecasting tool for planning timber harvesting and protection of spruce-fir forests attacked by the spruce budworm.** Gen. Tech. Rep. NE-91. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 38 p.
A dynamic model of budworm-infested spruce-fir forests is described. The Green Woods Model allows managers and analysts to predict forest composition and structure that result from various harvesting and protection strategies. The forest structure is represented as a distribution of area and volume by age class, species, and forest type. This structure changes through time as the natural process of forest development (growth, budworm-caused growth loss and tree mortality, and regeneration) interact with management strategies (timber harvesting and protection). The model is inherently flexible; the rate and timing of virtually all modeled processes, both natural and management-related, are controlled by the user.

Sheehan, Katharine A.; Dahlsten, Donald L. **Bionomics of Neodiprion species on white fir in northeastern California.** Hilgardia. 53(8): 1-24; 1985.

Shields, K. S. **Pathways of nucleopolyhedrosis virus infection in the gypsy moth, Lymantria dispar.** In: Microbial control of spruce budworms and gypsy moths: Proceedings of the symposium; 1984 April 10-12; Windsor Locks, CT. Gen. Tech. Rep. NE-100. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 123-124.

Shigo, Alex L. **Compartmentalization of decay in trees.** Scientific American. 252(4): 96-103; 1985.

Shigo, Alex L. **Stress and death of trees.** In: Spruce-fir management and spruce budworm: Region VI Technical Conference of SAF; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 31-39.
Trees survive after injury and infection so long as they set effective boundaries to resist spread of pathogens. Boundary-setting is beneficial so long as the volume of walled-off infected wood is small and the intervals between infection are long enough to allow enough new cells to be generated in new spatial positions that can hold enough energy reserves to maintain the tree. A tree may be able to trap solar energy, but when space for energy storage has decreased, all systems of the tree begin to diminish. Many secondary agents then attack. Fighting the secondary agents will not solve the basic problem of energy depletion, or stress, that may progress to irreversible strain and death. Answers to the basic problem of poor tree health will come only when tree management decisions are made on the basis of a much better understanding of the tree. Needed now is a new attitude about trees.

Shigo, Alex L. **How tree branches are attached to trunks.** Canadian Journal of Botany. 63(8): 1391-1401; 1985.
The vascular cambium and the growth ring it produces are continuous from trunk to branch, but the cells formed by the cambium in the branch crotch are oriented 90^{o} away from the tree axis. There is no local direct conduction between trunk tissues above a branch and within a branch. This was shown by dye movement and the pattern caused by bacterial and fungal pathogens. Pruning cuts that injured the collar of trunk tissues at the branch base resulted in rapid and extensive infection into the trunk above and below the branch. Pruning cuts that did not injure the collar of trunk tissues caused little internal injury, thus indicating that the trunk tissues were not exposed. At the beginning of the growing season, the branch tissues developed basipetally and turned abruptly downward to form a collar at the branch base. Later in the growing season, the trunk tissues developed about the collar of branch tissues. The envelopment of the branch collar by the trunk collar resulted in a "ball and socket" union.

Shigo, Alex L. **Wounded forests, starving trees.** Journal of Forestry. 83(11): 668-673; 1985.
A leading researcher presents a case on tree wounding to answer the question, "Have past forest practices predisposed our forests to stress?"

Shigo, A. L.; Dudzik, K. R. **Responses of uninjured cambium to xylem injury.** Wood Science and Technology. 19(3): 195-200; 1985.

Shigo, A. L.; Shortle, W. C.; **Shigometry: A reference guide.** Agric. Handb. 646. Washington, DC: U.S. Department of Agriculture, Forest Service; 1985: 48 p.

Shortle, Walter C. **Electrical methods for evaluating growth and decay potentials of fir/spruce sites.** In: Spruce-fir management and spruce budworm; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 99-103.
Measurements of cambial electrical resistance provide a rapid, simple and quantitative means to estimate growth potentials that can help assign risks to sites producing fir and spruce wood. Measurements of internal electrical resistance help refine estimates of risk by giving an indication of decay potential that affects wood quality.

Shortle, W. C. **Pathological losses.** In: Proceedings of the 1985 Penn State Forest Resources Issues Conference; 1985 March 19-20; University Park, PA. University Park, PA: Cooperative Extension Service, The Pennsylvania State University; 1985: 117-123.

Sinclair, Steven A.; Chambers, Paul C.; Hansen, Bruce G. **Forest products investment model: investment decision making on the microcomputer.** In: Proceedings of 2nd Annual Computer Symposium of the Forest Resources Institute; 1985 April 22-24; Louisville, KY. Florence, AL: Forest Resources Institute; 1985: 188-192.

Slick, Bernard M.; Curtis, Willie R. **A guide for the use of organic materials as mulches in reclamation of coal minesoils in the Eastern United States.** Gen. Tech. Rep. NE-98. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 144 p.
Provides information, recommendations, and guidelines for the use of organic materials as mulches in reclamation of coal minesoils in the Eastern United States. Includes a brief description of the environmental impacts of coal surface mining, the problems associated with disposal of organic wastes, and a discussion of mulch in relation to erosion, soil properties, and plant growth. Organic materials that have potential use as mulches for revegetating surface-mined lands are identified and described. Selection criteria for organic materials, application methods, equipment, and requirements are explained.

Smith, Harvey R. **Wildlife and the gypsy moth.** Wildlife Society Bulletin. 13: 66-174; 1985.

Solomon, Dale S. **Growth responses of balsam fir defoliated by spruce budworm.** In: Spruce-fir management and spruce budworm; 1984 April 24-26; Burlington, VT. Gen. Tech. Rep. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 105-111.

The annual defoliation of balsam fir trees by the spruce budworm produces different patterns of defoliation in different stands, which produce different growth responses in the radial increment along the bole. As the reduced amount of current foliage remains on the tree to become the 1- and 2-year-old foliage, the volume growth in the upper portion of the bole is reduced. When the reduced foliage remains on the tree to become the foliage in the third or fourth age class, the volume increment in the lower bole is reduced. The results of three levels of protection and the resulting growth response are discussed.

Solomon, D. S. **The impact of the spruce budworm on the growth response of trees in the spruce-fir forests of the Eastern United States.** In: Recent advances in spruce budworms research: Proceedings of the CANUSA Spruce Budworms Research Symposium; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 246-247.

Discussion of quantifying impacts on forest growth and yield within the population and impact assessment workshop II.

Solomon, D. S. **Quantifying impacts on forest growth and yield (summary).** In: Recent advances in spruce budworms research; 1984 September 16-20; Bangor, ME. Ottawa, ON: Canadian Forestry Service; 1985: 254.

Sonderman, David L. **Stand density--a factor affecting stem quality of young hardwoods.** Res. Pap. NE-561. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 8 p.

A 14-year-old mixed oak stand was thinned in 1977 to stocking levels of 30, 50, and 60 percent and a control. From this stand, 117 trees were selected and their stem-related defects recorded. Six years later these same trees were reevaluated. The number of limb defects per square foot of surface area increased substantially more in the heavily thinned plots than in the unthinned plots. Trends in these data confirm commonly held beliefs that stand density affects stem quality after only a few years.

Stern, E. George; Wallin, Walter B.; Whitenack, Kenneth R. **Pallet rigidity, a major indicator of pallet durability.** Forest Products Journal. 35(11/12): 83-86; 1985.

We are testing the hypothesis that pallet rigidity can be a major indicator of damage susceptibility and physical durability, and, therefore, an indicator of the pallet's life. This is accomplished by relating the rigidity of 915 wooden pallets with 194 variables to the torsional shear resistance in the plane of the pallet decks, that is, the computed torsional load-carrying capacity of all fasteners in all pallet joints. This correlation is determined to be highly significant statistically, a finding which confirms the hypothesis advanced.

Stern, E. George; Wallin, Walter B. **Model specification for driven fasteners for assembly of pallets and related structures.** Wood Science and Technology Paper. Blacksburg, VA: Virginia Polytechnic Institute and State University; 1985: 20 p.

Stern, E. Geroge; Wallin, Walter B. **Glossary of terms in pallet field.** Blacksburg, VA: Virginia Polytechnic Institute and State University; 1985. 24 p. In cooperation with National Wooden Pallet and Container Association.

Stern, E. George; Wallin, Walter B.; Whitenack, Kenneth R. **Pallet rigidity--a major indicator of pallet durability (expanded version).** Pallet & Container Lab. Bull. 4. Blacksburg, VA: Virginia Polytechnic Institute and State University; 1985.

Stutzman, Warren L.; Crawford, Hewlette S. **Estimation of the weight of vegetation using microwave transmission measurements.** In: Carver, Keith, ed. International Geoscience and Remote Sensing Symposium; 1985 October 7-9; Amherst, MA. New York, NY: The Institute of Electrical and Electronics Engineers, Inc.; 1985.

This paper reports on a technique for inferring the weight of standing vegetation from microwave transmission measurements. The technique was developed from 13 years of laboratory investigations and controlled field studies. It is currently being used in a USDA Forest Service ecological research program. It was found that if a full set of polarization measurements is made, a high degree of correlation occurs between depolarization-compensated attenuation and the weight of vegetation and woody shoots less than 1.27 cm (1/2 inch) in diameter along the signal path. The equipment is portable and the transmit and receive units are hand held for rapid data collection. Further, the method is nondestructive, permitting remeasurement of the same plots to examine time effects.

Sullenberger, Diane; Heisler, Gordon. **Using trees to reduce urban energy consumption: transferring technology to users.** The Allegheny Society of American Foresters. 1985 Summer: 16.

Urban forests are desirable for their esthetic value and for the shade they provide in metropolitan areas. The Forest Service is investigating ways by which both the trees and their accompanying shade areas may be utilized to reduce urban energy consumption.

Tate, Robert L. **Uses of street tree inventory data.** Journal of Arboriculture. 11(7): 210-213; 1985.

Describes how to use data from properly planned street tree inventories to create an urban tree management program, to obtain programmatic increases, to help a program in which survival is threatened, to protect from budget cutbacks, to increase the efficiency of an existing program, and to provide information for public information and education.

Tilghman, Nancy G. **Managing urban woodlands for a variety of birds.** NE-INF-63-85. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Sation; 1985: 8 p.

Tower, L.; Shigo, A.; Brennan, E. **The short-term effect of simulated acidic rainfall on the formation of discolored wood in Acer rubrum.** Journal of Arboriculture. 11(7): 197-199; 1985.

Valentine, Harry T. **Tree-growth models: Derivations employing the pipe-model theory.** Journal of Theoretical Biology. 117: 579-585; 1985.

Models of the growth rates of tree basal area and height are derived using the pipe-model theory of tree form. It is assumed that a tree can be totally partitioned into pipes and that each pipe undergoes steady-state growth. The model of basal area growth rate is derived from the growth rate of the aggregate area of the cross sections of all of the pipes comprising the tree. The model of height growth rate is derived considering only those pipes extending to the apex of the crown of the tree. The likelihood of dieback in the crown of a defoliated tree is discussed in light of the resultant model.

Wade, Gary L.; Thompson, Ralph L.; Vogel, Willis G. **Success of trees and shrubs in an 18-year-old planting on mine spoil.** Res. Pap. NE-567. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 10 p.

Reports the status of 18-year-old plantings of 25 tree and 25 shrub

species on surface-mine spoil. The value of the species for wood products wildlife habitat, site stabilizers, and soil builders is discussed.

Walk, Marie-Francoise; DeWalle, David R.; Heisler, Gordon M. **Can windbreaks reduce energy use in a mobile home park?** Journal of Arboriculture. 11(6): 190-195; 1985.

Effects of a coniferous windbreak on electrical energy use in a 66-unit mobile home park in central Pennsylvania were studied during the winters of 1981-82 and 1982-83. A 100-m long, single-row windbreak of white spruce trees with an average height of 6 m was artifically erected on the upwind edge of the park in 1981-92. During the winter of 1982-83, no windbreak was present. Wind speeds in the mobile home park were reduced by the windbreak by 9 percent at 3H (H=windbreak height) downwind from the windbreak, by 8 percent at 13H downwind, and 0 percent at 30H downwind. Using equations relating electrical energy use to climatic variables, we found that the energy use of 13 homes was similar between the two winters, 8 homes displayed a significantly lower energy use with the windbreak in place, and 20 homes showed a higher energy use with the windbreak in place. Differences in energy use between winters were not attributable to the windbreak; rather, they were due to changes in behavior of the occupants. If the windbreak had reduced wind speed by 50 percent rather than 0.9 percent and other factors were constant, total winter electrical energy use would have been reduced by an estimated 6.6 percent.

Walters, Russell S. **Black cherry provenances for planting in northeastern Pennsylvania.** Res. Pap. NE-552. Broomall, PA: U.S. Department of Agriculture, Forest Service. Northeastern Forest Experiment Station: 1985. 6 p.

Wargo, Philip M. **Interaction of stress and secondary organisms in decline of forest trees.** In: Proceedings, Air Pollutants Effects on Forest Ecosystems Conference; 1985 May 8-9; St. Paul, MN. St. Paul, MN: Acid Rain Foundation. 1985: 75-86.

Dieback and decline diseases are progressive and initiated when trees are altered by stress and are culminated when trees are attacked sometimes lethally by secondary organisms. Severe or prolonged stress alone can kill trees, but stressed trees usually succumb to invasions by pathogenic organisms. These organisms are secondary in time (not in importance) because changes in host condition are required for their successful attack. These organisms are usually part of the natural biota that already occur on or around the trees. Trees are highly resistant or immune to these opportunistic organisms until stress induces alterations in physical, physiological, or chemical features that enable them to succeed. Specific relationships of secondary organisms and effects of stress from insect defoliation, drought, and feeding by sucking insects are described. Red spruce decline is evaluated in terms of stress and secondary organism attack.

Wargo, Philip M.; Shaw, Charles G. III. **Armillaria root rot: the puzzle is being solved.** Plant Disease. 69(10): 826-832; 1985.

The gamut of pathogenic relationships of Armillaria occurs throughout the United States. There is a major contrast, however, between eastern deciduous forests, where Armillaria is predominantly a secondary pathogen on stressed trees, and western coniferous forests, where the fungus is often an aggressive primary pathogen. In this paper, we explain these relationships with recent developments in fungal taxonomy, genetics, and physiology. We also summarize disease expression, damage, and control strategies in coniferous forests of the Western United States and deciduous forests of the Eastern United States; and we indicate current needs and directions in disease research and management.

Wendel, G. W. **Performance of white ash progenies after 7 years in a West Virginia outplanting.** In: Proceedings, 29th Northeastern Forest

Tree Improvement Conference; 1984 July 18-20; Morgantown, WV. [Place of publication unknown]: Northeastern Forest Tree Improvement Conference; 1985: 90-97.

White ash seedlings from 45 sources representing 29 counties in 15 states were outplanted in West Virginia in April 1976. At the end of 7 years, overall survival is 61 percent. Average survival of the Arkansas, Louisiana, Mississippi, and Alabama families was 27 percent compared to 75 percent for the families north of southern Tennessee. Average total height was 4.7 feet for the 33 families used in the analysis; average 7-year height growth was 3.8 feet. Average stem diameter was 0.7 inch and 7-year average stem diameter growth was 0.5 inch. The best performance was recorded for Barbour County, WV, families. All of the best performers, however, were from latitudes between 38° and 40° N. Families from latitudes south of Tennessee are not recommended for planting in West Virginia.

Wendel, G. W.; Dorn, Donald E. **Survival and growth of black walnut families after 7 years in West Virginia.** Res. Pap. NE-569. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 6 p.

Average survival, 7-year stem diameter, and stem diameter growth differed significantly among 34 black walnut families planted in West Virginia. Average total height, height growth, and diameter at breast height were not significantly different among families. Families were from seed collected in West Virginia, Pennsylvania, North Carolina, and Tennessee. The 7-year results indicated that although survival was significantly different among families, differences in height growth were not well enough defined to recommend sources for planting.

Werner, Robert G.; Leonard, Raymond E.; Crevelling, James O. **Impact of backcountry recreationists on the water quality of an adirondack lake.** Res. Note NE-326. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 4 p.

This study reports the effects of recreational use on the water quality of an Adirondack lake. Phosphates, nitrates, conductivity, fecal coliform, transparency, and temperature were regularly measured over a period of 2 years and related to the recreational use that the lake received during that time. An adjacent lake, which was not visited by recreationists, served as a control. There was no apparent relationship between water quality and fluctuations in use at any of the sampling sites. There was also no significant variation in water quality between sites even though the use between the sites varied. Differences in water quality between the lake receiving recreational use and the control lake were negligible.

Wharton, Eric H.; Frieswyk, Thomas S.; Malley, Anne M. **Aboveground tree biomass statistics for Maine: 1982.** Resour. Bull. NE-86. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 116 p.

A statistical report based on the third forest survey of Maine conducted in 1980-82. Results of the survey are displayed in 87 tables containing estimates of timberland area, timber volume, numbers of trees, and aboveground tree biomass. These estimates were developed by several classifications including forest type, species, and size. The data are presented at two levels: state and county.

Widmann, Richard H. **Pulpwood production in the Northeast--1983.** Resour. Bull. NE-84. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985: 18 p.

This annual report contains information compiled from a canvass of all pulpmills that use pulpwood produced in the 14 Northeastern states. In 1983 total production reached 8,673,800 cords. This was up 3 percent (221,600 cords) from 1982. The roundwood portion

increased by less than 1 percent to 6,330,000 cords, whereas the residue portion increased by 10 percent to 2,343,800 cord equivalents. The receipts of pulpwood at the 42 mills in the region set a new high of 7,253,700 cords consumed.

Widmann, Richard H.; Wharton, Eric H. **The outlook for wood and wood-based construction materials in the Northeast--a resource point of view.** In: Proceedings, recent developments affecting the use of wood and wood-based building materials in design and construction; 1984 May 10-11; Danbury, Ct. Madison, WI: Forest Products Research Society, Northeast Section; 1985: 1-14.

Wilkinson, Ronald C. **Comparative white-pine weevil attack susceptibility and cortical monoterpene composition of western and eastern white pines.** Forest Science. 31(1): 49-42; 1985.
Cortical monoterpene composition of western white pine and eastern white pine was examined to interpret differential susceptibilities to white-pine weevil attack. Concentrations of seven of the eight monoterpenes detected differed significantly between samples of the two species growing in the same plantation. Higher concentrations of b-pinene and lower concentrations of camphene found in western white pine were the only difference between the two species that were consistent with differences reported by others. Concentrations of a-pinene and limonene in the more resistant species, western white pine, were similar to those previously found in the most susceptible eastern white pine individuals. Probably none of the individual cortical monoterpenes studied is the primary factor responsible for the differences in weevil attack susceptibility of the two species.

Wilkinson, Ronald C. **Year-to-year variation in sap-sugar concentration of sugar maple progenies and its potential effects on genetic selection for high sap sugar.** In: Proceedings, 29th Northeastern Forest Tree Improvement Conference; 1984 July 18-20; Morgantown, WV. [Place of publication unknown]: Northeastern Forest Tree Improvement Conference; 1985: 120-133.
Sugar concentration of sap from almost 400 sugar maples in each of two one-parent progeny test plantations was measured once in each of either 8 or 9 years between 1973 and 1983. Differences in sugar concentration among years were highly significant and accounted for the highest proportion of total variation in both plantations. Highly significant family x year interactions were also found. Only 1 family of 25 in each plantation was ranked among the 5 families highest in sap sugar in every year. The maximum change in yearly rank of several families occurred between consecutive years. Only one tree in each plantation was among the highest 10 percent of all trees in sap sugar in every year, and less than 10 percent of all trees were consistently above the plantation mean. A large proportion of the families or trees with the highest sap-sugar concentrations in 1983 would not be included among selections that would have been made if trees had been selected for high sugar content in any of the previous years. Measuring sap-sugar concentration several times within the sap-flow season may be a better method for characterizing progenies than single-day measurements made over a period of several years.

Williams, R. D.; Rink, G.; Funk, D. T. **Planting site and genotype affect black walnut seedling development more than nursery environment.** Canadian Journal of Forest Research. 15: 14-17.
A black walnut provenance--progeny test was established on four widely separate sites, with seedlings grown at two nurseries to contrast the effects of site, seedling size, and genotype. Five years after establishment, site and genotype effects continued to be large while the nursery effect, although statistically significant, was diminishing in importance. Therefore, seedling size resulting from cultural nursery manipulation is not as important

as proper geographic seed origin or site selection.

Williams, Robert D.; Rink, George; Funk, David T. **Planting site and genotype affect black walnut seedling development more than nursery environment.** Canadian Journal of Forest Research. 15: 14-17; 1985.

Withrow, Bob; Hewett, Chuck; Jennings, Dan; Saviello, Tom. **Forest biology research.** In: Forest Resources Research Advisory Committee, 1984 Annual Report. Misc. Rep. 306. Orono, ME: Maine Agricultural Experiment Station, University of Maine; 1985: 39 p.

Publications—1986

Adams, Edward L. **Ignoring short-duration downtimes can be costly.** National Hardwood Magazine. 1986 June: 2 p.

To determine the effect of short-duration downtimes--3 minutes or less--in dollars, data were analyzed for three different sawmills: a bandsaw headrig, a circular saw headrig, and a circular saw headrig with vertical edger.

Adams, Edward L. **SOLVE II on the PC - an analytical tool for the sawmill manager.** In: Wiant, Harry V., Jr.; Yandle, David O.; Kidd, William E., eds. Proceedings of forestry microcomputer software symposium; 1986 June 29-July 2; Morgantown, WV. Morgantown WV: West Virginia University; 1986: 355-366.

SOLVE II is a computerized system for analyzing hardwood sawmills based on their individual product yield, processing cost, processing time, and product price information. Although forest products utilization specialists in the Northeastern and North Central States have used the system to assist hundreds of managers in analyzing their mills, none of managers have used the system themselves because it requires access to a fairly large computer. To eliminate this problem, the system has been modified to run on IBM compatible microcomputers. This new version, called PC-SOLVE II, provides the same output information as the original system. With very little assistance from the forest products utilization specialists, hardwood sawmill managers can now make their own SOLVE II analysis.

Araman, Philip A. **Pacific rim demands for U.S. hardwoods.** In: Mathews, Edward E., ed. Proceedings 1986 southern forest economics workshop; 1986 April 16-18; New Orleans, LA. Raleigh, NC: Southern Forest Economics Workers; 1986: 45-51.

Araman, Philip A. **Implications of international trade for northern hardwoods.** In: Proceedings of a conference of the northern hardwood resource: management and potential; 1986 August 18-20; Houghton, MI. Houghton, MI: Michigan Technological University; 1986: 391-412.

Because of price competitiveness in the world marketplace, short-term demand for U.S. hardwood products (including northern hardwoods) on the export market probably will remain near current high levels and could increase because of promotional efforts and more favorable economic conditions. From a northern hardwood resource standpoint, there are tremendous inventories of hardwoods but also two problems. There is a limited amount of high-quality export material, and the demand is concentrated on just a few of our many hardwood species. This paper focuses on these problems and presents information on major U.S. hardwood export products and their markets. Select export species resources in Michigan, Minnesota, and Wisconsin also are discussed.

Araman, Philip A. **Hardwood exports: a thriving Pacific rim market.** Wood & Wood Products. 1986 June: 4 p.

Twenty-three percent of the U.S. hardwood log, lumber, and veneer exports in 1984 was shipped to the Pacific Rim market, primarily to Japan and Taiwan. The Taiwanese are purchasing mainly red and white oak to process into finished parts and furniture for the export market. Their largest furniture export market is the United States. According to Taiwanese statistics, 63 percent of its wood furniture exports from 1980-84 was shipped to the United States. The Japanese are buying mostly our "other" species such as red alder, black cherry, yellow-poplar, and cottonwood. Two-thirds of these purchases are dressed or planed, kiln-dried lumber. In contrast with Taiwan, the U.S. hardwoods going to Japan are used as substitutes for Japanese hardwoods in the production of furniture for domestic sales.

Auchmoody, L. R. Fertilizing Appalachian hardwoods. In: Smith, H. Clay; Eye, Maxine C., eds. Guidelines for managing immature Appalachian hardwood stands: Workshop proceedings; 1986 May 28-30; Morgantown, WV. SAF Publ. 86-02. Morgantown, WV: West Virginia University Books; 1986.

The use of fertilizers to improve hardwood growth rates has been of interest for more than 50 years. Responses to nitrogen suggest that many, if not most, forest sites in the central Appalachians are nitrogen deficient to some degree. Nitrogen responses may last for 5 years or more. Phosphorus deficiencies may also become important in some areas after nitrogen requirements have been satisfied. Neither research studies nor general experience is adequate to recommend fertilizer use in the region, except for young black cherry in northwestern Pennsylvania.

Baumgras, John E.; LeDoux, Chris B. **Costs of harvesting forest biomass on steep slopes with a small cable yarder: results from field trials and simulation.** In: Smith, Wayne H., ed., Proceedings of the third southern biomass energy research conference; 1985 March 12-14, Gainesville, FL. New York: Plenum Publishing Corporation; 1986: 133-142.

Baumgras, John E.; Yandle, David O. **APTHIN: A microcomputer program to evaluate multiproduct utilization alternatives for thinnings in Appalachian hardwood stands.** In: Forestry microcomputer software symposium; 1986 June 29-July 2; Morgantown, WV. Morgantown, WV: West Virginia University; 1986: 402-421.

The APTHIN program can be used to evaluate multiproduct harvesting opportunities that can increase both the volume and the value of wood harvested from thinnings. The program user supplies the basal areas to be removed from specified tree diameter classes, the local market values of primary products, and product units of measure. The program calculates harvest revenues for utilization alternatives that range from whole-tree chipping with four

roundwood product sorts to single-product roundwood or fiber harvest. Maximum amounts of wood are allocated to the higher value products, based upon the expected product yields and available markets. Program outputs include expected product yield, total yield, product mix to maximize gross revenue, and gross revenue per acre of thinning.

Becker, Charles W.; Woods, Frank W.; Curtis, Willie. **Water quality of mined and unmined watersheds in East Tennessee.** Journal of the Tennessee Academy of Science. 61(4): 98-104; 1986.

In late 1980 and early 1981, monitoring stations were installed in three small watersheds in the Cumberland Mountains and three in the Cumberland Plateau of east Tennessee to evaluate the effects of surface mining on water quality. Each set had a recently mined, old mined, and unmined watershed. Stream flow and concentration levels for 12 water quality parameters collected every four weeks from 1981 through 1984 were evaluated. Geology, soils and land cover were also taken into account.

Beckjord, Peter R.; Melhuish, John H., Jr.; Hacskaylo, Edward. **Ectomycorrhiza formation on sawtooth oak by inoculation with basidiospore chips of Pisolithus tinctorius and Scleroderma citrinum.** Journal of Environmental Horticulture. 4(4): 127-129; 1986.

Basidiospores of the ectomycorrhiza-forming fungi Pisolithus tinctorius and Scleroderma citrinum incorporated into an organic hydrocolloid and stored up to 5 years can be used successfully in inoculations. Container-grown sawtooth oak seedlings were inoculated with basidiospores that were incorporated and stored in chips of compressed sand and peat moss. Basidiospore chips were manufactured each year after several collections of sporocarps from two locations and stored up to 5 years. This study showed that sufficient basidiospores remained viable in chip form for ectomycorrhiza formation of sawtooth oaks.

Biller, Cleveland J.; Baumgras, John E. **Failure loads on small-diameter hardwood stumps.** In: Proceedings of 1986 winter meeting American Society of Agricultural Engineers; 1986 December 16-19; Chicago, IL. Chicago, IL: American Society of Agricultural Engineers; 1986. 14 p.

Equations for small-diameter hardwood trees were developed to give insight as to the variables that affect the holding capacity of Appalachian hardwood stumps. Tree diameter, stump diameter, and growth rates were significant variables in estimating maximum stump-holding capacity.

Biller, Cleveland J.; Baumgras, John E. **Analysis of rubber-tired skidder cycle times on steep-slope hardwood sites.** In: Proceedings of 1986 winter meeting of American Society of Agricultural Engineers; 1986 December 16-19; Chicago, IL. Chicago, IL: American Soceity of Agricultural Engineers; 1986. 17 p.

Regression equations are presented to estimate cycle time for a 69 kW (92 hp) rubber-tired skidder operating on a steep-slope hardwood site. The machine studied operated on bulldozed skidroads, winching trees as far as 45.7 m (150 ft) to the skidroad. Applications of these equations demonstrate the effect of skid distance and tree volume on skidding cost. Potential gains in skidding production resulting from prebunching are analyzed, and methods of determining the economic feasibility of prebunching and skidding are presented.

Birch, Thomas W. **The forest land owners of Maine, 1982.** Resour. Bull. NE-90. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 83 p.

A statistical analytical report on a mail canvass of private timberland owners in Maine. The study was conducted in conjunction with the third forest survey of Maine by the USDA Forest Service. It discusses landowner characteristics, attitudes, and intentions of owners regarding reasons for owning, recreational use, timber management, and harvesting.

Birch, Thomas W.; Pywell, Nancy A. **Communicating with nonindustrial private forest-land owners: Getting programs on target.** Res. Pap. NE-593. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 11 p.

Nonindustrial private forest-land owners can be motivated by programs directed to their needs and objectives. Seven target audiences in Pennsylvania were defined and outlets for information programs identified for each target audience. The primary objectives of each group and the benefits they expect from owning forest land were considered in the preparation of each group's program. This system is now being used by The Pennsylvania State University in its forest extension program.

Birch, Thomas W. **The private forest landowner--measuring change.** In: Program and abstracts. Midwest forest economists, Midwest forest mensurationists; 1986 August 13-14; Urbana, IL. Urbana IL: University of Illinois; 1986:

The Forest Inventory and Analysis Project is measuring change in the ownership pattern and attitudes of the forest-land owners in the 14 northeastern states. Such important variables used in describing the ownership situation as size of ownership; harvesting experience; intention to harvest; tenure of ownership; and owner's occupation, age, education, income, and reason for owning forest land are discussed. The energy crisis of the early 70's sparked renewed interest in wood as fuel and changed many owner's attitudes about timber harvesting. The use of trend information by policy-makers to evaluate programs and to estimate timber availability is also discussed.

Birch, Thomas W. **Forest inventory and analysis in the North: with emphasis on the hardwood resource.** In: Applications of forest inventory and analysis research to hardwood resource issues; 1985 October 29-30; Arlington, VA. Washington, DC: National Forest Products Association; 1986: 41-54.

Forest inventories have depicted an expanding hardwood resource. Hardwood growing-stock volume has shown increases in all diameter classes. This trend in hardwood volume masks significant differences in inventory trends by species, quality, and harvest levels between hardwood producing regions in the North. Special studies that describe opportunities for increased hardwood management are highlighted. Changes in owner attitudes toward harvesting timber are also described.

Bjorkbom, John C.; Walters, Russell S. **Allegheny hardwood regeneration response to even-age harvesting methods.** Res. Pap. NE-581. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 13 p.

Allegheny hardwood regeneration response to block clearcutting, alternate strip clearcutting, and two-cut shelterwood, and in an uncut control was compared. Stand regeneration success was evaluated 5 years after harvest. Clearcutting resulted in high mortality of advance regeneration. Thus, regeneration by block clearcutting was not successful, though both alternate strip clearcutting harvests were successful. The first cut of the shelterwood established new seedlings but did not stimulate growth. Regeneration level increased from inadequate to adequate and remained so after the final harvest. New seedlings appeared in the control after each seed crop, but few survived. Fenced seedlings grew taller in all harvest areas.

Brisbin, Robert L. **Quality hardwoods - what a forester needs to know.** In: Proceedings of the 1985 Pennsylvania State University Forestry Resources Issues Conference; 1985 March 19-20; University Park, PA. University Park, PA: The Pennsylvania State University; 1986: 35-44.

Brock, Samuel M; Jones, Kenneth D.; Miller, Gary W. **Felling and skidding costs associated with thinning a commercial appalachian hardwood stand in Northern West Virginia.** Northern

Journal of Applied Forestry. 3: 159-163; 1986.

Detailed cost information on thinning operations is needed to develop economic guidelines for managing immature central Appalachian hardwood stands. Three thinning treatments were applied in a 50-year-old mixed-oak, cove hardwood stand in northern West Virginia. A commercial logging contractor using chain saws and a rubber-tired skidder conducted the logging operations. Time-study data were used to compute production rates for felling marked trees and skidding tree-length logs to roadside landings for each thinning treatment. Production rates ranged from 2.7 to 3.0 cunits per hour depending on the residual stocking treatment. The cost of merchantable material at roadside ranged from $10.79 to $11.99 per cunit. Regression equations for predicting felling and skidding times were developed for each treatment. Data from these equations can be used in estimating production rates and costs for similar thinning operations. A nomogram is provided for estimating felling and skidding costs for a 60 percent residual stocking treatment, the current recommended silvicultural prescription for stands similar to the study area.

Brooks, Robert T. **Forest land wildlife habitat resources of south-central Ohio.** Resour. Bull. NE-94. Broomall, PA: U.S. Department of Agriculture, Forest Service; Northeastern Forest Experiment Station; 1986. 32 p.

A report on the first survey of south-central Ohio's forest land wildlife habitat resource. Results are estimates derived from the sample-based 1978 forest inventory of the 10-county region. Nineteen tables describing forest area, forest ownership, and snag, mast, and browse resources are included and discussed.

Brooks, Robert T.; Birch, Thomas W. **Opportunities and constraints for wildlife habitat management on private forests of the northeast.** Northern Journal of Applied Forestry. 3(3): 109-113; 1986.

The Northeastern Forest Inventory and Analysis unit has completed one full cycle of forest-land ownership surveys. The results of 14 state surveys show the majority of forest land of the region to be controlled by a large, diverse population of nonindustrial private landowners. These people are from varied background and exhibit a wide range of interests and attitudes toward wildlife, wildlife habitat, and forest management. The demographic and additional characteristics of forest landowners, together with the structural characteristics of their forest land, create opportunities for, and constraints upon, forest management favorable for wildlife habitat improvement.

Brooks, Robert T.; Frieswyk, Thomas S.; Ritter, Arthur. **Forest wildlife habitat statistics for Maine--1982.** Resour. Bull. NE-96. Broomall, PA: Department of Agriculture, Forest Service; 1986. 146 p.

A statistical report on the first forest wildlife habitat survey of Maine (1982). Findings are displayed in 85 tables covering forest area, landscape patterns, mast potential, standing dead and cavity trees, and understory woody-stemmed vegetation. Data are presented at county and/or unit and state levels of resolution.

Burns, Denver P. **Opening remarks.** In: Environmental influences on tree and stand increment. Proceedings of an international conference; 1985 September 23-27; Durham, NH. Misc. Publ. 691. Orono, ME: University of Maine; 1986: 1-2.

Burns, Denver P., comp. **Proceedings, IUFRO: Evaluation and planning of forestry research.** International Union of Forestry Research Organizations (S6.06-S6.06.01); 1985 July 25-26; Fort Collins, CO. Gen. Tech. Rep. NE-111. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 156 p.

Contains 23 papers presented in six technical sessions on forestry research management planning and evaluation.

Primary topics focus on nontraditional views and sources of information and emerging technologies affecting forestry research; methods for identifying research needs and strategies required for implementation; and research evaluation at the individual, program, and organizational levels.

Cannon, William N., Jr.; Barger, Jack H.; Kostichka, Charles J. **Time and materials needed to survey, inject systematic (sic) fungicides, and install root-graft barriers for Dutch elm disease management.** Res. Pap. NE-585. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 6 p.

Dutch elm disease control practice in 15 communities showed a wide range of time and material required to apply control methods. The median time used for each method was: sanitation survey, 9.8 hours per square mile; symptom survey, 96 hours per thousand elms; systemic fungicide injection, 1.4 hours per elm; and root-graft barrier installation, 2.2 hours per barrier (5.6 min/ft). The median amount of Arbotect 20-S used for disease therapy was 13 ounces per elm. The median amount of Vapam used for soil fumigation for root-graft control was 3 ounces per foot.

Chambers, Paul C.; Sinclair, Steven A.; Hassler, Curt C.; Hansen, Bruce G. **Forest products investment model: a microcomputer tool for incorporating risk into capital budgeting.** Forest Products Journal. 36(1): 64-68; 1986.

Chang, Ming Tu. **Biotechnology for the Forest Service--a new frontier.** In: Proceedings of the 1985 national gypsy moth review; 1985 November 18-21; Columbus, OH. Columbus, OH: Ohio Department of Natural Resources: 1986: 180.

Corbett, Edward S.; Lynch, James A. **#51. Frequency and magnitude of episodic stream pH depressions in a forested watershed.** Abstracts; 42nd Annual Northeast Fish & Wildlife Conference; 1986 April 27-30; Hershey, PA. [Place of publication unknown]: Northeast Association of Fish and Wildlife Resource Agencies; 1986: 119-120.

Acidification of surface water has serious consequences for the aquatic biota inhabiting these ecosystems. Although the effects of long-term acidification on the chemistry and biota of lakes has received much attention, the impact of short-term depressions of pH in streams is less well known. Of particular significance are episodic events, which cause rapid changes in water chemistry. When these events coincide with vulnerable life stages of aquatic organisms, they can be particularly devastating.

Crang, Richard E.; McQuattie, Carolyn J. **Qualitative and quantitative effect of acid misting and two air pollutants on foliar structures of Liriodendron tulipifera.** Canadian Journal of Botany. 64: 1237-1243; 1986.

Crawford, H. S.; Jennings, D. T. **The role of bird predation in spruce budworm control.** In: 1986 Eastern spruce budworm research work conference proceedings; 1986 January 7-8; Orono, ME. Orono, ME: University of Maine; 1986. Abstract.

Crawford, H. S.; Jennings, D. T. **Effects of birds on spruce budworm populations--a progress report.** In: Is good forestry good wildlife management?; 1985 January 6-8; Portland, ME. Misc. Publ. No. 689. Orono, ME: University of Maine; 1986: 164-167.

Crawford, Hewlette; Frank, Robert M. **Is good forestry good wildlife management?--some examples.** In: Is good forestry good wildlife management?; 1985 January 6-8; Portland, ME. Misc. Publ. No. 689. Orono, ME: University of Maine; 1986: 17-22.

Curtis, Willie R.; Dyer, Kenneth L.; Williams, George P., Jr. **A manual for training reclamation inspectors in the fundamentals of hydrology.** Ankeny, IA: Soil Conservation Society of

America; 1986. 56 p. [Prepared for the Office of Surface Mining and Enforcement by the U.S. Department of Agriculture, Forest Service.]
This handbook is intended to be a desk reference to help nonhydrologists achieve a basic understanding of hydrology as it relates to surface mining and reclamation. Surface coal mining and reclamation inspectors and other staff will find it useful in implementing regulatory programs. The handbook is not meant to be a comprehensive treatment of the subject. The handbook can be used in the training of surface mining and reclamation inspectors, both Federal and State, and as a basic reference for inspectors in carrying out their assigned duties. The handbook describes clues and indicators of potential problems, suggests ways to prevent or mitigate them, and discusses various observation and sampling techniques.

Czapowskyj, Miroslaw M.; Rourke, Robert V.; Grant, Walter J. **Growth and nutrient status of black spruce seedlings as affected by water table depth.** Res. Pap. NE-591. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 9 p.
A greenhouse experiment was conducted to study the effects of soil water level on growth, biomass accretion, and inorganic element uptake by black spruce. One-year-old containerized seedlings were grown for 3 years at three water table depths. All trees survived for the duration of the study confirming that black spruce has a certain degree of survival tolerance to high water tables. However, tree height, diameter growth, and biomass production significantly increased as the depth to water table increased. The foliar levels of N, P, K, Mg, Fe, Zn, and B increased and those of Cu and Mn decreased with the increasing depth to the water table. For ash and Ca, differences were significant but did not follow a consistent trend. In shoots, the level of N, Ca, and Mg increased and those of ash, K, Fe, Cu, B, Al, and Mn decreased with the increasing depth to the water table. The level of P was not affected by the water table. In roots, the level of N and Ca increased and the level of ash, Mn, Fe, Al, and Cu decreased with increasing depth to the water table. The level of P, Mg, and Zn was significantly different but did not follow any trend. Foliar concentration of ash, Ca, Na, Mn, Fe, Zn, Cu, Al, and B increased and concentration of N, P, K, and Mg decreased with the increasing foliage age. In shoots, ash Ca, Al, Fe, and Zn increased and N, P, K, Mg, and B decreased with the increasing tree and shoot age. In roots, Fe, Mn, Na, and Al increased and N, P, and Cu decreased with the increasing tree age.

Dale, Martin E.; Hilt, Donald E. **Thinning pole and small sawtimber mixed oak stands.** In: Smith, H. Clay; Eye, Maxine C., eds. Guidelines for managing immature Appalachian hardwood stands: Workshop proceedings; 1986 May 28-30; Morgantown, WV. SAF Publ. 86-02. Morgantown, WV: West Virginia University Books; 1986: 99-117.

The growth and yield of pole and small sawtimber mixed oak stands can be altered substantially by thinning. OAKSIM, an individual-tree growth and yield simulator, was used to study the timing, intensity, and frequency of intermediate thinnings in even-aged upland oak stands. Various thinning regimes were tested by projecting normal 30-year-old upland oak stands growing on sites 60 and 80 to rotation ages 80 and 120. Results indicate that one commercial C-level (40 percent residual stocking) thinning at age 40 provides a substantial increase in board-foot volumes and stand values for site index 60 stands at age 80. A second B-level (60 percent residual stocking) thinning can be applied to increase stand values. However, results indicate that a rotation age of 80 years is too short for site index 60 stands, regardless of the thinning regime. A rotation age of 120 years, with thinning, is much more realistic. A C-level thinning can be initiated at age 30 for site index 80 stands. A second B-level thinning and perhaps a third light thinning can be applied. These thinnings will produce a very reasonable 60 to 80 sawtimber trees

at rotation age 80. Extension of the rotation age to 120 years greatly increases the number of grade one trees larger than 16 inches in d.b.h.

Dale, Martin E.; Lutz, David E. **A field guide to quantity and value growth of upland oak.** Gen. Tech. Rep. NE-14. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 32 p.
Information is presented on the average yield and expected growth response of upland oak stands in Pennsylvania. Forest survey data were used to classify oak stands into 20 broad size-stocking classes. For each class, tables provide the expected quantity and value of wood before and after thinning treatments. Future stand development is given in terms of volume and value 10 years later with or without thinning treatments. Rate of value increase over the 10-year period is shown for each size-stocking class with or without a thinning treatment.

Dann, M. S.; Lynch, J. A.; Corbett, E. S. **Comparison of methods for estimating sulfate export from a forested watershed.** Journal of Environmental Quality. 15(2): 140-145; 1986.
Seven methods of estimating sulfate export from a forested watershed in central Pennsylvania were compared. One method involved simple linear regression of discharge and concentration data, two methods were based on regression models in which the concentration data were stratified by flow frequency or duration, two methods weighted the mean concentration by discharge, one method used a simple unweighted mean concentration, and one weighted export according to the length of the sampling period interval. The regression models produced the highest export estimates but were considered statistically invalid because the data set did not adhere to the statistical requirements of independence, normality, and linearity. Weighted and unweighted mean concentration methods gave the lowest estimates of export because they gave less emphasis to high flows during which the majority of sulfate was exported from the watershed. The period-weighted method gave intermediate to high export estimates because it took into consideration the large export of sulfate during high flows. This method appeared to offer the best estimate of sulfate export from the watershed studied within the conditions and limitations of the data set. Although limited to sulfate export from a forested watershed, these results would appear to be applicable to any ion, particularly if the solute concentration of the ion is flow related.

Davidson, Walter H. **A renewed interest in white pine.** Green Lands. 16(2): 32-33; 1986.
There is renewed interest in managing eastern white pine for timber production. Demand for high-grade white pine exceeds supply throughout the Northeast and Appalachian Regions. New markets are developing for smaller size and lower grade logs. White pine survives and grows well over a wide range of site and climatic conditions. Land managers should consider white pine as a species for reclamation and for planting on abandoned mined lands.

Davidson, Walter H. **Eastern white pine for surface mine reclamation.** In: Funk, David T., compiler. Eastern white pine: Today and tomorrow: Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture, Forest Service; 1986: 121. Poster Session.
Eastern white pine has several characteristics that make it a desirable species for surface mine reclamation. It is native to the Appalachian and Northern Interior Coal Fields. Past experience has shown it is well adapted to a wide variety of soil types and climatic conditions. It is more shade tolerant than many of the other species being used for reclamation. Thus it has a better chance of surviving when planted in mixtures with herbaceous species.

Davidson, Walter H. **Selecting hybrids and superior trees for reclamation planting.** In: 1986 National Meeting American Society for Surface Mining and Reclamation "New Horizons in Mined Land Reclamation"; 1986 March 17-20; Jackson, MS. Princeton, WV: American Society for Surface Mining and Reclamation; 1986: 165-168.

Tree species used in reclamation plantings should have the highest potential for survival and development on any given mine site. Selection criteria should include the ability to become established under adverse site conditions, rapid early growth, future market value, and freedom from insects and diseases. Results from field trials have identified several high potential hybrids and species for reclamation plantings. These include hybrid poplar, pitch x loblolly hybrid pine, Virginia pine, Austrian pine, European black alder, and black locust. Recommended hybrid clones and seed sources are listed.

DeGraaf, Richard M.; Wentworth, James M. **Avian guild structure and habitat associations in suburban bird communities.** Urban Ecology. 9: 399-412; 1986.

Breeding bird communities were compared in three suburbs: a 70-year-old area of large houses along streets shaded by mature trees (MT), primarily oaks and elms; a 15-year-old area built upon open agricultural land with young maple street trees (YT); and a 15-year-old area on which houses were built in small clearings within a second-growth oak-pine woodland (OP). Bird censuses each year for 5 years revealed that YT supported the lowest total avian density of the three suburbs; OP supported the greatest variety and total density of insectivores, and the lowest number of ground-gleaning omnivores; and MT supported the highest total avian density, comprised primarily of ground-foraging seed eaters and omnivores. Among nesting guilds, OP contained the fewest ground/herb nesters, and MT the most. Also, OP had the fewest shrub nesters, and MT the most. Tree cavity and twig nesters were significantly more numerous in OP, and tree branch nesters fewer in YT than in either OP/MT. Analyses of habitat structure revealed that shrub maturity is more important than numbers of shrubs, and that planted trees, no matter how mature or abundant, do not replace natural forest stands as habitat for most insectivorous species.

DeGraaf, Richard M. **Book review: Gullion, Gordon. Grouse of the North Shore.** Oshkosh, WI: Willow Creek Press; 1984. Journal of Wildlife Management. 40(1): 173-174; 1986.

Written for informed lay readers, this is not the summation of Gullion's quarter-century of research on the bird; the book seems best described as a "gift" book for grouse hunters, naturalists, and biologists.

DeGraaf, Richard M.; Rudis, Deborah D. **New England wildlife: habitat, natural history, and distribution.** Gen. Tech. Rep. NE-108. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 491 p.

Describes natural history profiles of New England wildlife species and their associations with forested and nonforested habitats. Provides a data base that will enable forest managers or wildlife biologists to describe the species or groups to be found in a given habitat.

DeWalle, David R.; Heisler, Gordon M. **Use of windbreaks for home energy conservation.** In: Hintz, David L.; Brandle, James R., eds. Proceedings of international symposium on windbreak technology; 1986 June 23-27, Lincoln, NE. Publ. No. 117. Lincoln, NE: Great Plains Agricultural Council, 1986. 269 p.

Windbreaks are effective in reducing energy needs for home heating by reducing air exchange rates in homes. Air exchange in homes is caused by pressure differences due either to temperature differences between inside and outside air on wind forces on the exterior surfaces of the home. Windbreaks are only effective in reducing air exchange caused by wind forces. Thus, windbreaks are more effective in saving energy in windy

climates. Available data indicate that annual energy savings for home heating with windbreaks is about 10 to 15 percent in the northeastern United States and 15 to 25 percent in the northcentral United States. Economic analyses indicate that windbreaks are cost effective with the value of heating energy savings exceeding costs for windbreak establishment and maintenance over a 20-year windbreak life.

Dorio, John C.; Marquis, David A. **White-tailed deer management in the Allegheny National Forest.** In: Proceedings integrated pest management symposium for northern forests; 1986 March 24-27; Madison, WI. [Location of publisher unknown]: [Publisher unknown]; 1986: 303- 313.

The deer population of the Allegheny National Forest has expanded beyond the carrying capacity of the habitat. The resulting paucity of tree seedlings has made it difficult to regenerate most stands. Silvicultural techniques have been employed to regenerate stands in spite of the large deer herd. The efforts by the Allegheny National Forest and the Pennsylvania Game Commission to reduce the deer population should eventually result in sustained high yields of high-quality hardwoods and improved habitat for deer and other wildlife species.

Dubois, Normand R. **Synergism between b-Exotoxin and Bacillus thuringiensis subspecies kurstaki (HD-1) in gypsy moth, Lymantria dispar, larvae.** Journal of Invertebrate Pathology. 48: 146-151; 1986.

Synergism was demonstrated in larvae of the gypsy moth fed an artificial diet containing mixtures of HD-IS-1980 (a standardized spore and crystal preparation of the HD-1 strain of Bacillus thuringiensis) and b-exotoxin. After 5 days of exposure, the LC50 of the B. thuringiensis mixed with 0.01 and 0.02 percent b-extoxin was significantly lower than that of B. thuringiensis alone. A significant increase in larval susceptibility to B. thuringiensis was also noted with the addition of 0.001 percent b-exotoxin when exposure time was increased to 7 days. Minimal concentrations of B. thuringiensis b-exotoxin and exposure times where synergism was observed were 0.79 ug/ml of the HD-1S-1980 preparation with 0.01 percent b-exotoxin after 11 days of exposure, 0.001 percent b-exotoxin with 3.125 ug/ml of HD-1S-1980 also after 11 days of exposure, and with 6.25 ug/ml of HD-1S-1980 plus 0.02 percent b-exotoxin after 3 days of exposure.

Duggin, M. J.; Rowntree, R. A.; Emmons, M.; Hubbard, N.; ODell, A. W.; Sakhavat, H.; Lindsay, J. **Short communication: the use of multidate multichannel radiance data in urban feature analysis.** Remote Sensing of Environment. 20: 95-105; 1986.

Dyer, Kenneth L. **Seasonal acid mine drainage from a surface-mined watershed in Eastern Kentucky.** 1986 National Meeting American Society for Surface Mining and Reclamation "New Horizons in Mined Land Reclamation"; 1986 March 17-20; Jackson, MS. Princeton, WV: American Society for Surface Mining and Reclamation; 1986: 131-139.

Jacks Branch and nearby streams in Knott County, eastern Kentucky, experienced highly acidic "flushouts" during spring runoff events, but were near neutral or alkaline for the rest of the year. The most acidic and saline discharges occurred a few hours or days following the peak discharge; the least saline discharges occurred near the discharge peaks as a consequence of dilution. The pH of Jacks Branch ranged from 2.7 to 8.1; dissolved solids ranged from 491 to 3,000 mg/1. Water-quality records for the past 11 years indicated little change in pH or dissolved solids over time. Two seams of coal have been mined on the watershed, the lower (Hazard No. 7) by auger mining and the upper (Hazard No. 9 or Hindman) by both strip and auger mining. Strong permanent springs emerged from the lower seam of coal assuring a dependable supply of good quality, near neutral or alkaline water in the main stream at base flow. Only at high-flow periods in the spring did enough highly acidic drainage from the upper mined area reach the main stream to seriously degrade the quality of

water. These acid discharges from the upper bench had pH values as low as 2.2 and dissolved solids up to 11,650 mg/1. They emerged in brief but strong flows directly from the highwall of the Hindman coal seam, a seam commonly associated with acid discharges in much of eastern Kentucky, and contained the products of pyrite oxidation.

Dyer, Kenneth L.; Crews, Jerry T. **Evaluation of Bentonite for the control of acid drainage from surface-mined lands, part 2.** In: Proceedings, Seventh annual West Virginia surface mine drainage task force symposium; 1986 April 1-2; Morgantown, WV. Morgantown, WV: West Virginia Mining and Reclamation Association; 1986: 1-11.

Echelberger, Herbert E.; Plumley, Harriet J. **Anatomy of backcountry management costs.** Res. Pap. NE-575. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 8 p.
Operation and management costs for several dispersed overnight site locations and backcountry trails in the White Mountain National Forest were studied. Average annual costs ranged from $200 to $1,500 per mile for trails and from $0.35 to $4.29 per visitor for overnight sites. Average annual costs for trails and overnight sites increased with elevation and use levels, but on a per-visitor basis, high-use trails cost less to maintain than low-use trails at all elevations. Costs per visitor at overnight sites were less well defined. The method used in this study may be useful to backcountry recreation managers in their efforts to acquire a better understanding of all the costs of providing backcountry recreation opportunities.

Echelberger, Herbert E. **American campground industry 1983 economic analysis.** Washington, DC: National Campground Owners Association; 1986. 21 p.

Edwards, Pamela J. **Conversion factors and constants used in forestry, with emphasis on water and soil resources.** Gen. Tech. Rep. NE-113. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 12 p.
Conversion factors and constants used in forestry are listed. Quantitative and qualitative water and soil resources values are emphasized. Brief explanations and derivations of some chemical parameters are given.

Fege, Anne S. **Economic and political factors influencing the development of the short rotation forestry technology.** In: Proceedings, IUFRO: Evaluation and planning of forestry research. International Union of Forestry Research Organizations (S6.06-S6.06.01); 1985 July 25-26; Fort Collins, CO. Gen. Tech. Rep. NE-111. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986: 123-135.
Short rotation forestry research has had a clear evolution in scope and direction over the past 15 years, and ways to characterize these changes are described in this paper: history of research support, changes in socioeconomic and technological factors, evolution of field research programs, and conclusions drawn from feasibility assessments. Findings reported in this article were gained from a case study in research evaluation focused on short rotation forestry.

Fernandez, I. J.; Czapowskyj, M. M. **Selected relationships for trace metals in Maine low elevation spruce-fir forest floors.** Bull. 119. Orono, ME: Maine Agricultural Experiment Station; 1986. 23 p.

Frank, Robert M. **A tale of two stands during a spruce budworm epidemic--and more.** In: 1986 Eastern spruce budworm research work conference proceedings; 1986 January 7-8; Orono, ME. Orono, ME: University of Maine; 1986. Abstract.

Frieswyk, Thomas S.; Malley, Anne M. **Aboveground tree biomass statistics for Vermont--1983.** Resour. Bull. NE-91. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 105 p.

A statistical report on the fourth forest survey of Vermont (1983). Findings are displayed in 72 tables containing estimates of forest area, numbers of trees, tree biomass, and timber volume. Data are presented by state and county level.

Frieswyk, Thomas S.; Malley, Anne M. **Biomass statistics for New Hampshire--1983.** Resour. Bull. NE-92. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 85 p.

A statistical report on the fourth forest survey of New Hampshire (1983). Findings are displayed in 72 tables containing estimates of forest area, numbers of trees, tree biomass and timber volume. Data are presented by state and county level.

Funk, David T., comp. **Eastern white pine: Today and tomorrow.** Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture; Forest Service; 1986. 124 p.

The Symposium "Eastern White Pine: Today and Tomorrow" was held in Durham, New Hampshire, June 12-14, 1985. The organizing committee was chaired by Theodore Howard of the University of New Hampshire and included Richard Weyrick, also of the University of New Hampshire, and M. E. Demeritt, David Funk, Kenneth Lancaster, William Leak, and Carl Tubbs of the USDA Forest Service. The Symposium was cosponsored by the University of New Hampshire Department of Forest Resources, the USDA Northeastern Forest Experiment Station and Northeastern Area State and Private Forestry, the Society of American Foresters Economics and Policy Working Group, and the Ruth E. Farrington Forestry Fund.

Furnival, George M.; Valentine, Harry T.; Gregoire, Timothy G. **Estimation of log volume by importance sampling.** Forest Science. 32(4): 1073-1078; 1986.

Importance sampling is proposed as a technique for estimating log volume that eliminates the bias of conventional methods arising from irregular log taper. In a trial of the technique, the average relative sampling error for individual logs, based on a measurement of one cross-section per log, was 5.2 percent. To estimate an aggregate volume, a two-stage sampling procedure is suggested in which importance sampling constitutes the second stage. Optimal sampling strategy is discussed briefly.

Galford, Jimmy R. **Effects of dimilin on red oak borer fertility, 1981.** Insecticide and Acaricide Tests: 11: 413; 1986.

Galford, Jimmy R. **Primary infestation of sprouting chestnut, red, and white oak acorns by Valentinia glandulella (Lepidoptera: Blastobasidae).** Entomological News. 97(3): 109-112; 1986.

Larvae of the acorn-infesting moth Valentinia glandulella usually are found in acorns damaged by rodents or other insects. However, data from field studies in Ohio indicate that female moths oviposit on, and larvae can develop in, sound sprouting acorns. Impact of the moths on seedling establishment was not significant.

Galford, Jimmy R. **The weevil Barypeithes pellucidus (Coleopetera: curculionidae) feeds on northern red oak, Quercus rubra, seedlings.** Entomological News. 97(3): 113-114; 1986.

The weevil Barypeithes pellucidus was found in association with dying seedlings of northern red oak. Laboratory observations confirmed that adult weevils readily fed on all parts of young oak seedlings.

Gansner, David A. **Silvicultural cutting opportunities in oak-hickory forests.** In: Program and Abstracts. Midwest

forest economists, Midwest forest mensurationists; 1986 August 13-14; Urbana, IL. Urbana, IL: University of Illinois; 1986: 25.
Because of today's conditions, major increases in silvicultural cutting would have to be spread over the next several years. But there is no denying that the physical resource necessary for significant expansion in the wood-using industry exists.

Gansner, David A. **Tree defoliation and mortality in new infestations.** In: Gypsy moth influence on stand management--how to cope; 1986 April 10; West Boylston, MA. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Area, State and Private Forestry; 1986: 4 p.

Gansner, David A.; Herrick, Owen W. **Impact of gypsy moth on a new frontier.** In: Proceedings of the 1985 national gypsy moth review; 1985 November 18-21; Columbus, OH. Columbus, OH: Ohio Department of Natural Resources; 1986: 73-75.

Garrett, Peter W. **Role of tree improvement in providing pest-resistant eastern white pine (Pinus strobus L.).** In: Funk, David T., comp. Eastern white pine: Today and tomorrow: Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture, Forest Service; 1986: 75-88.
Three of the major problems of eastern white pine are blister rust, white-pine weevil, and atmospheric pollution. Suggestions given for developing resistance to these problems include improvement of eastern white pine, hybridization between eastern white pine and other resistant five-needle pines, and the possible introduction of non-native white pines in the Northeast.

Garrett, Peter W.; Trew, I. Frederick. **Resistance of pitch x loblolly pine hybrids to fusiform rust (cronartium quercuum f. sp. fusiforme).** Plant Disease. 70(6): 564-565; 1986.

Gatchell, Charles; Hansen, Bruce G. **Standard blanks: A good value-added opportunity.** Northern Logger. 34(10): 26-31; 1986.
Value-added means different things to different people. We like the simple definition that value-added is income created. Value-added is generally used in the positive sense. But, if the income created does not meet or exceed the costs of raw materials and processing, there will be a very real and negative value-added to deal with. Of greater concern is whether the value-added opportunity is profitable. In this article, our indicator of profits is the IRR (internal rate of return), which is the annual rate earned on a given initial investment over a projected number of years. Whether and to what degree the end result is positive will depend on the choices made by managers.

Gatchell, Charles J.; Olson, James R. **Comparison of glue-line quality between gang edging and straight-line ripping.** Res. Pap. NE-588. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 7 p.
Gang edging with a dip-chain fed gang ripsaw produces gluing surfaces equal to those from a straight-line ripsaw in yellow-poplar and red oak. Special care in gluing red oak was needed to get shear strengths equal to solid wood values. However, the strength comparisons between sawing methods showed no differences between gang edging and straight-line ripping regardless of gluing procedures.

Gatchell, Charles J. **Savings with rip-first option.** The Hardwood News. 1986 March 17: 8.

Goldstein, Edward L.; Gross, Meir; DeGraaf, Richard M. **Breeding birds and vegetation: a quantitative assessment.** Urban Ecology. 9: 377-385; 1986.

Gottschalk, Kurt W. **Managing Appalachian hardwood stands to minimize gypsy moth impacts.** In: Smith, H. Clay; Eye, Maxine C., eds.

Guidelines for managing immature Appalachian hardwood stands: Workshop proceedings; 1986 May 28-30; Morgantown, WV. SAF Publ. 86-02. Morgantown, WV: West Virginia University Books; 1986: 181-207.

Intermediate stand treatments that may minimize gypsy moth impacts on Appalachian hardwood stands are recommended based on ecological and silvicultural information on the interaction of the insects and their hosts. Flow charts are presented that match the proper prescription to existing stand and insect population conditions. Pre-outbreak prescriptions focus on increasing stand vigor, removing trees most likely to die, reducing gypsy moth habitat, and reducing preferred gypsy moth food sources. Outbreak prescriptions prioritize stands for possible control actions, while post-outbreak prescriptions center on efficient salvage of dead trees.

Graber, Raymond E. **Stem quality of white pine--direct seeded in furrows vs. conventional planting.** In: Funk, David T., comp. Eastern white pine: Today and tomorrow: Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture, Forest Service; 1986: 121. Poster Session.

An 18-year-old eastern white pine stand that has been direct seeded on an old field is compared with a 6- by 6-foot plantation of the same age and seed source. Direct seeding resulted in a tree population more than 3 times larger than that of the plantation. The seeded trees had smaller branches and fewer, less serious weevil injuries than the plantation. The better quality stems of the seeded pine are largely attributed to the higher density of that stand. Costs of direct seeding are estimated to be less than one-quarter of conventional planting expenses.

Gregoire, Timothy G.; Valentine, Harry T.; Furnival, George M. **Estimation of volume with a taper function: A sampling approach.** In: Use of auxiliary information in natural resource inventories; 1985 October 1-2; Blacksburg, VA. SAF Publ. No. 86-01. Blacksburg, VA: Society of American Foresters; 1986: 164-170.

Gregorie, Timothy G.; Valentine, Harry T.; Furnival, George M. **Estimation of bole volume by importance sampling.** Canadian Journal of Forest Research. 16: 554-557; 1986.

Gregory, Robert A.; Wargo, Philip M. **Timing of defoliation and its effect on bud development, starch reserves, and sap concentration in sugar maple.** Canadian Journal of Forest Research. 16(1): 10-17; 1986.

Sapling sugar maple trees were defoliated artificially at 10-day intervals beginning May 27 and ending August 5, 1981. Refoliation, terminal bud and shoot development, and xylem starch and sap sugar concentration were observed in defoliated and control trees. All defoliated trees refoliated, but decreasingly with later defoliation. Defoliation caused an acceleration in the rate of primordia initiation in terminal shoot apices. After early season defoliations, the developing buds in the axils of the removed leaves abscissed, but axillary and terminal buds on the refoliated terminal shoots survived through winter. In late season defoliation, most buds of refoliated shoots did not survive and the next year's growth depended on axillary buds formed prior to defoliation. Thus, when progressing from early to late defoliations, the next year's shoot growth depended decreasingly on the last-formed and increasingly on the first-formed portions of the previous year's shoot. Early October starch concentration in xylem decreased with later defoliation and was nearly absent in shoots and roots of trees defoliated in late July. There was not, however, a corresponding decrease in sap sugar concentration. Mortality occurred only in late defoliated trees and was associated with starch depletion.

Gregory, Garold; Lewis, Robert; Schreiber, Lawrence; Roberto, Nick; Ichida, Jann; Thomas, Jacquelyn. **A pseudomonas species isolated from live**

oaks antagonistic to several tree pathogens. Pyhtopathology. 76(6): 652-653; 1986.

A bacterium, tentatively identified as Pseudomonas maltophilia, isolated from an oak, in Texas was found to be antagonistic in vitro to tree pathogens--Ceratocystis ulmi, C. fagacearum and Verticillium dahlia. An antibiotic produced on potato dextrose agar was purified by chromatography on a Sephadex LH-20 and a high-pressure liquid chromatographic (HPLC) column. The antibiotic was located in a single HPLC peak and inhibits Sclerotinia homeocarpa in addition to the previously mentioned fungi. The antibiotic is stable to autoclaving and is not inactivated by protease. A rifampicin and streptomycin resistant mutant of this bacterium has been developed to aid in its identification in tests for survival and distribution in plants. Experiments are underway to test this organism as a biocontrol agent for oak wilt and Dutch elm disease.

Halverson, Howard G.; Gleason, Stephen B.; Heisler, Gordon M. **Leaf duration and the sequence of leaf development and abscission in northeastern urban hardwood trees.** Urban Ecology. 9: 323-335; 1986.

Urban trees provide both physical and esthetic benefits that are often related to the presence or absence of leaves. Periods of leaf development and leaf abscission and the duration of the leaf season were determined for 12 common urban tree species. Apple, Norway maple, and grey birch developed leaves earlier than other species. Green ash tended to lose leaves earlier than other species. Actual dates were not considered important, because of weather differences between years, but the order of phenologic stages should be similar each year. The average time during which crowns were 50 percent or more of full density ranged from 154 days for green ash to 192 days for apple. Most species that developed leaves early tended to retain them longer and to have long leaf durations. Green ash lost leaves first and had the shortest leaf season.

Halverson, H. G.; Rowntree, R. A. **Urban tree effects on runoff quantity and quality.** In: IV International Congress of ecology; 71st annual meeting of the Ecological Society of America; 5th meeting of the International Society of Ecological Modeling; 1986 August 10-16; Syracuse, NY. [Location of publisher unknown]: [Publisher unknown]; 1986: 170 p.

Until recently, concepts of urban runoff were based on the assumption that cities were primarily impervious surfaces. However, air photo analyses indicate that viewed areas of most cities are approximately one-third grass, one-third tree crowns, and one-third artificial surfaces. From these data, estimates were made of the urban forest canopy interception capacity and effects on selected precipitation events in sample cities. Date with reports from published chemical analyses, suggest general conclusions about the quality and quantity of runoff from urban areas with different configurations of artificial and vegetation surfaces.

Hansen, Bruce G. **Program TREND: using shift-share analysis to analyze forest industry change.** In: Wiant, Harry V. Jr.; Yandle, David O.; Kidd, William E., eds. Proceedings of forestry microcomputer software symposium; 1986 June 29-July 2; Morgantown, WV. Morgantown, WV: West Virginia University; 1986: 379-387.

TREND uses shift-share analysis to examine many aspects of forest industry operation such as employment, value added, production, exports, sales, etc. While shift-share analysis traditionally has been used to examine regional "shifts" in employment and value added, it has significant potential as a tool to assess market performance and identify market opportunities. Shift-share analysis improves on simple percentage and absolute value measures by facilitating evaluation of individual performance on a relative basis. Output from program TREND consists of group summaries and individual descriptive statistics.

Hardie, Ian W.; Hassan, Aziz Abu. **An econometric analysis of residential demand for fuelwood in the United States, 1980-1981.** Forest Science. 32(4): 1001-1015; 1986.

This paper presents an econometric study of residential fuelwood demand in the United States. It is based on a residential energy consumption survey conducted by the U.S. Department of Energy in 1980-81. Estimates are derived of the probability that a particular household will burn wood and of the quantity of wood that will be burned. Aggregate fuelwood demand is predicted for five census regions and for the contiguous United States. The predicted average probability of burning wood is 0.32, and the average predicted quantity burned is 1.57 cords. Residential fuelwood demand is found to be quite responsive to changes in the price of nonwood heating fuel.

Hardy, Yvan; Mainville, Michel; Schmitt, Daniel M. **An atlas of spruce budworm defoliation in eastern North America, 1938-80.** Misc. Publ. 1449. Washington, DC: U.S. Department of Agriculture; 1986. 52 p.

Healy, William M. **Book review: Gullion, Gordon W. Managing Northern forests for wildlife.** Coraopolis, PA: The Ruffed Grouse Society; 1984. Journal of Wildlife Management. 50(1): 173; 1986.

The booklet will be useful for landowners and managers interested in wildlife associated with early successional forests.

Heisler, Gordon M. **Effects of individual trees on the solar radiation climate of small buildings.** Urban Ecology. 9: 337-359; 1986.

Under clear skies, a mid-sized sugar maple tree reduced irradiance in its shade on a south-facing wall by about 80 percent when in leaf, and by nearly 40 percent when leafless. Reductions by a similar-sized London plane were generally slightly smaller. The percentage reductions varied with the fraction (DR) of diffuse radiation, and could be approximated by regressions with DR2 as the independent variable.

Heisler, Gordon M. **Energy savings with trees.** Journal of Arboriculture. 12(5): 113-125; 1986.

In conventional buildings, trees increase, decrease, or have little effect on energy use depending on general climate, building type, tree species, and tree location. Tree arrangements that save energy provide shade primarily for east and west walls and roofs and wind protection from the direction of prevailing winter winds. Particularly for buildings specially designed to use solar energy and those with solar collectors, it is important to place tree crowns so they do not block sun from collectors and south walls. But conventional houses also benefit from winter sun. Deciduous trees provide better year-round shade than conifers, but do reduce solar energy significantly even without leaves. In winter, reductions in solar energy on south walls by a deciduous tree may be greater than reductions by the same tree in summer. Hence, growth rate and crown shape are important criteria in selecting shade trees, and the placement of trees around the house is important. A summary of research data suggests that the maximum potential annual effect of trees on energy use in conventional houses is about 20 to 25 percent compared to the same house in the open.

Heisler, Gordon M. **Managing trees for saving heating and cooling costs in houses.** Northbound. 1986 March-April: 12-14.

Because of the long, cold winters of the Lake States, winter heating bills are large, and winter is the period of most concern for saving energy. But summers have warm periods, and an ideal tree arrangement would shade houses in midsummer. Although it is not possible to place trees around a house to maximize wind protection, allow full sun on the house in winter, and provide complete shade in summer, careful planning can lead to compromises that meet most of these goals. Guidelines are presented for planning the tree management compromises for energy savings in the Lake States.

Helvey, J. D.; Kunkle, Samuel H. **Input-output budgets of selected nutrients on an experimental watershed near Parsons, West Virginia.** Res. Pap. NE-584. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 7 p.
A control watershed at the Fernow Experimental Watershed effectively neutralizes acids received in precipitation. However, sulfate input by precipitation greatly exceeds sulfate losses as streamflow and watershed acidification is a real concern.

Herrick, Owen W.; Gansner, David A. **Rating forest stands for gypsy moth defoliation.** Res, Pap. NE-583. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 4 p.
The severity of future defoliation can be estimated from the percentages of basal area in oaks, black oak, and chestnut oak, and in trees with good crowns, along with the average diameter of the stand. With information on these variables, the defoliation of any hardwood forest stand in an approaching gypsy moth infestation can be rated.

Hertel, G. D.; Mason, G. N.; McManus, M. L.; Wallner, W. E. **The Northeastern Forest Experiment Station's/University Cooperators Gypsy Moth Research Program.** In: Proceedings of the 1985 national gypsy moth review; 1985 November 18-21; Columbus, OH. Columbus, OH: Ohio Department of Natural Resources; 1986: 109-118.

Hornbeck, James W. **Modelling the accumulation and effects of chemicals in snow.** In: Modelling snowmelt-induced processes: Proceedings; 2nd scientific assembly of International Association of Hydrological Sciences; 1986 July; Budapest, Hungary. Budapest, Hungary: International Association of Hydrological Sciences; 1986: 155: 325-333.

Hornbeck, James W.; Martin, C. Wayne; Smith, C. Tattersall. **Protecting forest streams during whole-tree harvesting.** Northern Journal of Applied Forestry. (3): 97-100; 1986.
Whole-tree harvesting has potential to cause different responses in quality on forest streams than those resulting from bole only harvests. We sampled turbidity, temperature, and chemistry of streams draining watersheds that were whole-tree harvested in Maine, New Hampshire, and Connecticut. Changes in stream quality can be expected as a result of whole-tree harvesting, but common sense precautions suggested at the end of this paper can keep the changes within acceptable limits.

Hornbeck, James W.; Smith, Robert B. **Growth of eastern white pine: is it declining?** In: Funk, David T., comp. Eastern white pine: Today and tomorrow: Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture, Forest Service; 1986: 122. Poster Session.
Concern over the effects of acid deposition on eastern forests is greatest for red spruce, for which significant growth decline that began about 1960 has been documented. Much work remains to determine how much if any of this decline is due to acid deposition. Growth patterns for other species, including eastern white pine, are being determined. Nearly 2,000 white pine trees were cored during 1980-85 as part of the USDA Forest Service 10-year inventory of New England. The inventory is based on 7,500 plots randomly located across New England. White pine exhibits a trend toward narrowing widths in recent years, but does not show a growth decline like that found in red spruce.

Houston, David R.; Valentine, Harry T. **Classifying forest susceptibility to gypsy moth defoliation.** (Revised). Agric. Handb. 542. Washington, DC: U.S. Department of Agriculture; 1986. 19 p.
Over three decades ago, an excellent description was presented of forests susceptible or resistant to gypsy moth defoliation in the Northeast, especially in New England. The recent spread of the insect into new and different forest

situations has created a need for ways to predict the susceptibilities of forests that have yet to encounter gypsy moth defoliation. In this handbook, we describe susceptible and resistant New England stands and present an objective method for predicting the susceptibility of stands to defoliation.

Houston, David R. **Insects and diseases of northern hardwood ecosystems.** In: Proceedings of the conference on the northern hardwood resource: Management and potential; 1986 August 18-20; Houghton, MI. Houghton, MI: Michigan Technological University; 1986: 109-138.

Insects and diseases of most importance to northern hardwood ecosystems are those affecting the major species--maples, beech, birches, and basswood. Several features shared by most of these species, including shade tolerance, shallow root systems, diffuse porous xylem without true heartwood, and thin bark, influence which sorts of problems are important as well as their patterns of occurrence and development. Thus, there are few leaf diseases, but many insect defoliators; few vascular diseases, but many decays and discolorations; and several serious dieback/decline disease complexes triggered by stresses of drought, defoliation, or sucking insects and culminated by attacks by cambium-killing fungi and insects. Increased use of large, heavy machinery for harvest or thinning is resulting in marked increases in injuries to thin-barked, shallow-rooted northern hardwoods. The consequences of these practices will be significant increases in wound-associated problems such as the lethal sapstreak diseases of sugar maple and the degrading discolorations and decays of all species.

Huyler, Neil K. **The costs and returns of the Vermont cable yarder.** Northern Logger and Timber Processor. 35(2): 12-14, 17-18.

The purpose of the Vermont cable yarder project was to demonstrate to private landowners and loggers in the Northeast a harvesting system for handling fuelwood and small timber economically with little environmental impact. This article is a report on the production results and estimated cost and returns of the system from field tests conducted in the spring and summer of 1982.

Jakes, Pamela J.; Fege, Anne S. **Co-authorship patterns of USDA Forest Service research scientists at two regional experiment stations, 1981-1984.** In: Proceedings IUFRO: Evaluation and planning of forestry research. International Union of Forestry Research Organizations (S6.06-S6.06.01); 1985 July 25-26; Fort Collins, CO. NE-GTR-111. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986: 103-106.

Analyzes publications resulting from research sponsored by the North Central and Northeastern Forest Experiment Stations, USDA Forest Service, for Fiscal Years (FY) 1980 (October 1, 1979 through September 30, 1980) through FY 1984 (October 1, 1983 through September 30, 1984) in order to (1) identify changes in publication patterns, particularly in regard to co-authorship of publications, and (2) establish a baseline against which future changes in publication patterns could be measured.

Jennings, Daniel T. **Predator Workshop II: Future of predators in forest pest management.** In: Proceedings, 18th annual northeastern forest insect work conference; 1985 March 14-15; Portland, ME. Syracuse, NY: Syracuse University of New York; 1986: 58-61.

Jennings, Daniel T.; Houseweart, Mark W. **Helicopter propwash dislodges few spruce budworms.** Res. Note NE-333. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 7 p.

Propwash treatments from a low-flying Bell 47-G2 helicopter dislodged few spruce budworm larvae and pupae from host balsam-fir trees. After propwash treatments, both larval-pupal densities on branch samples and in drop-tray collections near the ground were not significantly different between treated

and control plots. Significantly more larvae were found in the lower crowns of treated trees, possibly indicating a downward shift in the larval population due to treatment. Residual parasitized larvae was 15.9 percent on treated trees and 14.6 percent on control trees.

Jennings, Daniel T.; Houseweart, Mark W.; Francoeur, Andre. **Ants (Hymenoptera: Formicidae) associated with strip-clearcut and dense spruce-fir forests of Maine.** Canadian Entomologist. 118: 43-50; 1986.

Jennings, Daniel T.; Jones, Richard L. **Field tests of kairomones to increase parasitism of spruce budworm (Lepidoptera: Tortricidae) eggs by trichogramma spp. (Hymenoptera: trichogrammatidae).** The Great Lakes Entomologist. 19(1): 185-189; 1986.

Hexane extracts of spruce budworm moth scales, applied at 0.04 moth-gram equivalents/branch and at 0.06 moth-gram equivalents/tree, failed to increase parasitism rates of trichogramma spp. in two cutover spruce-fir stands in Maine. Releasing "Maine-strain" T. minutum apparently increased parasitism rates about twenty fold. However, application of kairomone extracts to whole branches and to upper crowns of small trees may have interfered with host-searching behaviors of Trichogramma parasitoids.

Jensen, Keith F.; Yaussy, Daniel A. **Comparison of yellow-poplar growth models on the basis of derived growth analysis variables.** Tree Physiology. 1: 217-222; 1986.

Quadratic and cubic polynomials, and Gompertz and Richards asymptotic models were fitted to yellow-poplar growth data. These data included height, leaf area, leaf weight, and new shoot weight for 23 weeks. Seven growth analysis variables were estimated from each function. The Gompertz and Richards models fitted the data best and provided the most accurate derived variables. However, the Richards model was more complex to fit.

Jensen, K. F.; Roberts, B. R. **Changes in yellow-poplar stomatal resistance with SO_2 and O_3 fumigation.** Environmental Pollution. 41: 235-245; 1986.

The effect of O_3 and SO_2 on leaf diffusive resistance (LDR) of yellow-poplar seedlings was studied at 40 percent and 80 percent humidity. LDR was measured at 0800, 0900, 1100, 1400, and 1600 on seedlings fumigated from 0900 until 1400 each day for 5 consecutive days. Fumigation treatments were control, 0.15 ul litre^{-1} O_3, 0.25 ul litre^{-1} SO_2 and 0.15 ul litre^{-1} O_3 + 0.25 ul litre^{-1} SO_2. No change in daily LDR response was observed for the seedlings at 40 percent humidity. At 80 percent humidity, daily LDR response of seedlings in all four treatments changed significantly over the 5 days of the experiment. The range of the LDR values and the daily response curves both changed. The higher humidity apparently caused the stomata to open so that more pollutants could enter the leaves. The pollutants then interacted with the leaf cells and modified the stomatal response.

Johnson, Dale W.; Kelly, J. M.; Swank, W. T.; Cole, Dale W.; Hornbeck, James W,; Pierce, Robert S.; Van Lear, David. **A comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests.** ORNL Publ. No. 2508. Oak Ridge, TN: Oak Ridge National Laboratory Environmental Sciences Division; 1986. 107 p.

Jones, John R.; Schier, George A. **Growth.** In: DeByle, Norbert V.; Winokur, Robert P., eds. Aspen: Ecology and management in the Western United States. Gen. Tech. Rept. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1986: 19-24.

Kania, G. S.; Smith, H. R. **Observations of agonistic interactions between a pair of feral mute swans and nesting waterfowl.** The Connecticut Warbler. Fairfield, CT: Connecticut Ornithological Association; 1986; 6(3): 35-37.

Keys, Roy N. **Nutrient content and growth of an Austrian pine (Pinus nigra Arnold) seed source study on surface mine spoils.** In: 1986 national symposium on mining, hydrology, sedimentology, and reclamation; 1986 December 8-11; Lexington, KY. Lexington, KY: University of Kentucky; 1986: 267-274.
Foliage was collected from eight Austrian pine seed sources growing on four reclaimed surface mines, a reclaimed deep mine refuse dump, and an agricultural site. Analysis of the foliage nutrient content showed differences among sites and seed sources for most of the nutrients tested, and some site X source interactions. There were significant correlations of tree growth with foliage nutrient content and with soil nutrient content for several elements. Results could be used to determine the need for fertilization when growing certain sources of Austrian pine.

Leak, W. B. **Stocking of white pine.** In: Funk, David T., comp. Eastern white pine: Today and tomorrow: Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture, Forest Service; 1985: 51-54.
There are different opinions on whether white pine should be grown at high or low density. The high-density approach consists of little or no thinning until the stand reaches 6 to 8 inches d.b.h., maintenance of 90 to 100 square feet basal area per acre in poletimber stands and 120 to 140 square feet in sawtimber, and selective pruning. This approach should result in maximum board-foot volumes of medium-quality pine, low investments, and minimal hardwood understory development. Under the low-density approach, thinning may begin at mean diameters of 4 to 6 inches. Basal areas may be 30 to 40 square feet in poletimber and 60 to 80 square feet in sawtimber. A heavy commitment to pruning and hardwood understory control is required. This approach should produce lower volumes per acre per year (up to 30 percent), but results in earlier returns and higher log quality.

LeDoux, Chris B. **Applications of a stump-to-mill computer model to cable logging planning.** In: Wiant, Harry V., Jr.; Yandle, David O., Kidd, William E., eds. Proceedings of forestry microcomputer software symposium; 1986 June 29-July 2. Morgantown, WV. Morgantown, WV: West Virginia University; 1986: 395-401.
Logging cost simulators and data from logging cost studies have been assembled and converted into a series of simple equations that can be used to estimate the stump-to-mill cost of cable logging in mountainous terrain of the Eastern United States. These equations are based on the use of two small and four medium-sized cable yarders and are applicable for harvests of timber from 6 to 24 inches in diameter. Cost components can be easily calculated on a hand-held calculator. A computer program that could be adapted to many desktop and microcomputers is available that will calculate the total stump-to-mill logging cost for a specified set of logging conditions. The paper focuses on the application of the stump-to-mill computer model to actual East Coast forest conditions.

LeDoux, Cris B. **Bucking logs to cable yarder capacity can decrease yarding costs and minimize wood wastage.** Southern Journal of Applied Forestry. 10(3): 180-183; 1986.
Data from selected time and motion studies and a forest model plot, used in a simulation model, show that logging managers planning felling, bucking, and limbing for a cable yarding operation must consider the effect of alternate bucking rules on wood wastage, yarding production rates and cost, the number of chokers to fly, and total logging costs. Results emphasize the need to consider initial logging activities in terms of effects on cable yarding system

efficiencies and wood wastage. Results also emphasize the need to match payload (piece size) to cable yarder capacity. Results suggest that cable yarding costs can be decreased by 20 to 32 percent by simply bucking logs to yarder capacity.

LeDoux, Chris B. **MANAGE: A computer program to estimate costs and benefits associated with eastern hardwood management.** Gen. Tech. Rep. NE-112. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 7 p.
The integration of harvesting, silviculture, and market and economic concerns is demonstrated with a complete systems simulation model called MANAGE. The application of MANAGE and the type of decisionmaking output provided is emphasized. A 40-year-old red and white oak stand was selected for demonstration. Results suggest that the use of cable logging technology to manage young hardwood stands on steep terrain will dictate few entries with heavy volume removals to maximize net values. MANAGE can be used to evaluate other combinations of harvesting, silviculture, and market and economic scenarios.

LeDoux, Chris, B.; Fight, Roger D.; Ortman, Tom L. **Stump-to-truck cable logging cost equations for young-growth Douglas-fir.** Western Journal of Applied Forestry. 1(1): 19-21; 1986.

LeDoux, Chris B.; Starnes, Lawson W. **Cable logging production rate equations for thinning young-growth Douglas-fir.** Forest Products Journal. 36(5): 21-24; 1986.
A cable logging thinning simulation model and field study data from cable thinning production studies have been assembled and converted into a set of simple equations. These equations can be used to estimate the hourly production rates of various cable thinning machines operating in the mountainous terrain of western Oregon and western Washington. The equations include seven small- and medium-sized cable yarders and are applicable to up-hill thinnings of Douglas-fir from low to high volume removals. Hourly production rates can be easily calculated on a hand calculator using log size, volume removed per acre, and average yarding distance as inputs. The equations can be used to develop reasonable approximations of delay-free hourly production for several cable yarders operating in thinnings, under a variety of site and stand conditions.

Liebhold, A. M.; Elkinton, J. S.; Wallner, W. E. **Effect of burlap bands on between-tree movement of late-instar gypsy moth, Lymantria dispar (Lepidoptera: Lymantriadae).** Environmental Entomology. 15(2): 373-379; 1986.

Luppold, William G.; Anderson, R. Bruce. **A regional analysis of pallet supply and demand.** Res. Pap. NE-580. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 8 p.
This paper examines the factors that affect regional pallet supply and demand by developing, estimating, and interpreting models for the eight major census regions with viable pallet markets.

Luppold, William G.; Anderson, R. Bruce. **Hardwood use in the pallet industry.** National Hardwood Magazine. 60(7): 43, 56-58; 1986.
In 1983, about 4.2 billion board feed of hardwood lumber was used by the pallet industry. It is estimated that 2.8 billion board feet of that was low-grade lumber produced by hardwood grade mills; and the remaining 1.4 billion board feet of material was produced by in-house sawmills integrated with pallet-production facilities. Pallets are used as labor-saving devices in the transporting and warehousing of industrial commodities, processed food products, and building supplies, so pallet production tends to be located in areas where manufacturing or food-processing facilities are located. Ninety-eight percent of the hardwood material consumed by the pallet industry is used by producers in the Central and

Eastern Regions. The pallet industries in the East North-Central and South Atlantic Regions are the largest users of hardwood materials. The pallet industry in New England is a small user of hardwood lumber.

Luppold, W.G. **Can hardwood lumber prices be predicted?** Furniture Design & Manufacturing. 1986 October: 4 p.

Lynch, James A.; Hanna, C. Mark; Corbett, Edward S. **Predicting pH, alkalinity, and total acidity in stream water during episodic events.** Water Resources Research. 22(6): 905-912; 1986.

Acid precipitation was found to significantly influence the chemistry of a small headwater stream in central Pennsylvania. Stream discharge during 18 storms was sampled and analyzed for pH, bicarbonate alkalinity, and titratable acidity levels. The precipitation events varied considerably in their amounts, durations, and intensities and also produced highly variable hydrologic responses from the water shed. Stream pH and alkalinity levels were found to react inversely to stream discharge during storm flow periods, with their lowest levels occurring almost simultaneously with peak flow. In comparison, storm flow acidity was directly related to the discharge rate, with the peaks nearly coinciding. Models predicting the fluctuations in storm flow pH, alkalinity, and total acidity were developed. These models, which explained 88, 91, and 80 percent of the variations in stream pH, alkalinity, and acidity, respectively, used as their independent variables such hydrometeorological parameters as antecedent flow rate, time to peak, peak flow rate, quick flow volume, and storm precipitation amounts. These results suggest strongly that the hydrologic response of a watershed has potential application as an index of stream sensitivity to changes in pH, alkalinity, and acidity during acid precipitation/snowmelt events.

Lynch, James A.; Corbett, Edward S.; Kostelnik, Kevin M. **Atmospheric deposition: spatial and temporal variation in Pennsylvania: 1985.** University Park, PA: The Pennsylvania State University; 1986: 81 p. [Prepared for The Pennsylvania Department of Environmental Resources.]

McManus, M. L. **Weather related gypsy moth mortality.** In: Proceedings of the national gypsy moth review; 1985 November 18-21; Columbus, OH. Columbus, OH: Ohio Department of Natural Resources; 1986: 109-118.

McPherson, E. G.; Rowntree, R. A. **Computers: tree shade.** Landscape Architecture Magazine. 76(3): 88-91; 1986.

Marquis, David A. **Thinning Allegheny hardwood pole and small sawtimber stands.** In: Smith, H. Clay; Eye, Maxine C., eds. Guidelines for managing immature Appalachian hardwood stands: workshop proceedings; 1986 May 28-30; Morgantown, WV. SAF Publ. 86-02. Morgantown, WV: West Virginia University Books; 1986: 68-84.

Thinning in Allegheny hardwood stands should begin when sapling basal area drops below about 20 square feet per acre. Before that time, thinnings produce low yields and require investments in precommercial removal of saplings that are not economically justified. Once commercial thinnings are begun--at about 50 years of age--stands should be maintained at densities between about 60 and 80 percent relative density, with emphasis on selection for removal of poor-quality trees within the smaller merchantable size classes to achieve an appropriate stand structure and species composition. Toward the end of the rotation, thinnings shift from a strict thinning from below to a combination thinning in the slower maturing species and partial harvest of the faster maturing species. A computer program called SILVAH is available to summarize stand data, make recommendations on the appropriate type of thinning in particular stands, and generate marking instructions that

ensure the appropriate manipulation of stand density, structure, and species composition.

Marquis, David A. **Integration of timber and wildlife in silvicultural prescription writing.** 18th IUFRO World Congress; Division 2; Vol. II. Forest Plants and Forest Protection. Yugoslav IUFRO World Congress; 1986: 565-573.

A stand-level procedure for analyzing site and vegetation variables is described, and the use of that data to determine the best silvicultural prescription is discussed. The procedure provides for a single inventory of existing conditions and analyses of that data in ways that allow evaluations of current conditions for both timber and wildlife resources. The analysis of stand conditions in combination with specific landowner objectives is then used to select a silvicultural prescription that represents the best current knowledge in that forest type and resource area. The system is computerized in a program called SILVAH, which writes narrative descriptions of stand conditions in terms of timber and wildlife goals, and selects a recommended treatment.

Martens, David G. **Increasing rough-mill efficiency.** Wood & Wood Products. 1986 August: 63-68.

Describes a computer program called OPTIGRAMI that helps rough-mill managers allocate lumber resources more efficiently and improve future plant performance. OPTIGRAMI determines the optimum, or least-cost, grade mix of lumber needed to produce a given cutting order of dimension parts. If the optimum grade mix is not available, the program can be used to determine the best alternative. It also shows which lengths should be taken from each grade to achieve the minimum total cost.

Martens, David G. **Produce yellow-poplar furniture dimension at minimum cost by using YELLOPOP.** Res. Pap. NE-592. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 15 p.

Describes a computer program called YELLOPOP that determines the least-cost combination of lumber grades required to produce a given cutting order of furniture dimension parts. If the least-cost mix is not available, YELLOPOP can be used to determine the next best alternative. The steps involved in using the program are also described.

Martens, David G. **Reduce dimension costs by using WALNUT.** Res. Pap. NE-586. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 10 p.

A computer program called WALNUT is described that determines the least cost combination of lumber grades required to produce a given cutting order of furniture dimension parts. If the least-cost mix is not available, WALNUT can be used to determine the next best alternative. The steps involved in using the program are described.

Martens, David G.; Whitenack, Kenneth R.; Nevel, Robert L., Jr. **OPTIGRAMI users manual.** Gen. Tech. Rep. NE-109. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 11 p.

A computer program called OPTIGRAMI has been developed to determine the optimum, or least-cost, grade mix of hardwood lumber required to produce a given cutting order of furniture dimension parts. If the optimum mix is not available, OPTIGRAMI can be used to determine the next best alternative. The users manual describes the steps involved in using the program.

Martin, C. Wayne; Pierce, Robert S.; Likens, Gene E.; Bormann, F. Herbert. **Clearcutting affects stream chemistry in the White Mountains of New Hampshire.** Res. Pap. NE-579. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 12 p.

Commercial clearcutting of northern hardwood forests changed the chemistry of the streams that drained from them.

By the second year after cutting, specific conductance doubled, nitrate increased tenfold, calcium tripled, and sodium, magnesium, and potassium doubled. Chloride and ammonium did not change; sulfate decreased. Concentrations of most ions returned to reference levels after 4 years, though sulfate remained depressed, potassium remained elevated, and acidity decreased.

Mazzone, H. M.; Podgwaite, J. D. **Standard and novel functions of insect latent viruses.** In: Proceedings Symposium, Host-regulated developmental mechanisms in vector anthrapods; 1986 February 3-6; Vero Beach, FL. Vero Beach, FL: University of Florida; 1986: 212-216.

Melhuish, J. H., Jr.; Wade, G. L. **Effect of soil phenolic compounds on growth and fatty acid composition of** Pisolithus tinctorius. Transactions Kentucky Academy of Science. 46(3-4): 129-133; 1986.

One to 1,000 u mol/L of ferulic, p-coumaric, and vanillic acids in liquid growth (dry-weight production) increased total lipids as percent of dry weight and lowered to 18:1 to 18:2 fatty acid ratio in the ectomycorrhizal fungus Pisolithus tinctorius. Vanillic acid affected the fatty acid ratios only at the higher concentrations tested. Two and three times normal nutrient concentrations decreased growth but partly offset some of the effects of ferulic acid. These results suggest that phenolic compounds produced by some higher plants may cause alteration of growth and liquid synthesis in P. tinctorius.

Melhuish, J. H., Jr.; Willis, R. B.; Wright, C. S. **Separation and identification of phenolic acids and related compounds by gas chromatography and fourier transform infrared spectroscopy.** Journal of Chemical Ecology. 13(2): 317-322; 1986.

Phenolic acids and related compounds were separated by gas chromatography using three separate columns. One of these columns was coupled to a Fourier transform infrared spectrometer. The trimethylsilyl derivatives could be separated and identified by comparing the relative retention times of the three different columns. However, where there was overlap, the accompanying infrared data clearly distinguished between the questionable derivatives, thus enabling characterization of all derivatives.

Michaels, Joseph A.; Stone, M. Brian; Sendak, Paul E. **The economic importance of Vermont's sawtimber.** Res. Pap. NE-587. Broomall, PA: U.S. Department of Agriculture; Forest Service; Northeastern Forest Experiment Station; 1986. 12 p.

This paper concentrates on the potential economic importance of Vermont's sawtimber. The timber industry employed over 9,000 workers in 1980, and the value of stumpage cut that year was worth approximately $459 million to the State's economy. Preliminary resurvey data indicate that sawtimber inventory now exceeds 14 billion board feet. Yet, sawtimber removals have averaged only 200 million board feet per year over the last 10 years. We used an input-output model called IMPLAN V1.1 to predict socio-economic impacts of several sawtimber production levels. The results indicate that improved markets for the existing resource could significantly contribute to the State's economy. If 50 percent of the projected annual growth could be marketed, an additional $152 million contribution could be made to the State's gross product and over 9,000 new jobs created.

Mielke, Manfred E.; Houston, David R.; Bullard, Allan T. **Beech bark disease management alternatives.** In: Proceedings integrated pest management symposium for northern forests; 1986 March 24-27; Madison, WI. Madison, WI: UWEX Cooperative Extension Service, University of Wisconsin-Extension, 1986: 272-280.

Beech bark disease has the potential to affect American beech throughout its range. Strategies to deal with the disease vary according to the geographic proximity of beech scale to tree stands in question, the rate of buildup of

scale within the stand, the amount of mortality caused by Nectria spp., and the endemic levels of the disease agents. Monitoring disease agents and tree condition, reducing beech populations, salvaging affected trees, and protecting potential and actual resistant trees are the major components in beech bark disease management.

Miller, Gary W.; Hanks, Leland F.; Wiant, Harry V., Jr. **A key for the Forest Service hardwood tree grades.** Northern Journal of Applied Forestry. 3(1): 19-22; 1986.

A dichotomous key organizes the USDA Forest Service hardwood tree grade specifications into a step-wise procedure for those learning to grade hardwood sawtimber. The key addresses the major grade factors, tree size, surface characteristics, and allowable cull deductions in a series of paired choices that lead the user to a decision regarding tree grade. Subtle grading rules, previously presented as footnotes to the major specifications, are included in the key. It simplifies the process so that the beginner can learn the system quickly, without detailed instruction from experienced tree traders.

Miller, Gary W.; Sarles, Raymond L. **Costs, yields, and revenues associated with thinning and clearcutting 60-year-old cherry-maple stands.** Res. Pap. NE-582. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 18 p.

Logging costs, product yields, and harvest revenues were determined for three thinning treatments (75, 60, and 45 percent residual stocking) and clearcutting in 60-year-old cherry-maple stands. The study area was logged by a three-man crew using chain saws and a wheeled skidder. Time study and yield data indicated that production rates and costs were similar among the four treatments. Production rates ranged from 18.5 to 19.3 cunits per day, depending on the treatment. Total logging costs, including felling, bucking, skidding, loading, hauling, and roads, ranged from $44 to $35 per cunit, decreasing as the cut increased. Sawlog yields ranged from 1,621 to 13,281 board feet per acre (International 1/4-inch rule), while pulpwood yields ranged from 630 to 1,897 cubic feet per acre. Harvest revenues were sufficient to pay for roads and timber sale costs in all treatments except the lightest thinning treatment.

Miller, Gary W. **Cultural practices in Appalachian hardwood sapling stands--are they worthwhile?** In: Smith, H. Clay; Eye, Maxine C., eds. Guidelines for managing immature Appalachian hardwood stands: workshop proceedings; 1986 May 28-30; Morgantown, WV. SAF Publ. 86-02. Morgantown, WV: West Virginia University Books; 1986: 33-45.

Forest managers often question the economic feasibility of cultural practices in hardwood sapling stands. Investment factors, including initial treatment cost, required rate of return, investment period, and stand response to treatment are discussed in terms of how they affect the outcome of early investments in even-aged hardwood stands. Attention is focused on precommercial thinning in hardwood sapling stands. Guidelines are provided to indicate the maximum allowable treatment cost under which precommercial thinning can be profitable. Data suggest that precommercial thinning is economical only in young stands containing relatively high-value species.

Montgomery, M. **Population Dynamics of the Gypsy Moth in Yugoslavia.** In: Proceedings of the 1985 national gypsy moth review; 1985 November 18-21. Columbus, OH. Columbus, OH: Ohio Department of Natural Resources; 1986: 68-72.

Montgomery, Michael E. **Gypsy moth host plant relationships and population dynamics.** In: Population dynamics of the gypsy moth in Yugoslavia; 1986 September 9-16; Ljubljana, Yugoslavia. Ljubljana, Yugoslavia: Yugoslave IUFRO World Congress Organizing Committee; 1986: 743-754.

The gypsy moth is the major defoliator of mixed-oak forests in the United States. Some species in the birch and willow families produce larger more fecund gypsy moth than oak, but nonpreference for immature leaves on these indeterminate growth species decreases likelihood of their defoliation. The relationship of gypsy moth with Betula series albae may be more coevolved than that with oak, and provides insight on why populations on oak are unstable. Forests on xeric, rocky ridgetops and well-drained sands are more susceptible to defoliation than vigorous, mesic-bottomland forests. Differences in species composition, leaf exposure to sunlight, and soil moisture stress are suggested as factors that contribute to susceptibility.

Myers, John R.; Miller, Gary W.; Wiant, Harry V., Jr.; Barnard, Joseph E. **Butt-log grade distributions for five Appalachian hardwood species.** Res. Pap. NE-590. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 4 p.

Tree quality is an important factor in determining the market value of hardwood timber stands, but many forest inventories do not include estimates of tree quality. Butt-log grade distributions were developed for northern red oak, black oak, white oak, chestnut oak, and yellow-poplar using USDA Forest Service log grades on more than 4,700 trees in West Virginia. Butt-log grade distributions indicate the probabilities associated with species and d.b.h. class. These estimates are useful for predicting the value of timber stands for which stand tables are available.

Nevel, Robert L., Jr.; Engalichev, Nicolas; and Gove, William G. **The timber industries of New Hampshire and Vermont--a periodic assessment of timber output.** Resour. Bull. NE-89. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 56 p.

Reports the results of a survey of the timber industries of New Hampshire and Vermont; contains statistics on industrial timber production and receipts, and production and disposition of the manufacturing residues. Comparisons are made with most recent data, and trends in industrial wood output are noted. Includes 25 statistical tables.

Nilon, C. H., Jr. **Quantifying small mammal habitats along a gradient of urbanization.** Syracuse, NY: State University of New York, College of Environmental Science and Forestry; 1986. 149 p. Ph.D. dissertation.

Noel, Diane S.; Martin, C. Wayne; Federer, C. Anthony. **Effects of forest clearcutting in New England on stream macroinvertebrates and periphyton.** Environmental Management. 10(5): 661-670; 1986.

Northeastern Forest Experiment Station. **Guide to experts in forestry and natural resources.** NE-INF-67-86. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 40 p.

Our greatest resource is the expertise of the people who work at the Station and Area. To help make this abundant expertise available to the people who need it, the Northeastern Forest Experiment Station and Northeastern Area State and Private Forestry offices have compiled a list of Forest Service experts in the Northeast on a variety of subjects related to forestry and natural resources.

Northeastern Forest Experiment Station. **Publications of the Northeastern Forest Experiment Station--1984.** Gen. Tech. Rep. NE-110. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 29 p.

An annotated list of publications by Northeastern Forest Experiment Station scientists in 1984.

ODell, Thomas M. **Effect of heavy defoliation by gypsy moth on white pine survival and growth rate.** In: Funk, David T., comp. Eastern white

pine: Today and tomorrow. Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture, Forest Service; 1986: 122. Poster Session.

The mortality and growth of dominant, intermediate, and overtopped white pines that had been heavily defoliated were compared with undefoliated trees. At the end of the 5-year period, following 1 year of attack by the gypsy moth, 100 percent defoliation resulted in 28 percent mortality, and 90 percent defoliation resulted in 8 percent mortality; defoliation less than 90 percent caused little mortality. Diameter-growth losses were appreciable in the year of and that following defoliation, and for the 5-year period following defoliation. Managed stands had significantly less mortality and growth loss than unmanaged stands.

ODell, Thomas M. **Effect of heavy defoliation by gypsy moth on white pine survival and growth rate.** In: Funk, David T., comp. Eastern white pine: Today and tomorrow. Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture; Forest Service; 1986: 122. Abstract, Poster session.

Ossenbruggen, P. J.; Peters, M. A.; Shigo, A. L. **Potential failure of a decayed tree under wind loading.** Wood and Fiber Science. 18(1): 168-186; 1986.

Patric, J. H.; Helvey, J. D. **Some effects of grazing on soil and water in the eastern forest.** Gen. Tech. Rep. NE-116. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 25 p.

Although woodland grazing in the Eastern United States has greatly decreased during recent decades, it still is widely practiced. This literature review indicates minimal damage to the soil and water resource unless grazing intensity greatly exceeds the land's carrying capacity.

Patton, Roy L.; Garraway, Michael O. **Ozone-induced necrosis and increased peroxidase activity in hybrid poplar (Populus sp.) leaves.** Environmental and Experimental Botany. 26(2): 137-141; 1986.

Peroxidase activity was assayed in leaves from two positions (nodes 5 and 15) along the stems of four clones of hybrid poplar that had been fumigated with ozone at 0.14 ul/l for up to 6 weeks. Two clones were designated ozone-sensitive, and two were designated ozone-resistant according to the amount of ozone-induced injury that developed. Ozone-induced lesions were seen on leaves at both sampled nodes of the sensitive clones and on the leaves at node 15 on one of the resistant clones. Peroxidase activity was higher in leaves from the sensitive clones than in leaves from the resistant clones and higher in old (node 15) leaves than in young (node 5) leaves. These results are discussed in terms of a possible mediating effect of peroxidase activity on ozone-induced foliar injury.

Pechak, David G.; Noble, Reginald D.; Dochinger, Leon. **Ozone and sulfur dioxide effects on the ultrastructure of the chloroplasts of hybrid poplar leaves.** Bulletin of Environmental Contamination and Toxicology. 36: 421-428; 1986.

Peters, Penn A. **Estimating average volume per turn for skidding systems.** In: Wiant, Harry, V., Jr.; Yandle, David O.; Kidd, Willialm E., eds. Proceedings of forestry microcomputer software symposium; 1986 June 29-July 2; Morgantown, WV. Morgantown, WV: West Virginia University; 1986: 422-439.

This paper presents an HP-9845 computer program, VOLPTN, written in BASIC, that calculates average volume per turn as a function of average volume per piece removed, the load capacity, and the load curve intercept.

Phillips, Ross A. **A temporary bridge to support skidder traffic.** Northern Logger. 34(10): 20-21; 1986.

A portable bridge to improve skidding conditions has been designed by the USDA

Forest Service. The bridge can be rapidly placed in the needed location and quickly recovered after use. Design for the bridge is included so that construction of the bridge can be accomplished in most shops that do steel work.

Pierce, R. S.; Siccama, T. G. **Chapter 5. Hubbard Brook Experimental Forest background and synthesis.** In: Coupling of ecological studies with remote sensing: potentials at four biosphere reserves in the United States. Dept. State Publ. 9504. Washington, DC: U.S. Department of State; 1986: 41-51.
This paper outlines characteristics for the Hubbard Brook Experimental Forest in New Hampshire, a designated Biosphere Reserve in the MAB Program. It briefly discusses some of the historical development and summarizes the treatments imparted on the basin. A summary of production on Watershed 6, one that is characteristic of this northern hardwood forest, is provided.

Podgwaite, J. D. **Effects of insect pathogens on the environment.** Fortschritte der Zoologie. 32: 279-287; 1986.

Podgwaite, J. D.; Mazzone, H. M. **Latency of insect viruses.** Advances in Virus Research. 31: 293-320; 1986.

Podgwaite, John D.; Rush, Peter; Hall, David; Walton, Gerald S. **Field evaluation of a nucleopolyhedrosis virus for control of redheaded pine sawfly (Hymenoptera: Diprionidae).** Journal of Economic Entomology. 79: 1648-1652. 1986.
Populations of redheaded pine sawfly larvae in Michigan and Wisconsin were treated by mistblower with high and low doses of Lecontvirus, a nucleopolyhedrosis virus product. In both states, a dose rate of 5.0×10^9 polyhedral includsion bodies (PIB) per hectare virtually eliminated larval populations in 2 weeks. In Wisconsin, the low dose (1.0×10^9 PIB per hectare) reduced the larval population by >96 percent 31 days after treatment, though foliage protection was significantly lower than that provided by high-dose treatments.

Podgwaite, J. D.; Shapiro, M. **Evaluation of sunlight protectants for gypsy moth, Lymantria dispar L., nucleopolyhedrosis virus.** In: Samson, R. A.; Vlak, J. M.; Peters, D., eds. Fundamental and applied aspects of invertebrate pathology; 1986 August 17-22; Looijen, Wageningen. Looijen, Wageningen: Ponson and Looijen; 1986: 154.

Reardon, R. C.; Kaya, H. A.; Fusco, R. A.; Lewis, F. B. **Evaluation of Steinernema seltiae and S. bibionis (Rhapditida; Steinernematidae) for suppression of Lymantria dispar and (lepidoptera: lymantriidae) in PA.** U.S.A. Agriculture Ecosystems & Environment. 15(1): 1-10; 1986.

Reardon, Richard C.; Kolodny-Hirsch, Douglas; McManus, Michael L. **Gypsy moth integrated pest management.** In: Proceedings integrated pest management symposium for northern forests; 1986 March 24-27; Madison, WI. Madison, WI: UWEX Cooperative Extension Service, University of Wisconsin-Extension, 1986: 203-215.
An integrated pest management approach is being implemented in an attempt to evaluate the feasibility of managing gypsy moth populations at low levels over a wide range of ecological, geographic, and land-use areas. This approach relies heavily on density, trend and population quality data collected in the survey and monitoring system; development of decision matrices; implementation of intervention strategies/tactics; and an evaluation system. Hopefully, this pilot project will serve as a model for additional attempts to manage low-density populations.

Remington, Susan B. **Amount and characteristics of logging residue on harvested areas in Vermont.** Northern Journal of Applied Forestry. 3(2): 63-65; 1986.
An assessment of the type and volume of logging residue was completed for 49

harvested areas in Vermont (manual felling, ground skidding). The line intersect technique was used to sample residue in the areas. On a per-acre basis, the mean volume of logging residue was 264 ft^3 with a range of 69 to 797 ft^3. The average volume of residue found in a softwood stand was 169 ft^3 with a range of 69 to 313 ft^3. The average volume of residue found in a hardwood stand was 329 ft^3 with a range of 69 to 797 ft^3. The average piece size was 3.4 in diameter at the small end, 6.1 in at the large end, with a length of 16.3 ft and volume of 1.6 ft^3.

Remington, Susan B.; Dennis, Donald F. **New Hampshire's stumpage and roadside prices: Characteristics and Trends.** Res. Note NE-332. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 8 p.

Reports average stumpage and roadside prices and their relative rates of change for timber and logs in New Hampshire for 1964 to 1983. Stumpage and roadside prices increased overall from 1964 to 1983. Roadside prices increased at a slower rate than stumpage prices. Real sawtimber prices increased for all species except hemlock during the period. Red oak prices increased at the greatest rate. Hardwood-pulpwood stumpage prices increased over the study period while spruce/fir and other softwood-pulpwood stumpage prices decreased in real terms. For the 20-year period, harvest cost for sawtimber decreased in real terms while the harvest cost for pulpwood increased less than 1 percent.

Reynolds, Hugh W.; Araman, Philip A. **Program BLANKS on the IBM-PC.** Gen. Tech. Rep. NE-107. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 28 p.

Describes a computer program that allows a company to determine the number of edge-glued, standard-size blanks needed to satisfy the rough-part needs specified in a given cutting bill. Program BLANKS has been written in FORTRAN using 80 column card input for use on a mainframe computer. The program has been translated to BASICA for use on the IBM-PC. Also described are rough-part cutting bill input file creation and manual sorting programs. A sample rough-part cutting bill and a blanks analysis are included.

Reynolds, Hugh W.; Hansen, Bruce G. **Making black cherry blanks from System 6.** Res. Pap. NE-574. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 10 p.

Low-grade, small-diameter black cherry timber was used to make System 6 cants. Cherry from the Allegheny National Forest, west-central Pennsylvania, north-central Pennsylvania, western Maryland, and the Monongahela National Forest was used. The cants were resawed to 4/4 boards, the boards dried, and blanks were made at the Princeton Laboratory's System 6 pilot plant. By varying the rough mill procedures, differences in board quality and cutting bill requirements were accommodated keeping yields high. The cherry from the Pennsylvania and Maryland sites gave similar yields, while the West Virginia cherry gave 5 percent higher yields. Gum streak was not a problem. Pennsylvania and Maryland cherry gave a 39.0 percent return, and West Virginia cherry gave a 50.3 percent return on a $2.2 million 10-year investment.

Reynolds, Hugh W.; Hansen, Bruce G. **System 6: a pricing strategy for long blanks.** Res. Pap. NE-573. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 14 p.

In System 6, small-diameter, low-grade hardwood timber is used to make blanks in standard sizes. Blanks are made in one thickness and one quality class but in all the standard lengths during each production run. The quantity of blanks per length can be varied, while keeping total yield high, by using proper production control techniques. However, when the percentage of long blanks is

increased beyond 15 percent, yields of required blanks will drop--though total yields remain constant--and earnings will be lowered. We describe a procedure that can be used to keep constant or improve earnings when the demand for long blanks exceeds the 15-percent level.

Reynolds, Hugh W.; Kallio, Edwin. **Application of the system 6 process to hardwood thinnings.** In: Sturos, John A., comp. Hardwood thinning opportunities in the Lake States; Proceedings of a Symposium; 1984 April 20; Escanaba, MI. Gen. Tech. Rep. NC-113. St. Paul, MN: U.S. Department of Agriculture, Forest Service; 1986: 114-119.

Additional revenues to support the best silvicultural practices can be gained by selling logs and bolts from commercial cuts to producers of high-valued products. System 6 is a new technology to convert small-diameter, low-grade timber from hardwood thinnings to a new, high-valued product called blanks. This new technology can provide jobs at low investment levels per job while improving the hardwood forest.

Romancier, Robert M. **Opening remarks for White Pine Symposium.** In: Funk, David T., comp. Eastern white pine: Today and tomorrow: Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture; Forest Service; 1986: i.

Rothwell, Frederick M. **Degradation of woody mulching materials by minesoil microorganisms.** In: 1986 Annual Meeting of the American Society for Surface Mining and Reclamation; 1986 March 17-20: Jackson, MS. p. 71.

Mulch materials such as hardwood bark have a high content of polymerized lignin, and are relatively resistant to microbial degradation. The initial stage in decomposition of this complex polymer is generally attributed to the metabolic activities of white rot Basidiomycete fungi. A member of this group of fungi was isolated from hardwood bark materials used as a mulch on minesoil plots. Results suggest that in addition to the effectiveness of hardwood bark as a temporary aid in stabilizing the surface and improving soil microclimatic conditions for establishing revegetation, it also may represent an important long-term source of structural units for humus formation.

Rowntree, Rowan A. Ecology of the urban forest--Introduction to Part II. Urban Ecology. 9: 229-243; 1986.

Eleven studies of urban forest function are introduced in two general categories: factors influencing the evolution of the urban forest, and effects of the urban forest on human and faunal environments.

Safford, L. O.; Czapowskyj, M. M. **Fertilizer stimulates growth and mortality in a young Populus-Betula stand: 10-year results.** Canadian Journal of Forest Research. 16: 807-813; 1986.

Following a uniform thinning, a young bigtooth aspen, quaking aspen, paper birch, and red maple stand was treated with nitrogen (N), phosphorus (P), and lime, singly and combined. Nitrogen increased the growth of all species. Lime and P also tended to increase the growth of bigtooth aspen and paper birch. Nitrogen increased mortality and lime reduced mortality. Quaking aspen suffered proportionally greater mortality than other species. The results suggest that both N and lime will be required for an optimum response of aspen and birch growing on acid spodosols in the Northeast, but the cause of and a means to avoid increased mortality caused by fertilizer needs to be determined before large-scale N fertilizer treatments are adopted.

Sarles, Raymond L.; Luppold, William G. **Technoeconomic analysis of conventional logging systems operating from stump to landing.** Res. Pap. NE-577. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 23 p.

Analyzes technical and economic factors for six conventional logging systems suitable for operation in eastern forests. Discusses financial risks and

business implications for loggers investing in high-production, state-of-the-art logging systems. Provides logging contractors with information useful as a preliminary guide for selection of equipment and systems. Discusses economic effects of harvesting systems on future stumpage prices and longrun supply of roundwood material.

Sarles, Raymond L. **Cost of thinning in Appalachia using a truck-mounted crane.** Tech. Pap. Harvesting 4. 235442 (86-P-4). Washington, DC: American Pulpwood Association, Inc. Inc.; 1986. 17 p.

Schier, George A. **Seedling growth and nutrient relationships in a New Jersey Pine Barrens soil treated with "acid rain."** Canadian Journal of Forest Research. 16(1): 136-142; 1986.
The effects of simulated acid rain solutions on growth of pitch pine seedlings in undisturbed soil cores from the New Jersey Pine Barrens were examined. Solutions of pH 5.6, 4.0, and 3.0 (SO_4^{2-}-Cl^--NO_3^-, 4:2:1), totaling 1.4 times annual ambient precipitation, were applied directly to soil cores from the A horizon during a 1-year period. By varying photoperiod and diurnal temperature, two growing "seasons" with an intervening dormant period were simulated. Soil chemistry, soil leachate chemistry, seedling nutrition, and seedling growth were monitored. Seedling dry weight was significantly greater at pH 3.0 than at the less acid treatments. Foliar nutrient contents indicated that growth stimulation at pH 3.0 probably resulted because of increased availability of nitrogen and input of nutrient cations from acid- induced weathering of soil minerals. There were sharp increases in Ca and Mg leaching when the pH of the irrigating solution was lowered, but solution acidity had little effect on depletion of K. Declines in nutrient leaching during the experiment indicated that weatherable cations were becoming depleted. Although Al mobility was greatly accelerated by an increase in acid inputs, Al toxicity symptoms were not observed.

Schreiber, L. R.; Conaway, E. E.; Peacock, J. W. **Aggressiveness, competitiveness, and stability of tolerance of benzimidazole-tolerant strains of Ceratocystis ulmi.** Plant Disease. 70(2): 154-158; 1986.

Scott, Charles T. **Proposed Northeastern forest survey emphasizing disturbance detection.** In: Proceedings, Use of auxiliary information in natural resource inventories conference; 1985 October 1-2; Blacksburg, VA. SAF Publ. 86-01. [Location of publisher unknown]: [Publisher unknown]; 1986: 146-151.
The Northeastern Forest Survey has used two- and three-occasion Sampling with Partial Replacement (SPR) since the early 1960's. Currently, the use of SPR has been complicated by outdated stratification information and by the complexity of three- and four-occasion SPR estimation. The new design proposed for the Northeast addresses these problems and the need for improved trend information. The design: 1) uses land change information from aerial photographs as part of the double sampling for stratification design, 2) requires the classification of remeasured plots into the new strata, 3) remeasures a high proportion of plots while adding some new plots, and 4) ignores the SPR regression and weighted estimation procedures. The new design is expected to be more cost effective for trend information and is nearly as efficient for current estimates as the three-occasion SPR design. The new design should be much easier to understand and to analyze.

Scott, Charles T. **An evaluation of sampling with partial replacement.** In: Proceedings, Use of auxiliary information in natural resource inventories conference; 1985 October 1-2; Blacksburg, VA. SAF Publ. 86-01. [Location of publisher unknown]: [Publisher unknown]; 1986: 74-79.
Sampling with Partial Replacement (SPR) has been used in forestry since the early 1960's as an alternative to Continuous Forest Inventory (CFI) and temporary surveys. An evaluation of the

advantages and disadvantages of SPR is presented based on nearly 25 years of experience in the Northeast. The advantages of SPR are: 1) cost-effectiveness for both current and trend information, 2) protection against unrepresentative samples, and 3) sampling design flexibility. The disadvantages are: 1) complicated sampling design, 2) complicated analytical procedures, and 3) changing strata sizes between surveys. Potential solutions to some of the problems are discussed.

Scott, Charles T. **A test of ocular estimation of merchantable tree heights.** Program and Abstracts. Midwest Forest Economists, Midwest Forest Mensurationists; 1986 August 13-14; Urbana, IL. Urbana, IL: University of Illinois; 1986: 30.
Field trials were conducted to separate the error in each step caused by estimation. The results were evaluated both for unbiasedness and consistency between four cruisers. Three estimation methods were used; 1) ocular estimation, 2) ocular estimation after using instrument on nonsample tree, and 3) measurement with instrument.

Seymour, Robert S.; Hannah, Peter R.; Grace, James R.; Marquis, David A. **Silviculture: The next 30 years, the past 30 years. Part IV. The Northeast.** Journal of Forestry. 84(7): 31-38; 1986.
For the past 30 years these trends have characterized silviculture in the Northeast: growing-stock volumes have increased dramatically; even-age silviculture expanded; the importance of advance reproduction has been established for most species and successful regeneration results from variations of shelterwood cuttings; several million nonindustrial owners are motivated either by nontimber values or short-term financial concerns; advances in silviculture have been applied to a limited area, mostly on public and industrial forests. In the next 30 years the following developments are likely: Ingrowth may decline abruptly, contrary to earlier predictions, causing inventories to level off and eventually decline. Silvicultural emphasis will shift from intermediate practices to regeneration. If harvesting pressure intensifies, the forest of the 21st century conceivably could be regenerated largely during the next three decades.

Shevenell, B. J; Shortel, W. C. **An ion profile of wounded red maple.** Phytopathology. 76(2): 132-135; 1986.
Twelve red maple trees with multiple drill wounds were studied to determine the ion content of tissues associated with wounds. Water extracts of sapwood, discolored wood, and the boundary layer between them were analyzed for ion content by ion chromatography and atomic absorption spectrophotometry. Total phenols, extract electrical resistance, pH, and total soluble dry matter were also determined. There were greater accumulations of K^+, Ca^{2+}, acetate, oxalate, formate, and phenols in the boundary tissue than in sapwood. Discolored wood had increased levels of K^+, acetate, malate, oxalate, and formate compared to sapwood. The organic anions seem to occur as acids in the discolored wood and as K-salts in the boundary tissue.

Shigo, A. L.; Gregory, F. G.; Campana, R. J.; Dudzik, K. R.; Zimel, D. M. **Patterns of starch reserves in healthy and diseased American elms.** Canadian Journal of Forest Research. 16(2): 204-209; 1986.
Healthy American elms stored starch all year in 12 to 18 growth rings. Starch reserves in healthy elms were lowest at the time of leaf expansion, which was also the time of spring vessel formation and the time of highest susceptibility to Ceratocystis ulmi. Nonconductive barrier zones separated infected wood from wood that normally stored starch. The new wood cells that formed after the barrier zone was completed did not store starch until the end of the growth period. When additional infections occurred the same growth period or the next growth period, the tree had only a single functioning growth ring to maintain starch reserves. Trees inoculated with C. ulmi in June had significantly less starch reserves than controls in August of the same year.

All trees in one study that died during the end of 1984 had trace amounts of starch at the end of 1983. The data suggest that depletion in trunk starch reserves is a manifestation of the host-pathogen interaction that is correlated with tree death.

Smith, H. Clay; Eye, Maxine C., eds. **Guidelines for managing immature Appalachian hardwood stands: Workshop proceedings.** 1986 May 28-30; Morgantown, WV. SAF Publ. 86-02. Morgantown, WV: West Virginia University Books; 1986: 283 p.

Smith, H. Clay; Lamson, Neil I. **Wild grapevines--a special problem in immature Appalachian hardwood stands.** In: Smith, H. Clay; Eye, Maxine C., eds. Guidelines for managing immature Appalachian hardwood stands: Workshop proceedings; 1986 May 28-30; Morgantown, WV. SAF Publ. 86-02. Morgantown, WV: West Virginia University Books; 1986: 228-239.
Wild grapevines are highly desirable to wildlife but often are detrimental to timber production. Information is available on controlling the growth of grapevines in immature Appalachian hardwood stands. Overstory shading and cutting of grapevines near groundline are the keys to control. Suggestions are provided that allow the forest manager and landowner to make decisions on grapevine management to satisfy objectives ranging from maximum wildlife interest to maximum production of quality timber.

Smith, H. Clay; Lamson, Neil I. **Cultural practices in Appalachian hardwood sapling stands--if done, how to do them.** In: Smith, H. Clay; Eye, Maxine C., eds. Guidelines for managing immature Appalachian hardwood stands: Workshop proceedings; 1986 May 28-30; Morgantown, WV. SAF Publ. 86-02. Morgantown, WV: West Virginia University Books; 1986: 46-61.
Recommendations concerning the use of cleanings, liberation cuts, thinnings, and crop-tree release practices in Appalachian hardwood sapling stands are discussed. In general, cleanings are not recommended. Good judgment is necessary in deciding whether to use liberation cuts. When thinning fully stocked sapling stands by a low thinning technique, one-third to one-half of the basal area should be removed to obtain an acceptable growth response. Recommendations for crop-tree release include selecting 50 to 75 crop trees per acre and releasing them by a crown-touching method in stands where the average height of codominant trees is at least 25 feet tall. Guidelines are provided for selecting and releasing crop trees of both seedling and stump sprout origin.

Smith, C. T., Jr.; McCormack, M. L., Jr.; Hornbeck, J. W.; Martin, C. W. **Nutrient and biomass removals from a red spruce - balsam fir whole-tree harvest.** Canadian Journal of Forest Research. 16(2): 381-388; 1986.
A mechanized whole-tree harvest was conducted on a watershed in central Maine dominated by Picea rubens Sarg. and Abies balsamea (L.) Mill. The harvest removal and redistribution of biomass, nitrogen, phosphorus, calcium, magnesium, and potassium were estimated and evaluated with respect to estimates of site nutrient reserves. Regression equations were developed to estimate the nutrient contents and ovendry weight of the aboveground components of the Picea rubens and Abies balsamea. Unit area estimates of nutrient and biomass removals were based on the application of the regression equations to a tally of all trees on twelve 0.04-ha square plots. Unit area estimates were made of exchangeable and total nutrients contained in the forest floor and glacial till above a hardpan. The harvest removed 90 percent of the biomass, 91 percent of the nitrogen, phosphorus, potassium, and calcium and 90 percent of the magnesium in the above-stump portions of the forest. These removals were from 2 to 4 times the amount of nutrients that would have been removed by a bole-only harvest, while increasing biomass removals by 1.4 times. The nutrients removed by the harvest were between 0.1 and 5 percent of the total soil reserves. Nutrient emovals are evaluated in the context of three commonly used evaluation

approaches: static comparisons of nutrient pools, nutrient-input output budgets, and computer simulation.

Smith, C. Tattersall; Martin, C. Wayne; Tritton, Louise M., eds. **Proceedings of the 1986 symposium on the productivity of northern forests following biomass harvesting.** Gen. Tech. Rep. NE-115. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 104 p.
Provides a regional prospective on resources, problems, and trends related to biomass harvesting in the Northeast.

Solomon, Dale S. **SIMSAP/SIMTIM: A forest growth simulator for even-aged northern hardwoods.** In: Wiant, H. V., Jr.; Yandle, D. O.; Kidd, W. E., eds. Proceedings of the forestry microcomputer software symposium; 1986 June 30-July 2; Morgantown, WV. Morgantown, WV: West Virginia University; 1986: 97-116.
SIMSAP begins with sapling stands after regeneration and uses an exponential process to determine changes in the numbers of stems by species. Available treatments include weeding and pruning, which will change the exponential curve and the quality distribution, respectively. The sapling stage continues until the mean stand diameter reaches 3.0 inches, at which time understory trees are deleted, leaving only the main crown canopy and a mean stand diameter of 4.5 inches. SIMTIM, the poletimber-sawtimber-harvest phase, uses stocking guides based on quadratic mean stand diameter, number of trees, and basal area per acre of trees in the main crown canopy. Growth and yield predictions for managed and unmanaged stands are based on site index, and age, and are allotted by residual basal area, percent sawtimber, and species composition. Thinning begins when the stand reaches the A line, a user-specified diameter, or a level of basal area above the B line. A quality-line-thinning, which retains a residual basal area of 80 ft2/acre until the quadratic mean stand diameter reaches 6.0 inches, also can be specified. Both thinning and harvest yields are presented in cubic feet and board feet per acre. The model is coded in FORTRAN 77 and available on mainframe and IBM compatible microcomputers with at least 128 Kb.

Solomon, Dale S. **Annual increment of stressed spruce and fir trees.** In: Environmental influences on tree and stand increment. Proceedings of an international conference; 1985 September 23-27; Durham, NH. Misc. Publ. 691. Orono, ME: University of Maine; 1986: 49-56.
Spruce and fir trees from northern Maine are used to show the annual increment along the bole of trees growing under stress from spruce budworm attacks. The reduction in radial increment occurs first in the upper bole and then is reduced in the lower bole after continued defoliation. The growth rates of trees growing under environmental stress are compared with expected long-term growth responses and decline of natural stands. Mensurational changes in radial increment within the bole that must be considered when comparing tree growth response to environmental stress are discussed, and precautions needed when interpreting isolated results are noted.

Solomon, Dale S.; Brann, Thomas B., eds. **Environmental influences on tree and stand increment.** Proceedings of an international conference; 1985 September 23-27; Durham, NH. Misc. Publ. 691. Orono, ME: University of Maine; 1986. 186 p.
An international conference on environmental influences on tree and stand increment was held at the University of New Hampshire in September 1985 to provide a forum for the international exchange of research methodology by scientists working on the mensurational aspects of forest tree and stand increment. Included were discussions on the techniques and methods of measuring tree and stand increment, the use of these techniques in predicting future growth, and changes in that growth that occur as a result of external stress or changes in the environment.

Solomon, Dale S.; Hayslette, Homer T., Jr. **Predicted foliage production for defoliated balsam fir trees using a matrix model.** In: Environmental influences on tree and stand increment. Proceedings of an international conference; 1985 September 23-27; Durham, NH. Misc. Publ. 691. Orono, ME: University of Maine; 1986: 138-145.

A matrix model is developed to estimate foliage weight of defoliated and nondefoliated balsam fir trees. Foliage weight in each of seven age-classes can be predicted by knowing the d.b.h. and age of the tree. After defoliation by the spruce budworm, the maturation of each age class of foliage is followed and compared with a sampled estimate or foliage from defoliated trees. Defoliation patterns followed annually are: (1) continued severe; (2) increasing; and (3) continuously light removal of the current-year foliage class. The model provides a basis for estimating the amount of foliage annually in each age class.

Solomon, Dale S.; Hosmer, Richard A.; Hayslett, Homer T., Jr. **A two-stage matrix model for predicting growth of forest stands in the Northeast.** Canadian Journal of Forestry Research. 16: 521-528; 1986.

Matrices are used to model ingrowth, survivor growth, and mortality for stands in different forest types in the Northeast. Equations are developed for several species from softwood and northern hardwood stand data estimating the probability of trees remaining in a diameter class, increasing one or two diameter classes, or dying. By knowing species composition and diameter distribution, FIBER predicts stand yields for managed and unmanaged stands with densities ranging from 9.2 to 41.3 m^2/ha using 5-year iterations. Actual and predicted volume estimates from independent data sets are compared for different species compositions, densities, thinning operations, and harvest intervals in the softwood, northern hardwood, and mixed-wood forest types.

Solomon, Dale S.; Hosmer, Richard A. **FIBER: A growth model for forest stands in the northeast.** In: Wiant, H. V., Jr.; Yandle, D. O.; Kidd, W. E., eds. Proceedings of the forestry microcomputer software symposium; 1986 June 30-July 2; Morgantown, WV. Morgantown, WV: West Virginia University; 1986: 131-145.

A new stand model, FIBER, has been developed to predict growth and yield for spruce-fir, northern hardwood and a mixture of these types in the Northeast. FIBER is a matrix model using linear equations to predict ingrowth, probability of survivor growth, and mortality by species. The model incorporates changing transition probabilities to predict volume and project diameter distributions over time. Comparisons with actual volumes from separate data sets are given. FIBER has been coded in Fortran 77; is user friendly; and is available for the mainframe and IBM compatible microcomputers with at least 256 Kb. The model can be applied to managed and unmanaged stands, both even-aged and uneven-aged, over a range of densities, site indices, species mixtures, and intermediate treatments. Thinning and harvest yields are presented.

Solomon, Dale S.; Leak, William B. **Simulated yields for managed northern hardwood stands.** Res. Pap. NE-578. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 24 p.

Board-foot and cubic-foot yields developed with the forest growth model SIMTIM are presented for northern hardwood stands grown with and without management. SIMTIM has been modified to include more accurate growth rates by species, a new stocking chart, and yields that reflect species values and quality classes. Treatments range from no thinning to intensive quality product management over a range of sites.

Sonderman, David L. **Changes in stem quality of young thinned hardwoods.** Res. Pap. NE-576. Broomall, PA: U.S. Department of Agriculture, Forest

Service, Northeastern Forest Experiment Station; 1986. 9 p.
Describes changes in limb-related defects on 18-year-old, even-aged hardwoods 6 years after thinning. Stocking levels of 30, 45, and 60 percent were studied. There were fewer defects per square foot of surface area in the higher stocking plots than in the lower stocking plots. The average number of live limbs decreased 83 percent in the unthinned plots and increased slightly in the heavily thinned plots. The results showed that frequency and size of limb-related defects are affected by stand density over a short period of time.

Stern, George E.; Wallin, Walter B.; Whitenack, Kenneth R. **Evidence shows pallet rigidity to be a major indicator of pallet durability.** Pallet Enterprise. 6(1): 42-45; 1986.

Stevens, J. C.; Richards, N. A. **Village and street tree resources: a comparison of structure.** Arboricultural Journal. 10(1): 45-52; 1986.

Stout, Susan Laurane. **22-year growth of four planted hardwoods.** Northern Journal of Applied Forestry. 16(2): 69-72; 1986.

Stout, Susan Laurane; Nyland, Ralph D. **Role of species composition in relative density measurement in Allegheny hardwoods.** Canadian Journal of Forest Research. 16: 574-579; 1986.
Two frequently used measures of relative stand density, the tree area ratio and the stand density index, were fitted to data from Allegheny hardwood stands. Both were modified to reflect the influence of species composition, since the proportion of the basal area in different species groups had an important effect on the measurement of relative stand density in this mixed species forest type. The tree area ratio model provided a better fit to the data than the stand density index model, particularly when adapted to include three species groups: one based on Prunus serotina Ehrh. and Liriodendron tulipifera L., one based on Acer rubrum L., and one based on Acer saccharum Marsh. and Fagus grandifolia Ehrh.

Thatcher, R. C.; Mason, G. N.; Hertel, G. D. **Integrated pest management in southern pine forests.** Agric. Handb. 650. Washington, DC: U.S. Department of Agriculture; 1986. 38 p.

Thompson, Ralph L.; Vogel, Willis G.; Wade, Gary L; Rafaill, Barbara L. **Development of natural and planted vegetation on surface mines in southeastern Kentucky.** In: 1986 national meeting American Society for Surface Mining and Reclamation "New Horizons in Mined Land Reclamation"; 1986 March 17-20; Jackson, MS. Princeton, WV: American Society for Surface Mining and Reclamation; 1986: 145-153.
Descriptive studies were made of the flora and vegetation on five 17- to 20-year-old surface mines that originally had been partly or entirely planted with herbaceous and woody species. A rich flora was found on these mines as a result of natural secondary successsion and artificial plantings. Certain similarities in vegetation were evident at all sites; yet, distinct differences existed that appeared to be influenced by site and minesoil characteristics, planted species, and contiguous plant communities. Results of these studies indicate that potentially productive forests are reestablishing on older surface-mined sites in southeastern Kentucky.

Tilghman, Nancy G.; Evans, Keith E. **A framework for nongame management in midwestern forests.** In: Management of nongame wildlife in the Midwest: A developing art. 47th Midwest Fish and Wildlife Conference; 1985 December 17; Grand Rapids, MI. Madison, WI: North Central Section of the Wildlife Society; 1986: 97-115.

Trimble, G. R, Jr., Tryon, E. H., Smith, H. Clay, Hiller, J. D. **Age and stem origin of appalachian hardwood reproduction following a clearcut and herbicide treatment.** Res. Pap.

NE-589. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 8 p.
Seven years after a clearcut and herbicide treatment in a West Virginia stand of Appalachian hardwoods, root and stem ages were determined for sugar maple, black cherry, and white ash. Age was used to verify origin and origin was used to evaluate reproduction stem development 7 years after clearcutting. Sugar maple stems originated from advanced reproduction; black cherry originated primarily from seedlings that germinated during or after treatment; and white ash stems were a mixture of seedlings, advanced reproduction, and stump sprouts.

Valentine, Harry T.; DuBois, Normand R.; Podgwaite, John D. **Optimizing the timing of applications of Bt to control gypsy moth: a modeling analysis.** In: Proceedings of the fourth international colloquium of invertebrate pathology; 1986 August 18-22; Veldhoven, The Netherlands. Wageninngen, The Netherlands: Foundation of the Fourth International Colloquium of Invertebrate Pathology. 1986: 580-583.
A dynamic model abundance was modified to include the effects of a foliar application of Bt insecticide on the larval population. The model was used to determine the best time to apply insecticide to control larval abundance in forests susceptible to gypsy moth herbivory. Because many of the values of the parameters of the model were first-order approximations, sensitivity analyses were performed to assess how changes in these values affect optimal application times.

Valentine, Harry T.; Gregoire, Timothy G.; Furnival, George M.; Solomon, Dale S. **Unbiased estimation of bole increment.** In: Environmental influences on tree and stand increment. Proceedings of an international conference; 1985 September 23-27; Durham, NH. Misc. Publ. 691. Orono, ME: University of Maine; 1986: 67-72.
A two-stage sampling procedure that furnishes an unbiased estimate of the volume increment of a tree bole is described. Simulation and a field-test indicate the expected precision of an estimate.

Vogel, Willis G.; Rothwell, Willis G. **Bark mulch aids establishment of black walnut planted on Western Kentucky mine spoils.** In: Kolar, Clay A., ed. Better reclamation with trees: Proceedings of the fifth annual conference; 1985 June 5-7; Carbondale, IL. [Location of publisher unknown]: [Publisher unknown]; 1986: 104-110.
Mulching with hardwood bark greatly increased survival of black walnut seedlings planted on sandy loam mine soil in western Kentucky. Four methods of planting the seedlings were compared--planting bar, mattock, 8-inch auger hole backfilled with soil, and auger hole backfilled with topsoil. Half of the seedlings in each treatment were mulched by placing a bushel of shredded hardwood bark around each seedling when it was planted. A dense ground cover (about 90 percent) predominantly of Sericea lespedeza (Lespedeza cuneata) had become established by the fourth year after planting. After 7 years, survival of black walnut trees averaged 58 percent for mulched trees and 17 percent for unmulched ones. There were small differences in survival among the methods of planting.

Voorhis, Nancy G. **Sugarbush management in young stands: Effects of crop tree thinning.** Northern Journal Applied Forestry. 3(3): 106-108; 1986.
Three thinning intensities were tested in a sugar maple sapling stand in Vermont. The results were used to develop a guide for the efficient development of desirable sugarbush trees. The guide shows thinning intensity and timing alternatives.

Wade, Gary L. **Forest topsoil seed banks for introducing native species in eastern surface-mine reclamation.** In: Proceedings 1986 national meeting American Society for Surface Mining and Reclamation "New Horizons in Mined

Land Reclamation"; 1986 March 17-20; Jackson, MS. Princeton, WV: American Society for Surface Mining and Reclamation; 1986: 155-164.

Three pioneer communities, a mix of commonly used reclamation species, a community from a forest soil seed bank, and a mixed community of reclamation species plus seed bank species were established on surface-mine spoils in microplots. A total of 84 taxa originated from the soil seed bank, including five tree species. Adding the reclamation species to the seed bank soil resulted in significantly fewer established native species, including tree seedlings in the resulting community; many native species were stunted or phenologically delayed. The seed bank community produced more aboveground biomass and sequestered more N, P, K, Ca, and Mg in vegetation than in the other two communities. Speed of ground cover development ranked reclamation mix > reclamation mix plus seed bank > seed bank, but amounts of cover were not significantly different 16 weeks after the study was established. Differential effects of pioneer communities on ecosystem development on surface-mined lands and use of soil seed banks in their establishment are discussed.

Wagar, J. Alan; Heisler, Gordon M. **Rating winter crown density of deciduous trees: a photographic procedure.** Landscape Journal. 5(1): 9-18; 1986.

A study was undertaken to develop inexpensive yet accurate procedures for rating trees in terms of winter crown density, which correlates closely with amount of blocked solar radiation. Such procedures provide a basis for identifying better trees for energy-conserving planting. Leafless crowns of 69 trees of three species were photographed. The proportion of each crown image consisting of tree parts was then determined by dot-grid procedures. Crown density was least for the Kentucky coffeetree, greatest for Modesto ash trees, and intermediate for London plane trees. Crown density increased with tree size, and the pattern of this increase differed among species. The azimuth at which trees were photographed did not affect density estimates. The elevation angle at which photos were taken did affect density estimates, but regression procedures permit estimates based on a convenient elevation angle to be adjusted to correspond with estimates based on photos taken at the elevation best expressing the sun's average angle above the horizon during the dates and hours of interest. Photographic and dot-count procedures are rapid, require no specialized equipment, and are well suited to ranking species and cultivars by the density of their winter crowns.

Wallner, William E.; McNamee, Peter J. **Research and management priorities for gypsy moth in North America.** 18th IUFRO World Congress; Division 2; Vol. II. Forest Plants and Forest Protection. Yugoslav IUFRO World Congress; 1986: 755-764.

Walton, Gerald S. **The number of observed classes from a multiple hypergeometric distribution.** Journal of the American Statistical Association. 81(393): 169-171; 1986.

The distribution of the number of classes observed, when sampling without replacement from a finite population comprised of k classes, is derived and factorial moments are given. The mean and up to the fourth central moment are presented. A simple application to an ecological problem illustrates the computations, and other potential applications are discussed.

Weisel, J.; Echelberger, H. E.; Deeg, B. F.; Shepard, B. **National cross-country ski area operations survey, winter 1984-85.** Jackson Hole, WY: National Nordic Consultants of Jackson Hole, WY; 1986. 78 p.

Wendel, G. W.; Smith, H. Clay. **Monongahela National Forest - Clover Run White Pine Plantation.** In: Funk, David T., comp. Eastern white pine: Today and tomorrow: Symposium proceedings; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture, Forest Service; 1986: 118. Poster Session.

The "Clover Run White Pine Plantation" was established in 1933 on the Monongahela National Forest near Parsons, West Virginia. White pine was planted at a spacing of 6 x 6 feet in alternate double rows with yellow-poplar, European larch, and Japanese larch. One part of the plantation was planted to pure white pine. None of the co-planted species have survived. At 51 years, there is an average of 44 Mbf per acre in the plantation. In 1948, 1958, and 1960, some of the best trees were pruned to 17 and 24 feet. Fomes annosus root rot was discovered in 1959 and has declined since 1966; no stump treatments have been applied since 1971. At present, the residual stand appears to be vigorous and healthy.

Wendel, G. W.; Smith, H. Clay. **Effects of prescribed fire in a central Appalachian oak-hickory stand.** Res. Pap. NE-594. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 8 p.

A prescribed fire in a central Appalachian mixed hardwood stand caused considerable damage to the butt logs of many overstory trees. Although there were increases in the abundance and distribution of several species of hardwoods, advanced red and chestnut oaks were poorly distributed 5 years after burning. An abundance of striped maple and other shrubs in the understory poses a threat to the development of desirable tree species. More research is needed on timing of fire in relation to oak seed crops and on reducing competition before fire can be recommended as a regeneration tool in central Appalachian hardwood stands.

Wharton, Eric H.; Powell, Douglas S. **Eastern white pine: Inventory and dynamics.** In: Funk, David T., comp. Eastern white pine: Today and tomorrow: Symposium proceedins; 1985 June 12-14; Durham, NH. Gen. Tech. Rep. WO-51. Washington, DC: U.S. Department of Agriculture, Forest Service; 1986: 16-21.

Timberland in the Eastern U.S. contains 4.5 million acres of white pine forest type, but most of this resource is found in New England and New York. Here, the eastern white pine growing-stock resource is growing at nearly twice its removal rate. The sawtimber resource is composed primarily of lower tree-grade material, which has shown some improvement in quality during recent years.

White, M. S.; Argent, R. M.; Sarles, R. L. **Effects of outside storage on the energy potential of hardwood particulate fuels. Part III. Specific gravity, ash content, and pH of water solubles.** Forest Products Journal. 36(4): 69-73; 1986.

About 150 tons of green, hardwood whole-tree fuel chips were stored outdoors in a 20-foot-high, conical pile at Blacksburg, Va. The pile was monitored for 1 year to determine the effect of outside storage on the rate of fiber loss, the level of noncombustibles in the fuel, and the pH of water-soluble matter. Chip samples were extracted from within the pile on a regular schedule. At ambient temperatures above 20°C, wood substance loss occurred at a uniform rate of 1.5 percent per month. Ash content increased by 0.23 percent per month after the first 4 months of storage. Water-soluble fractions of wood and bark were highly acidic (4.1 and 3.7 pH, respectively) and changed little over the study.

Widmann, Richard H. **Pulpwood production in the Northeast--1984.** Resour. Bull. NE-93. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 17 p.

This annual report contains information compiled from a canvass of all pulp mills that use pulpwood produced in the 14 Northeastern states. In 1984 total production reached 9,006,600 cords--up 5 percent (401,600 cords) from 1983. The roundwood portion increased by 5 percent to reach 6,648,800 cords, whereas the residue portion increased by 4 percent to 2,357,800 cord equivalents. The receipts of pulpwood at the 41 mills in the region set a new high of 9,503,300 cords consumed.

Widmann, Richard W. **Pulpwood production in 1984: Sets record; most notable gain in roundwood.** Northern Logger. 34(8): 20-21; 1986.
Twenty northeastern and north central states produced a total of 14.3 million cords of pulpwood in 1982. Although the total volume was the same as in 1981, production shifted from residues to roundwood. Pulpwood from manufacturing residues dropped nearly one-quarter million cords to the lowest level since 1975, while roundwood increased about one-quarter million cords to a new high.

Widmann, Richard H.; Wharton, Eric H. **The current and changing hardwood resource base in the Northeast, with a close look at Pennsylvania.** In: Proceedings, forest management decisions based on future forest product requirements; 1985 March 19-20; State College, PA. State College, PA: The School of Forest Resources and the Cooperative Extensive Service of The Pennsylvania State University; 1986: 12 p.
Forest surveys conducted by the USDA Forest Service in the Northeastern States have shown potential timber surpluses. This situation has occurred because the resource is growing faster than it is being cut, and the surplus is accumulating. As a result, we have a very valuable resource that is maturing. With the increasing value of the resource comes more opportunities to make and influence changes, particularly in the Northeast.

Widmann, Richard H.; Long, Michael. **Ohio timber products output--1983.** Resour. Bull. NE-95. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 29 p.
This report contains information compiled from a canvass of all sawmills and all other primary wood-product manufacturers that were operating in Ohio in 1983. The total industrial harvest in Ohio was over 82 million cubic feet in 1983. This was up 17 percent since 1978. Sawlogs accounted for 57 percent of the total and pulpwood accounted for 36 percent. Data are presented by product at two levels; state and geographic unit.

Wilkinson, R. C. **Site and age differences in family heritability estimates for bole diameter and sugar concentration of sap from open-pollinated progeny tests of sugar maple.** In: Thirtieth Northeastern Forest Tree Improvement Conference; 1986 August 21-24; Orono, ME. Orono, ME: The University of Maine; 1986.

Wilkinson, R. C.; Hawley, G. J. **How superior are sweet trees?** New England Farmer. 10(1): B2; 1986.

Woods, Frank W.; Becker, Charles W.; Curtis, Willie. **Haul roads: postmining management problems.** In: Proceedings of 1986 national meeting of the American Society for Surface Mining and Reclamation; "New Horizons in Mined Land Reclamation"; 1986 March 17-20; Jackson, MS. Princeton, WV: American Society for Surface Mining and Reclamation; 1986: 215-219.
Monitoring stations were installed in three small watersheds in the Cumberland Mountains and three in the Cumberland Plateau of east Tennessee to evaluate the effects of surface mining on water quality. Each set had a recently mined, old mined, and unmined watershed. Stream flow and concentration levels for five water-quality parameters, collected every 4 weeks from 1981 through 1984, were evaluated. Differences in water quality were found between mined and unmined watersheds, with mined ones usually having generally higher levels of minerals and greater turbidity. However, one unmined watershed yielded poorer water quality than its old mined counterpart watershed for most of the parameters tested, apparently due to an unpaved road. Water quality of one new mine also continued to deteriorate following mining due to controlled road use, trash dumping, and poor reclamation.

Woods, Frank W.; Becker, Charles W.; Curtis, Willie. **Recovery of water quality after strip mining.** Tennessee Farm and Home Science. 140: 10-13; 1986.

Surface mining can produce high levels of sediment and dissolved minerals in streams and other waters. Poor reclamation and haul roads can also lower water quality and prolong the period of recovery following mining. The study reported here was made to determine the rate at which the water quality of streams in watersheds subject to surface mining runoff returns to normal.

Yaussy, Daniel A. **Green lumber grade yields from factory grade logs of three oak species.** Forest Products Journal. 36(5): 53-56; 1986.
Multivariate regression models were developed to predict green board foot yields for the seven common factory lumber grades processed from white, black, and chestnut oak factory grade logs. These models use the standard log measurements of grade, scaling diameter, log length, and proportion of scaling defect. Any combination of lumber grades (such as 1 Common and Better) or total yield from a log can be predicted with these models. The coefficients presented here can be used in computer programs related to sawmill simulations, economic modeling, or log-yard inventory systems.

Author	Location
Adams, Edward L.	Princeton
Anderson, R. Bruce	Princeton
Araman, Philip A.	Princeton
Auchmoody, Luther, R.	Warren
Barger, Jack H.	Delaware
Baumgras, John	Morgantown
Beaton, John	Delaware
Berry, Frederick (Ret)	Delaware
Biller, Cleveland J.	Morgantown
Birch, Thomas W.	Broomall
Blum, Barton M.	Orono
Brisbin, Robert L.	Delaware
Brooks, Robert T.	Broomall
Burns, Denver P.	Broomall
Cannon, William N.	Delaware
Chang, Ming Tu	Delaware
Corbett, Edward S.	University Park
Crawford, Hewlette	Amherst
Curtis, Willie	Berea
Dale, Martin E.	Delware
Davidson, Walter H.	Princeton
DeBald, Paul S. (Ret)	Delaware
DeGraaf, Richard M.	Amherst
Demeritt, M. E., Jr.	Durham
Dennis, Donald	Burlington
Dochinger, Leon S.	Delaware
Donley, David E.	Morgantown
Dubois, Normand R.	Hamden
Dyer, Kenneth L.	Berea
Echelberger, Herbert	Burlington
Edwards, Pamala J.	Parsons
Ernst, Richard L.	Warren
Federer, C. Anthony	Durham
Feicht, David L.	Morgantown
Frank, Robert M.	Orono
Frieswyk, Thomas S.	Broomall
Funk, David T.	Durham
Galford, Jimmy R.	Delaware
Gansner, David A.	Broomall
Garrett, Peter W.	Durham
Gatchell, Charles J.	Princeton
Gibson, Lester (Ret)	Delaware
Godwin, Paul A.	Hamden
Gottschalk, Kurt	Morgantown
Graber, Raymond	Durham
Gregory, Garold (Ret)	Delaware
Gregory, Robert A.	Burlington
Grimble, David G.	Orono
Halverson, Howard G.	Berea
Hansen, Bruce G.	Princeton
Healy, William M.	Amherst
Heisler, Gordon M.	University Park
Helvey, J. David	Parsons
Herrick, Owen W. (Ret)	Broomall
Hertel, Gerard D.	Broomall

Author	Location
Hilt, Donald E.	Delaware
Hornbeck,James W.	Durham
Horsley, Stephen B.	Warren
Houston, David R.	Hamden
Huyler, Neil K.	Burlington
Jennings, Daniel T.	Orono
Jensen, Keith F.	Delaware
Kingsley, Neal	Delaware
Kochenderfer, James N.	Parsons
Lamson, Neil I.	Parsons
Leak, William B.	Durham
LeDoux, Chris B.	Morgantown
Leonard, Raymond (Ret)	Durham
Lewis, Franklin B.	Hamden
Luppold, William G.	Princeton
McManus, Michael L.	Hamden
McQuattie, Carolyn J.	Delaware
Malley, Anne M.	Broomall
Marquis, David A.	Warren
Martens, David G.	Princeton
Martin, C. Wayne	Durham
Mazzone, H. M. (Ret)	Hamden
Melhuish, John H.	Berea
Miller, Gary W.	Parsons
Montgomery, Michael	Hamden
More, Thomas A.	Burlington
Mott, Gordon (Ret)	Orono
Nevel, Robert L.	Broomall
ODell, Thomas M.	Hamden
Ossenbruggen, Sharon	Durham
Patton, Roy	Delaware
Peacock, John	Delaware
Peters, Penn A.	Morgantown
Phillips, Ross A.	Morgantown
Pierce, Robert S.	Durham
Podgwaite, J. D.	Hamden
Powell, Douglas S.	Broomall
Rast, Everette D.	Princeton
Remington, Susan B.	Burlington
Reynolds, Hugh W.	Princeton
Romancier, Robert M.	Broomall
Rothwell, Frederick M.	Berea
Rowntree, Rowan	Syracuse
Safford, Lawrence O.	Durham
Sarles, Raymond L.	Princeton
Schier, George A.	Delaware
Scott, Charles T.	Broomall
Sendak, Paul E.	Burlington
Sheehan, Katharine	Morgantown
Shields, Kathy S.	Hamden
Shigo, Alex L. (Ret)	Durham
Shortle, Walter C.	Durham
Smith, H. Clay	Parsons
Solomon, Dale S.	Orono
Sonderman, David L.	Princeton

Author	Location
Stout, Susan L.	Warren
Tilghman, Nancy G.	Warren
Valentine, Harry T.	Hamden
Vogel, Willis G. (Ret)	Berea
Wade, Gary	Berea
Wallin, Walter B.	Princeton
Wallner, William E.	Hamden
Walters, Russell S.	Warren
Walton, Gerald S.	Hamden

Author	Location
Wargo, Philip M.	Hamden
Wendel, George W.	Parsons
Wharton, Eric H.	Broomall
Widmann, Richard H.	Broomall
Wilkinson, Ronald	Burlington
Wright, Susan	Delaware
Yaussy, D. A.	Delaware
Yawney, Harry W.	Burlington

☆U. S. GOVERNMENT PRINTING OFFICE: 1987/748-076/60005