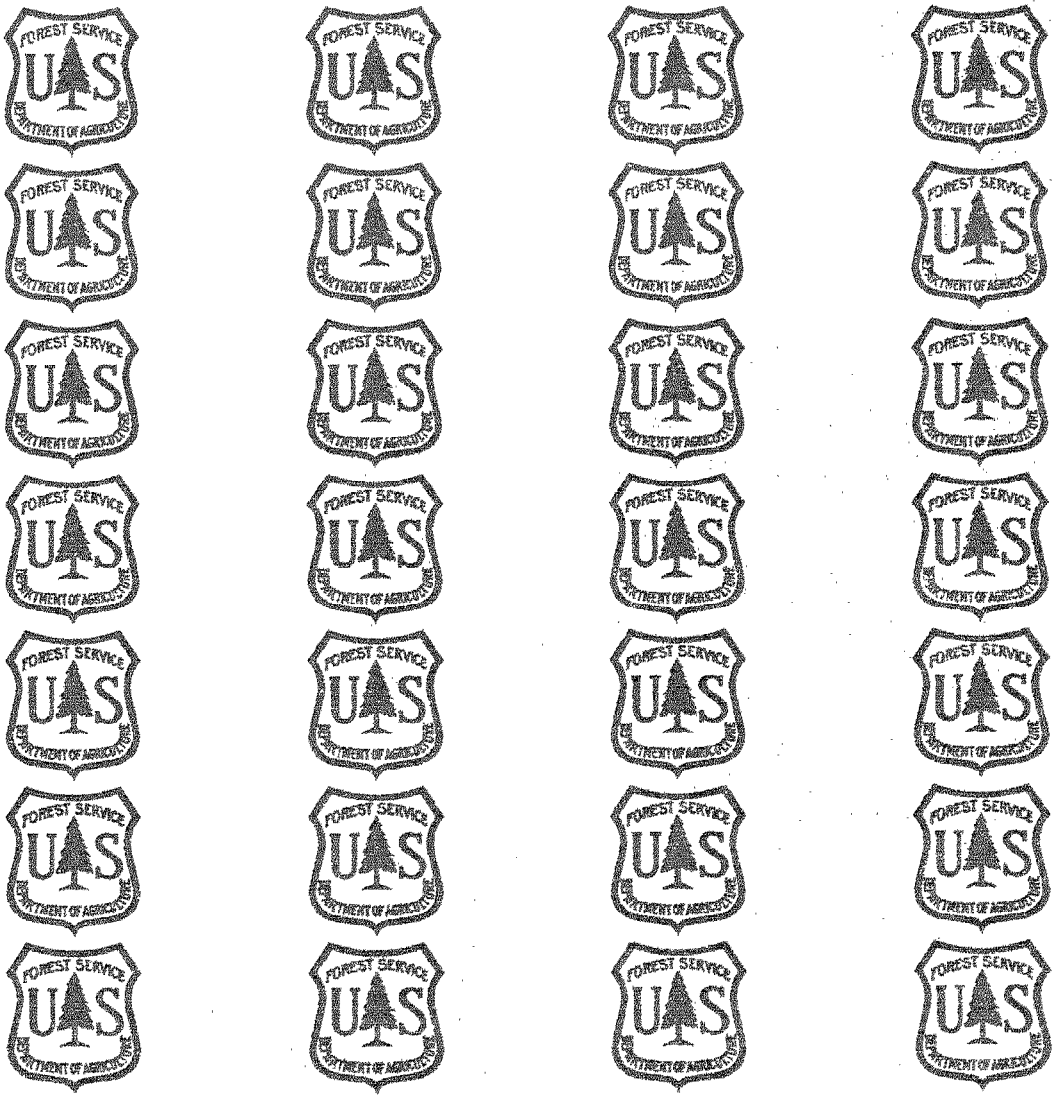
United States
Department of
Agriculture

Forest Service

**Northeastern Forest
Experiment Station**

General Technical
Report NE-127

Publications of the Northeastern Forest Experiment Station--1987



Publications--1987

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, E. L. 1987. **PC-SOLVE II--IBM-Compatible analysis system for hardwood sawmills.** Northern Logger. 35(9): 18-19, 27.
The SOLVE II computerized system for analyzing hardwood sawmills has assisted managers in analyzing hundreds of mills in the Northeastern and North-Central States. However, the system required the use of a large computer and managers had to rely on others to provide this service. This problem has been eliminated by a new IBM-compatible microcomputer version of the system. Called PC-SOLVE II, this new version provides the same output as the original system. With little assistance, hardwood sawmill managers can now make their own SOLVE II analysis.

Adams, Edward L. 1987. **PC-SOLVE II user's manual: a procedural guide for the microcomputer version of SOLVE II sawmill analysis tool.** Gen. Tech. Rep. NE-116. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 9 p.
A procedural guide for using the PC-SOLVE II system for analyzing hardwood sawmills. PC-SOLVE II is a microcomputer version of the original SOLVE II system. It requires the same input data and provides the same output information as the original system. To use the new system you need an IBM-PC or compatible microcomputer that (1) has 512K of resident memory, (2) uses Microsoft disk operating system (MS-DOS) Version 2.0 or greater, (3) has at least one floppy disk drive, and (4) is attached to a printer.

Anderson, R. Bruce. 1987. **Future availability of pallet raw material in the North.** Pallet Enterprise. 7(3): 31-32, 34.
Volume of material usage in the northern region raises many questions that are centered around the future availability of wood raw materials for the northern pallet industry. How will this resource be affected by the demands of a growing hardwood timber-using industry? Will there be sufficient volumes of wood raw material to meet the needs of the growing pallet industry? The pallet and container industry must be considered as the primary influence on this resource in the coming decades. The effect of increased pallet use on the North's wood resource will depend on what is out there now and in the future, what will be needed, and how it will be used.

Anderson, R. Bruce. 1987. **Pallet use in the grocery industry.** Pallet Enterprise. 7(5): 20, 22-23.
Discusses the current use of pallets in the grocery distribution system as well as changes in pallet use over the next decade.

Araman, Philip A. 1987. **Export markets for value-added forest products--hardwood panel and specialty products.** In: Plenary session IB: export markets for value-added forest products: executive summary; 1987 June 21-24; Louisville, KY. Madison, WI: Forest Products Research Society.
The Pacific Rim and western Europe have joined Canada as major markets for hardwood products from the United States. There are supplies of hardwood to meet future increases in demand so long as ways can be found to accommodate a greater variety of grades and species. Standard rough-dimension or edge-glued panels could help the grade-utilization situation by making an exportable product from nonexportable grades of lumber. These products also would create increased employment and value-added forest products for the export markets. The tightening of hardwood supplies from Southeast Asia should help provide additional demand for these dimension products and provide opportunities for a greater variety of U.S. species in the Pacific Rim and Western Europe.

Araman, Philip A. 1987. **Standard sizes for rough-dimension exports to Europe and Japan.** Wood & Wood Products. May. 2 p.
European and Japanese standard-size rough-dimension products are described, and their apparent sizes are listed. One set of proposed standard

sizes of rough dimension that could be manufactured in the United States for these markets is presented. The benefits of the production and sale of standard sizes of export rough dimension also are highlighted.

Araman, Philip A. 1987. **Eastern United States hardwood sawtimber resources and export potential.** In: Busby, Rodney L.; de Steiguer, J. Edward; Kurtz, William B., eds. Proceedings, 1987 joint meeting of Southern Forest Economics Workers and Midwest Forest Economists; 1987 April 8-10; Asheville, NC. [Place of publication unknown]: [Publisher name unknown]: 127-134.
To look at the export potential of the Eastern hardwood sawtimber resources including the Southern and Northern regions, hardwood resource data were compiled from USDA Forest Service state resource evaluation reports on a set of select export species. The species are the select oaks, yellow birch, hard maple, black walnut, black cherry, and the ashes. These species were chosen on the basis of their importance to the export market. Resource data are presented on the standing hardwood sawtimber (inventory growth and removals) of the select export species, and on all hardwood sawtimber. Estimates of standing sawtimber for 1985 are presented along with projections for 1990, 1995, and 2000 for the Eastern United States and the Northern and Southern regions.

Araman, Philip A.; Hansen, Bruce G. 1987. **Log, lumber, and veneer hardwood export markets.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 387-394.
Dramatic changes have taken place in the hardwood export market in the past 10 years. World demand for U.S. hardwood logs, lumber, and veneer has increased by more than 100 percent. Exports to Europe and the Pacific Rim, in particular, have grown significantly. A quantitative assessment of the U.S. export situation is presented. Also addressed are such issues as the importance of exports to our primary industry and likely short-term future developments in the hardwood export market.

Auchmoody, L. R. 1987. **Evaluating growth responses to fertilization: reply.** Canadian Journal of Forest Research. 17(1): 94.

Baker, C. J.; Tomerlin, J. R.; Mock, N.; Davidson, L.; Melhuish, J. 1987. **Effects of cations on germination of urediniospores of *Uromyces phaseoli*.** Phytopathology. 77: 1556-1560.
Urediniospores of Uromyces phaseoli races 39 and 40 germinated better in unpurified tap water than in ultrapure laboratory water. Experiments with freeze-dried residue of tap water dissolved in utlrapure water suggested that the tap water contained a component that simulated spore germination. When ions were removed from the tap water with ion-exchange resins, only cation-exchange resins decreased spore germination. Analysis of the tap water demonstrated that the major inorganic cations present were Ca^{2+}, K^{+} Mg^{2+}, and Na^{+}. Spores of both races were incubated for 3 to 4 hours with solutions containing varying amounts of these cations. Germination was measured with a microscope to view 100 spores for each of five replicates. Calcium, at concentration between 0.1 and 3 mm, had stimulatory effect proportional to the amount of cation present. Concentration of calcium greater than 3 mm had little or no additional effect on germination. Spore germination in the presence of Ca^{2+} was comparable to that of tap water. Magnesium had a lesser effect on spores.

Barger, Jack H.; Cannon, William N., Jr. 1987. **Response of smaller European elm bark beetles to pruning wounds on American elm.** Journal of Arboriculture. 13(4): 102-104.
From 1982 to 1984, inflight smaller European elm bark beetles were captured on American elms that were therapeutically pruned for Dutch elm disease control. Pruning wounds were treated with wound dressing or left untreated to determine effects of the treatments on beetle attraction. Significantly more beetles were captured at pruning sites than away from pruning sites, regardless of treatment. No differences were detected in beetle captures at pruning sites with or without wound dressing. Male to female sex ratios were unaffected.

Barger, Jack H.; Cannon, William N., Jr. 1987. **Effects of ozone and acid rain on pesticide degradation, Delaware, Co., OH., 1986.** Insecticide and Acaricide Tests: 1987. 12:354.
Two-year-old red and white oak seedlings were sprayed with insecticides to determine if chemical efficacy against gypsy moth larvae was affected by exposure to various levels of atmospheric deposition.

Barger, Jack H.; Hall, Richard W.; Townsend, Alden M. 1987. **Atmospheric deposition effects on host quality for insect herbivores.** In: National Acid Precipitation Assessment Program; Terrestrial Effects Task Group (V), peer review; 1987 March 8-13; Atlanta, GA. [Place of publication unknown]: [Publisher name unknown]: 199-205.
Atmospheric deposition has been shown to affect host-plant suitability for insect herbivores. We evaluated host-plant mediated effects of atmospheric deposition on the fecundity of elm leaf beetle.

Barger, Jack H.; Hall, Richard W.; Townsend, Alden M. 1987. **Atmospheric deposition effects on host quality for insect herbivores.** National Acid Precipitation Assessment Program. Terrestrial Effects Task Group (V), peer review; 1987 March 8-13; Atlanta, GA. [Place of publication unknown]; [Publisher name unknown]: 27. Abstract.

Baumgras, John E. 1987. **Hooking rules increase cable yarder productivity.** Northern Journal of Applied Forestry. 4: 33-35.
Hooking rules designed to increase average turn volume by limiting the minimum volume yarder per turn were tested with a small skyline cable yarder. The test was conducted on a steep-slope Appalachian hardwood site, harvesting fuelwood from logging residue. Average volume per turn increased from 10.0 to 12.3 cubic feet, increasing yarder production from 121 to 156 cubic feet per hour. This reduced the yarding cost from $22.74 per hundred cubic feet to $17.75 per hundred cubic feet.

Baumgras, John E. 1987. **Production study of the Swedish Rottne Snoken 810 harvester/processor in Pennsylvania softwood plantations.** In: Tufts, Robert, ed. Improving productivity through forest engineering. Proceedings of the Council on Forest Engineering: 9th annual meeting; 1986 September 29-October 2, Mobile, AL. [Place of publication unknown]: [Publisher name unknown]: 63-68.
Production study results are presented for the Swedish Rottne Snoken 810 harvester/processor. Capable of harvesting softwoods on adverse terrain, this machine can function as a harvester, felling and processing trees; or as a processor, limbing and bucking manually felled trees. Results for the machine operating in both modes include cycle-time statistics, producting rates, and cost estimates. Tests were conducted in southwestern Pennsylvania, where unthinned plantations of Norway spruce and Scotch pine on slopes up to 40 percent were clearcut. When felling and processing in stands with tree volumes averaging 5 to 25 ft^3, volume per productive hour ranged from 280 to 630 ft^3. When processing manually felled trees in stands with tree volumes averaging 3 to 5 ft^3, volume per productive hour ranged from 240 to 360 ft^3. Regression equations are presented for estimating harvesting cycle time in minutes per tree as a function of tree and cycle characteristics.

Birch, Thomas W.; Spencer, John S., Jr. 1987. **Hardwoods in the north.** In: The northern hardwood resource: management and potential; 1986 August 18-20; [Place of meeting unknown]. Houghton, MI: Michigan Technological University. 11 p.
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.

Bormann, F. H.; Bowden, W. B.; Pierce, R. S.; Hamburg, S. P.; Voigt, G. K.; Ingersoll, R. C.; Likens, G. E. 1987. **The Hubbard Brook sandbox experiment.** In: Jordon, W. R.; Gilpin, M. E.; Aber, J. D., eds. Restoration Ecology. Cambridge, UK: Cambridge University Press: 251-256.

Bowers, Lynn J.; Melhuish, John H., Jr. 1987. **Elemental analysis of red oak and loblolly pine growing near an inactive chromium smelter.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 231-245.
Reports a pilot study of 24 tree cores collected from red oak and loblolly pine growing near an inactive chromium smelter north of Memphis, Tennessee. The trees sampled included growth rings formed in presmelter, smelter, smelter-with-scrubber, and postsmelter years. The investigators used dendrochronological techniques to establish the exact years and growth trends on the cores and argon plasma emission spectrometry for elemental analysis. The elemental concentrations detected in the cores are comparable with those reported for trees growing in pollution-impacted areas. Variance in the data was used to calculate the number of samples

needed for further research. The data substantiate previous observations that metal accumulation rates vary with growth rate within trees, among trees on the same site, and among species.

Briggs, R. D.; Cunia, T.; White, E. H.; Yawney, H. W. 1987. **Estimating sample tree biomass by subsampling: some empirical results.** In: Wharton, Eric H.; Cunia, Tiberius, eds. Estimating tree biomass regressions and their error; proceedings of the workshop on tree biomass regression functions and their contribution to the error of forest inventory estimates; 1986 May 26-30; Syracuse, NY. Gen. Tech. Rep. NE-117. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 119-127.
Describes procedure used to measure the green weight and estimate, by subsampling, the dry weight of the above-ground components of 29 randomly selected sugar maple trees. Foliage and branch dryweights were determined by direct measurement. Bole wood and bole bark dry weight were estimated by stratified subsampling and subsequent application of ratio-type estimators. An analysis was made of the variation of subsamples within sample trees and variance components are calculated and listed for use in later studies.

Brisbin, Robert L.; Dale, Martin E. 1987. **Estimating tree-quality potential in a managed white oak stand by Markov Chain analysis.** Canadian Journal of Forestry Research. 17: 9-16.
Thinning practices have been shown to increase diameter and volume growth but there have been few studies on the effects of thinning on product potential. The effect of thinning to various basal-area levels on the limb-related defect development of 80-year-old white oak is analyzed by Markov Chain analysis. The transition probabilities from the Markov Chain analysis were used to predict the expected number of limb-related defects by 5-year intervals for 40 years after treatment. At this age, the average tree in the untreated plots and the standard thinning had a probability of 0.81 of attaining grade 1. The average tree in the heavy and severe thinning had only a probability of about 0.25 of attaining grade 1. Generally, severe thinnings may result in a decrease of tree quality, particularly in white oak.

Brooks, Robert T.; Frieswyk, Thomas S.; Malley, Anne M. 1987. **Forest wildlife habitat statistics for New Hampshire--1983.** Resour. Bull. NE-97. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 107 p.
A statistical report on the first forest wildlife habitat survey of New Hampshire (1983). Findings are displayed in 58 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.

Brooks, Robert T., Frieswyk, Thomas S.; Malley, Anne M. 1987. **Forest wildlife habitat statistics for Vermont--1983.** Resour. Bull. NE-100. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 118 p.
A statistical report on the first forest wildlife habitat survey of Vermont (1983). Findings are displayed in 67 tables covering forest area, landscape patterns, mast potential, standing dead and cavity trees, and lesser woody-stemmed vegetation. Data are presented at county and/or unit and state levels of resolution.

Bryant, J. E.; Yendol, W. G.; McManus, M. L. 1987. **Distribution of deposit in an oak forest following aerial application of *Bacillus thuringiensis*.** In: Green, George W., ed. Proceedings of a symposium on the aerial application of pesticides in forestry; 1987 October 20-22; Ottawa, ON. Ottawa, ON: National Research Council Canada and Canadian Forestry Service: 261-265.
A 10.1 ha hardwood forest stand was aerially sprayed with 29.6 BIU/ha of *Bacillus thuringiensis* (Bt). Leaves were sampled individually from 10 sample trees to examine the distribution of deposit within the canopy using fluorescent-tracer and image-analysis techniques. Artificial targets above the canopy showed significant variation in the deposit arriving above sample trees. A high degree of variation with no significant differences was found in the mean deposits at upper and lower canopy levels, also with directions within a level. Spray deposit was distributed lognormally between leaves. Image analysis yielded both quantitative and qualitative information on spray deposit on a single-leaf basis.

Burns, Barbara S.; Houston, David R. 1987. **Managing beech bark disease: evaluating defects and reducing losses.** Northern Journal of Applied Forestry. 4: 28-33.
Beech bark disease often produces bark defects that may result in trees being classed erroneously as cull. Because of this, sale overruns occur, and

sound trees are mistakenly left uncut in the woods. The disease occurs when Nectria fungi attack and kill bark predisposed by the beech scale. It results in several types of bark defects on residual trees that do not succumb or on young trees developing in the presence of the causal complex. Defects can be more or less serious depending on the depth of infection. A sawmill study showed that on trees with recognizable, superficial defects, yield is little affected. When the cambium is damaged, however, defects may lead to losses in lumber yield or quality. Understanding how defects develop helps in estimating volume, identifying high-risk trees, and making prescriptions that leave stands more resistant to beech bark disease.

Bush, Robert J.; Sinclair, Steven A.; Shaffer, Robert M.; Hansen, Bruce G. 1987. **Equipment needs and capital expenditure budgets for eastern sawmills and pallet manufactures.** Forest Products Journal. 37(11/12): 55-59.
A mail survey was used to gather information from sawmills and pallet manufacturers in the Eastern and Southeastern United States. The equipment needs mentioned most often were dry kilns, resaws, headrigs, edgers, and planers. Equipment was needed most often to increase production capacity or improve yield. Equipment purchase plans, which many times differed from needs, most often included rolling stock such as fork-lift trucks, automobiles, trucks, and front-end loaders. A substantial number of firms also planned to purchase dry kilns, carriages, and edgers. Planned capital expenditures over the next 12 months averaged $400,000 per firm and $1,105,000 per firm over the next 5 years.

Collins, Judith A.; Jennings, Daniel T. 1987. **Nesting height preferences of eumenid wasps (Hymenoptera: Eumenidae) that prey on spruce budworm (Lepidoptera: Tortricidae).** Annals of the Entomological Society of America. 80: 435-438.
Three species of eumenid wasps, *Ancistrocerus adiabatus* (Saussure), *Ancistrocerus antilope* (Panzer), and *Euodynerus leucomelas* (Saussure) accepted and provisioned predrilled wooden blocks placed in a spruce-fir forest of Maine. The eumenids preyed on late instars of the spruce budworm, *Choristoneura fumiferana* (Clemens), and on other lepidopterous defoliators. Spruce budworm accounted for 94 percent of provisioned prey. There was no significant difference in acceptance among trap-nesting blocks at four heights (0.0, 0.5, 1.0, and 1.5 m). However, there was a trend toward increased acceptance of blocks at 0.5 m.

Collins, Judith A.; Jennings, Daniel T. 1987. **Spruce budworm and other lepidopterous prey of eumenid wasps (hymenoptera: eumenidae) in spruce-fir forests of Maine.** Great Lakes Entomologist. 20(3): 127-133.
Three species of eumenid wasps, *Ancistrocerus adiabatus*, *Ancistrocerus antilope*, and *Euodynerus leucomelas*, accepted and provisioned trap-nesting blocks with lepidopterous larvae. A pyralid, *Nephopteryx* sp., was the most commonly provisioned prey. *A. adibatus* and *E. leucomelas* preyed on late instars of the spruce budworm, *Choristoneura fumiferana*; however, budworms accounted for only 6 percent of the provisioned prey. Estimates of budworm population densities before and after wasp predation, and subsamples of provisioned prey indicated no significant reduction (x = 0.065%) in budworm populations attributable to trap-nesting wasps.

Cooper, Robert J.; Dodge, Kevin M.; Martinat, Peter J.; Smith, Harvey R.; Whitmore, Robert C. 1987. **Impacts of the gypsy moth on nongame bird populations.** In Fosbroke, Sandra; Hicks, Ray R., Jr., eds. Proceedings of coping with the gypsy moth in the new frontier; 1987 August 4-6; Morgantown, WV. Morgantown, WV: West Virginia University Books: 48-58.
A descriptive model is presented that depicts impacts of a gypsy moth outbreak on bird populations at four stages: pre-outbreak, outbreak, and subsequent, and long-term impacts. Pre-outbreak impacts are limited largely to increases in food supply. Birds that feed on gypsy moths at this stage may help maintain gypsy moth populations below outbreak level. Outbreak effects include alteration of prey abundance and availability, associated changes in bird foraging behavior, adverse energetic effects, and increased predation and nest parasitism. Deep-forest birds are likely to locally avoid heavily defoliated areas. Open-habitat species are likely to move into such areas. Subsequent effects may involve substantial changes in habitat structure and tree species composition resulting from tree mortality causing species-specific responses by the bird community. Long-term effects may result from widespread alteration of tree species composition through mortality of preferred gypsy moth host trees.

Corbett, Edward S.; Lynch, James A. 1987. **The gypsy moth--does it affect soil and water resources?** In: Fosbroke, Sandra; Hicks, Ray R., Jr., eds. Proceedings of coping with the gypsy moth in the new frontier; 1987 August 4-6; Morgantown, WV. Morgantown, WV: West Virginia University Books: 39-46.
The impacts of gypsy moth defoliation on soil and water resources are evaluated. Estimates of changes in nutrient reallocation from vegetation to soils are presented. Water yield increased by as much as 13.6 cm on heavily defoliated watersheds. Increased densities of indicator organisms were found on test watersheds. Fecal streptococci densities as high as 25,000/100 ml were found in stream samples during periods of active defoliation, while fecal coliform densities exceeded 90/100 ml on occasion.

Crang, Richard E.; McQuattie, Carolyn J. 1987. **A quantitative light microscopic technique to assess the impact of air pollutants on foliar structure.** Transactions of the American Microscopical Society. 106(2): 164-172.
Describes a technique for light microscopy combining two morphometric procedures, computer-assisted tracing (CAT) and point-counting (PtC), for a model study in the quantitative analysis of leaf tissues exposed to acidic misting (pH 5.6, 4.6, 3.6, or 2.6) alone and in conjunction with 0.1 ppm NO_2 fumigation. Total leaf-tissue areas were more easily determined by CAT, but cell and air space components within the mesophyll area were more readily determined by PtC. Similar values for total mesophyll area were obtained by both CAT and PtC calculations, even when a minimal number of light micrographs were used. The integration of CAT and PtC provides a rapid, yet reliable, quantitative method to determine relative leaf tissue alterations at the light microscopic level under pollutant stress conditions. In this study, point-counting of leaf components, such as mesophyll cells and air space, also provided a determination of significant alterations not always visually evident within the tissue.

Davidson, Walter H. 1987. **Pitch x loblolly hybrid pine performance on a West Virginia minesoil.** In: Proceedings, 30th northeastern forest tree improvement conference; 1986 July 22-24; Orono, ME. Orono, ME: School of Forest Resources; University of Maine: Department of Forest Biology: 96-101.
A small plantation of pitch x loblolly hybrid pine was established on a reclaimed surface mine in Boone County, West Virginia, in April 1981. In the test, 215 hybrid and 216 pitch pine seedlings were used from 19 pitch pine mother trees and 24 loblolly pine seedlings. The site was covered with a moderately dense stand of sericea lespedeza and K-31 tall fescue. Rows were rototilled to prepare the site for planting. First-year survival was excellent--nearly 100 percent. After 5 years, overall survival was 88 percent. Much of the mortality can be attributed to excess moisture. The average height of hybrids was 4.4 feet after 5 years; 13 percent of the seedlings were 6.0 feet or taller. Pitch pines averaged 4.0 feet with only 6 percent of the seedlings 6.0 feet or taller. The acceptable performance of pitch x loblolly hybrid pine on this site indicates it has good potential for planting on reclaimed surface mines.

Davidson, Walter H.; Graves, Donald H. 1987. **Opportunities for forestry practices on reclaimed surface mines.** In: Proceedings, 1987 national symposium on mining, hydrology, sedimentology, and reclamation; 1987 December 7-11; Lexington, KY. Publ. UKYBU145. Lexington, KY: University of Kentucky: 327-330.
Forestry is a viable and productive use of reclaimed mined land. Experience in the eastern and central coalfields has shown that productive forests can be established after mining. Case studies showing successful reforestation illustrate the potential of mined lands for forest production.

Davidson, Walter H.; Hutnik, Russell J.; Bauman, Randall A. 1987. **Ponderosa pine--a reclamation species for the east?** In: 4th biennial symposium on surface mining and reclamation on the Great Plains and 4th annual meeting of the American Society for Surface Mining and Reclamation; 1987 March 17-19; Billings, MT. Rep. No. 8704. Bozeman, MT: Montana State University, Reclamation Research Unit: H-8-1-H-8-7.
Species trials involving ponderosa pine for revegetating acid minesoils in Pennsylvania have met with variable success. The most extensive study, involving 49 provenances was established in the spring of 1969. After 17 years, overall survival was 57 percent and mean diameter at breast height was 2.7 inches. Most of the mortality had occurred within 2 years following planting, but mortality is increasing again as a result of infection by the western pine gall rust. This disease apparently was present on several seedlings at time of planting. Although the overall performance of the planting is only mediocre, certain seed sources had significantly better survival,

growth, and/or disease resistance than others. The best four sources, at plantation age 17, had nearly 80 percent mean survival and averaged 3.8 inches in d.b.h.

DeGraaf, Richard M. 1987. **Managing northern hardwoods for breeding birds.** In: Nyland, Ralph D., ed. Managing northern hardwoods: proceedings of a silvicultural symposium; 1986 June 23-25; Syracuse, NY. Misc. Publ. No. 13 (ESF 87-002). SAF Publ. No. 87-03. Syracuse, NY: State University of New York: 348-362.
Documents changes that occur in bird species composition as stands of northern hardwoods develop after clearcutting in northern New England, identifies breeding bird compositions associated with different timber size classes, and provides habitat management guidelines to enhance bird species richness.

DeGraaf, Richard M. 1987. **Breeding birds and gypsy moth defoliation: short-term responses of species and guilds.** Wildlife Society Bulletin. 15: 217-221.
A two-summer comparison of foliated and gypsy moth-defoliated oak stands in central Pennsylvania yielded no differences in richness of breeding bird species between stands. Three species differed in abundance--black-capped chickadees and wood thrushes were less abundant in defoliated stands, and house wrens were more abundant in defoliated stands. Blue jays and northern orioles decreased in defoliated stands in the second year of the study. There were no differences in abundances of foraging guilds between foliated and defoliated stands. Among nesting guilds, abundances of tree-branch and tree-twig nesters decreased significantly in the second year of the study.

DeGraaf, Richard M.; Chadwick, Nan L. 1987. **Forest type, timber size class, and New England breeding birds.** Journal of Wildlife Management. 51(1): 212-217.
Breeding birds in poletimber and mature sawtimber stands of six forest cover types were grouped by association with timber size class, forest cover type, interactions of timber size and type, and key habitat components that occur irrespective of stand condition or forest type. Thirty bird species showed that different distributions were functions of the interaction of cover type and size class. Breeding birds were grouped as stand condition obligates, forest type obligates, or species that prefer more than one forest type regardless of stand condition, prefer one stand condition, select a specific stand condition-forest type interaction, or are habitat generalists. The results are useful when planning the mix of types of distribution of timber size classes in the Northeast.

DeGraaf, Richard M.; Richard, David A. 1987. **Forest wildlife of Massachusetts: cover type, size class, and special habitat relationships.** C-182. Amherst, MA: University of Massachusetts, Cooperative Extension. 51 p.
Identifies habitats used by Massachusetts wildlife for the benefit of foresters and landowners interested in improving the diversity of wildlife through forest management.

Dempsey, Gilbert P. 1987. **Variations in productivity and performance in grade lumber industries in Kentucky, Pennsylvania, and West Virginia--1982.** Res. Pap. NE-604. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 18 p.
Sawmill effectiveness is crucial to the growth and development of wood industries among locales, states, regions, and countries. Productivity rations, structural factors, and other indicators of economic performance were used to measure the relative productive efficiency of the grade hardwood lumber industries in Kentucky, Pennsylvania, and West Virginia. Despite undercapitalization, the industries' latent capacity and efficiency potential provide the base and make the prospect for socially desirable economic development a highly viable option in all three states.

Dempsey, Gilbert P. 1987. **Sawmill productivity and performance: North and South.** In: Busby, Rodney L.; de Steiguer, J. Edward; Kurtz, William B., eds. Proceedings, 1987 joint meeting of the Southern Forest Economics Workers and the Midwest Forest Economists; 1987 April 8-10; Asheville, NC. [Place of publication unknown]: [Publisher name unknown]: 107-116.
A single period assessment was made of the sawmill (lumber products) industry's operational structure and performance in 11 Eastern States--6 northern and 5 southern. The Northern States were predominantly grade hardwood lumber producers and operated in a mature market. Outputs of softwood dimension and lumber products dominated southern production and most states were in a combined growth and species transition mode. During

1982, the 11-state industry produced 26 percent of the Nation's total output of lumber products. The South's industry was larger than the North's in production capacity, plant size, use of productive inputs, and receipts. The South also led in capital investment, number and quality of employment (such as the provision of higher wages and full-year employment), and labor and capital productivity. Material costs were relatively lower in the North, which also had the highest value added by manufacturers.

Dennis, Donald F. 1987. **Rates of value change on uncut forest stands in New Hampshire.** Northern Journal of Applied Forestry. 4: 64-66.
Nominal rates of value change for 141 uncut forest plots in New Hampshire averaged 15.9 percent annually for the 10 years ending in 1983. By contrast, average annual nominal returns were 8.3 percent for the Standard and Poors 500 stock average and 7.6 percent for the Forges bond and preferred stock composite fund from 1973 to 1983. Regression analysis failed to establish useful predictative relationships between stand variables and rates of value change, but some results were clear. Forest type was an important factor in determining rate of value change. Much of the difference between rates of value change among forest-type groups was due to differences in price trends for various species. Rates of value change declined at higher elevations and within forest-type groups.

Dennis, Donald F.; Remington, Susan B. 1987. **Trends in harvest cost in New Hampshire: 1964 to 1983.** Res. Note NE-335. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 2 p.
Timber harvesting costs for New Hampshire from 1964 to 1983 were examined. During this period, real harvesting costs for sawtimber decreased at an average annual rate of 1.2 percent, while stumpage prices increased. Real harvesting costs for pulpwood declined at an average annual rate of 0.8 percent. Harvest cost data for fuelwood were available only for 1973 to 1983. During this period, real harvesting cost increased at an average annual rate of 3.2 percent.

DeWalle, David R.; Halverson, Howard G.; Sharpe, William E. 1987. **Snowpack dry deposition of sulfur: a four-day chronicle.** In: Proceedings, 43rd annual eastern snow conference; 1986 June 5-6; Hanover, NH. [Place of publication unknown]: [Publisher name unknown]: 185-189.
A 4-day sequence of dry deposition measurements based on a snowpack mass balance indicated large sulfur dry deposition on the first day under blowing snow conditions followed by 3 consecutive days of essentially zero snowpack sulfur exchange under stable conditions. Snowpack mass balance data were adjusted for the effects of blowing snow to calculate sulfur dry deposition rates of 4.13 mg $m^{-2}d^{-1}$ and a deposition velocity for total atmospheric sulfur of 0.4 cm s^{-1} on the first day.

Echelberger, Herbert E. 1987. **Economic analysis of the American campground industry--1983.** Washington, DC: National Campground Owners Association. 11 p.

Echelberger, Herbert E. 1987. **An economic analysis of the cross-country ski industry--1984-85 season.** In: Proceedings, 1986 NRPA leisure research symposium; Anaheim, CA. Anaheim, CA; National Recreation and Park Association. 6 p.

Ernst, Richard L. 1987. **Growth and yield following thinning in mixed species Allegheny hardwood stands.** In: Nyland, Ralph D., ed. Managing northern hardwoods: proceedings of a silvicultural symposium; 1986 June 23-25; Syracuse, NY. Fac. of For. Misc. Publ. No. 13 (ESF 87-002); SAF Publ. No. 87-03. Syracuse, NY: State University of New York: 211-222.

Federer, C. Anthony; Hornbeck, James W. 1987. **Expected decrease in diameter growth of even-aged red spruce.** Canadian Journal of Forest Research. 17: 266-269.
Weibull functions provide close least-square fits to tables for stand basal area and density versus age in even-aged second-growth red spruce as reported by W. H. Meyer (USDA Tech. Bull. 142). The annual mean radial and basal-area increments of the trees can be calculated from the two Weibull functions. For a stand following Meyer's tables and reaching breast height in 1915, mean tree basal-area increment increases steadily to a maximum in the early 1960's and then declines; mean radial increment is constant from 1925 to 1955 and then declines rapidly. This behavior matches closely the results from 3,001 red spruce increment cores in New England and New York, and suggests that forest aging is an important cause of decreasing diameter growth of red spruce.

Federer, C. Anthony; Hornbeck, James W. 1987. **Red spruce diameter growth and Weibull functions for even-aged stand development.** In: Proceedings of the international symposium on ecological aspects of tree-ring analysis; 1986 August 17-21; Tarrytown, NY. Tarrytown, NY: Marymount College: 18-25.
Weibull functions are used to describe the relation of stand basal area and stand density to stand age for even-aged red spruce forests. The annual mean radial and basal-area increments of the trees as a function of age follow algebraically. These expressions indicate that the recent decrease in regional red spruce growth may be a consequence of an aging forest. To obtain better growth or smoothing functions, we applied an equation for mean basal-area increment as a function of basal area to individual-tree chronologies. Dendrochronologists should study further the relation of individual-tree growth to growth of the entire stand.

Fege, Anne S. 1987. **Evaluation of researchers' decisions in short-rotation forestry.** Forest Science. 33(1): 30-42.
A survey of short-rotation forestry research from 1966-82 provided insights into the political, socioeconomic, institutional, and personal factors influencing decisions made by forestry researchers. Scientists first entered short-rotation forestry research because of personal contacts with other scientists, because they considered this a "productive" research area, because funds were available, and because of the "energy crisis." They attributed their success primarily to cooperation with other scientists and potential users and to adequate financial support. These findings offer insight into the individual decisions and the economic and political factors that will shape other forestry research frontiers.

Galford, Jimmy R. 1987. **Effect of *Stelidota octomaculata* (Coleopetera: Nitidulidae) on germinating acorns under laboratory conditions.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 419-422.
Stelidota octomaculata (Say), an unreported acorn pest, feeds on the radicle of germinating acorns. Ninety-nine percent of the acorns exposed to feeding from two or more *S. octomaculata* failed to produce seedlings while 99 percent of uninfested acorns produced seedlings. Several generations of this nitidulid have been reared continuously on acorns. Field studies have confirmed acorns as a natural host.

Galford, Jimmy R. 1987. **Feeding habits of the weevil *Barypeithes pellucidus* (Coleoptera: Curculionidae).** Entomological News. 98(4): 163-164.
The weevil *Barypeithes pellucidus* was observed feeding on 18 species of plants in central Ohio. Feeding was light to very light on most species. Northern red oak, asters, American elm, hawthorn, and black cherry were preferred.

Galford, Jimmy R.; Wright, Susan L.; Peacock, John W. 1987. **Entomologists look at oak regeneration.** Ohio Woodlands/Conservation in Action. Summer: 12-13.
Examines one of the least researched aspects of the oak regeneration problem: the impact of insects on oak seedling establishment and survival. Although many studies have been conducted on damage to acorns by insects, little is known about the effect of insects on germinating acorns and oak seedlings.

Gansner, David A. 1987. **Site productivity and tree mortality on new frontiers of gypsy moth infestation.** Res. Note NE-340. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 3 p.
Recent analysis of forest stand losses to gypsy moth has provided basic information for analyzing the relationship between forest site productivity and tree mortality on new frontiers of infestation. Poor timber-growing sites had the lowest rates of mortality. Oak mortality (number of trees) amounted to 18 percent on poor sites compared with 26 percent on medium and 28 percent on good sites.

Gansner, David A.; Birch, Thomas W.; Frieswyk, Thomas S. 1987. **What's up with sugar maple?** National Woodlands. 10(6): 5-6.

Gansner, David A.; Dale, Martin E.; Herrick, Owen W.; Dickson, David R.; Lutz, David E. 1987. **Silvicultural cutting opportunities in oak-hickory forests.** Northern Journal of Applied Forestry. 4: 59-63.
Analysis of cutting opportunities for oak-hickory forests of Pennsylvania reveals a timber bonanza for expanding wood-using plants. The current potential cut from silvicultural thinning, regeneration, and harvest opportunities totals 58 million cords. It amounts to 20 times the current annual harvest of all hardwood volume from the state. On the stump, the

conversion value of this material totals $615 million. Moreover, the good housekeeping associated with the silviculture would improve timber productivity and quality.

Gansner, David A.; Herrick, Owen W. 1987. **Impact of gypsy moth on the timber resource.** In: Fosbroke, Sandra; Hicks, Ray R., Jr., eds. Proceedings of coping with the gypsy moth in the new frontier; 1987 August 4-6; Morgantown, WV. Morgantown, WV: West Virginia University Books: 11-20.
Recent studies in infested areas provide an up-to-date look at how the gypsy moth has affected the timber resource. Oak timber, which has borne the brunt of gypsy moth attacks, accounts for a smaller percentage of the total hardwood inventory than it used to. But other less vulnerable species such as red maple, ash, and yellow-poplar have grown to take up the slack. There has been little effect on average stocking. One finding deserving special mention is the great amount of variability in loss. It follows that planning for cost-effective gypsy moth control programs should aim at those timber stands most sensitive to heavy damage--with efforts made to identify such areas and hold damage to acceptable levels.

Gansner, David A.; Herrick, Owen W. 1987. **Using timber stand and tree characteristics to estimate rates of value changes.** In: Economics of eastern hardwood management. Penn State forest resources issues conference; 1987 March 9-11; University Park, PA. University Park, PA: The Pennsylvania State University, School of Forest Resources and Cooperative Extension Service: 53-60.

Gansner, David A.; Herrick, Owen W. 1987. **Estimating the benefits of gypsy moth control on timberland.** Res. Note NE-337. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 3 p.
A recent study of forest stand losses to gypsy moth has provided basic information for evaluating the benefits of control on new frontiers of infestation. Protecting highly susceptible trees from impending attack can prevent a potential loss of 15 percent in their timber value and 2.8 percent in their compound rate of value growth.

Gansner, David A.; Herrick, Owen W.; Mason, Garland N.; Gottschalk, Kurt W. 1987. **Coping with the gypsy moth on new frontiers of infestation.** Southern Journal of Applied Forestry. 11(4): 201-209.
Forest managers on new frontiers of infestation are searching for better ways to cope with the gypsy moth. Presented here are information and guidelines for remedial action to minimize future losses. Methods for assessing potential stand defoliation (susceptibility) and mortality (vulnerability), monitoring insect populations, and selecting action alternatives are discussed.

Gatchell, Charles J. 1987. **Want to use more low-grade lumber? Why not rip first.** Wood and Wood Products. 92(8): 113-115.
Discusses the gang-rip-first option and suggests a rough-mill approach that appears suitable for today's hardwood resource if gluelines can be accepted in the final product.

Gatchell, Charles J. 1987. **Rethinking the design of the furniture rough mill.** Forest Products Journal. 37(3): 8-14.
Discusses the crosscut-first rough mill with emphasis on the effects of lumber quality, cutting bills, and operator efficiency on yields. Adding a gang-rip-first option is recommended. This will use more of the lower grades of lumber while meeting the needs of the furniture and cabinet industries. Current research that indicates why gang ripping to glueline-quality edges should be effective is discussed. A rough mill that uses log-run lumber (No. 2 Common and Better) and allows a gang-rip-first or crosscut-first option also is described.

Gatchell, C. J. 1987. **Rethinking the design of the furniture rough mill.** Forest Products Abstracts. 10(8): 234. Abstract 1281.
The operation of a cross-cut first rough mill is discussed with emphasis on the effects of lumber quality, cutting bills and operator efficiency on yields of furniture blanks. Adding a rip-first option is recommended for increasing the use of lower grades of lumber. A rough mill is described that uses log-run lumber (No. 2 Common or Better) to provide sufficient long lengths to satisfy the needs of the furniture and cabinet industries so long as gluelines are acceptable.

Glass, Ronald J. 1987. **Comparing the value of deer to timber and farm outputs: Inconsistencies in valuation techniques.** In: Proceedings, deer, forestry, and agriculture: interactions and strategies for management; 1987 June 15-17; Warren, PA. [Place of publication unknown]: [Publisher name unknown]: 160-172.

Glass, Ronald J.; Gustke, Nancy. 1987. **Visitor expectations, satisfactions, and views toward financial support for selected New Hampshire historic sites.** Res. Note NE-334. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 6 p.
Although the number of visitors to New Hampshire state-owned historic sites has declined during the last 20 years, the results of a survey indicate that most respondents are satisfied with the level of services provided. The majority of visitors indicated that historic sites need not be "self-supporting;" they were willing to pay an entry fee and did not object to donation boxes. Seventy percent indicated that the current $2.00 entry fee is reasonable.

Glass, Ronald J.; Muth, Robert M. 1987. **Pitfalls and limitations in the use of fishery valuation techniques.** Transactions of the American Fisheries Society. 116: 281-389.
While considerable effort has been made to develop fishery valuation techniques, success has been limited in applying the results to management situations. Most of these valuation measures have been economic in nature so they must be interpreted within a broader context of valuation with particular concern for the objectives of public ownership and management. Added to the conceptual shortcomings of many valuation techniques are difficulties in securing consistent and accurate measurements. All of these limitations must be considered when valuation measures are applied to resource management situations.

Gottschalk, Kurt W. 1987. **Silvicultural guidelines for forest stands threatened by the gypsy moth: a summary.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 509-510.
Silvicultural treatments that may minimize gypsy moth impacts on host hardwood stands are recommended based on ecological and silvicultural information on their interactions. Decision charts are presented that match the proper prescription to existing stand and insect population conditions.

Gottschalk, Kurt W. 1987. **Impacts of gypsy moth defoliation on regeneration of forest stands: a summary.** In: 1986 gypsy moth annual review. 1986 December 1-4; Norfolk, VA. [Place of publication unknown]: [Publisher name unknown].
Gypsy moth defoliation can affect the regeneration of forest stands in several ways. There are four phases in the regeneration process and each phase can be affected to a certain degree. Actual and potential impacts in each of these phases are outlined.

Gottschalk, Kurt W. 1987. **Effects of shading on growth and development of northern red oak, black oak, black cherry, and red maple seedlings. II. Biomass partitioning and prediction.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 99-110.
Northern red oak, black oak, black cherry, and red maple seedlings were grown under light treatments ranging from 8 to 94 percent of full sunlight for 2 years. Growth was least at the lowest light level, and total dry weight increased with increasing light. Total dry-weight rankings (largest to smallest) at all light levels were black cherry, northern red oak, black oak, and red maple. As light increased, allocation of biomass into leaves and stems decreased while branch biomass held constant except for black cherry, which increased. Allocation of biomass into roots increased significantly with increased light. Seedling biomass could be predicted with a reasonable degree of accuracy across light levels from D^2H measurements taken late in the growing season. Data on biomass accumulation and root development suggest that increasing light to 20 percent or more will help advanced regeneration seedlings become well established, giving them the potential to grow rapidly after release.

Gottschalk, Kurt W. 1987. **Prevention: the silvicultural alternative.** In: Fosbroke, Sandra; Hicks, Ray R., Jr., eds. Proceedings of coping with the gypsy moth in the new frontier; 1987 August 4-6; Morgantown, WV. Morgantown, WV: West Virginia University Books: 92-104.
Silvicultural treatments that may minimize gypsy moth impacts on host hardwood stands are recommended based on ecological and silvicultural information on their interactions. Decision charts are presented that match the proper prescription to existing stand and insect population conditions.

Green, Edwin J.; Scott, Charles T. 1987. **Simulation of subsampling selection rules for hardwood tree heights.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood

velop marking guides and implement silvicultural treatments for forest trees threatened with gypsy moth infestation.

Hertel, Garard (sic) D.; Zarnoch, Stanley J.; Arre, Theresa; Eagar, Christopher; Mohnen, Volker; Medlarz, Susan. 1987. **Status of the spruce-fir cooperative research program.** In: Proceedings, 80th annual meeting of APAC; 1987 June 21-26; New York, NY. Publ. 87-34.2. Pittsburgh, PA: Air Pollution Control Association. 20 p.

Hicks, R. R., Jr.; Coster, J. E.; Mason, G. N. 1987. **Forest insect hazard rating: applying a little understood management tool using the southern pine beetle and the gypsy moth.** Journal of Forestry. 85(10): 20-26.

Hilt, Donald E. 1987. **Using OAKSIM: an individual-tree growth and yield simulator for managed, even-aged upland oak stands.** In: Proceedings, 15th annual hardwood symposium of the Hardwood Research Council; 1987 May 10-12; Memphis, TN. Memphis, TN: Hardwood Research Council: 67-86.
OAKSIM is an individual-tree growth and yield simulator for managed, even-aged, upland oak stands. It is designed to help forest-land managers evaluate alternatives related to that silvicultural practice most likely to influence tree and stand growth. OAKSIM can assist managers in evaluating thinning alternatives for single stands or in developing general thinning guidelines applicable to many stands. The timing (age), intensity (residual stand density), and frequency of intermediate thinnings for a wide range of age, site, and stand conditions can be studied in detail. Growth and yield projections up to 50 years for various thinning alternatives can be made for stands 30 to 120 years old.

Hilt, Donald E.; Dale, Martin E. 1987. **Effects of precommercial thinning on diameter growth in young central hardwood stands.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 179-187.
Three young central hardwood stands that developed after clearcutting mature upland oak stands on good sites were each precommercially thinned one time in this study. Stand ages were 13, 17, and 21 years when thinning occurred. Yellow-poplar, red maple, and bigtooth aspen were the predominant species. Thinning reduced stocking levels to approximately 70, 50, and 30 percent of normal. Regression techniques were used to analyze diameter growth rates 5 years after thinning. Thinning increased diameter growth at all ages and residual stocking levels; the heavier the thinning, the greater the response. The magnitude of the response, however, was progressively greater with increasing stand age, suggesting that precommercial thinnings be delayed until age 20.

Hilt, Donald E.; Teck, Richard M.; Blodgett, Richard H. 1987. **Development and implementation of growth and yield models in the Northeast.** In: Seymour, Robert S.; Leak, William B., eds. Proceedings of the New England growth and yield workshop; 1987 January 7-9. Durham, NH. CFRU Inf. Rep. 17. Misc. Rep. 325. Durham, NH: University of Maine, College of Forest Resources: 31-45.
Development of reliable growth and yield models for the Northeast is difficult because this region is dominated by mixed-species stands with indeterminate age and size structures that have evolved from a multitude of cutting practices. Existing growth and yield models for the Northeast are reviewed and efforts to implement these models are discussed. The overall approach to developing a new individual-tree model with species-specific coefficients for the entire Northeast is described. Problems associated with the use of forestry inventory and analysis data to build the model are discussed, and initial results of an individual-tree diameter growth model for northern New England are presented.

Hilt, Donald E.; Teck, Richard M.; Gullett, Thomas L. 1987. **Uses, types, and availability of growth and yield models for the central hardwood region.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 513.
Lists growth and yield models that have been developed for the central hardwood region. Also includes models that are in the development stage.

Hilt, Donald E.; Teck, Richard M.; Fuller, Leslie G. 1987. **Generalized individual-tree models for the northeast.** The Compiler. 5(4): 17-27.

Hornbeck, J. W. 1987. **Growth patterns of red oak and red and sugar maple relative to atmospheric deposition.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hard-

wood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 277-282.
Regional, long-term growth patterns were determined by measuring ring widths on increment cores from 750 red oaks, 687 red maples, and 521 sugar maples. All three species showed generally increasing growth rates from 1900 through the early 1980's. Temporary periods of declining growth coincided with periods of documented defoliation by insects or below-average precipitation. There are no obvious unexplained growth declines like those reported for red spruce and balsam fir. Separating impacts of atmospheric deposition may be even more difficult for hardwood species than for conifers.

Hornbeck, J. W.; Federer, C. A.; Pierce, R. S. 1987. **Effects of whole-tree clearcutting on streamflow can be adequately estimated by simulation.** In: Forest hydrology and watershed management: proceedings of the Vancouver symposium; 1987 August; Vancouver, BC. IAHS-AISH Publ. 167. [Place of publication unknown]: [Publisher name unknown]: 565-573.
A range of values was assigned to parameters of the BROOK hydrologic model to simulate streamflow for fast, medium, and slow regrowth on whole-tree clearcut basins in Maine, New Hampshire, and Connecticut. Simulated increases in streamflow for the first year after harvest at the New Hampshire site ranged from 167 mm for fast regrowth to 255 mm for slow regrowth. The measured increase estimated using paired control and treatment basins was 175 mm. Simulated increases in the second year ranged from 74 to 234 mm, while the paired-basin estimate was 71 mm. Annual outputs of dissolved nutrients showed only small differences when calculated with simulated versus measured streamflow. At the Maine and Connecticut sites where streamflow was not measured, increases in simulated annual streamflow differed little from those for New Hampshire, but seasonal increases and relative increases varied considerably. BROOK is a viable alternative for estimating streamflow when stream-gauging is impractical.

Hornbeck, J. W.; Martin, C. W.; Tritton, L. M.; Pierce, R. S.; Smith, R. B. 1987. **Changes in nutrient outputs in streamflow after harvesting central hardwoods.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1986 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 479-485.
During the winter of 1981-82, two watersheds in a central hardwood forest in Connecticut were harvested, one by clearcutting with whole-tree removal, the other by commercial thinning. Streamflow, precipitation, and soil solution from harvested and control watersheds were sampled for major nutrient ions for 2 years before and 3 years after harvest. Daily streamflow was estimated using the BROOK hydrologic model. Commercial thinning had no detectable impacts on the hydrologic and nutrient ion budgets. However whole-tree clearcutting increased nutrient outputs in a streamflow by 28 kg ha^{-1} or 90 percent for Ca; 23 kg ha^{-1} or 171 percent for K; and 15 kg ha^{-1} or 75 percent for Mg over a 3-year period. Combined losses of NH_4-N and NO_3-N, which were near zero before treatment, were 19 kg ha^{-1}. These losses resulted from both increased concentrations of nutrient ions in streamwater and increased water yield.

Hornbeck, J. W.; Martin, C. W.; Pierce, R. S.; Bormann, F. H.; Likens, G. E.; Eaton, J. S. 1987. **The Northern hardwood forest ecosystem: ten years of recovery from clearcutting.** Res. Pap. NE-596. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 30 p.
Two even-age management systems, progressive strip cutting and block clearcutting, have been studied since 1970 on small watersheds at the Hubbard Brook Experimental Forest, New Hampshire. In the strip cutting, all merchantable trees were harvested in a series of three strips over 4 years (1970-74). In the block clearcutting, all trees were harvested in a single operation in 1970. This paper contrasts progressive strip cutting and block clearcutting for the 10-year period after initiation of harvest in terms of hydrologic response, erosion losses, stream water ions, nutrient leaching, nutrient removals in harvested products, and natural regeneration of vegetation.

Hornbeck, J. W.; Smith, R. B.; Federer, C. A. 1987. **Extended growth decreases in New England are limited to red spruce and balsam fir.** In: Proceedings of the international symposium on ecological aspects of treering analysis; 1986 August 17-21; Tarrytown, NY. Tarrytown, NY: Marymount College: 38-44.

Trends in annual growth rates from 1900 to 1980 were determined for eight species by measuring ring widths on increment cores extracted from thousands of dominant and codominant trees throughout New England. Red spruce showed a steady increase in annual basal-area increment until about 1960, then a regionally consistent decrease in growth through 1980. Balsam fir showed a less marked decrease in growth rates beginning about 1970. Eastern white pine, eastern hemlock, red oak, red and sugar maple, and white ash had generally increasing growth rates over the 80-year period. Decreasing growth rates for red spruce and balsam fir are not explained easily. Factors involved include defoliation by the spruce budworm, maturation of the forest, climatic change, unusual weather events, and atmospheric deposition.

Houston, David R. 1987. **Forest tree declines of past and present: current understanding.** Canadian Journal of Plant Pathology. 9: 349-360.
Comparison of many dieback/declines indicates a common etiology; "natural" stresses physiologically alter tissues that are then attacked and killed by facultative parasites. Because these attacks succeed only after stress, and because mortality is a common consequence, stress is considered predispositional. Recent attention has focuses on declines in western Europe. Temporal correlation of damage on a variety of hosts with increases in air pollutants has fostered a hypothesis that anthropogenic air pollution (AAP) has triggered a general forest decline. This hypothesis has fueled speculation that AAP is responsible for recent declines of *Picea rubens* or *Acer saccharum* in the northeastern United States and Canada, and for synchronous growth declines in many species. Research is underway to determine if AAP is associated with growth loss, mortality, or changes in forest structure and function.

Houston, David R.; Houston, Daniel B. 1987. **Resistance in American beech to *Cryptococcus fagisuga*: preliminary findings and their implications for forest management.** In: Demeritt, Maurice E., Jr., ed. Proceedings, 30th northeastern forest tree improvement conference; 1986 July 22-24; Orono, ME. Orono, ME: University of Maine: 105-116.
An understanding of the genetic relationships (origins) of extant resistant trees, and the genetic structure of stands in which they occur, is a prerequisite to developing silvicultural guidelines designed to maintain or enhance future levels of resistance to beech bark disease. Preliminary analyses comparing trees on the basis of nine polymorphic isozyme systems from dormant buds indicate that within groups of resistant trees, many individuals are genetically identical (clonal), while others have unique isozyme "genotypes." The slight differences noted between many of the unique trees growing in close proximity within resistant groups suggest that they may represent half- or full-sibs.

Houston, David R.; Valentine, Harry T. 1987. **Beech bark disease: patterns of canker development in aftermath forests in Maine.** Phytopathology. 77(1): 118.
Beech bark diseases occurs when bark of American beech is infested by the beech scale, then infected and killed by *Nectria* spp. In long-affected stands, internal defect results as trees are cankered over time. The amount of defect, patterns of its development, and the relationship of climate to these patterns were studied in 50 trees from two stands in Maine. Two cross sections from each of five 1-m-long bolts from each tree were selected by importance sampling. The total area of canker on the outside surface of each growth sheath of each bolt was estimated from the arc lengths of cankers on the annual rings of the sampled cross sections. Cankering began in stems 12 to 37 years old and 2 to 11 cm in diameter. Rates of cankering increased over time; years of high or low cankering were synchronous between trees and stands.

Huyler, Neil K.; Mishkit, Tim D. 1987. **Small-scale fuelwood chipping--Is it profitable?** Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 4 p.

Huyler, Neil K.; Mishkit, Tim D. 1987. **Small-scale fuelwood chipping--Is it profitable?** Northern Logger. 11: 6-7; 26.

Jacobsen, Jennifer M.; Luppold, William G. 1987. **Determinants of hardwood lumber price.** In: Kossuth, Susan V.; Pywell, Nancy A., compilers. Current topics in forest research: emphasis on contributions by women scientists: proceedings of a national symposium; 1986 November 4-6; Gainesville, FL. Asheville, NC: Southeastern Forest Experiment Station: 127-130.
Increased export activity in the hardwood and oak lumber markets coincided with rising prices of these commodities, which also coincided with an increase in the overall price level of all commodities. To deter-

mine the effect of domestic and international demands on prices of hardwood and oak lumber, relative price models were developed to remove the effects of inflation. The models indicated that exports to Europe have had and will have an influence on hardwood lumber price, and that oak price seems to be more sensitive to changes in exports than overall hardwood lumber price. The main determinants of hardwood lumber and oak lumber prices were domestic demand and millstock levels.

Jennings, D. T.; Collins, J. A. 1987. **Coniferous-habitat associations of spiders (Araneae) on red spruce foliage.** Journal of Arachnology. 14: 315-326.
Coniferous-habitat associations were determined for 16 species of adult spiders collected from red spruce foliage in northern Maine. Most of the spiders have been found on three or more (range 1 to 15) conifer species. Spider-conifer habitats were positively correlated with geographic states and provinces. Mean conifer-habitat associations did not differ between web spinner and hunter species. Significantly more species of spiders from red spruce foliage were associated with northern conifers than with western conifers, but not with southern conifers. Comparison of the red spruce fauna with 16 selected spider-tree faunal studies showed that 1) Sorensen's similarity quotients (QS) were significantly greater for genera than for species, and 2) mean species QS values were significantly greater for northern than for southern but not for western conifers. The spider fauna on red spruce is closely allied with that on other northern conifers; however, none of the 16 spider species are restricted to conifers.

Jennings, Daniel T.; Collins, Judith A. 1987. **Spiders on red spruce foliage in Northern Maine.** Journal of Arachnology. 14: 303-314.
Spiders of 10 families, 16 genera, and at least 21 species were collected from foliage of *Picea rubens* Sarg. in northern Maine. Foliage samples were collected from tree crowns with an extendable pole pruner. Of 157 individuals, erigonids were numerically dominant (36 percent), followed by philodromids (18 percent) and salticids (15 percent). Mean spider densities/m^2 of foliage area were nonsignificant among sampling sites, but significantly more spiders were collected during the second sampling period (24-25 July) than during the first sampling period (7-8 June). Differences in spider densities between sampling periods were attributed to 1) seasonal activities and reproductive cycles of individual species, 2) weather during collection of foliage samples, and 3) two sampling methods (i.e., pole pruner with clamping device or pole pruner with catchment basket).

Jennings, Daniel T.; Parker, Frank D. 1987. **Habitats and spider prey of *Dipogon sayi sayi* (hymenoptera: pompilidae) in Washington County, Maine.** Great Lakes Entomologist. 20(3): 135-140.
Spider wasps were reared from three types of trap-nests deployed in strip-clearcut areas of a spruce-fir-mixed hardwood forest of Maine. Collections of *Dipogon sayi sayi* from Moosehorn National Wildlife Refuge, Washington County, represent the eastern-most records for the United States. Spider prey included females of *Misumena vatia*, *Xysticus emertoni* (new prey record), and *X. punctatus*, and juveniles and penultimate males of *Xysticus* sp. We found no evidence of nest-site competition between spider wasps and eumenid wasps (Hymenoptera: Eumenidae) that prey on spruce budworm when available nesting sites ranged from 320 to 4,400.

Jensen, K. F. 1987. **Effect of simulated acid rain and ozone on growth of red and white oak seedlings.** In: Perry, R.; Harrison, J. N. Acid rain: scientific and technical advances. London: Selper, Ltd.: 576-579.
One-year-old red and white oak seedlings were treated with simulated rain solutions of pH 3.0, 3.5, and 4.2 and fumigated with ozone at 0.0, 0.07, or 0.15 ul l^{-1} The seedlings were treated with ozone for 8 hours on each of 3 consecutive days and followed by 1.25 cm of rain on the fourth day. This treatment sequence was repeated each week for 18 weeks. Seedlings were harvested after 6, 12, and 18 weeks, and seedling height, leaf area, and leaf and stem weight determined. Ozone and acid rain only had a small effect on seedling growth because of the determinate nature of oak growth.

Jensen, Keith F. 1987. **Response of yellow-poplar (*Liriodendron tulipifera* L.) seedlings to acid rain and ozone.** In: National Acid Precipitation Program, Terrestrial Effects Task Group (V), peer review; 1987 March 8-13; Atlanta, GA. [Place of publication unknown]: [Publisher name unknown]: 26. Abstract.

Jensen, Keith F. 1987. **Response of yellow-poplar (*Liriodendron tulipifera* L.) seedlings to acid rain and ozone.** In: National Acid Precipitation Program, Terrestrial Effects Task Group (V), peer review; 1987

March 8-13; Atlanta, GA. [Place of publication unknown]: [Publisher name unknown]: 192-198.
To determine the impact of low levels of ozone and rain acidity on the growth of yellow-poplar seedlings, one-year-old seedlings were exposed to 0.0, 0.05, 0.1, or 0.2 ppm ozone for 8 hours on each of 3 consecutive days. On the fourth day they were treated with 1.25 cm of rain with a pH of either 3.0, 4.0, or 5.5. The plants were then placed on a greenhouse bench for the remainder of the week. This procedure was repeated weekly from May until mid October. On July 15, September 1, and October 15 seedlings in each treatment were harvested and leaf area, leaf weight, new growth weight, and height were determined. Stepwise regression analysis was used to develop surfaces for each of these variables at each harvest. Growth analysis variables were then calculated from the response surfaces. Growth of the yellow-poplar seedlings was affected by both ozone and rain acidity. At the September harvest, only acidity had an impact on growth. In general, growth increased with a decrease in acidity.

Kimmel, R. O.; Healy, W. M. 1987. **Imprinting: a technique for wildlife research.** In: Kimmel, Richard O.; Schulz, John W.; Mitchell, George J., eds. Perdix IV; gray partridge workshop; Minnesota Department of Natural Resources, [Date of meeting unknown]; [Place of meeting unknown]. Madelia, MN: Farmland Wildlife Populations and Research Group: 39-52.
Describes techniques used to imprint and work with human-imprinted birds, and discusses the potential and limitations of using human-imprinted animals in wildlife studies.

Kingsley, Neal P. 1987. **NIPFs: looking into the galaxy.** National Woodlands. January-February: 20-23.

Kingsley, Neal P. 1987. **Management of NIPF land: some thoughts on making it happen.** IN: Economics of eastern hardwood management. Penn State forest resources issues conference; 1987 March 9-11; University Park, PA. University Park, PA: The Pennsylvania State University, School of Forest Resources and Cooperative Extension Service: 135-142.

Kingsley, Neal P.; DeBald, Paul S. 1987. **Hardwood lumber and stumpage prices in two eastern hardwood markets: the real story.** Res. Pap. NE-601. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 17 p.
Current and real prices of hardwood lumber and stumpage prices are discussed. Results show that inflation wiped out most of the apparent price increases in two major hardwood lumber markets. Stumpage prices also failed to increase in real terms for most species in Ohio. Current and real prices trends for eight major eastern species are shown for 1964 through 1985.

Kochenderfer, J. N.; Helvey, J. D. 1987. **Using gravel to reduce soil losses from minimum-standard forest roads.** Journal of Soil and Water Conservation. 42(1): 46-50.
Soil losses were monitored for 4 years on 11 sections of forest road in the central Appalachians. The roads were used for both timber management and recreation. Nine road sections were located on a newly constructed, minimum-standard truck road and two sections were on a graveled, higher standard road. Average annual soil losses ranged from 47 tons per acre on the ungraveled road sections to 6 tons per acre on the sections surfaced with 3 inches of clean limestone gravel. After the first year, traffic counts averaged 33 per week on the minimum-standard road and 60 per week on the higher standard road. Soil losses on the graveled sections of the minimum-standard road were similar to those measured on the higher standard road.

Kochenderfer, J. N.; Helvey, J. D.; Wendel, G. W. 1987. **Sediment yield as a function of land use in central Appalachian forests.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 497-502.
Total sediment yield was measured for up to 6 years from three forested watersheds with different land-use histories. Average annual sediment yield was 31 pounds per acre from a 96-acre watershed that had not been logged for 80 years; 166 pounds per acre from a 94.4-acre watershed that was partially logged in 1977; and 253 pounds per acre from a 28.6-acre watershed that was farmed for many years and then allowed to revegetate naturally during the past 50 years. Sediment deposits in a 2.6-acre reservoir at the mouth of an intensively managed 1,600-acre forested drainage averaged 463 pounds/acre/year over an 18-year period. A comparison of suspended sediment (mg/1) and tur-

bidity in nephelometric turbidity units based on more than 500 samples from each of two watersheds showed excellent correlation.

Krause, C. R.; Dochinger, L. S. 1987. **Sulfur accumulation in red maple leaves exposed to sulfur dioxide.** Phytopathology. 77: 1438-1441.
Investigations were conducted to visualize the localization of sulfur in leaf tissue of red maple trees exposed to sulfur dioxide. Cuttings were exposed to charcoal-filtered air or 0.15 ppm of SO_2 in environmental chambers for 42 days. Scanning electron microscopy and energy dispersive X-ray analysis revealed accumulations of sulfur in the chloroplasts of mesophyll cells exposed to SO_2. Chloroplast perforations were visualized in leaves exposed to SO_2 but not in leaves exposed to charcoal-filtered air. Chloroplast perforation and sulfur accumulation could be preliminary stages of cytolysis reported in previous studies and partly explain the mode of action of SO_2 as a phytotoxicant.

Krusic, Paul; Kenney, Marianne; Hornbeck, James. 1987. **Preparing increment cores for ring-width measurements.** Northern Journal of Applied Forestry. 4(2): 104-105.

Kuser, John E.; Knezick, Donald R.; Garrett, Peter W. 1987. **Pitch x loblolly hybrids after 10 years in New Jersey.** Northern Journal of Applied Forestry. 4(4): 207-209.
Eleven years after planting, 88 percent of the pitch x loblolly hybrid families in a 1973 southern New Jersey test plantation are taller than the top pitch pine control, and 94 percent are taller than the top loblolly pine control. Ten years after planting, 88 percent of the pitch x loblolly hybrid families in a nearby test plantation established in 1974 are taller than the top pitch pine control, and 100 percent are taller than the top loblolly pine control.

Lamson, Neil I. 1987. **Estimating northern red oak site-index class from total height and diameter of dominant and codominant trees in central Appalachian hardwood stands.** Res. Pap. NE-605. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 3 p.
Northern red oak site-index (SI) class was estimated using height and diameter of dominant and codominant trees for five Appalachian hardwood species. Methods for predicting total height as a function of diameter are presented. Because total height of 4- and 6-inch trees varies less than 5 feet for the three northern red oak SI classes, use trees that are at least 8 inches in d.b.h. when estimating site class.

Lamson, Neil I. 1987. **D.b.h./crown diameter relationships in mixed Appalachian hardwood stands.** Res. Pap. NE-610. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 3 p.
Linear regression formulae for predicting crown diameter as a function of stem diameter are presented for nine species found in 50- to 80-year-old mixed hardwood stands in north-central West Virginia. Generally, crown diameter was closely related to tolerance; more tolerant species had larger crowns.

Lamson, Neil I.; Smith, H. Clay. 1987. **Precommercial treatments of 15- to 40-year old northern hardwood stands.** In: Nyland, Ralph D., ed. Managing northern hardwoods: proceedings of a silvicultural symposium; 1986 June 23-25; Syracuse, NY. Fac. of For. Misc. Publ. No. 13 (ESF 87-002); SAF Publ. No. 87-03. Syracuse, NY: State University of New York: 160-175.
Discusses three precommercial practices: cleanings, basal-area thinnings, and crop-tree release. On the basis of available information, recommendations are made and guidelines presented for applying these practices in northern hardwood stands.

Leak, W. B. 1987. **Fifty years of compositional change in deciduous and coniferous forest types in New Hampshire.** Canadian Journal of Forest Research. 17: 388-393.
Fifty-year records (52-53 years) from 29 cruise plots on the Bartlett Experiment Forest, New Hampshire, indicated that composition is moving toward a predominance of one or two tolerant species in response to soils (habitat) and, to a lesser extent, elevation. Plots on fine till are moving toward American beech and sugar maple, with some indication that perpetuation of sugar maple in this region of granitic soils depends on canopy disturbance. Stands on coarse washed (sandy) till are moving toward beech, with some representation of tolerant conifers. Plots with shallow basal till (well drained to poorly drained), shallow bedrock, or ice-contact gravel are moving toward eastern hemlock and/or red spruce. Eastern hemlock is successful below elevations of 500 to 550 m, while red spruce is successful at higher elevations.

Leak, W. B. 1987. **Comparison of standard and actual tree-growth trends for deciduous and coniferous species in New Hampshire.** Canadian Journal of Forest Research. 17: 1297-1300.
Recent concerns over the decline of tree growth in the Northeast have revealed the need for data on standard or expected tree growth over time or tree diameter, unaffected by stand or climatic factors. Examples of standard growth curves are developed and compared with past sample-tree increments on 30 plots with a known 52- to 53-year record of change in stand density.

Leak, W. B. 1987. **Characteristics of five climax stands in New Hampshire.** Res. Note NE-336. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 5 p.
Analysis of species composition, stand density, and diameter distribution in five climax or old-growth stands in New Hampshire indicates that the northern hardwood climax is characterized by at least 65 to 70 percent tolerant hardwoods, 130 ft² of basal area per acre, and q ratios (2-inch diameter classes) of 1.3 to 1.4. Climax spruce-hemlock have at least 70 percent tolerant softwoods, 180 to 200 ft² of basal area per acre, and q's of 1.5 to 1.6.

Leak, William B.; Solomon, Dale S.; DeBald, Paul S. 1987. **Silvicultural guide for northern hardwood types in the Northeast (revised).** Res. Pap. NE-603. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 36 p.
A practical guide to the management of northern hardwoods for timber production in New England and New York. Both even-age and uneven-age management are considered, and specific treatments are prescribed for a range of stand conditions and management objectives.

LeDoux, Chris B. 1987. **ECOST: A stump-to-mill timber production cost-estimating program for cable logging eastern hardwoods.** Compiler. 5(4): 33-34.
ECOST uses data from stand inventory, cruise data, and the logging plan for the tract in question to produce detailed stump-to-mill cost estimates for specific proposed timber sales. These estimates are then used in combination with specific landowner objectives to access the economic feasibility of cable logging a given area. The program output is summarized in tabular format by harvesting component, as are input parameters. ECOST also provides comparison of alternative harvesting machines; equipment selection; timber stand prescription planning; and, linked with a suitable growth model, optimizes silvicultural investment and break-even analyses.

LeDoux, Chris B. 1987. **Estimating yarding costs for the Clearwater yarder.** Res. Pap. NE-609. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 4 p.
Describes an equation that can be used to estimate yarding costs for the Clearwater yarder in clearcuts and light and heavy thinnings in eastern hardwoods. Yarding costs can be estimated with a handheld calculator or the data can be incorporated into stump-to-mill desktop and mainframe computer programs.

LeDoux, Chris B.; King, Bruce W.; Harou, Patrice A. 1987. **Predicting bunching costs for the Radio Horse 9 winch.** Res. Pap. NE-595. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 7 p.
Data from field studies and a prebunching cost simulator have been assembled and converted into a general equation that can be used to estimate the prebunching cost of the Radio Horse 9 winch. The methods can be used to estimate prebunching cost for bunching under the skyline corridor for swing with cable systems, for bunching to skid trail edge to be picked up by a skidder or forwarder, or bunching to roadside for stand cleanings and firewood sales. Costs can be determined easily with a hand calculator. The equation also can be incorporated into larger stump-to-mill desktop and mainframe computer programs.

Luppold, William G. 1987. **The changing hardwood lumber market.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-46; Knoxville, TN. Knoxville, TN: University of Tennessee: 401-408.
Tremendous change has occurred in the hardwood lumber market during the last 15 years. Lumber usage, such as the wood-flooring industry, has decreased among traditional industries while the pallet industry's demands and international demands for domestically produced hardwood lumber have grown considerably. Traditional pricing mechanisms for hardwood lumber have changed to reflect

activity in the three major markets rather than activity in only the furniture market. Price cycles also have become more pronounced, especially in real terms. The changes that have occurred and the impact of these changes on the marketing and pricing of hardwood lumber are discussed.

Luppold, William G. 1987. **Competition and the pallet industry.** Pallet Enterprise. 7(2): 40, 42.
It is often said that the pallet industry is competitive, but what does this mean? To an individual pallet producer, it probably means that if the pallet producer raises prices without provocation, some customers will go elsewhere. It also probably means constantly looking for ways to reduce costs to make higher profits and increase a customer base, or both. However, in economic terms, what the pallet producer sees as a competitive market is only the result of a competitive environment. Competition and how it affects the pallet market is discussed.

Luppold, William G. 1987. **Material usage trends in the wood household furniture industry.** Res. Pap. NE-600. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 10 p.
Examines wood material use by the wood-furniture industry in descriptive and numerical terms.

Luppold, William G.; McKeever, David B. 1987. **North American industrial markets: current wood use and trends.** In: Hamel, Margaret P., ed. Proceedings of North American wood/fiber supplies and markets: strategies for managing change; 1986 October 2-4; Chicago, IL. Madison, WI: Forest Products Research Society: 125-130.
Presents estimates of hardwood and softwood lumber, hardwood and softwood plywood and veneer, and reconstituted panel consumption for furniture, wooden pallets and skids, railroad crossties, wooden boxes and crates, dunnage, blocking and bracing, and miscellaneous end uses. Trends in consumption over the past 20 years are examined. These trends are based primarily on U.S. Department of Commerce, Bureau of the Census, Census of Manufactures reports. Recent USDA Forest Service reports and information from industry and trade associations also are used.

Lynch, James A.; Corbett, Edward S.; Kostelnik, Kevin M. 1987. **Atmospheric deposition: spatial and temporal variation in Pennsylvania--1986.** Publ. ER8714. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute. 119 p.

Lynch, James A.; Corbett, Edward S.; Kostelnik, Kevin M. 1987. **Atmospheric deposition: spatial and temporal variation in Pennsylvania--1986.** Publ. ER8714A. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute. 253 p.

Marquis, David A. 1987. **Assessing the adequacy of regeneration and understanding early development patterns.** In: Nyland, Ralph D., ed. Managing northern hardwoods: proceedings of a silviculture symposium; 1986 June 23-25; Syracuse, NY. Fac. of For. Misc. Publ. No. 13 (ESF 87-002); SAF Publ. No. 87-03. Syracuse, NY: State University of New York: 143-159.
In view of the critical nature of the regeneration period, it is important that silvicultural practices used during this time be selected carefully. This requires that the existing stand's potential for regeneration be assessed accurately, and that the new stand's development be monitored after treatment. Describes techniques that can be used to assess regeneration adequacy at these times, and explains how these measure can be used to select appropriate regeneration practices.

Marquis, David A. 1987. **Silvicultural techniques for circumventing deer damage.** In: Proceedings, deer, forestry, and agriculture: interactions and strategies for management; 1987 June 15-17; Warren, PA. [Place of publication unknown]: Plateau and Northern Hardwood Chapters Allegheny Society of American Foresters: 125-136.
The key to management practices and techniques that ensure adequate seedling regeneration in the presence of a large deer herd is providing so much deer food within the home range of the local herd that the deer cannot consume all of it. In turn, some seedlings escape to form the next stand. This is accomplished by selecting areas with abundant advance regeneration; stimulating advance regeneration through shelterwood cutting (using herbicides for site preparation where needed); maximizing the area in high food-producing condition (regeneration and thinned areas), and special measures such as fertilization and direct protection. These techniques do not work in all stands, but enable timber harvests to continue on selected sites until deer populations are brought into better balance with habitat carrying capacity.

Martens, David G.; Araman, Philip A. 1987. **North American industrial markets: importance of technological innovations in domestic markets.** In: Hamel, Margaret P., ed. Proceedings of North American wood/fiber supplies and markets: strategies for managing change; 1986 October 2-4; Chicago, IL. Madison, WI: Forest Products Research Society: 131-134.
Technological innovations have played a major role in the industrial markets for wood and fiber in this country. Increased productivity has resulted in greater efficiency of wood use and major changes in raw material use patterns. The evolution of technological innovation within the pallet industry and its effect on patterns of raw material consumption are discussed. Recent and proposed technical innovations are described and their future effects on the use of the wood resource examined. Recent innovations related to solid wood use by the furniture industry and their effect on the efficiency of wood use are discussed.

Martin, C. Wayne. 1987. **Silvicultural prescriptions affect the nutrient status of northern hardwood forest.** In: Mroz, Glenn D.; Reed, David D., compilers. Proceedings, conference on the northern hardwood resource: management and potential; 1986 August 18-20; Houghton, MI. Houghton, MI: Michigan Technological University: 250-259.
In a northern hardwood forest of New Hampshire, a conventional clearcut increased water yield by 7 percent over 10 years; a progressive stripcut increased water yield only by 4 percent. A commercial thinning did not increase water yield. Nitrogen removed from the watersheds in wood products and leaching losses over a 10-year period was estimated to be 7 percent of the site capital for whole-tree clearcutting, 3 percent for conventional clearcutting, 2 percent for progressive stripcutting, and less than 1 percent for a commercial thinning. Calcium removed in wood and streamwater over 10 years was 4 percent of the total site capital for whole-tree clearcutting, 2 percent for conventional clearcutting, 1 percent for progressive stripcutting, and 2 percent for commercial thinning.

Martin, C. Wayne; Tritton, Louise M.; Hornbeck, James W. 1987. **Revegetation after whole-tree clearcutting of hardwoods in Connecticut.** In: Hay, Ronald L.; Woods, Frank W.; DeSelm, Hal, eds. Proceedings, 6th central hardwood forest conference; 1987 February 24-26; Knoxville, TN. Knoxville, TN: University of Tennessee: 119-126.
A 6-ha watershed in the hardwood forest of Connecticut was whole-tree harvested. Prior to cutting, the density of trees and shrubs was 1,163 stems ha^{-1}, and the above-ground living biomass was 168,400 kg ha^{-1}. By the end of the third growing season after cutting, density was 965,400 stems ha^{-1}, and biomass was 7,830 kg ha^{-1}. Postharvest biomass contained approximately 21 percent of the nitrogen, 6 percent of the calcium, and 22 percent of the potassium of the preharvest forest. Data from the Connecticut site are compared to revegetation after intensive harvests in other locations within the central hardwood forest.

Mason, Garland N. 1987. **Rating stand susceptibility to gypsy moth defoliation.** In: Fosbroke, Sandra; Hicks, Ray R., Jr., eds. Proceedings of coping with the gypsy moth in the new frontier; 1987 August 4-6; Morgantown, WV. Morgantown, WV: West Virginia University Books: 65-72.
The susceptibility of forest stands to defoliation by gypsy moths is determined by many factors. Most notable of these are species composition, site characteristics, and stand history. Certain combinations of these factors contribute to favorable habitat for the gypsy moth and less suitable habitat for its natural enemy complex. Species preferences are listed and three methods are described for rating individual forest stands for susceptibility to gypsy moth defoliation.

Mason, Garland N.; Gottschalk, Kurt W. 1987. **Hazard rating for gypsy moth.** In: 1986 gypsy moth annual review; 1986 December 1-4; Norfolk, VA. [Place of publication unknown]: [Publisher name unknown]: 200-210.

Mazzone, H. M. 1987. **Control of invertebrate pests through the chitin pathway.** In: Biotechnology in invertebrate pathology and cell culture. New York, NY: Academic Press: 439-450.
Considers a number of biotechnological advances that can be used against destructive insects and disease-causing fungi of trees.

McManus, Michael L. 1987. **The gypsy moth problem: history, biology, spread.** In: Fosbroke, Sandra; Hicks, Ray R., Jr., eds. Proceedings of coping with the gypsy moth in the new frontier; 1987 August 4-6: Morgantown, WV. Morgantown, WV: West Virginia University Books: 1-10.
The gypsy moth, which has caused a myriad of problems in North America since it was introduced,

is broadly distributed throughout Europe and Asia. The initial establishment and spread of the insect in the Northeast is traced along with the actions that were employed to eradicate and then retard its westward movement. The bioecology and behavior of the different life stages of the insect is described, and the many interacting factors that affect the dynamics of gypsy moth populations both here and abroad are discussed.

McQuattie, Carolyn J.; Schier, George A. 1987. **Effects of ozone and aluminum on pitch pine ectomycorrhizae.** In: Sylvia, D. M.; Hung, L. L.; Graham, J. H., eds. Mycorrhizae in the next decade: practical applications and research priorities. Proceedings, 7th North American conference on mycorrhizae; 1987 May 3-8; Gainesville, FL. Gainesville, FL: University of Florida, Institute of Food and Agricultural Sciences: 98-99.

Melhuish, J. H., Jr.; Beckjord, P. R.; Vogel, W. G. 1987. **Flowering requirements of *Tussilago farfara*.** Transactions of the Kentucky Academy of Science. 48(1-2): 1-4.
Because *Tussilago farfara* L. (coltsfoot) has become naturalized and occurs on disturbed and waste places in the Northeastern United States, it may have potential in surface-mine reclamation. Seeding would be more practical and economical than planting rhizomes, but fresh seeds are viable only for about a month, interfering with planting schemes. It was determined that flowers can be uniformly generated by placing mature plants in cold storage for 3 months any time of year to ultimately generate seeds when needed for various revegetation/ reclamation planting schemes.

Meyer, G. A.; Montgomery, M. E. 1987. **Relationships between leaf age and the food quality of cottonwood foliage for the gypsy moth *Lymantria dispar*?** Oecologia (Berlin). 72: 527-532.
The cottonwood tree continues to produce leaves late into the growing season, exposing midseason herbivores to leaves of a wide range of maturity. Gypsy moth larvae preferred and grew best on the oldest cottonwood leaves and suffered higher mortality and 85 percent less growth when fed young, expanding leaves. Concentration of phenolics in the youngest leaves was 3 times that in the oldest leaves and was negatively correlated with caterpillar growth rate. The active phenolics were not identified; tannin was present but its concentration changed more with season than leaf age.

Miller, Donald; Gradischer, Lee; Orzel, Joseph; Leak, William; Miller, Eileen. 1987. **Changes in vegetation and breeding bird use in an Atlantic white-cedar swamp from 1951 to 1984.** In: Atlantic white-cedar wetlands symposium; 1984 October 9-11; Woods Hole, MA. [Place of publication unknown]: [Publisher name unknown]: 229-230.

Northeastern Forest Experiment Station. 1987. **Forest research: Burlington, Vermont.** NE-INF-76-87. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 9 p.

Northeastern Forest Experiment Station. 1987. **Publications of the Northeastern Forest Experiment Station--1985 and 1986.** Gen. Tech. Rep. NE-119. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 85 p.
An annotated list of publications by Northeastern Forest Experiment Station scientists and cooperators in 1985 and 1986.

Northeastern Forest Experiment Station. 1987. **Forest research: Orono, Maine.** NE-INF-74-87. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 7 p.
Researchers at the Northeastern Forest Experiment Stations Laboratory at Orono, Maine, have been conducting research on spruce-fir forests since 1950. Components of this research mission include: (1) the development and refinement of silvicultural prescriptions; (2) the relationships between natural enemies of insect pests and silviculture prescriptions; (3) growth and yield responses of spruce-fir stands, including the effects of disease and insect pests; and (4) soil fertility, site productivity, and nutrient requirements of major species.

Northeastern Forest Experiment Station. 1987. **Research at the Northeastern Forest Experiment Station.** NE-INF-28-R8/87. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 16 p.
Describes forest research conducted by 100 scientists of the Northeastern Forest Experiment Station.

Nelson, Brad; Auchmoody, L. R. 1987. **Fertilization of young clearcuts.** In: Proceedings, deer, forestry, and agriculture: interactions and strategies for management; 1987 June 15-17; Warren, PA. [Place of

publication unknown]: Plateau and Northern Hardwood Chapters Allegheny Society of American Foresters: 108-117.
Fertilization of young clearcuts to stimulate seedlings to rapidly grow out of the reach of deer is an effective method for regenerating Allegheny hardwoods that are subject to intense deer browsing. Since 1977, more than 10,000 acres on the Allegheny National Forest have been fertilized, resulting in well-stocked stands of Allegheny hardwoods. Impacts of fertilization on wildlife other than deer are variable depending on the habitat requirements of the species. Fertilization will remain a viable alternative for regenerating Allegheny hardwood stands until increased clearcutting and a decrease in the deer herd bring the forest on the Allegheny Plateau into an ecological balance.

Nevel, Robert L., Jr.; Blyth, James E. 1987. **Veneer log production and receipts in the Northeastern and North-Central States in 1984.** Northern Logger. 35(10): 52-54.
Veneer log production in the 21 Northeastern and North-Central States totaled 269.9 million board feet in 1984, up 11 percent from 1980. Over four-fifths of the logs produced in the area were harvested in Maine, Maryland, New York, Pennsylvania, Vermont, Indiana, Michigan, and Wisconsin. Nearly 70 percent of both the area's veneer log production and consumption was in the Northeast, which has two-thirds of the states and less than two-fifths of the veneer mills. The output of veneer logs since 1980 rose in the northeastern region and fell in the north-central region. In 1984, 187.3 million board feet of veneer logs were produced in the Northeast. Most of this region's production came from trees harvested in Maine, Maryland, New York, and Pennsylvania.

Nevel, Robert L., Jr.; Wharton, Eric H. 1987. **Veneer log production and receipts in the Northeast, 1984--a periodic assessment of regional timber output.** Resour. Bull. NE-98. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 17 p.
Evaluates regional timber output based on a canvass of the veneer plants in the Northeast and contains statistics for 1984 on the veneer-log production and receipts by states and species, log shipments between states and regions, and the disposition of manufacturing residues. Trends in production and an outlook for the industry are presented along with a list and map of veneer plants in the Northeast.

Ossenbruggen, H. Sharon. 1987. **Protecting trees in lawns.** Lawn Servicing. July: 16-17.
Presents basic tree facts to give trees and turf an opportunity to coexist in the lawn.

Patton, Roy L. 1987. **Effect of ozone and simulated acid rain on sugar and starch in roots of red and white oaks.** Phytopathology. 77(11): 1618.
One-year-old oak (*Quercus rubra* and *Q. alba*) seedlings were treated with simulated rain solutions of pH 3.0, 3.5, or 4.2 and fumigated with ozone at 0.0, 0.07, or 0.15 ul l^{-1}. The seedlings were fumigated with ozone for 8 hours on each of 3 consecutive days and treated with 1.25 cm of rain on the fourth day of each week. This regime was repeated for 18 weeks. Eight seedlings of each species were harvested from each treatment after 6, 12, and 18 weeks for measurement of sugars (anthrone reagent) and starch (enzyme digestion followed by assay for glucose) in the roots. In general, sugar content remained stable and starch content increased in both species with successive harvests. The effects of ozone and rain treatments on root sugar and starch were variable over the harvests.

Patton, R. L. 1987. **Effects of acid sprays on peroxidase activity in silver maple (*Acer saccarinum* L.) leaves.** Phytopathology. 77(12): 1761.
One-year-old dormant seedlings were potted and placed in a greenhouse. After 12 weeks there were 11 to 16 leaf-pairs along the stem of each plant. The plants were divided into 4 groups (8 per group) and each group was sprayed with a different acidified solution (pH 2.6, 3.6, 4.6, 5.6) to determine whether pH had an effect on peroxidase activity (PA) in leaves from any of several nodes. On the day after the final spray, leaves at nodes 3, 5, 7, 9, and 11 were harvested, examined for injury, and lyophilyzed. Only leaves sprayed with the pH 2.6 solution showed signs of injury. PA differed among leaves from different nodes but pH had no effect on PA. PA was greatest in leaves from node 11 and in injured leaves.

Peters, Penn A.; Biller, Cleveland J. 1987. **Preliminary evaluation of the effect of vertical angle of pull on stump uprooting failure.** In: Proceedings, 9th annual Council on Forest Engineering meeting; 1987 September 29-October 2; Mobile, AL. Mobile, AL: Council on Forest Engineering: 90-93.

Stumps are commonly used as guyline anchors for construction, oil drilling, and cable yarding equipment. Stumps are often loaded at a steep angle relative to the ground. Stump failure loads as reported in the literature are restricted to stumps loaded parallel to the ground. To investigate the effect of vertical angle on stump failure loads, 10 pairs of matched stumps on level terrain were loaded until failure occurred by uprooting; one stump of the pair was subjected to a 45-degree pull. The mean value of the 45-degree-pull failure loads was 7 percent less than the mean value of the parallel-pull failure loads. Maximum stump d.b.h. pulled was 7.7 inches.

Peters, Penn A.; Koten, Donald E. 1987. **Skidding costs for all rubber-tired cable skidders.** 87-6010. [Presented at the 1987 summer meeting of the American Society of Agricultural Engineers; 1987 June 28-July 1; Baltimore, MD.] St. Joseph, MI: American Society of Agriculture Engineers. 17 p.
A model was developed to estimate skidding costs for all rubber-tired cable skidders. Costs decreased with increased load capacity, increased loading efficiency, and decreased skid distance. Costs were minimal when the average piece size was approximately equal to one-twelfth the load capacity. Costs were sensitive to the efficiency of loading.

Plass, William T. 1987. **Runoff and sediment yield following mulch and soil stabilizer treatments.** In: 4th biennial symposium on surface mining and reclamation on the Great Plains and 4th annual meeting of the American Society for Surface Mining and Reclamation; 1987 March 17-19; Billings, MT. Reclam. Res. Unit Rep. No. 8704. Bozeman, MT: Montana State University: G-6-1-G-6-10.
Provides a basis for comparing the effectiveness of 26 mulch and soil stabilizer treatments in reducing surface runoff and sediment yield. Square plots with no vegetative cover, a surface area of 4 m^2 and a slope of 10 degrees were used in this field study. Surface runoff and sediment yield were measured after rainfall events. Results indicate that treatments may increase plant available moisture and reduce seed loss attributed to surface runoff or wind.

Rast, Everette D.; Brisbin, Robert L. 1987. **Six-year effects of two late spring frosts on Appalachian hardwoods.** Northern Journal of Applied Forestry. 4: 26-28.
Summarizes what we know about some of the key aspects of urban forest structure and function, and how this information can be useful to planners and managers.

Rast, Everette D.; Sonderman, David L.; Hilt, Donald E. 1987. **Recognizing hardwood quality: key to increased profits?** In: Proceedings, symposium on the multiple-use of California's hardwood resources; 1986 November 12-14; San Luis Obispo, CA. Gen. Tech. Rep. PSW-100. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station: 273-278.
To maximize the dollar return from California's hardwood resources, that industry must allocate the resource to its best end use and strive to increase the utilization of all material now considered as waste. To achieve the proper allocation of this resource to its best end use, you must be able to recognize and accurately classify the quality characteristics of standing timber, cut logs, and end products. Quality classification and grading systems allow us to segregate the tree or its parts into groups, all with similar characteristics. This enables the individual to determine value and predict the volume of end products.

Reardon, R.; McManus, M.; Kolodyn-Hirsch, D.; Tichenor, R.; Raupp, M.; Schwalbe, C.; Webb, R.; Meckley, P. 1987. **Development and implementation of a gypsy moth integrated pest management program.** Journal of Arboriculture. 13(9): 209-216.
The current approach to gypsy moth management in the United States involves applying insecticides to eliminate isolated infestations and to suppress populations in areas of regulatory concern or where socioeconomic impacts are projected to occur. An alternative approach, integrated pest management, is being implemented over a wide range of ecological, geographic, and land-use areas within a three-county area in Maryland to evaluate the feasibility of managing gypsy moth populations at low levels. This project is structured around a comprehensive biological monitoring system that provides an annual data base on the distribution, density, and trend of gypsy moth populations. This information, in conjunction with ancillary data for landscape features (e.g., soil type, vegetation cover type, and land use) and stand susceptibility to defoliation rating, provides guidelines for prescribing an array of intervention activities. This program also supports ongoing cooperative studies in data-base management, refinement of sampling methods, and evaluation of intervention activities.

Jackknife and bootstrap estimators and variance estimators were compared with a classical estimator and variance estimator for sampling with partial replacement (SPR) on two occasions; 120 plots were sampled at time 1. At time 2, 10, 20, or 30 plots were remeasured, and a new sample size of size 20 was also selected. The samples were drawn from three large samples of forest plots from the Northeastern United States, which were treated as populations. Although variables are correlated on the two occasions, the assumptions of linearity and homogeneity of variance are questionable. The classical estimator generally is preferable to the jackknife and bootstrap estimators when both estimation bias and efficiency are important in SPR sampling. The jackknife variance estimator generally is preferable if variance estimation bias and confidence limit coverage rates are taken into consideration, particularly for skewed populations with small sample sizes.

Schroeder, Herbert W.; Cannon, William N., Jr. 1987. **Visual quality of residential streets: both street and yard trees make a difference.** Journal of Arboriculture. 13(10): 236-239.
Research has shown that street trees have a powerful impact on how people judge the esthetic quality of residential streets. In this study, observers' ratings of the scenic quality of streets in photographs showed that trees on private property in front of homes also enhance the quality of the view down the street. Street trees contribute most to the visual quality of the street where there are few yard trees, and the least where there are many yard trees. This implies that arborists and urban foresters should give highest priority to planting street trees in neighborhoods where there are few yard trees.

Scott, Charles T.; Schreuder, Hans T.; Griffith, Douglas M. 1987. **A comparison of optical bar, high-altitude, and black-and-white photography in land classification.** Photogrammetric Engineering and Remote Sensing. 53(2): 203-306.
For large-area forest surveys, 1981-84 color-infrared national high-altitude program (NHAP) and 1983 optical bar color (OBC) infrared photography resulted in equally precise estimates of land-use/land-cover area. Both were only slightly more precise than 1970 black and white photography. OBC was the least cost effective because optical bar imagery usually is flown specifically for a survey, whereas NHAP and older black and white photography are readily available. Optical bar photography can be used effectively up to 35 degrees from nadir.

Sheehan, Katharine A. 1987. **Gypsy moths and northeastern forests: modeling a complex biological system.** In: 1985 symposium on systems analysis in forest resources; 1985 December 9-11; Athens, GA. SAF Publ. 86-03. Athens, GA: Georgia Center for Continuing Education: 444-454.
A model that simulates the population dynamics of gypsy moth and the effects of gypsy moth defoliation on stand growth and yield are being tested and refined. Current knowledge from a wide range of disciplines has been incorporated into this model. Model components include tree growth and mortality, gypsy moth feeding and growth, gypsy moth and natural enemies (parasites, predators, and pathogens), and compensatory mortality. Techniques used to develop, test, and refine this model are described. Approaches taken to develop research-oriented and management-oriented versions of this model are addressed.

Shortle, Walter C. 1987. **Defect, discoloration, cull, and injuries in northern hardwoods.** In: Nyland, Ralph D., ed. Managing northern hardwoods: proceedings of a silvicultural symposium; 1986 June 23-25; Syracuse, NY. Fac. of For. Misc. Publ. No. 13(ESF 87-002); SAF Publ. 87-03. Syracuse, NY: State University of New York: 244-251.
Discusses the dynamic immune system of living northern hardwood trees, how it varies, and how to regulate it.

Shortle, W. C.; Hill, J. L. 1987. **Ionized oak heartwood associated with checking during kiln drying.** Holzforschung. 41(3): 133-136.
Ionization of water extracts of wood that indicate altered drying properties and subsequent degrade can be detected by electrical methods. Kiln-dried oak showing severe checking yielded water extracts with electrical resistances equivalent to those of altered heartwood in early stages of decay when wood becomes ionized. Kiln-dried oak from the same charge showing little to no checking yielded extracts with electrical resistances equivalent to healthy, unaltered heartwood.

Shortle, W. C.; Smith, K. T. 1987. **Electrical properties and rate of decay in spruce and fir wood.** Phytopathology. 77(6): 811-814.
Electrical resistance measurements were related to both the occurrence of discolored and decayed wood in red spruce and balsam fir sites and the rates of decay in balsam fir in vitro. Internal electrical resistance (R) of spruce and fir was measured for

three sites per species and one mixed spruce-fir site in Maine and New Hampshire. Spruce with R1 >250 k (low ionization) had no discolored or decayed wood in stem cross sections in 140 cm above groundline. Within fir sites, as the percentage of trees with R1 < 100 k (high ionization) increased, the mean cross-sectional area of discolored and decayed wood also increased. Electrical properties of aqueous extracts from various types of balsam fir wood were associated with different rates of decay caused by *Haematostereum sanguinolentum* and other fungi in vitro. Wood located interior to sapwood, nondiscolored, and of relatively low ionization decayed at the slowest rate.

Smith, C. T.; Hornbeck, J. W.; Martin, C. W.; Turcotte, D. E. 1987. **Impact of intensive harvesting on the spruce-fir ecosystem: relationship to soil drainage.** In: Williams, Thomas M.; Gresham, Charles A., eds. Predicting consequences of intensive forest harvesting on long-term productivity by site classification. Proceedings of a workshop; 1987 October 2-9; Georgetown, SC. Georgetown, SC: Clemson University, Baruch Forest Science Institute: 41-50.
The impacts of whole-tree clearcutting on nutrient cycling and site productivity have been studied in the red spruce-balsam fir type of northern Maine using the paired watershed approach. Whole-tree clearcutting removed about 90 percent of the above-ground nutrients. These removals were much larger than the streamwater losses that occurred in the first 3 years after harvest. Site classification by soil drainage class was important for understanding the impacts of the harvest. The nutrient losses associated with the nitrate leaching after harvest were greatest on the moderately well-drained soils, and negligible on the wetter soils of the Chesuncook catena. Mechanical harvesting equipment caused greater disturbance on the somewhat poorly and poorly drained soils than the moderately well-drained soils.

Smith, H. Clay; Miller, Gary W. 1987. **Managing Appalachian hardwood stands using four regeneration practices--34-year results.** Northern Journal of Applied Forestry. 4: 180-185.
Adjacent Appalachian hardwood stands in West Virginia established on excellent growing sites were managed for a 34-year period using four regeneration practices. These practices included a commercial clearcut, a 15.5-inch diameter limit, and two single-tree selection methods. An uncut area was maintained as a control. Stand development, growth response, and stumpage revenue data were summarized for each treatment. At 34 years after the initial treatments, the commercial clearcut stand had the greatest variety of tree species for future management. This stand was dominated primarily by yellow-poplar and black locust. Selection and diameter-limit treatments promoted sugar maple on these excellent sites. Stand quality improved through management.

Smith, Kevin T. 1988. **Electrical resistance and previsual decay detection.** In: Proceedings, 6th symposium on the nondestructive testing of wood; 1987 September 14-16; Pullman, WA. Pullman, WA: Washington State University: 125-135.

Solomon, Dale S.; Hosmer, Richard A. 1987. **Adaptation of a spruce-fir growth model to simulate extraordinary stress.** In: Economic and social development: a role for forests and forestry professionals: workshop proceedings; 1987 October 18-21; Minneapolis, MN. Bethesda, MD: Society of American Foresters: 63-67.
Increased stress from insect attacks, drought, atmospheric pollutants, and other variables has caused forest managers and environmentalists to be concerned over the development of guidelines for predicting the growth response of individual trees and forest stands. The accurate prediction of growth response must include the interaction of different species, site conditions, and physical alterations within the stands before reliable comparisons can be made. A two-stage matrix model, FIBER, includes many of these different interactions for the spruce-fir and northern hardwood forests of the Northeast. FIBER has been used for comparison of stressed and unstressed stands on a regional basis. Examples of tree and stand growth under extraordinary stress are presented.

Solomon, Dale S.; Hosmer, Richard A. 1987. **SIMSAP and SIMTIM: modeling growth in even-aged northern hardwoods from saplings to sawtimber.** Compiler. 5(2): 20-23.
SIMSAP and SIMTIM are separate computer programs for modeling growth of natural or treated even-aged northern hardwoods. SIMSAP models growth for stands with a mean stand diameter ranging from 1 to 4.5 inches. SIMTIM models growth for stands from 4.5 inches average diameter to a user-specified quadratic mean diameter or rotation age.

Solomon, Dale S.; Hosmer, Richard A.; Hayslett, Homer T., Jr. 1987. **FIBER handbook: a growth model for spruce-fir and northern hardwood types.** Res. Pap. NE-602. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 19 p.
A matrix model, FIBER, has been developed to provide the forest manager with a means of simulating the management and growth of forest stands in the Northeast. Instructional material is presented for the management of even-aged and multi-aged spruce-fir, mixedwood, and northern hardwood stands. FIBER allows the user to simulate a range of silvicultural treatments for a variety of species compositions growing on different sites. The internal structure of the model is defined and explanations on the use of FIBER are offered. Examples of input, interim procedures, and final output are shown.

Solomon, Dale S.; Hosmer, Richard A.; Hayslett, Homer T., Jr. 1987. **FIBER 2.0: modeling growth in spruce-fir, northern hardwoods, or mixed spruce-fir and hardwood stands.** Compiler. 5(2): 21; 24-25.
FIBER is a two-stage matrix model developed for simulating management and growth of forests in the Northeastern United States. Stands may be even- or uneven-aged, and managed or unmanaged. The model is valid for spruce-fir, northern hardwood, or mixed spruce-fir and northern hardwood forest types.

Solomon, Dale S.; Hosmer, Richard A. 1987. **User's guide for the northern hardwood stand models: SIMSAP and SIMTIM.** Res. Pap. NE-606. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 13 p.
SIMSAP and SIMTIM are computer programs developed to simulate the stand growth and development of natural and treated even-aged northern hardwood stands. SIMSAP begins with species distributions by quality class in sapling stands after regeneration. 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. Using available data, the connecting phases of the models have been tested to determine the effects of silvicultural treatments (or no treatment) on long-term stand response. The models are coded in FORTRAN 77 and are available on mainframe and IBM compatible microcomputers with a minimum of 256 K.

Sonderman, David L. 1987. **Stem-quality changes on young, mixed upland hardwoods after crop-tree release.** Res. Pap. NE-597. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 7 p.
Relative change of several types of stem defects was studied over an 8-year period to determine the effects of crop-tree thinning on the development of tree quality. Special interest was given to changes in relative quality associated with defect indicators of crop trees compared to trees in unthinned plots. The relative quality classes of the crop trees went from "poor" to "medium" for red maple and "poor" to "good" for aspen. The oaks stayed in the poor classification and yellow-poplar remained unchanged in the medium classification. Results showed a decrease in the number of epicormic branches on the crop trees, and an increase in the size of live limbs.

Sonderman, David L.; Rast, Everette D. 1987. **Quality of thinned trees in even-aged, upland oak stands.** Northern Journal of American Forestry. 4: 4-5.
The actual quality of the trees removed by two thinning methods--light and moderate--was determined. Basal area, spacing, species, and quality are important aspects of most thinning operations. This research directs additional attention toward quality by evaluating the trees removed by the relative quality index and by provisional grade specifications for hardwood growing-stock trees.

Sonderman, David L.; Rast, Everette D. 1987. **Changes in hardwood growing-stock tree grades.** Res. Pap. NE-608. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 8 p.
Describes changes in provisional tree grades for 351 young, mixed upland hardwood trees 6 years after thinning. Treatments of 30, 50, and 70 percent stocking plus a crop-tree release were applied. Results indicate that light thinning and crop-tree thinning produced higher quality and better grade trees than heavy thinning.

Stout, Susan Laurane. 1987. **Planning the right residual: relative density, stand structure and species composition.** In: Nyland, Ralph D., ed. Managing northern hardwoods: proceedings of a silvicultural symposium; 1986 June 23-25; Syracuse, NY. Fac. of For. Misc. Publ. No. 13 (ESF 87-002); SAF Publ. No. 87-03. Syracuse, NY: State University of New York: 176-190.

Stout, Susan L.; Marquis, David A.; Ernst, Richard L. 1987. **A relative density measure for mixed-species stands.** Journal of Forestry. 85(6): 45-47.
In any species or forest type for which the appropriate data exist or can be collected, tree-area ratio equations can be calculated using standard statistical programs available for most computers. The primary advantage of the procedure is its flexibility for use in stands with a variety of species compositions.

Stribling, H. Lee; Smith, Harvey R. 1987. **Effects of Dimilin on diversity and abundance of forest birds.** Northern Journal of Applied Forestry. 4: 37-38.
Dimilin is used in gypsy moth control programs because of its low toxicity to nontarget vertebrate species and nonpersistence in the environment. While Dimilin does not seem to directly endanger birds, it can reduce populations of invertebrate food items. At the application rate used in this study, Dimilin can be used in forest insect control programs without causing a significant decrease in the overall size of diversity of breeding bird populations.

Tabor, C. A.; Barnett, N. M. 1987. **An experimental system for studying interrelationships between the embryo and megagametophyte of *Pinus strobus* during seed germination.** Canadian Journal of Botany. 65: 1212-1217.
An experimental culture system was devised that provided a reliable means for conducting quantitative studies on interrelationships between embryos and megagametophytes of *Pinus strobus* L. during germination and early seedling development. By controlling imbibition rates, it was possible to synchronize germination of intact megagametophytes and obtain cultures with uniform morphological characteristics for use in biochemical studies. Early seedling development was affected by time of removal of the megagametophpytes from the embryos; organs were larger if megagametophytes were left intact for longer periods of time.

Thomas, J. Daniel; Brooks, Robert T., Jr. 1987. **Methods for estimating the forest biomass in the Tennessee Valley Region.** In: Wharton, Eric H.; Cunia, Tiberius, eds. Estimating tree biomass regressions and their error: proceedings of the workshop on tree biomass regression functions and their contribution to the error of forest inventory estimates; 1986 May 26-30; Syracuse, NY. Gen. Tech. Rep. NE-117. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 189-192.
Species-specific weight prediction equations using a segmented log-log form were applied to USDA Forest Service plot- and tree-level data from state inventories in the 201-county Tennessee Valley region to produce the detailed biomass estimates essential for regional resource management and industrial development. The forest biomass inventory, annual growth, removals, and net change of merchantable growing stock biomass; and the biomass potentially available each year for use as energywood were estimated. The total oven-dry weight of above-ground woody biomass is estimated to be 1,223.3 million tons or 40.2 tons per acre of commercial forest land.

Tilghman, Nancy G. 1987. **Characteristics of urban woodlands affecting breeding bird diversity and abundance.** Landscape and Urban Planning. 14: 481-495.
Breeding bird communities were studied in 32 forest islands surrounded by urban development. These isolated woodlands in Springfield, Massachusetts, provided breeding habitats for a wider variety of birds (77 species) than previously described for other urban habitats (e.g., 4 times as many species as found in urban residential areas in the same city in a previous study). Recommendations are made to improve the design and management of urban woodlands for enrichment of avifauna within a city.

Tilghman, Nancy G. 1987. **Characteristics of urban woodlands affecting winter bird diversity and abundance.** Forest Ecology and Management. 21: 163-175.
Winter bird communities were studied in 1982 and 1983 in 32 forest islands surrounded by urban development. Forty-six bird species were recorded in these urban woodlands. Size of woodland, building density immediately adjacent to the woods, amount of edge, and distance to the nearest body of water were the forest island characteristics that best predicted the number of species present, explaining more than 60 percent of the variation in multiple regression models. Models for bird abundance only accounted for about 20 percent of the variation.

Tilgham [sic], Nancy L. 1987. **Woodland birds in the city.** Massachusetts Wildlife. 37(2): 34-37.
Discusses which woodlands support the greatest variety of birdlife and why. The four major factors influencing the kind and number of birds in urban

woodlands are size of the woodland, well-developed understories, variety of microhabitats, and human disturbance.

Tilghman, Nancy G. 1987. **Deer population and their impact on regenerating northern hardwoods.** In: Nyland, Ralph D., ed. Managing northern hardwoods: proceedings of a silvicultural symposium; 1986 June 23-25; Syracuse, NY. Fac. of For. Misc. Publ. No. 13 (ESF 87-002); SAF Publ. No. 87-03. Syracuse, NY: State University of New York: 286-297.

Tilghman, Nancy G. 1987. **Maximum deer populations compatible with forest regeneration--an estimate from deer enclosure studies in Pennsylvania.** In: Proceedings, deer, forestry, and agriculture: interactions and strategies for management; 1987 June 15-17; Warren, PA. [Place of publication unknown]: Plateau and Northern Hardwood Chapters Allegheny Society of American Foresters: 71. Abstract.
Browsing by white-tailed deer is a major cause of regeneration failure in the Allegheny hardwood forests of northwestern Pennsylvania. This study measured the impact of deer at five deer densities on tree seedlings, woody shrubs, and herbaceous plants in large enclosures over a 5-year period. Within each enclosure, five deer densities were maintained (0, 10, 20, 40, and 80 deer per square mile), with three cutting treatments (clearcut, thinning, and uncut) in each density. After 5 years, tree seedlings in the clearcuts at the lowest deer densities were nearly twice as tall as those at the highest deer densities. Browsing at high deer densities also reduced the diversity of tree seedlings, resulting in nearly pure black cherry regeneration. Fern cover increased with increasing deer densities, while blackberry cover decreased. Populations should be maintained at or below 15 deer per square mile to ensure tree regeneration of adequate species composition.

Tritton, Louise M. 1987. **Review of soil biotechnology--microbial factors in crop productivity.** Applied Biochemistry and Biotechnology: 14(1): 73-74.
This work edited by J. M. Lynch (Blackwell Scientific Publications) probably is too technical and succinct to reach all of the intended audience of farmers, foresters, and growers, as well as microbiologists, soil scientists, and plant scientists. However, it emphasizes that knowledge from all of these fields must be taken into account to successfully develop soil biotechnology.

Tritton, Louise M.; Martin, C. Wayne; Hornbeck, James W.; Smith, C. Tattersall, Jr.; Pierce, Robert S. 1987. **Whole-tree clearcutting as perturbation of the forest ecosystem.** 72nd annual meeting of the Ecological Society of America; 1987 August 9-14; Columbus, OH. In: Bulletin of the Ecological Society of America. 68(3): 433. Abstract.
Whole-tree clearcutting (WTCC) perturbs northeastern forest ecosystems in several characteristic ways. On the basis of studies of sites in New Hampshire, Connecticut, and Maine, the greatest impact of WTCC is the removal of all commercial living and dead stems with up to 96 percent of the above-ground biomass, and up to 0.3 percent Mg, 2 percent P, 3 percent K, 5 percent N, and 13 percent Ca of the total nutrient reserves. Mechanized WTCC causes a greater proportion of soil disturbance than other harvesting practices; mineral soil is exposed on as much as 18 percent of the site and more than 80 percent of the site shows compaction. Despite different hydrologic regimes between study sites, increases in the quantity of streamflow after WTCC seem fairly uniform.

Tritton, Louise M.; Martin, C. Wayne; Hornbeck, James W.; Pierce, Robert S. 1987. **Biomass and nutrient removals from commercial thinning and whole-tree clearcutting of central hardwoods.** Environmental Management. 11(5): 659-666.
The objective of this research was to evaluate the impacts of increasing product removal on biomass and nutrient content of a central hardwood forest ecosystem. Commercial thinning, currently the most common harvesting practice in southern New England, was compared with whole-tree clearcutting or maximum above-ground utilization. Using a paired-watershed approach, three adjacent, first-order streams in Connecticut were studied. During the winter of 1981-82, one was whole-tree clearcut, one was commercially thinned, and one was designated as the untreated reference. Before treatment, living and dead biomass and soil on the whole-tree clearcut site contained 578 Mg ha^{-1} organic matter, 5 Mg ha^{-1} nitrogen, 1 Mg ha^{-1} phosphorus, 5 Mg ha^{-1} potassium, 4 Mg ha^{-1} calcium, and 13 Mg ha^{-1} magnesium. Calcium appeared to be the nutrient most susceptible to depletion with 13 percent of total site Ca removed in whole-tree clearcut products. Only 4 percent (16 Mg ha^{-1}) of the total organic matter and less than 2 percent of the total

nutrients were removed from the thinned site. Partial cuts appear to be a reliable management option, in general, for minimizing nutrient depletion and maximizing long-term productivity of central hardwood sites.

Tubbs, Carl H. 1987. **The cutting edge.** In: Nyland, Ralph D., ed. Managing northern hardwoods: proceedings of a silvicultural symposium; 1986 June 23-25; Syracuse, NY. Fac. of For. Misc. Publ. No. 13 (ESF 87-002); SAF Publ. No. 87-03. Syracuse, NY: State University of New York: 412-415.

Tubbs, Carl H.; DeGraaf, Richard M.; Yamasaki, Mariko; Healy, William M. 1987. **Guide to wildlife tree management in New England northern hardwoods.** Gen. Tech. Rep. NE-118. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 30 p.
Discusses the culture and management of trees with value as components of wildlife habitat in the northern hardwood and associated types in New England. Information is provided for choosing the most suitable trees for wildlife habitats and estimating the impact of timber production. Suggestions are made for choosing the numbers of trees for a variety of common situations and for cultural procedures to enhance the value of trees as wildlife habitat. Hard and soft mast production is discussed, and guides for culture and management of mast are presented. Simplified habitat objectives and a key are provided for choosing and culturing wildlife trees.

Valentine, Harry T.; Gregoire, Timothy G.; Furnival, George M. 1987. **Unbiased estimation of total tree weight by three-stage sampling with probability proportional to size.** In: Wharton, Eric H.; Cunia, Tiberius, compilers. Estimating tree biomass regressions and their error: proceedings of the workshop on tree biomass regression functions and their contribution to the error of forest inventory estimates; 1986 May 26-30; Syracuse, NY. NE-GTR-117. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 129-132.
A three-stage procedure for estimating the total tree weight in a plot uses discrete sampling with probability proportional to size, sampling--a continuous analogue of sampling with probability proportional to size. Published regression functions that predict tree weight from diameter at breast height can be used to assign probabilities of selection to the trees for the first-stage sampling.

Vogel, Willis G. 1987. **A manual for training reclamation inspectors in the fundamentals of soils and revegetation.** Washington, DC: U.S. Department of the Interior, Office of Surface Mining and Enforcement. In cooperation with U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 178 p.
Provides surface mining and reclamation inspectors with a basic knowledge and understanding of soils and vegetation as they relate to surface mining and reclamation. Also provides guidance in understanding and adapting principles and practices of soil and plant sciences appropriate to overburden and soil removal, replacement, testing, and treatment; selecting and using species for various conditions and land uses; and evaluating revegetation success.

Vogel, Willis G.; Gray, Brent. 1987. **Will trees survive on topsoiled surface mines?** In: Proceedings, 1987 national symposium on mining, hydrology, sedimentology, and reclamation; 1987 December 7-11; Lexington, KY. Lexington, KY: University of Kentucky: 301-305.
Trees planted on surface mines reclaimed by postlaw requirements often fail to survive. This problem seems to be related to excessive compaction of minesoils that occurs with the replacement and grading of overburden and especially topsoiling materials. To investigate this situation, survival of pine seedlings planted in spring 1982 was compared to topsoiled and non-topsoiled surface-mine spoil in western Kentucky. In spring 1983, pine seedling survival was 89 percent on the topsoiled area and about 48 percent on the spoil. By October 1983, survival of pine had dropped to 4 percent on the topsoiled area and about 36 percent on the spoil. The topsoiled area supported a herbaceous cover averaging about 50 percent; cover on the spoil averaged about 70 percent. The high mortality of pine trees on the topsoil seemingly was related to a lack of soil moisture during the extremely dry late summer of 1983.

Voorhis, Nancy G. **Thinning guides for developing desirable sugarbush trees.** Maple Syrup Digest. 27(1): 27-31.
Describes three thinning intensities young maple stands and uses the results to produce guidelines for developing sugarbushes.

Wade, Gary L. 1987. **Nutrient concentration, content, and niche in pioneer plant communities.** Bulletin of the Ecological Society of America. 68(3): 438-439.
Four pioneer plant communities, a mix of three grasses and *Lespedeza cuneata* commonly used in surface-mined land reclamation, a community of native species derived from a forest topsoil seed bank, a mix of seed bank plus reclamation species, and a *Chenopodium album*-dominated community differed significantly in biomass production and the amounts of N, P, K, Ca, Mg, Mn, Fe, Cu, and Zn contained in aboveground biomass. Species' niches were defined based on concentrations of nutrients (niche breadth as Levins' B) and nutrient content as fractions of the total nutrient contents of each community (niche share). Niche breadth and niche share were influenced by community membership. Niche shares in plant communities were summed to quantify community nutrient-content niches, which varied significantly among these communities.

Wade, Gary L. 1987. **Nutrient capital sequestration in pioneer plant communities on surface-mine spoil.** Journal of the Tennessee Academy of Science. 62(2): 32.
Sequestration of nutrient capital in biomass after disturbance is an important ecosystem recovery mechanism that may be important to new ecosystems on surface mines. Four pioneer community types, a reclamation mix of grasses and lespedeza, native species from a forest topsoil seed bank, a native species plus reclamation mix, and a Chenopodium-dominated community were established in microplots to determine differences in ability to sequester nutrients in biomass. The four communities produced different amounts of the initial nutrient capital at the end of the first growing season. Community content of nine elements was not strictly proportional to biomass. Nutrient uptake characteristics of the dominant species as well as biomass determined pioneer community nutrient capital sequestration. Community N, K, Mg, and Zn contents were most strongly correlated with biomass; Ca, Mn, and Fe contents were least correlated with biomass.

Wade, Gary L. 1987. **Species, soil, and community effects on plant nutrient concentrations.** ASB Bulletin. 34(2): 70. Abstract.
Nutrient concentrations in plant species in three pioneer communities on two surface-mine spoils were compared to determine differences in plant nutrition as influenced by species, soils, and community.

Wade, Gary L. 1987. **Forest topsoil seed bands for introducing native species (Tennessee, Kentucky).** Restoration and Management Notes. 5(1): 29-30.
Emphasizes the use of forest topsoils as a propagule source rather than as a growth medium. Topsoils also introduce soil microflora and fauna that have important roles in decomposition, nutrient cycling, formation of soil organic matter, and soil formation generally. Seed-bank species also may create a new seed bank that may serve as an instrument for ecosystem recovery after future disturbances.

Wallner, W. E. 1987. **Factors affecting insect population dynamics: differences between outbreak and non-outbreak species.** Annual Review of Entomology. 32: 317-340.
Comparisons of the biological attributes of endemic and epidemic insects demonstrate that these population types are significantly different in many ways. Direct comparisons are unlikely to yield solutions for pest problems or to rescue rare and endangered species. This review underscores that each population type has evolved a set of physical and behavioral traits for species survival. It does not necessarily hold that any one characteristic has overwhelming survival value. Rather, combinations of features and relative capacity for adaptation determine the success of a given insect species.

Walters, R. S. 1987. **Effect of site factors on oak regeneration after partial cutting.** In: Agronomy Abstracts: 267-277. Abstract.
Successful oak regeneration requires large, well-developed advance seedlings before final overstory removal. In many stands, advance oak regeneration is lacking or the seedlings are too small to regenerate the stand. Methods are needed for increasing the size and number of seedlings. This study evaluated the effect of partial cutting, burning, herbicide treatment, and site factors on oak seedling establishment and seedling height growth after 2 years. Height increased with decreasing overstory density and also was greatest on the burned plots. A weak relationship between growth and aspect modified by slope steepness also occurred, but no other site variables were significant. Stand density, aspect modified by slope steepness, and understory treat-

ments accounted for only a small percentage of the variation in height growth. The number of commercial seedlings taller than 30 cm increased as the residual overstory was reduced. Oaks increased on moderately dry to dry sites while yellow-poplar increased on the mesic sites. The effects of fire and herbicide treatment were mixed, though both generally resulted in an increase in seedlings over the control.

Wargo, P. M.; Carey, A. C.; Geballe, G. T.; Smith, W. H. 1987. **Occurrence of rhizomorphs of *Armillaria* in soils from declining red spruce stands in three forest types.** Plant Disease. 71: 163-167.
The occurrence of rhizomorphs of *Armillaria* in soil around dead trees was determined in stands of declining red spruce in hardwood, transition, and montane boreal forest types that differ in elevation. Rhizomorph incidence and population density were significantly lower in the higher elevation transition and montane boreal forest types. These data suggest that previously reported infrequent colonization of declining red spruce at high elevations is due to low levels of inoculum of *Armillaria* in forest soils. High lead concentration and low pH of the organic layer of soils in the higher elevation spruce-fir stands in the Northeast were correlated with low levels of inoculum, but these factors alone do not explain the variation in occurrence of the fungus.

Wargo, P. M.; Carey, A. C.; Geballe, G. T.; Smith, W. H. 1987. **Effects of lead and trace metals on growth of three root pathogens of spruce and fir.** Phytopathology. 77(1): 123. Abstract.
Armillaria (Biol Spp 1) (AM), *Scytinostroma galactinum* (SG), and *Perenniporia subacida* (PS) were given at pH 4.5 and 3.5 on malt agar containing the metals. Growth of three fungi was inhibited by soluble ($Pb(C_2H_3O_2)_2$) lead (Pb) at concentrations above 10 ppm. Inhibition was greater at pH 3.5. Rhizomorph growth by AM also was inhibited by insoluble ($PbSO_4$) Pb at concentrations above 10 ppm, especially at pH 3.5. PS and SG were inhibited at 1,000 ppm insoluble Pb. Addition of trace metals (Cd, Cu, Ni, and Zn) to the Pg amended medium at (Cd, Cu, Ni, and Zn) to the Pg amended medium at (MIN) and maximum (MAX) concentraminimum (MIN) and maximum (MAX) concentrations inhibited all three fungi depending on pH and trace-metal concentrations. There was no interactive effect of trace-metals and Pb on growth of PS and SG, but for AM at pH 4.5 there was an additional progressive decrease in rhizomorph growth with increasing concentrations of Pb up to 300 ppm in both MIN and MAX.

Wargo, Philip M.; Houston, David R. 1987. ***Armillaria* root disease in a christmas tree plantation established on a former forested site.** Phytopathology. 77(1): 123. Abstract.
Mortality of balsam fir in a Christmas tree plantation that had been planted on former forest land was attributed to *Armillaria* root disease. The forest, mixed deciduous and pine, was cut in winter 1978. Stumps were chipped to below ground level and fir seedlings were planted in autumn 1978. Mortality appeared first in 1982 and by 1985 clusters of dead and chlorotic trees were apparent. In 1985 we evaluated the role of *Armillaria* and made management suggestions. Examination of many trees showed that *Armillaria* had colonized nearly all dead trees, most chlorotic trees, and many "healthy" green trees. In one 0.75-acre block 806 trees were examined for *Armillaria* at the root collar (RC). Twenty-seven of 39 dead trees, 11 of 24 chlorotic trees, and 61 of 743 green trees were colonized at the RC.

Weinstein, Leonard H.; Kohut, Robert J.; Jacobson, Jay S. 1987. **Research at Boyce Thompson Institute on the effects of ozone and acidic precipitation on red spruce.** IN: Proceedings, 80th annual meeting of APCA; 1987 June 21-26; New York, NY. Publ. 87-34-1. Pittsburgh, PA: Air Pollution Control Association. 20 p.

Wendel, G. W. 1987. **Abundance and distribution of vegetation under four hardwood stands in north-central West Virginia.** Res. Pap. NE-607. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 6 p.
Forest floor samples were collected from four hardwood forest stands in West Virginia to study species composition, abundance, and distribution of vegetation that originated from seeds, rootstocks, and rhizomes. The abundance and distribution of plants on square-foot sections of forest floor that were lifted and moved to the greenhouse indicate that up to 800,000 stems per acre may occur during the first year under ideal conditions. Sweet birch was the most abundant tree species, blackberry the most abundant shrub, and species of violets the most abundant herbaceous plants.

Wendel, G. W.; Lamson, Neil I. 1987. **Effects of herbicide release on the growth of 8- to 12-year-old hardwood trees.** Res. Pap. NE-598. Broomall, PA: U.S. Department of Agriculture, For-

est Service, Northeastern Forest Experiment Station. 4 p.
In 8- to 12-year-old Appalachian hardwood stands, crop trees were released by stem-injecting competing trees with a 20 percent aqueous solution of glyphosate. Species released were black cherry, red oak, and sugar maple. Release treatments were (a) injection of all trees within a 5-foot radius of the crop-tree bole, and (b) injections of all trees whose crown touched the crop tree. Five-year diameter growth of all species was significantly increased by both release treatments, but height growth was not affected by either treatment. Survival of released crop trees was higher and crown-class retrogression of released trees was less than unreleased trees. Glyphosate was effective in controlling most hardwood species during the 5 years of observation.

Wharton, Eric H. 1987. **Availability of woody residuals in southwestern New York and north-central Pennsylvania.** In: Petroleum production solids and woody residuals: waste or resource? 1987 May 14; Bradford, PA. Syracuse, NY: State University of New York; Northeast Petroleum Forest Resource Cooperation: IV-1-IV-19.
Timberlands in southwestern New York and north-central Pennsylvania contain nearly one-half billion green tons of above-ground tree biomass, or 98 green tons per acre. Most--64 percent--has been reserved traditionally for products such as sawlogs, pulpwood, and veneer logs. The remainder is nongrowing stock composed of the tops of growing-stock trees, cull trees, and saplings. These sources of wood material remain following typical harvesting operations. Growing-stock species that are not preferred and stem cull sections also remain following harvesting. Utilization of these sources and nongrowing stock has improved, but current harvesting removes only half of the total wood fiber available. Another source of residuals, manufacturing residues, are less available. At present, the bulk of woody residual results from harvesting. A number of constraints may reduce the availability of woody residues in the future. On privately owned timberland in southwestern New York and north-central Pennsylvania, a small number of forest landowners control a large timberland base. The proportion of timberland area that these owners will make available for harvesting averages 34 percent in southwestern New York and 55 percent in north-central Pennsylvania.

Wharton, Eric H.; Cunia, Tiberius, eds. 1987. **Estimating tree biomass regressions and their error: proceedings of the workshop on tree biomass regression functions and their contribution to the error of forest inventory estimates;** 1986 May 26-30; Syracuse, NY. Gen. Tech. Rep. NE-117. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 303 p.
Proceedings of a workshop cosponsored by the USDA Forest Service, the State University of New York, and the Society of American Foresters. Papers were presented on the methodology of sample-tree selection, tree-biomass measurement, construction of biomass tables and estimation of their error, and combining the error of biomass tables with that of the sample plots or points. Other papers were presnted on various aspects of biomass research currently being conducted in the United States, Canada, and abroad.

Wharton, Eric H.; Nevel, Robert L., Jr.; Powell, Douglas S. 1987. **Supply and demand of timber for wood turning in Maine.** Res. Pap. NE-599. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 29 p.
An analytical report on the volume of wood used by the wood-turning industry in Maine, and on the volume of timber from Maine's timberlands that may be suitable for turnstock. Findings are based on the third forest resource survey of Maine timberlands, and an industry canvass of primary manufacturing mills using wood from Maine timberlands, both conducted in 1982. Also reports the volume of turnstock consumed by Maine mills, the volume produced from Maine timberlands, the volume suitable to be harvested for turnstock, and changes over time.

White, M. S.; Wallin, W. B. 1987. **Effect of wood pallet design on structural durability: a statistical analysis of observed in-service damage.** Forest Products Journal. 38(11/12): 32-38.
The performance of 877 (48 by 40) partial 4-way, wood stringer-type pallets representing 17 designs was monitored during 3 years of service. After each trip in 16 unit-load handling environments, the number, location, and level of damage to each pallet were recorded. Damage to deckboards was significantly more frequent and severe than damage to stringers. The cumulative effect of all design characteristics studied resulted in more than a 500-percent change in durability, from an average of 58 to 298 damage-free handlings. Performance in pallets was

significantly affected by 1) wood species; 2) reinforced or leadingedge deckboards; 3) moisture content of lumber at the time of assembly; and 4) number and type of fasteners used in construction.

Widmann, Richard H. 1987. **Pulpwood production in the Northeast--1985.** Resour. Bull. NE-99. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 26 p.
Reports 1985 data compiled from a canvass of all pulpmills that use pulpwood produced in the 14 Northeastern States. In 1985, total production was 8,807,400 cords, down 2 percent from 1984. Roundwood production was 6,479,900 cords and pulpwood from residues totaled 2,327,500 cords. Each of these declined by 3 and 1 percent, respectively, from the previous year. Receipts of pulpwood at mills in the region totaled 9,455,100 cords.

Willis, Raymond G.; Gentry, Claude E. 1987. **Automated method for determining nitrate and nitrite in water and soil extracts.** Communications in Soil Science and Plant Analysis. 18(6): 625-636.
Describes an Auto-Analyzer method for measuring nitrate plus nitrite in 13 commonly used soil extraction solutions. The Auto-Analyzer usually is equipped with a column containing cadmium chips. In this study, the column was replaced with a cadmium-silver wire inserted in plastic tubing. The advantage is that there is no compaction of cadmium chips, the need to debubble the sample stream before it enters the reductor is eliminated, the dead volume is decreased, and the copper sulfate treatment process is eliminated except for one given the first time the wire is used.

Wong, B. L.; Melhuish, J. H., Jr.; McQuattie, C. J. **The role of mycorrhizae in the accumulation of trace metals under different pH concentrations in conifer tree organs and tissues.** In: National Acid Precipitation Assessment Program, Terrestrial Effects Group (V), peer review; 1987 March 8-13; Atlanta, GA. [Place of publication unknown]; [Publisher name unknown]: B-3: 220-225.
Acid deposition may affect forest trees through soil mediated responses by an acceleration of soil acidification and/or enhancement of solubility and mobility of metal ions. These ions may be present naturally in soils or deposited directly onto the soil from some form of atmospheric pollution. Because the concentration of some heavy (or trace) metals may be increasing in the forest ecosystem, information is needed about the effects of trace metals on trees and beneficial microorganisms such as mycorrhizal fungi that are necessary for the growth of forest trees.

Wong, B. L.; Melhuish, J. H., Jr.; McQuattie, C. J. 1987. **Response of mycorrhizal and non-mycorrhizal loblolly pine seedlings to different pH and Pb concentrations.** In: Sylvia, D. M.; Hung, L. L.; Graham, J. H., eds. Mycorrhizae in the next decade: practical applications and research priorities. Proceedings, 7th North American conference on mycorrhizae; 1987 May 3-8; Gainesville, FL. Gainesville, FL: University of Florida; Institute of Food and Agricultural Sciences: 110. Abstract.
Discusses the role of mycorrhizae in the accumulation and distribution of Pb in loblolly pine seedlings, and on the effect of such treatments (pH and Pb) on the ultrastructure of mycorrhizal and nonmycorrhizal roots.

Wong, B. L.; Melhuish, J. H., Jr.; McQuattie, C. J. 1987. **The effect and distribution of Al in mycorrhizal and non-mycorrhizal pine seedlings.** Mycological Society of America Newsletter. 38(1): 56. Abstract.

Wright, Susan L. 1987. **Managing insects affecting oak regeneration by prescribed burning.** In: Current topics in forest research: emphasis on contributions by women scientists: proceedings of a national symposium; 1986 November 4-6; Gainesville, FL. Gen. Tech. Rep. SE-46. Asheville, NC. U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station: 186-192.
The lack of oak regeneration in many areas of the Eastern United States has generated interest in prescribed burning as a forest management tool to improve the natural regeneration of oak stands. Data indicate that burning may reduce the populations of several insect pests of oak regeneration, including the acorn weevil and the sap beetle. The intensity of the burn seems to be critical in reducing insect populations.

Wright, Susan L. 1987. **Prescribed burning as a technique to manage insect pests of oak regeneration.** In: Prescribed burning in the Midwest: state-of-the-art; 1986 March 3-6; Stevens Point, WI. Stevens Point, WI: University of Wisconsin Extension. 91-96.
Studies were established prior to two prescribed burns conducted in southeastern Ohio in the

springs of 1984 and 1985 to investigate the effect burning had on the oak acorn weevil. Two survey techniques were used to monitor insect populations before and after the burn: the baited pitfall can and the collection of litter samples. Although the intensity of the burn seems critical, our data indicate that burning may reduce populations of this insect. Survey techniques were not available to determine the effects of burning on other known pests of oak; however, it is possible that burning at the appropriate times in the life cycle of these pests would reduce the numbers of insects and/or eliminate breeding material.

Wright, S. L.; Galford, J. R.; Peacock, J. W. 1987. **The role of insects in the oak regeneration problem.** Ohio Journal of Science. 87(2): 49.
As Ohio's oak forests are harvested, the species composition of many stands are changing to less desirable commercial tree species. This phenomenon is caused by inadequate amounts of oak regeneration present before a harvest.

Yaussy, Daniel A. 1987. **Green lumber grade yields from sugar maple and basswood factory grade logs.** Northern Journal of Applied Forestry. 4: 154-157.
Multivariate regression models were developed to predict green board-foot yields for the common factory-lumber grades processed from sugar maple and basswood factory grade logs. These models use the standard log measurements of grade, scaling diameter, log length, and proposition of scaling defect. Any combination of lumber grades (such as 1 Common and Better) or total yield can be predicted with these models. That coefficients presented 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
Biller, Cleveland J.	Morgantown
Birch, Thomas W.	Broomall
Brisbin, Robert L.	Princeton
Brooks, Robert T.	Broomall
Cannon, William N.	Delaware
Corbett, Edward S.	University Park
Dale, Martin E.	Delaware
Davidson, Walter H.	Berea
DeGraaf, Richard M.	Amherst
Dempsey, Gilbert P.	Princeton
Dennis, Donald	Burlington
Dochinger, Leon S.	Delaware
Eagar, Christopher	Broomall
Echelberger, Herbert	Burlington
Edwards, Pamela J.	Parsons
Ernst, Richard L.	Warren
Federer, C. Anthony	Durham
Frieswyk, Thomas S.	Broomall
Galford, Jimmy R.	Delaware
Gansner, David A.	Broomall
Garrett, Peter W.	Durham
Gatchell, Charles J.	Princeton
Glass, Ronald J.	Burlington
Gottschalk, Kurt	Morgantown
Halverson, Howard G.	Berea
Hansen, Bruce G.	Princeton
Healy, William M.	Amherst
Heisler, Gordon M.	University Park
Helvey, J. David	Parsons
Hertel, Gerard D.	Broomall
Hilt, Donald E.	Delaware
Hornbeck, James W.	Durham
Hosmer, Richard A.	Durham
Houston, David R.	Hamden
Huyler, Neil K.	Burlington
Jennings, Daniel T.	Orono
Jensen, Keith F.	Delaware
Kochenderfer, James N.	Parsons
Krusic, Paul	Broomall
Lamson, Neil I.	Parsons
Leak, William B.	Durham
LeDoux, Chris B.	Morgantown
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
Melhuish, John H.	Berea
Miller, Gary W.	Parsons
Mishkit, Tim D.	Burlington
Montgomery, Michael	Hamden
Nevel, Robert L.	Broomall
Ossenbruggen, Sharon	Durham
Patton, Roy	Delaware
Peacock, John	Delaware
Peters, Penn A.	Morgantown
Pierce, Robert S.	Durham
Powell, Douglas S.	Broomall
Rast, Everette D.	Princeton
Reardon, Richard	Morgantown
Redding, James L.	Warren
Remington, Susan B.	Burlington
Rowntree, Rowan	Syracuse
Schier, George A.	Delaware
Scott, Charles T.	Broomall
Sheehan, Katharine	Morgantown
Shortle, Walter C.	Durham
Smith, H. Clay	Parsons
Smith, Harvey R.	Hamden
Smith, Kevin T.	Morgantown
Smith, R. B.	Durham
Solomon, Dale S.	Orono
Sonderman, David L.	Princeton
Stout, Susan L.	Warren
Tabor, Christopher A.	Burlington
Teck, Richard M.	Delaware
Tilghman, Nancy G.	Warren
Tritton, Louise M.	Burlington
Valentine, Harry T.	Hamden
Wade, Gary	Berea
Wallin, Walter B.	Princeton
Wallner, William E.	Hamden
Walters, Russell S.	Warren
Wargo, Philip M.	Hamden
Wharton, Eric H.	Broomall
Widmann, Richard H.	Broomall
Willis, Raymond G.	Berea
Wong, Betty L.	Burlington
Yamasaki, Mariko	Durham
Yaussy, Daniel A.	Delaware
Yawney, Harry W.	Burlington

Northeastern Forest Experiment Station. 1989. **Publications of the Northeastern Forest Experiment Station--1987**. Gen. Tech. Rep. NE-127. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 39 p.

An annotated list of publications by Northeastern Forest Experiment Station scientists and cooperators in 1987.

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

Northeastern Forest Experiment Station
Holdsworth Hall
University of Massachusetts
Amherst, MA 01003

Northeastern Forest Experiment Station
Forestry Sciences Laboratory
1835 Bill Hill Road
Berea, KY 40403

Northeastern Forest Experiment Station
370 Reed Road
Broomall, PA 19008

Northeastern Forest Experiment Station
George D. Aiken Sugar Maple Laboratory
705 Spear Street, P.O. Box 968
Burlington, VT 05402

Northeastern Forest Experiment Station
Forestry Sciences Laboratory
359 Main Road
Delaware, OH 43015

Northeastern Forest Experiment Station
Louis C. Wyman Forestry Sciences Lab.
P.O. Box 640
Durham, NH 03824

Northeastern Forest Experiment Station
Center for Biological Control of
Northeastern Forest Insects and Diseases
51 Mill Pond Road
Hamden, CT 06514

Northeastern Forest Experiment Station
Forestry Sciences Laboratory
180 Canfield Street, P.O. Box 4360
Morgantown, WV 26505

Northeastern Forest Experiment Station
USDA Building - University of Maine
Orono, ME 04469

Northeastern Forest Experiment Station
Timber and Watershed Laboratory
P.O. Box 445
Parsons, WV 26287

Northeastern Forest Experiment Station
Forestry Sciences Laboratory
P.O. Box 152
Princeton, WV 24740

Northeastern Forest Experiment Station
c/o State University of New York
College of Environmental Science & Forestry
5 Moon Library
Syracuse, NY 13210

Northeastern Forest Experiment Station
The Pennsylvania State University
301 Forest Resources Laboratory
University Park, PA 16802

Northeastern Forest Experiment Station
Forestry Sciences Laboratory
P.O. Box 928
Warren, PA 16365