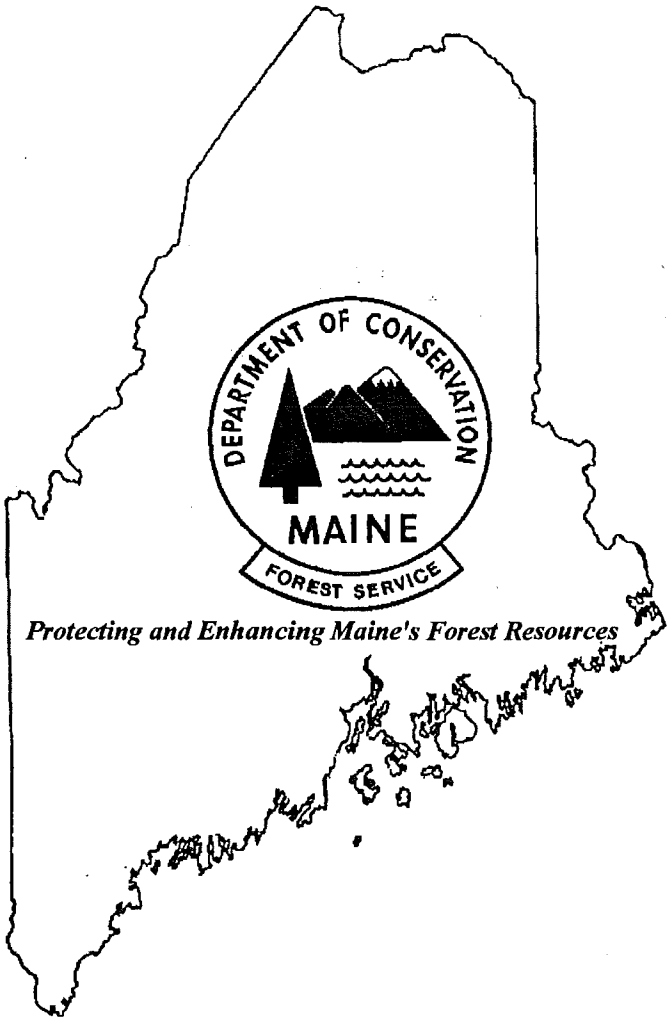
Forest & Shade Tree Insect & Disease Conditions

for Maine

A Summary of the 1994 Situation



Insect & Disease Management Division
Summary Report No. 9
March 1995

Maine Forest Service
MAINE DEPARTMENT OF CONSERVATION
Augusta, Maine

MAINE

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Issued 3/20/95

Printed under appropriation number 010-04A-5600-562

Acknowledgments

This summary has been compiled and edited by **Richard Dearborn** and **Clark Granger** from input received from the Insect and Disease Management staff and many cooperators. State Entomologist, **Dave Struble** contributed entries and proofread the final draft. **Dick Bradbury**, **Henry Trial, Jr.**, **Don Ouellette** and **Charlene Donahue** of our staff either wrote items or otherwise contributed to the compilation process. Retired pathologist **Doug Stark** again assisted us with a number of forest pathology issues. Our regular field staff, **Mike Devine, Jody Connor, Skip Cram, Mike Skinner, Grayln Smith** and **Dave Stewart** provided us with information and records on various insects and diseases and assisted on several intensive state and federal projects. Thanks go also to the federally funded seasonal staff: **Joy Leavitt, Kathy Murray, Keven Ireland, Laurie Mann, David Rhinebolt, Travis Willey, Dave Pierce,** and **Wayne Searles** who worked on the Forest Health Monitoring Program while **Rex Waite** and **Jeff Wilder** continued their work on the White Pine Blister Rust Program.

A special debt of gratitude goes to **Betty Barry** who had to take information from a number of sources in various formats, including roughly written notes and bring these into a cohesive computer generated product that could be proofread. Credit is also due to both Betty and **Dot Arbour** who are keepers of the mailing list and who prepare this summary for mailing.

Our thanks go to many other administrative and field staff in the Maine Department of Conservation who facilitate much of our work and to cooperators associated with the USDA-Forest Health Protection, USDA-APHIS, Maine Department of Agriculture, University of Maine at Orono, and cooperators in other New England States and Maritime Provinces of Canada.

We would also like to extend our appreciation to those in the business sector and individuals who came to us over the year with questions, comments or problems for diagnosis. Through our efforts to address each of these client needs we were better able to serve others.

Without the generous support of all, this effort would have fallen far short of its goal.

FOREST & SHADE TREE INSECT & DISEASE CONDITIONS FOR MAINE
A SUMMARY OF THE '1994 SITUATION

Comments from the State Entomologist

I am very pleased with the accomplishments of the I&DM Division during 1994. We have monitored the health of the forest resource across the entire state, and have developed strategies and overseen remedial actions to address current and anticipated impacts of a broad range of detected insect and disease problems. Despite the general budgetary constraints of the recent past, and the associated reduction in available resources, we have managed to maintain an effective organization that addresses the needs and expectations of the people of the state. While in some cases the Division has had to adjust traditional approaches in dealing with problems and limit the amount of time we can invest on certain issues, we have been able to address most issues and meet our legislated mandates.

As we begin under a new administration, looking for better ways to serve the people of the state, I think that it is worthwhile to reflect on what it is that we do, and why.

The well-being of Maine's citizens is heavily dependent on its forest resources. These forests provide much of the raw materials to fuel Maine's mills and serve as the backdrop for the forest-based recreation industry. Forest-based recreation and manufacturing activity provides employment to more than 50,300 people (12% of Maine's employment) and generates over $888 million in payroll. The overall annual contribution of the forest resource to Maine's economy exceeds $7,418,500,000.

Along with the direct economic contribution, the forests of the state provide watershed, environmental, wildlife, and recreational benefits. Forested parks and individual shade trees provide similar amenities in urban and suburban settings. Virtually everyone benefits from maintaining these resources in a healthy state. In the succinct terms of the Maine Forest Service Mission Statement: "The key to Maine's past, present, and future quality of life and economic prosperity for its citizens is permanently linked to the condition of the State's forest resources."

The mission of the Insect and Disease Management Division is to protect the forest, shade and ornamental tree resources of the state from significant insect and disease damage, to preserve the overall health of the resource, and to provide pest management information and assistance to homeowners, municipalities, and forest landowners and managers. The Division efforts focus on the following functions:

- Providing timely, accurate, and appropriate assessments and predictions of current and potential forest pest species and their impacts, and of forest health conditions for the State's forest resources.
- Developing preventive and remedial management prescriptions for major forest resource problems.
- Providing technical advice and assistance (including diagnostic services and site-specific management/control strategies) in response to requests from landowners, municipalities and individuals.
- Conducting and supervising pest control actions when and where appropriate.
- Conducting and administering quarantine activities directly relating to Maine's forest resource to protect the resource base and minimize constraint of commerce.

The extent and diversity of the resource protected, ranging from 17.5 million acres of commercial timberland (half of which is owned by non-industrial private owners) to individual shade trees scattered across 498 municipalities require that the I&DM Division optimally utilize its limited resources. Over the past few years we have actively developed strategies to augment internal Division capability.

- We have increased the use of computer technology including geographical information systems to record, manage, analyze and publish pest and forest response data.

- We have formed formal and informal partnerships with our clients, other agencies within the state, neighboring jurisdictions, and the federal government to optimize efficiency through sharing resources, analyses, and information.
- Although we have aggressively developed project proposals and pursued cooperative grants to address specific issues, we have attempted to minimize dependence of core program functions on these outside funding sources.
- We are increasingly utilizing remote sensing to direct on-ground efforts.
- At the local level, we continue to expand our network of cooperators to augment detection capabilities and to provide an outreach function to help address local problems.

In reporting the various pest conditions and their impact on the health of Maine's forest resource, the following sections of this annual summary capture most of the activities conducted as part of I&DM's core functions. However, this report is not a complete summary of Division activities and accomplishments. The activities conducted by Division staff in support of other operations, both within and outside the Maine Forest Service, are not well articulated. And although we try to acknowledge you, our client/cooperators, the few words written here do not convey the extent of our reliance or express our appreciation for your contribution.

These Forest & Shade Tree Insect & Disease Condition Reports serve as one of the primary vehicles for relaying general information from us to you; it is critical that they be useful. We sincerely hope that you will read them, use them, and keep in touch with us regarding information or suggested improvements so that they continue to meet your needs.

Personnel Notes

New Personnel: Charlene Donahue was hired in June to fill the Entomologist I vacancy created by Dan Pratt's retirement. Charlene previously worked on biological and chemical control of spruce budworm with Dr. John Dimond, and spent a number of years working for the Cooperative Extension Service at the Pest Management Unit at UMO where she was coordinator and leader of the USDA-APHIS Cooperative Agricultural Pest Survey in Maine.

In addition to providing diagnostic and technical assistance to our clientele, Charlene is also developing and overseeing the conversion of existing I&DM data to an electronic format to streamline storage, analysis, and integration capabilities within I&DM. Her experience and expertise have proved to be valuable assets augmenting traditional Division strengths.

Dr. Auburn E. Brower (May 22, 1898 to April 8, 1994) - While his career with the Maine Forest Service spanned only 37 years, his avocation as a naturalist was spread over more than 90 years. "Ed" or "Doc" was born in Saint Louis, Missouri and grew up on a small family farm in Willard near Springfield. From his early days around the turn of the century Ed was close to the land and spent many happy hours between chores watching and collecting birds, insects and plants. This interest eventually led to further education and a B.S. degree in education from the State College at Springfield. After a brief stint teaching high school Ed went on to Cornell University in Ithaca, N.Y. where he received his Ph.D. in entomology in 1932. It was during his years at Cornell that he met and then married Lurana Cole Van Doren. This was the start of a family which was to include three children: Edward, John and Katherine.

On May 16, 1931, a year before completing his work at Cornell, Ed came to work for the Maine Forest Service at the field lab which was then on the grounds of the Jackson laboratory in Bar Harbor. When a new (and present) entomology lab was constructed on the Augusta Mental Health Institute grounds in 1938, "Doc" moved from Bar Harbor to Augusta where he spent the next 30 years as this Division's survey entomologist.

We all owe Dr. Brower a debt of gratitude and recognition for his many accomplishments and years of devoted service to the better understanding and protection of Maine's natural resources.

Cooperative MFS/USFS Projects

Forest Inventory & Analysis (FIA) Decennial Survey

Currently the FIA unit of the U.S. Forest Service is conducting its decennial survey of the forest resources of Maine. FIA began this evaluation in 1994 and is scheduled to complete field remeasurements in 1995. Because the results of this survey will disclose the status and trends of the resource, they are important to the state in the formulation of forest resource policy. The MFS has placed a high priority on completion of this survey within the alloted time frame and therefore is providing assistance to facilitate its completion.

During 1994, and continuing into 1995, the I&DM field staff has been locating "missing" high priority plots in Aroostook, Penobscot, Piscataquis and Washington counties. These plots have been measured several times in the past and are key to evaluating changes in forest condition. Familiarity with the area and knowledge of the changes that have occurred since the last resurvey have enabled I&DM staff to locate plots that the FIA crews could not find.

For 1995 the MFS effort has been expanded. I&DM staff have trained Fire Control staff in plot location procedures. Currently up to 16 Forest Fire Control and I&DM staff are working on this project as other projects allow.

In addition to concentrating on traditional measures of level and trend of forest productivity, the FIA unit is also assessing indicators of forest health. These indicators were developed cooperatively by FIA, I&DM, and our state counterparts in New Hampshire and Vermont to facilitate linking various regional pest incidence, FIA, and National Forest Health Monitoring program data sets. For several types of chronic damages (e.g. stem cankers), this data set will provide the best regional assessment of extent and intensity. As part of the cooperative effort the I&DM Division has provided training and quality control oversight.

North American Maple Project -NAMP

The NAMP has provided data on the general condition and health of a large portion of the sugar maple resource in Maine since its beginning in 1988. These data are obtained from nine sets of paired plots (a total of 18 plots) from the western central portion of the state. These plots are a subset of 233 plots that cover the sugar maples from Nova Scotia and P.E.I. in Canada to Minnesota.

Maine's sugar maple plots had healthy trees with very full and solid crowns in 1994. Sugar maples that are tapped annually by Maine sugar producers appear to be well managed and do not differ in health measurements from 'unmanaged' sugar maples. Maples across the range of this international project in the past have exhibited fluctuating levels of health but are presently in overall good health.

Several pamphlets have been produced from these years of data collection. Detailed information is available on this project in a report entitled "Temporal change in sugar maple crown condition from 1988-1994" compiled by Andrew Molloy and Douglas Allen. This is available to interested parties from this office.

National Forest Health Monitoring Program (NFHM)

The NFHM program, of which Maine was a charter participant, continued to expand in 1994 toward an anticipated nationwide effort. The number of states actively collecting nationally standardized data for the program increased from 14 in 1993 to 17 in 1994 with the addition of three midwestern states: Michigan, Minnesota, and Wisconsin. Additional states are expected to join the effort in 1995. The NFHM program is a cooperative effort between the U.S. Forest Service, the EPA and the states designed to annually collect and evaluate nationally standardized data on the health of the nation's forests.

Through the NFHM program the MFS is able to access state, regional and national data related to the numerous forest health parameters. Approximately 250 NFHM plots are located in the New England region and of these 137 fall in Maine. In addition to the basic long term core information (annual tree health measurements, land use patterns, cover type information, and forest inventory data), three new indicators were added to the list of data collected by the program. Two of the new indicators are designed to assess the extent and diversity of

vegetation cover; one for vascular plants, the other for lichens. The other new indicator (PAR) assesses the quantity of photosynthetically active radiation penetrating the canopy, measuring the plants ability to utilize available sunlight. Data collected for NFHM serves as a valuable baseline for assessing levels and trends of forest health in Maine.

The MFS also continued to use the NFHM plot network as a vehicle to enhance accumulation of additional insect and disease data for ongoing survey and evaluation efforts. Checklists of insect and disease problems associated with the forest type of each NFHM plot were completed for each plot visited in 1994. We continued to improve field guides and held training sessions designed to improve the ability of NFHM crews to detect and evaluate a wider range of pests and problems encountered during annual plot measurements.

Competitive Focus Funding Grants

(Determination of the Impact of Hemlock Loopers, *Lambdina fiscellaria* (Guen.), and *L. athasaria* Defoliation on Eastern Hemlock, Balsam Fir, and White Spruce Tree Health) - Although hemlock looper now appears to be declining in most of New England, the recent widespread outbreak raised a number of questions regarding pest management options. Through the financial support of the USFS several studies were conducted by the I&DM Division and other cooperating states. This multi-state study is the last to be completed. The final report is anticipated in April.

(MFS Insect and Disease Historical Database) - The I&DM Division was awarded a cooperative grant by the USFS to develop and test an electronic relational database to store, manage, and query the MFS historical insect and disease data set. The format envisioned will facilitate access to the historical data to 1) define the biodiversity of areas 2) substantiate predictive models 3) show spatial/temporal distribution of species 4) describe population trends.

Brown (= Black) Ash Health Evaluation

In response to reports of brown ash crown dieback and mortality scattered throughout the state, the MFS initiated an evaluation of the health of the brown ash resource in 1992. After initial surveys of brown ash condition confirmed that indeed a significant decline had occurred, the I&DM Division entered into a cooperative agreement with the USFS to evaluate and hopefully identify causal agents or conditions which led to the decline. The evaluation project objectives included:

- Evaluation of the health of the brown ash resource in Maine and a determination of the extent and severity of the observed decline
- Investigation of possible correlations among various site factors in affected stands
- Categorization of the contribution of specific stressors as predisposing, exacerbating, or causal
- Providing the owners and users of Maine's brown ash resource, and the interested public, with the findings of these investigations

The I&DM Division has now completed the evaluation of the severity and extent of the brown ash decline and has published its findings (Forest Health Monitoring Evaluation: Brown Ash (*Fraxinus nigra*) In Maine, A Survey of Occurrence and Health , I&DM Division, Technical Report No. 33).

The most significant conclusion of the study was that brown ash continues to be in a state of severe decline throughout the state. Over 50 percent of all study trees exhibit more than 20 percent crown dieback and over 30 percent of those trees exhibit more than 80 percent crown dieback. These levels of dieback are much greater than levels seen in other common Maine tree species. In many of the study plots, the majority of brown ash trees are so badly damaged that they will likely never regain commercial value. Larger and generally older trees have more dieback and worse crown condition than younger, smaller trees. Also, brown ash stands on higher, drier sites are in better condition than stands on lower wetter sites. These relationships, the fact that the decline occurs throughout the study area, and evidence of other growth declines in the 50's and 60's suggest that the decline is chronic and probably caused by recurring stress factors. The strong relationship between site condition

and dieback suggests that the presence of water (drainage), the physical action of water, or perhaps changes in watersheds may be significant contributing factors to the decline.

The I&DM Division has distributed copies of this report to interested clients. We have also given presentations and scheduled field trips.

Currently the MFS is continuing its investigation of possible causes of this decline through cooperation with the University of Maine in a study of the dendrochronology of affected brown ash stands. The University study is examining stressors thought to be important in the pattern of brown ash decline as they relate to tree growth.

Management of Root Sprouting in American Beech to Enhance Numbers of Clones Resistant to Beech Bark Disease (From a progress report submitted by Dr. David R. Houston, Principal Plant Pathologist with the USFS).

This cooperative study between the USFS, the Maine Bureau of Public Lands and the Maine Forest Service, was established to assess the potential of two harvesting systems (clearcutting vs. partial cutting) conducted during two seasons (winter vs. summer) to manage the subsequent initiation and survival of root sprouts from root systems of cut or standing trees resistant or susceptible to beech bark disease. The site for this study was selected and the study began in 1989 on the Maine Public Reserve Lot on the east side of Seboeis Lake in T4 R9. Initial plot measurements were taken prior to harvests. These harvests were conducted in the winter-late spring of 1991.

Accomplishments as of January 1, 1995:

- In the summer of 1994, individual sprouts and seedlings being followed in the 149 plots were remeasured for the third and final time. As in 1993, causes of mortality were noted where possible, and counts were made of the total numbers of sprouts and seedlings in each 15-foot radius plot.
- The original work plan called for the destructive sampling of the sprouts in each plot to ascertain their affiliations with the central plot tree or stump. It was mutually agreed not to do this in order to permit a possible remeasurement of growth and survival in the future. All living seedlings and sprouts were retagged with aluminum tags and positions reflagged.
- The 24 regeneration plots (12 one-meter and 12 two-meter diameter plots) in each of the original 15 ten-acre blocks were remeasured 5 years after they were established.
- All data have been entered and are awaiting summarization and analysis. Hopefully this will be accomplished by July 1 so that final reporting can be accomplished by termination of the Agreement in December, 1995.

Future Work

- Field work is essentially completed. Should funds and personnel become available, it would be desirable to obtain beech regeneration data in plots randomly placed in each of the harvested blocks. The purpose of this is to account for any overexposure effects that may have resulted in clearing logging debris from the study plots. Approximately ten days work by a crew of four would be required.

Associated Studies

- **Vegetative propagation trials**--We are cooperating with others to develop ways to propagate selected, high quality, highly resistant beech. Some resistant trees identified in the management study, but not part of the plot system, have been sampled in the past. In Jan. 1995, twigs from 19 trees, most of them plot trees, were collected with assistance of Maine Bureau of Public Lands personnel. Attempts are underway to graft onto beech seedlings, incorporate into tissue cultures, or to root this material. The locations of most of these trees were referenced in the summer of 1995 using GPS. See also Beech Scale (page 21).

Publications

A file of publications is maintained by the I&DM Division (MFS) on a variety of subjects relating to the protection of Maine's forest resources from pests. This file contains publications of our own plus many from other sources as well. Besides a number of fact sheets we still have copies of two of our more popular booklets: Bull. #25 - Field Book of Destructive Forest Insects (1980) and Bull. #10 (5th Revision) - The Planting and Care of Shade Trees (1985). A number of our Technical Report series, now numbering 34, are also still in stock for more detailed information on specific subjects. A list of available titles is available upon request. Sets of the first eight conditions summaries, such as this one, are also available on a very limited basis.

In addition to published reports our staff continues to give talks to a variety of groups including schools and to provide items of interest to the news media and various association newsletters as well.

The following items were published over the past year by I&DM staff:

Insect & Disease Management Division. 1994 (March). Forest & Shade Tree-Insect & Disease Conditions for Maine - A Summary of the 1993 Situation. MFS, I&DM Division. Summary Report No. 8. 65 pp. Compiled and edited by R.G. Dearborn and C.A. Granger.

------ 1994. Forest & Shade Tree-Insect & Disease Conditions for Maine. 8 issues from April 13 through October 5. MFS, I&DM Div. Compiled and edited by R.G. Dearborn and C.A. Granger.

Trial, H., Jr. and M.E. Devine: 1994 (May). Forest Health Monitoring Evaluation: Brown Ash (*Fraxinus nigra*) in Maine - A Survey of Occurrence and Health. MFS, I&DM Div. Tech. Rpt. No. 33. 37 pp.

Trial, H., Jr. and M.E. Devine. 1994 (December). The Impact of the Current Hemlock Looper, *Lambdina fiscellaria* (Guen.), Outbreak in Selected Severely Damaged Stands of Eastern Hemlock. MFS, I&DM Div. Tech. Rpt. No. 34. 16 pp.

The following items were published over the past year by I&DM staff in cooperation with other agencies:

Millers, I., D.C. Allen, D. Lachance and R. Cymbala. 1994 (June). Sugar Maple Crowns in Good Condition in 1994. USDA-FS-NA-TP-03-94. A foldout brochure.

Molloy, A.W. and D.C. Allen. 1995 (February). Temporal Change in Sugar Maple Crown Condition from 1988-1994. North American Maple Project. Syracuse, N.Y.., SUNY-CESF. 64 pp.

Twardus, D., M. Miller-Weeks and A. Gillespie. 1995. Forest Health Assessment for the Northeastern Area - 1993. USDA-FS-NA-TP-01-95. 61 pp.

University of Massachusetts Cooperative Extension Service. 1994 (March). 1994 New England Management Recommendations for Insects, Diseases and Weeds of Shade Trees and Woody Ornamentals. Compiled and edited by R.D. Childs and M. Castonguay, with assistance from the Maine Forest Service and other New England state agencies. 248 pp., 12 color plates +.

Important references on ecosystem classification systems mentioned in this report are:

Bailey, R.G., P.E. Avers, T. King and W. McNab, eds. 1994. Ecoregions and subregions of the United States (map). Washington, DC: U.S. Geological Survey. Scale 1:7,500,000; colored. Accompanied by a supplementary table of map unit descriptions compiled and edited by McNab and Bailey. Prepared for the U.S. Department of Agriculture, Forest Service.

Fincher, J. and M. Smith. 1994. A discriminant function approach to ecological site classification in northern New England. Res. Pap. NE-686. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 12 p.

McMahon, J.S. 1990. The biophysical regions of Maine: Patterns in the landscape and vegetation. Orono, ME: University of Maine. 119 p. Thesis.

McMahon, J. and J. Bernard. 1993 (May). An ecological reserves system for Maine: Benchmarks in a changing landscape. A report to the 116th Maine Legislature. Natr. Res. Policy Div. Maine State Planning Office. 94 pp. & foldout map of Biophysical Regions of Maine.

McNab, W. and P.E. Avers. 1994. Ecological subregions of the United States: Section descriptions. Administrative Publication WO-WSA-5. Washington, DC: U.S. Department of Agriculture, Forest Service. 267 p.

Useful Suggestions

Many readers may only want to read selected sections of this report or about items of particular interest to them. We have retained roughly the same format as we used last year to target particular items. The Table of Contents along with the "Highlights" section (including Table 1) and the Index should help you narrow down your search for items of particular interest but you still may wish to scan the entire report to pick up new items of interest as well. Keep in mind the following when scanning for particular problems:

- **Insect problems** are broken down into three categories. All **softwood insect pests** including those in plantation and ornamental situations, are grouped in Section A. In this report all **hardwood insect pests** are now discussed in Section B. **Insect pests of ornamentals and shrubs** can be found in Section C along with **insects and other arthropods of medical or nuisance significance.** A table showing the variety of **public assistance** requests received is included in Section C (page 41).
- **Tree diseases** are listed alphabetically in a separate section beginning on page 43.

We hope that you will find these suggestions helpful. Any comments or suggestions for further improvement are welcome.

Forest Insect and Disease Conditions for Maine

Highlights of the 1994 Season

With each passing year the demands on our forest resources increase and concern over the extent and significance of various problems becomes more apparent. During 1994 ground and aerial surveys were used to delineate a number of problems which came to our attention. Aerial surveys were used to map areas of hardwood decline in northern Maine, defoliation by satin moth and variable oakleaf caterpillar in central and eastern Maine and gypsy moth in southern Maine. Ground surveys were used to determine the extent and severity of these as well as other problems such as Bruce spanworm, fall webworm, hemlock looper and others which could not be readily detected from the air.

Hardwood decline and variable oakleaf caterpillar were most striking on a broad scale but problems affecting Christmas trees, shade trees, ornamentals and public health generated their share of concern as well. Balsam shootboring sawfly, birch leafminer, browntail moth, fall cankerworm, fall webworm, introduced pine sawfly, Japanese beetle, maple problems, mites, salt damage, viburnum leaf beetle and white pine blister rust were among the more common tree and shrub problems encountered in 1994 (see Table 1). Browntail moth, salt marsh mosquitoes and ticks dominated the area of public health issues while carpenter ants, cluster flies, chinch bugs, the infamous Asian lady beetle and various seedbugs captured the household and nuisance awards.

Introduced species are often cause for concern and can achieve news level notoriety. So far the Asian gypsy moth, common pine shoot beetle and hemlock woolly adelgid have stayed south of Maine borders. Other introductions such as the butternut canker, columbine sawfly, Asian lady beetle and viburnum leaf beetle, however, have showed up in numbers in new areas in Maine.

Rodent damage and various environmental and site related problems added a little diversity to our problem solving activities in 1994. Quarantines, however, changed little. These are discussed in more detail later in this report.

In retrospect the 1994 season was fairly typical in content, including the standard fare while presenting its usual share of surprises. We have tried to present the situation as we experienced it. We hope that you find the enclosed material useful and at the same time as entertaining as we have. We have consolidated entries to enhance their readability yet have included enough information to allow land managers to make sound management decisions. We hope you enjoy it.

Table 1. Pest problems status for 1994 and damage level trends from 1993 -1994.

Those of special significance

Aspen Leafroller/tiers	→*	<70,000 A.
Balsam Fir Sawfly	↓	100 A.
Balsam Shootboring Sawfly	↑	400 A. heavy
Balsam Twig Aphid	→	low & local
Birch Skeletonizer	↘	high
Black Army Cutworm	↓	not reported
Brown Ash Decline	↘	high
Browntail Moth	↗	local Casco Bay
Bruce Spanworm	↗	<10,000 A.
Bud Abortion (balsam fir)	→	low
Butternut Canker	↑	12 counties
Cone Buds (balsam fir)	↘	low to moderate
Dogwood Anthracnose	→	York County
Drought	→	moderate
European Larch Canker	→	static
Fall Cankerworm	↗	high, Aroo Cty. boxelder only
Gypsy Moth	↓	1,706 A.
Hardwood Decline	↗	180,000 A. high, north
Heat Injury	↓	low
Hemlock Looper	↓	low
Introduced Pine Sawfly	↗	600 A. SW ME
Late Spring Frost	↗	moderate, local
Meadow Vole Damage	↗	local, high on ornamentals
Pinewood Nematode	→	local
Rd. Salt Spray /Pooling Damage	↑	high
Satin Moth	↘	1,600 A. Central ME
Variable Oakleaf Caterpillar	↑	>220,000 A.
Viburnum Leaf Beetle	↑	high, **New** in 1994
White Ash Dieback	↘	moderate
Winter Browning	↘	low
Yellowheaded Spruce Sawfly	→	high

Perennial Problems

Air Pollution	↓	low
Alder Flea Beetle	→	locally high
Annosus Root Rot	→	low
Arborvitae Leafminer	→	low
Ash Anthracnose	→	low
Ash Leaf and Twig Rust	→	low
Balsam Gall Midge	→	low
Balsam Woolly Adelgid	↗	20 A. Christmas trees
Beech Bark Disease	→	high
Birch Casebearer	↓	low, open areas
Birch Leafminer (*Messa*)	→	moderate, coastal
Boxelder Canker	→	low
Coral Spot Nectria Canker	↗	moderate
Cristulariella Leaf Spot	→	very low
Dutch Elm Disease	→	high
Eastern Larch Beetle	↘	low to moderate, local
Fall Webworm	↘	higher north
Fir-fern Rust	→	low
Forest Tent Caterpillar	→	very low
Horse Chestnut Leaf Blotch	→	moderate
Larch Casebearer	→	high, local
Larch Sawfly	→	low, scattered
Large Aspen Tortrix	↓	low
Mountain Ash Sawfly	→	high, local
Oak Leaftier/Skeletonizer	→	low
Pear Thrips	→	low
Pine Needle Rust	→	low
Pitch Mass Borer	↗	local, spruce SW ME
Porcupine Damage	→	locally high
Rhabdocline needle Cast	→	moderate
Saddled Prominent	→	low
Saratoga Spittlebug	→	low
Scleroderris Canker	→	low
Sirococcus Shoot Blight (Larch)	↗	moderate
Spider Mites	→	high, local
Spruce Beetle	→	low
Spruce Budmoth	→	moderate
Spruce Budworm	→	low
Stillwell's Syndrome	→	low
White Pine Blister Rust	→	low
White Pine Weevil	→	high

* damage levels: ↗- up slightly; ↘- down slightly; ↑- up; ↓- down; →- stable at level indicated.

Light Trap Survey

A total of 24 light traps were operated during the 1994 season at selected locations throughout the state. This marked the fifty-second season for this important surveillance and detection program for lepidopterous forest defoliators. Although we try and maintain consistent trap locations, some changes have been necessary. One such change in 1994 involved the establishment of a trap station at Arundel to provide increased coverage for York County. Other changes involved relocation of the trap within the Town of Steuben and transfer of the trap from Matagamon to Shin Pond. Roughly 25 pests are monitored on a fairly consistent basis and of these twelve are compared annually (Table 2 lists nine of these). The results of seasonal catches are used to supplement data from other surveys such as those for larvae, damage or to compare to pheromone catches. These trap catches are also monitored for new and unusual species, especially in southwestern Maine at South Berwick where an oak-hickory forest type is present (one of the few such areas in Maine) and at Arundel. A general summary of the results of this survey for 1994 can be found in Table 2. Annual comparisons for some pest species have been interwoven into the regular report.

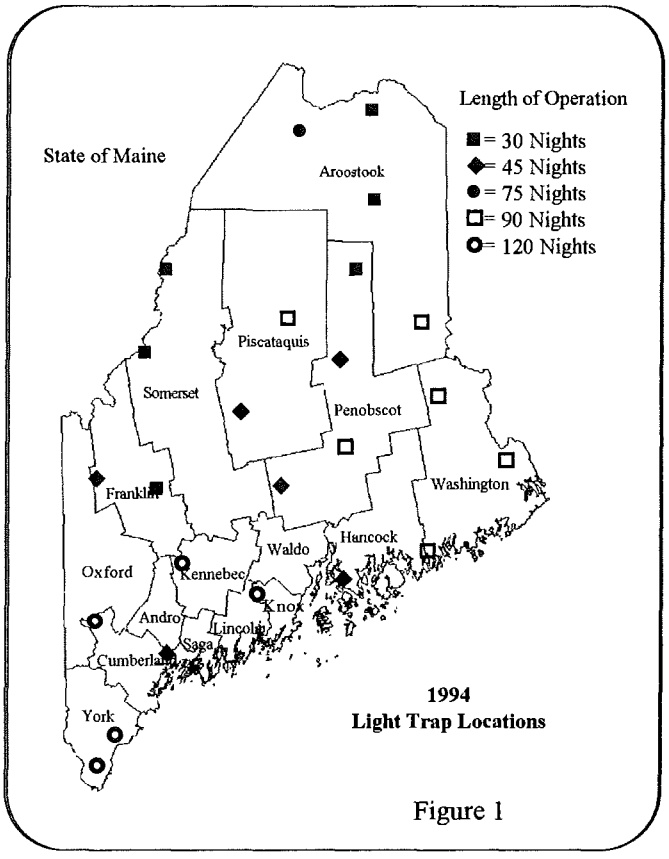


Figure 1

The trap sites and periods of trap operation (Figure 1) were selected to provide optimum measurement of the distribution and abundance of insects affecting the forest resources of the state. Trapping periods target potential forest pests for each specific site and forest type. Traps used to monitor spruce-fir insects were operated throughout the month of July; whereas traps monitoring hardwood insects as well were operated from mid June through July. Special trapping periods were established at some locations for the spring hemlock looper, *Lambdina athasaria* and the fall hemlock looper, *Lambdina fiscellaria fiscellaria*.

Table 2. Comparison summary of light trap survey collections of forest pest species, 1994.

	Species								
Location	***Choristoneura conflictana***	***Choristoneura fumiferana***	***Dryocampa rubicunda***	***Heterocampa guttivata***	***Leucoma salicis***	***Lochmaeus manteo***	***Lymantria dispar***	***Malacosma disstria***	***Symmerista* spp.**
Allagash	0	0	0	1	0	0	0	64	0
Arundel	0	0	468	0	0	0	0	82	4
Ashland	0	0	0	1	5	1	0	117	0
Blue Hill	1	0	46	2	9	9	4	221	32
Brunswick	0	0	27	0	0	0	0	35	5
Calais	0	0	29	0	3	0	0	52	0
Chesuncook	0	0	8	10	0	10	0	2	2
Dennistown	0	0	5	0	1	0	0	89	0
Elliotsville	0	0	30	0	0	0	0	53	1
Exeter	6	16	9	0	0	0	0	8	3
Greenbush	0	0	14	4	1	7	0	87	0
Guerette	2	0	0	1	7	3	0	32	0
Haynesville	0	2	12	1	5	39	0	176	0
Kingfield	0	2	0	2	0	7	0	97	0
Millinocket	0	0	66	2	4	148	7	73	0
Mt. Vernon	0	1	11	1	0	12	27	187	23
No. Bridgton	0	0	6	2	0	3	2	223	12
Rangeley	0	0	0	0	0	0	0	57	0
Shin Pond	1	0	0	1	14	2	0	124	0
So. Berwick	0	0	189	0	0	0	4	371	1
St. Aurelie	0	0	0	0	0	1	0	28	3
Steuben	0	5	33	1	8	2	0	169	3
Topsfield	0	0	37	0	18	235	0	178	13
Washington	0	0	101	0	0	2	0	111	44
Tota Moths	**10**	**26**	**1,085**	**27**	**75**	**478**	**42**	**2,413**	**134**

Ecoregions (Biophysical Regions)

Since 1992 we have alerted our readers to the possibilities for utilizing the system of Biophysical Regions developed by Janet McMahon (1990). Three publications by the USFS in 1994 (Bailey, Fincher, and McNab - see Publications, pages 6-7) discuss more widespread application of such systems under the broader national/international system of Ecoregions. The federal system groups McMahon's fifteen regions, now essentially subsections, into six Sections within three Provinces (Figure 2). Detailed descriptions of various aspects of each Section are provided by McNab and more information on land classifications systems using an approach to the northeast scenario has been discussed by Fincher.

Ecoregions (USFS)*

212 Laurentian Mixed Forest Province

Section 212A
Aroostook Hills and Lowlands
2 Subsections (3,4)

Section 212B
Maine and New Brunswick Foothills
and Eastern Lowlands - 2 subsections (7,8)

Section 212C
Fundy Coastal and Interior
2 subsections (11,15)

Section 212D
Central Maine Coastal and Interior
3 subsections (10,13,14)

M212 Adirondack
New England Mixed Forest -
Coniferous Forest - Alpine Meadow Province
Section A - White Mountain
4 subsections (1,2,5,6)

221 Eastern Broadleaf Forest (Oceanic)
Section A - Lower New England
2 subsections (9,12)

*Numbers in ( ) refer to Biophysical Regions as given by Janet McMahon (1990).

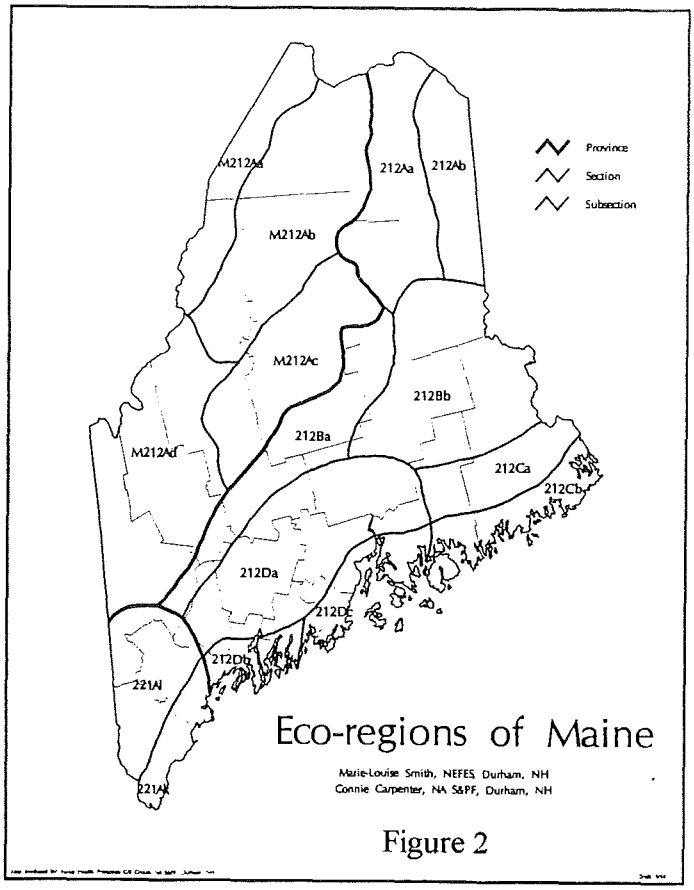


Figure 2

INSECT Problems Associated With Trees in 1994

(A) Insect Pests of Softwoods
(including plantations, nurseries and Christmas trees)

Adelgids (various) - These close relatives of the aphids (they are often referred to as aphids) are generally considered the more serious pests of trees and more difficult to control as well. Most species can, and usually do, alternate between a spruce host and some other softwood species. Of all of the adelgids, the **balsam woolly adelgid**, **hemlock woolly adelgid** and **pine leaf adelgid** probably cause, or have the potential to cause, the most serious softwood damage in Maine. There are at least seven other species that occur in Maine and which may cause local problems annually. More notable among these are: the **pine bark adelgid,** the **Cooley spruce gall adelgid, eastern spruce gall adelgid** and **red spruce (gall) adelgid**. The pine bark adelgid is most often a problem in Maine in stressed stands of white pine in and around urban developments and can cause some mortality. The gall makers are most often a problem on ornamentals or in plantations and tend to cause mostly aesthetic damage.

Aphids (*Cinara* spp. and others) - Aphid populations were high again in 1994 but frequently were not noticed until someone was stung by an attendant yellowjacket or even later in the season by someone who saw the blackening due to sooty mold fungus. Early control easily knocks populations down and thereby prevents such problems. While most high aphid populations can cause such problems as described, host injury often does not seem serious. The most serious injury noted in 1994 involved breakage of leaders on white pine just below the first whorl of branches where 1993 Cinara aphids caused notable dessication of tissues evidenced in roughening of the bark.

Arborvitae Leafminer (a complex of 4 species) - Populations in most forested areas declined in 1994 and where increases were observed they were extremely light. This complex does, however, continue to be a problem on ornamentals especially hedges in urban areas.

Balsam Fir Sawfly (*Neodiprion abietis*) - This species normally occurs statewide at low endemic levels but high, localized populations have caused noticeable defoliation in coastal Washington County over the past few years. Defoliation acreage has continued to fall from a high of 25,000 acres in 1992 to roughly 2,500 acres in 1993 and then to 100 or less in 1994. Further decline is expected.

Balsam Gall Midge (*Paradiplosis tumifex*) - Populations continued low and spotty in 1994.

Balsam Shootboring Sawfly (*Pleroneura brunneicornis*) - Populations of this species rose sharply in many balsam fir Christmas tree plantations across the state in 1994. The heaviest damage appeared to be in southern and central Maine, especially in plantations adjacent to forested areas of wild balsam fir. Although treatment for balsam twig aphid is thought to provide some control, plantations sprayed this past season for twig aphid still showed significant sawfly damage. Although so called "double balsam" seemed to be more heavily affected in many plantations, regular balsam and fraser fir did not escape damage from this pest. A summary of plantations showing the heaviest tip damage is shown in Table 3. Tip damage to woodland trees was also heavy across the state but the acreage was diffuse and no acreage figures were developed.

Table 3. Balsam shootboring sawfly damage - 1994

County	Acres	Comments
Hancock	100	Severe in Blue Hill
Kennebec	100	Heavy in China
Knox	0	Scattered pockets heavy
Lincoln	0	Scattered pockets heavy
Penobscot	100	Mod/severe in Dixmont
Piscataquis	100	Heavy in Sangerville
Total	**400**	

A project is now underway to try to define the life cycle of this species in Maine and to develop a possible control strategy.

Balsam Twig Aphid (*Mindarus abietinus*) - Populations of this pest of Christmas trees and wreath brush stock remained generally low in 1994 although some control was necessary in plantations.

Balsam Woolly Adelgid (*Adelges piceae*) - The infestation of balsam fir Christmas trees in Kennebec County and ornamentals in Lincoln County by the gout phase of this insect was brought to our attention in 1994 again showing us that this common forest pest can have economic implications. Infested trees exhibited the characteristic goutiness at the junction of the current and past year's growth. Several stages of these tiny insects were found at the base of next season's buds when trees were checked in August. While we do not expect this to be a widespread problem on Christmas trees or ornamentals, growers and landowners should be aware of it and watch for any unusual growth patterns.

Populations of the woolly trunk phase remain low and spotty across central Maine but are negligible elsewhere. In coastal Washington and Hancock Counties damage to woodland balsam fir is still very visible and some mortality evident.

Bark Beetles (various) - Bark beetles have played an important role in accelerating the decline of stressed softwoods in Maine but have seldom been the primary pests that western species have. Two of the more notably destructive species in Maine over the years have been the **eastern larch (bark) beetle** and the **spruce beetle**. These are discussed separately.

Surveys to detect new introductions are still underway by Me. Coop. Ext. Serv. personnel in cooperation with the USDA-APHIS-PPQ. No new introductions were reported in 1994.

Black Army Cutworm (*Actebia fennica*) - No reports of damage to plantations by this species were received in 1994. Problems in plantations can usually be minimized if not eliminated by proper planting procedure.

Common Pine Shoot Beetle (*Tomicus piniperda*) - This introduced European pest of pines has not yet been found in Maine.

Conifer Sawflies (various) - Sawfly populations changed little in 1994. While balsam fir sawfly numbers declined, those of the yellowheaded spruce sawfly remained at roughly 1993 levels and the introduced pine sawfly became increasingly visible. All are discussed separately.

Conifer Swift Moth (*Korscheltellus gracilus*) - Moths of this species appeared on schedule in August of 1994 but were difficult to find. Numbers appear to be down even in stands of red spruce in Steuben (Washington County) and Gouldsboro (Hancock County) where larvae were fairly common in 1993.

Cooley Spruce Gall Adelgid (*Adelges cooleyi*) - Galls of this species are fairly common on Colorado blue spruce around home grounds almost every year. Damage to Douglas fir in Christmas tree plantings was again a problem in 1994; luckily Douglas fir is not widely grown in Maine for Christmas trees.

Eastern Larch Beetle (*Dendroctonus simplex*) - This problem appeared to stabilize at nearly endemic levels in 1994. Stands exhibiting mortality are especially striking and although we received a few reports of such stands in 1994, most did not show active bark beetle populations.

Eastern Spruce Gall Adelgid (*Adelges abietis*) - This species is probably the most abundant and serious spruce gall adelgid and often causes heavy gall production especially on white and Norway spruce in plantations. In 1994 gall production on woodland white spruce in portions of southern Hancock and Washington counties was extremely heavy. Trees with over 75% of the tips bearing galls were not uncommon, and galls were evident elsewhere but not as heavy. These were some of the highest populations seen in woodland situations in a number of years.

European Pine Shoot Moth (*Rhyacionia buoliana*) - This species continues to be a very local problem on red pine in Maine primarily in Sagadahoc and Lincoln counties.

Fir Coneworm (*Dioryctria abietivorella*) - Tip mining activity by this species was not observed in 1994.

Gypsy Moth (*Lymantria dispar*) - See page 28.

Hemlock Loopers (*Lambdina athasaria* and *L. fiscellaria*) - Although both of these species occur in Maine, it is *L. fiscellaria* which causes most of our defoliation. Defoliation by the more common fall looper (*L. fiscellaria*) continued to drop sharply in 1994 and no defoliation was detected in aerial surveys (as compared to 42,100 acres in 1993). This species occurs statewide. The less common (for Maine) spring looper (*L. athasaria*) that occurs primarily in southwestern Maine continued to remain at very low numbers in 1994 and no defoliation was detected. Table 4 shows light trap catch results for *L. athasaria*. A complete discussion of *L. fiscellaria* situation can be found in the special reports section (page 58).

Table 4. Total number of spring hemlock looper *(Lambdina athasaria)* moths collected at light, 1992-1994

Location	Year 1992	1993	1994
Arundel			10
Mount Vernon	2	7	0
North Bridgton	81	34	49
South Berwick	1	0	6
Washington	0	0	0
Total No. of Moths	**84**	**41**	**65**
Total No. of Traps	**4**	**4**	**5**

Hemlock Woolly Adelgid (*Adelges tsugae*) - This species has still not been found in Maine even though it occurs as near as northeastern Massachusetts. The Maine Forest Service and the Maine Department of Agriculture continue to closely monitor the status of this pest and maintain a joint quarantine regulating the importation of hemlock products from infested areas (**Quarantines** page 57). To help prevent the introduction of the hemlock woolly adelgid, hemlock nursery stock should not be brought to Maine from infested areas. Ornamental plantings in Maine which include hemlock should be checked to see if the adelgid is present. Any woolly insects on twigs or foliage should be suspect. Suspected infestations should be reported immediately to either the State Horticulturist (Me. Dept. of Agr., State House Station #28, Phone (207) 287-3891) or MFS, I&DM (Phone (207) 287-2431). Cooperation is needed to protect our hemlock resource.

Introduced Pine Sawfly (***Diprion similis***) - The marbled, green and yellow larvae of this species were more common on white pine in 1994 than they have been for several years. Overall defoliation was light except in Gray, New Gloucester and Poland where roughly 600 acres were more visibly damaged (Androscoggin County -500 A, Cumberland County -100 A).

Jack Pine Sawfly (***Neodiprion pratti banksianae***) - Populations of this species were a chronic problem in 1994 as they have for the past few years. Defoliation of mature jack pine in infested coastal areas of Hancock and Washington counties from Steuben to Mt. Desert remained localized in 1994 and again ranged from light to moderate. Most of the infested trees were on rocky, poor growing sites and therefore stunted (roughly 25± feet tall). These trees frequently had other problems as well such as the **northern pitch twig moth** and one of the **gall rusts**.

Larch Casebearer (***Coleophora laricella***) - Feeding activity by this species declined in 1994 and although some very local "scorching" was evident it was lighter and less widespread than in 1993.

Larch Sawfly (***Pristiphora erichsonii***) - No serious infestations were observed in 1994 but scattered larval colonies seemed to be noted more often than in 1993.

Mites - (See pine fascicle and spruce spider mites)

Nesting (or Webspinning) Pine Sawflies (Pamphiliidae) - No infestations were observed in 1994.

Northern Pitch Twig Moth (***Petrova = Retinia albicapitana***) - "Gobs" of pitch containing larvae or pupae of this species were still very common and unsightly on twigs and branches of jack pine especially in Hancock and Washington counties. Most of these pitch masses were at the base of small branches or around buds. Damage by this insect is usually limited to minor twig and branch mortality and the unsightly pitch masses. This species has a two year life cycle.

Pales Weevil (***Hylobius pales***) - No reports of damage from pales weevil were received in 1994.

Pine Bark Adelgid (***Pineus strobi***) - Several areas of light to moderate infestation of eastern white pine were seen in 1994 in urban developments. The white woolly adelgids were very visible on the smooth bark of fairly young (<10" DBH) trees. Associated tree stress was probably site related and not caused by the pine bark adelgid.

Pine Fascicle Mite (***Trisetacus alborum***) - Damage to white pine from this species remained low in 1994 but population increases were observed in some stands by fall. What may be the same or related (in habits) species has been observed on Scotch pine in Rangeley where damage appeared heavy.

Pine Gall Weevil (***Podapion gallicola***) - This insect continues to show up wherever red pine is found but is seldom more than a nuisance. Occasionally, however, branches of some trees may be galled sufficiently to cause heavy flagging (dead branch tips). The flagging, when light, can be confused with that caused by the **red pine cone beetle** (*Conophthorus resinosae*), unless you look for galls.

Pine Leaf Adelgid (***Pineus pinifoliae***) - No reports of damage to white pine were received in 1994. Galls normally appear on red and black spruce in odd years and should show up in 1995 where populations exist. This species has been on a low damage cycle for several years now.

Pine Needleminer (***Exoteleia pinifoliella***) - This species is primarily a pest of jack and pitch pine in Maine. Although populations remained generally low in 1994, mined needles could be found locally on pitch pine throughout Cumberland and York counties.

Pine Spittlebug (*Aphrophora parallela*) - Spittle masses containing the nymphs of this species were slightly more abundant overall on a variety of conifers in 1994. This seems to be a perennial problem with annual, and often local, population fluctuations. Control is usually not necessary.

Pine Tip Boring Bark Beetles (*Pityophthorus* spp.) - The incidence of tip borers on pines, especially white pine, appeared to be low again in 1994.

Pitch Mass Borer (*Scynanthedon pini*) - Concern over unusual pitch production exuding from the boles of spruce, especially Colorado blue spruce, on home grounds around the Portland area in September and October prompted several requests for assistance in 1994. It appears that most situations involved activities of the pitch mass borer. Although the pitch "globs" produced were numerous and striking in many cases, damage to most trees did not appear serious. As larvae were still active and moth emergence had not occurred from most of the globs it appeared that the heaviest infestation was only one or two years old. Most globs had hardened over and moth emergence is expected in 1995. Although similar but less intensive situations were found on white pine and spruce in other parts of southwestern Maine north through at least Kennebec County, this problem should not pose a long term threat to the resource. Most woodland infestations appeared to be on eastern white pine.

Red Spruce (Gall) Adelgid (*Pineus floccus*) - Populations of this species declined in 1994 in infested areas of Phippsburg (Sagadahoc County). Galls were present but fewer in number than in 1992 and damage to white pine was not as visible.

Saratoga Spittlebug (*Aphrophora saratogensis*) - This insect continues to be a chronic problem on some sites, especially in frost pockets, and varies in intensity from year to year. The Saratoga spittlebug in Maine is primarily a problem on plantation red pine in Androscoggin, Cumberland, Hancock, Sagadahoc and Washington counties. Most areas exhibiting damage in past years have either died or grown out of the susceptible stage. Although no new areas of infestation were found in 1994, one 50 acre plantation in Washington County was surveyed to determine damage levels (moderate).

Spruce Beetle (*Dendroctonus rufipennis*) - Aerial and ground surveys did not show any significant incidence of new spruce beetle attack in 1994. Coastal islands in Hancock County where new attacks were observed in 1993 did not show any new activity in 1994. The problem seems to have stabilized.

Spruce Budmoth (primarily *Zeiraphera canadensis*) - This problem tends to be chronic in white spruce plantations across northern and eastern Maine. Those wishing to plant and manage white spruce will have to continuously address this problem until the trees reach at least 15-20 feet and the crowns close.

Spruce Budworm (*Choristoneura fumiferana*) - Spruce budworm populations remained very low again in 1994 as evidenced from a variety of surveys conducted. No larvae were collected in general surveys and the number of moths collected in both light traps and pheromone traps remained very low.

The last area of defoliation found in Maine involved a Christmas tree plantation in Franklin (Hancock County) where defoliation has declined from light in 1992 to trace in 1994. There has been no significant defoliation anywhere in Maine since 1989.

Spruce budworm moth activity was monitored using the statewide network of 24 light traps (Figure 1). Moth catches remained very low as they have for several years (Tables 5 and 6). The total number of moths caught was half the number of moths caught in 1993. Moths were recorded from only 5 of 24 traps in 1994 compared to 11 traps that caught moths in 1993. Table 6 shows a comparison of spruce budworm moth catches since 1961.

Table 5. Total number of spruce budworm (*Choristoneura fumiferana)* moths collected at light

Location	Year 1989	1990	1991	1992	1993	1994
Allagash		3	0	1	7	0
Arundel						0
Ashland	0	0	0	0	0	0
Blue Hill	6	1	0	0	4	0
Brunswick	16	0	3	0	0	0
Calais		11	3	0	0	0
Chesuncook		0	1	0	1	0
Clayton Lake	18	4				
Dennistown	3	0	0	0	0	0
Elliotsville	0	0	0	0	2	0
Exeter	9	10	4	5	21	16
Greenbush	10	0	1	0	1	0
Guerette	1	0	0	0	0	0
Haynesville	7	1	0	0	0	2
Kingfield	0	0	0	0	2	2
Matagamon	0	0	0	1	2	
Millinocket	0	0	1	0	0	0
Mt. Vernon	0	1	0	0	2	1
No. Bridgton	0	0	0	1	0	0
Rangeley	7	1	0	2	8	0
Shin Pond						0
South Berwick	0	0	0	0	2	0
St. Aurelie	1	0	0	0	0	0
Steuben	548	73	8	0	0	5
Topsfield	15	0	0	0	0	0
Washington	26	2	0	6	0	0
Total Number of Moths	**731**	**107**	**21**	**16**	**52**	**26**
Total Number of Traps	**22**	**24**	**23**	**23**	**23**	**24**

Table 6. Spruce budworm seasonal light trap summary - 1961-1994

Year	Total # Moths	# Traps	Average # Moths/Trap
1961	763	17	44.9
1962	258	23	11.2
1963	133	24	5.5
1964	159	25	6
1965	83	24	3.5
1966	51	24	2
1967	120	26	4.6
1968	948	24	39.5
1969	5,415	27	201
1970	1,076	24	45
1971	20,653	25	826
1972	15,959	24	665
1973	39,069	24	1,628
1974	158,784	24	6,616
1975	149,874	23	6,516
1976	22,308	16	1,394
1977	24,212	15	1,614
1978	220,264	17	12,957
1979	95,811	16	5,988
1980	100,537	19	5,291
1981	39,724	20	1,986
1982	49,200	20	2,460
1983	144,673	18	8,037
1984	17,983	20	895
1985	13,233	20	661
1986	1,365	20	68
1987	464	20	23.2
1988	29	17	1.7
1989	710	1	33.8
1990	103	23	4.5
1991	21	23	0.9
1992	16	23	0.7
1993	52	23	2.3
1994	26	24	1.1

Spruce budworm moth catches have also been monitored using pheromone traps. Eleven of the pheromone trap locations have been associated with light traps. Catches in the pheromone traps were also very low in 1994 and lower than in 1993 (Table 7) . One location in Franklin (Hancock County) had an average of 37 moths per trap but all other locations had 4 moths per trap or less. Of the 24 locations trapped, moths were caught at 12 and only 6 locations had more than one moth per trap.

Table 7. Spruce budworm pheromone trap catch in Maine - 1992 to 1994**

Location	*Year*			*Location*	*Year*		
	1992	*1993*	*1994*		*1992*	*1993*	*1994*
Allagash		5	<1	Jonesboro	11	1	<1
Calais *	<1	<1	<1	NE Carry		<1	
Chesuncook*	6	2	<1	Princeton		2	
Clayton Lake		2	<1	Steuben *	32	4	2
Coburn Gore		1	<1	St. Pamphile		7	1
Connor		<1	<1	Topsfield *	1	<1	<1
Daaquam		<1	<1	Waltham	25	2	4
Dennistown *	5	1	<1	Smith Pond *	6	3	<1
Dickey Brook *	<1	3	<1	St Frances Lake		1	<1
Duck Lake	<1	<1	<1	Oxbow	10	<1	<1
Franklin			37	Ragmuff		1	
Garfield	6	2	<1	Rangeley		1	2
Greenbush *	3	<1	<1	Ste. Aurelie *	2	<1	<1
Haynesville *	4	1	<1	Matagamon ***	18	4	1

* Light trap locations

** These figures reflect a per trap average from a cluster of three traps

*** A light trap at this location only in 1992 and 1993

Spruce Spider Mite (***Oligonychus ununguis***) - Mites are one of those perennial problems with great variability in local and seasonal populations. They do, however, appear to be more of a serious problem on ornamentals and Christmas trees. Weather conditions were again very favorable for the development of spruce spider mites in many parts of Maine in 1994. Populations reached damaging levels on balsam and Fraser fir, especially in portions of central Maine and mottling of the foliage was locally very heavy.

White Pine Weevil (***Pissodes strobi***) - The white pine weevil is one of those chronic problems in most areas of Maine and seriously limits growth of good straight white pine unless controlled. The number of requests for advice and assistance on this problem in 1994 was fairly normal and most involved only white pine or Colorado blue spruce. There were few reports of attacks on other species such as black or Norway spruce or other pines. The white pine weevil continues to cause serious stem deformity on much of the regenerating white pine within the state. Mortality of the main leader is often as high as 90% or more in plantations and other open grown trees which are four feet or more in height.

Yellowheaded Spruce Sawfly (***Pikonema alaskensis***) - Larvae of this species continued to defoliate roadside, plantation, ornamental and other open-grown spruce across much of Maine in 1994. Damage was most severe on white spruce in areas previously affected and was widespread along roadsides in Androscoggin, Aroostook, Cumberland, Hancock, Kennebec, Knox, Lincoln, Penobscot, Sagadahoc and Waldo counties. This was the fourth year in the current outbreak. The numbers of **greenheaded spruce sawfly** (*Pikonema dimmockii*) which are usually associated with the yellowheaded appeared to decline in 1994.

(B) Insect Pests of Hardwoods

Alder Flea Beetle (***Altica ambiens alni***) - Defoliation of alder by the blackish larvae of this species was again heavy but spotty across the state. Browned alder thickets were a common sight although in many cases a sprinkling of green alders gave these thickets a mottled look! In some areas we noticed increased numbers of the lighter and chunkier larvae of the **alder leaf beetle** (*Chrysomela mainensis*) which have been scarce in recent years. Where there was green foliage enough left to feed on, larvae of the **alder woolly sawfly** (*Eriocampa ovata*) seemed to be more common than usual as well.

Aphids, Leafhoppers, Treehoppers and Scales (various) - The activities of these "suckers of sap," occasionally a problem as their overflow honeydew drizzled down on cars, did not seem as abundant as they have been some seasons. Our only measure of abundance for these insects is based on the frequency of reports and these were down in number.

Ash Flowergall Mite (***Aceria fraxiniflora***) - This mite causes male flower bud proliferation (clumping), on white ash. It continues to be prevalent and noticeable at least as far north as T6 R8 WELS (Penobscot County) with heaviest infestations in southwestern Maine.

Aspen Leafroller (***Pseudexentera oregonana***) - Populations of this leafroller and its damage covered roughly the same areas in 1994 as in 1993 (Figure 3) although their numbers and intensity of feeding dropped noticeably from heavy in 1993 to light or moderate in 1994.

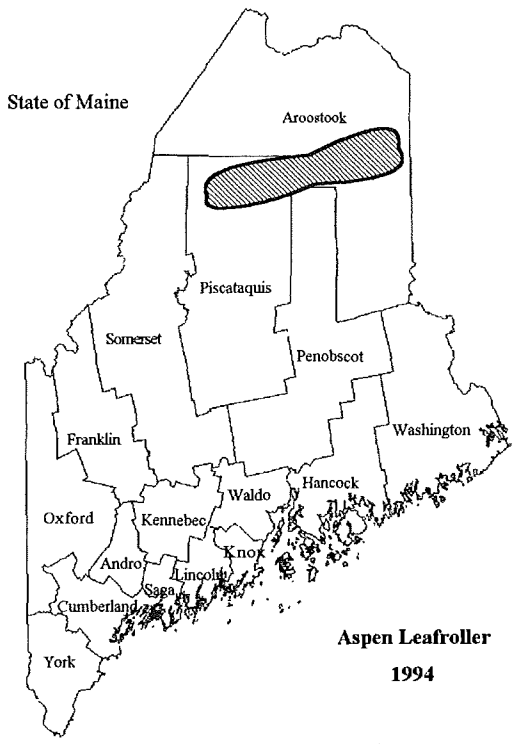


Figure 3

Balsam Poplar Leafminer (***Lyonetia* sp.**) - Populations of this species again remained very low in 1994 in infested areas of Aroostook County. The reddening effect of mined foliage was not as evident from either the air or the ground as it has been in previous seasons.

Beech Scale (***Cryptococcus fagisuga***) - Beech in Maine continues to suffer from the onslaught of a variety of problems but those in the beech bark disease complex appear to be the principal stressors. **Beech bark disease**, an introduced problem, involves an insect/fungus complex (*C. fagisuga*/*Nectria* spp.) which stresses, deforms and kills beech. It occurs statewide but varies locally and annually at least in intensity of expression. Although *C. fagisuga* appears to be the most common scale involved, the **birch margarodid** (*Xylococculus betulae*) is also an important component of the complex. In recent years another scale, the **oystershell scale** (*Lepidosaphes ulmi*), has added another factor to the beech complex. Fortunately some relief comes from the feeding activities of the **twice-stabbed lady beetle** (*Chilocorus stigma*) whose hunger for scales helps to significantly reduce their numbers.

The impact of all of this activity is made more pronounced when complicated by **drought** and defoliation by such things as the **variable oakleaf caterpillar**. The 1994 season saw locally dry conditions and locally severe defoliation by the variable oakleaf caterpillar and other hardwood defoliators (pages 30 and 35) that hit some already stressed stands. While some beech may weather the storm, other trees may succumb. Studies of beech management options aimed at reducing the impact of this problem are still underway (see page 5).

Birch Casebearer (***Coleophora serratella***) - Populations of this species and feeding damage declined noticeably in 1994 from 1993 levels. Defoliation in 1994 was spotty and mostly on roadside trees, trees growing in open areas or on coastal peninsulas. Although some activity could be found on birch statewide, the heaviest feeding occurred in Aroostook, Hancock and Washington counties (Table 8).

This insect caused severe stress in birch stands defoliated from 1983-1985. A number of these stands have been monitored annually to measure any mortality and/or decline. Trees have generally recovered and currently stand change is static.

Table 8. Birch casebearer (*Coleophora serratella*) defoliation - 1994

County	Acres	Comments
Aroostook	4000	Moderate/severe defoliation roadside - locally
Hancock	3000	Moderate defoliation
Washington	3000	Moderate defoliation
Total	**10000**	

Birch Catkin Bug (***Kleidocerys resedae***) - Large numbers of catkin bugs descending from an abundant crop of birch catkins in August and September of 1994 prompted many alarmed homeowner calls for assistance. This was the heaviest crop of these seed feeders in years. To make matters worse these small (5mm) creatures climbed the sides of homes in search of hibernation sites and crawled over children who were jumping into raked birch leaves. Fortunately the species is more of a nuisance than pest unless someone wishes to save seed. In some areas the small **catkin weevil** (*Apion simile*) was also more abundant than usual although nowhere nearly as prolific as the catkin bug. The larger **mottled stink bug** (*Elasmucha lateralis*) was evident in numbers on some trees and conspicuous as they stood guard over their egg clutches or small herds of nymphs.

Birch Leafminer (***Messa nana***) - This birch leafminer continued to be more prevalent than the other three common species in Maine during the 1994 season. Although light *M. nana* defoliation could be seen on birch statewide, the most notable defoliation occurred within the southern half of the state, especially in coastal sections (Figure 4). Roughly 25,000 acres of moderate to heavy defoliation was observed, primarily in Knox, Lincoln and Waldo counties.

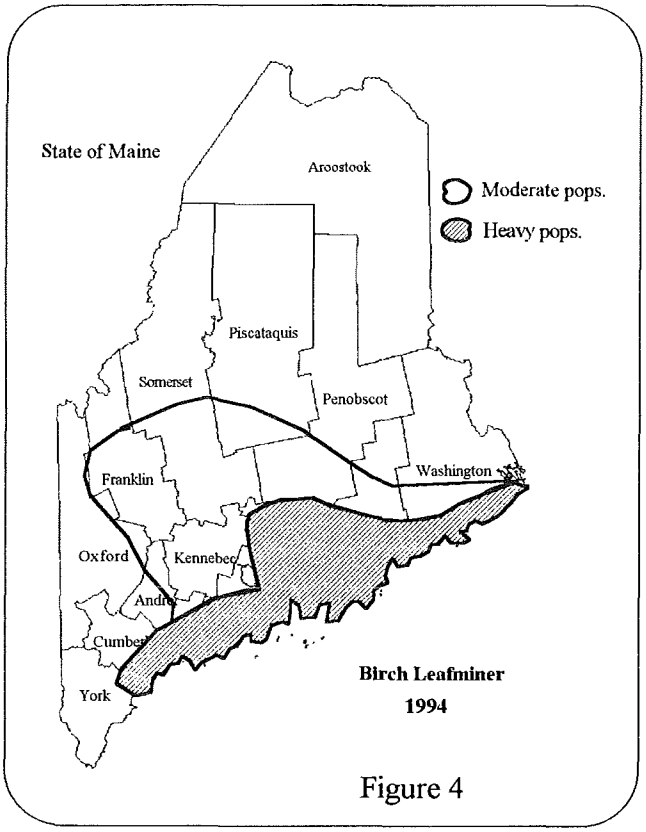


Figure 4

Birch Problems (various) - Birch seems to be exceeded only by beech as the favorite food plant of a variety of insects. In addition to those birch problems identified separately, **fall webworm** and **Japanese beetle** (southern only) caused some locally noticeable defoliation. **Lacebugs** (*Corythucha* spp.) caused noticeable mottling and yellowing of the foliage in some instances. Other defoliators which could be found on birch occasionally are listed under **hardwood defoliators** (page 30).

Birch budgall mites (*Aceria rudis*) cause a bud proliferation on birch somewhat similar to the ash flowergall mite on ash. The resulting clumped buds resemble galls at a distance. Infestations tend to be limited to individual trees or clumps of trees and although damage to the hosts is usually minimal it can be aesthetically unattractive. Several reports of activity by this species came to our attention in 1994.

Birch Sawflies (various) - Sawfly larval feeding was heavier in northcentral Maine (Figure 5) in 1994 than it had been for several years. Although the **birch sawfly** (*Arge pectoralis*) was the predominant species it was not difficult to find infestations of the **dusky birch sawfly** (*Croesus latitarsus*) and **striped alder sawfly** (*Hemichroa crocea*) as well. Often two or three of the species occurred together. Defoliation ranged from moderate to heavy in pockets. Light to moderate defoliation of individual trees or clumps of trees occurred elsewhere across the state as well, especially in Aroostook, Hancock, Somerset and Washington counties.

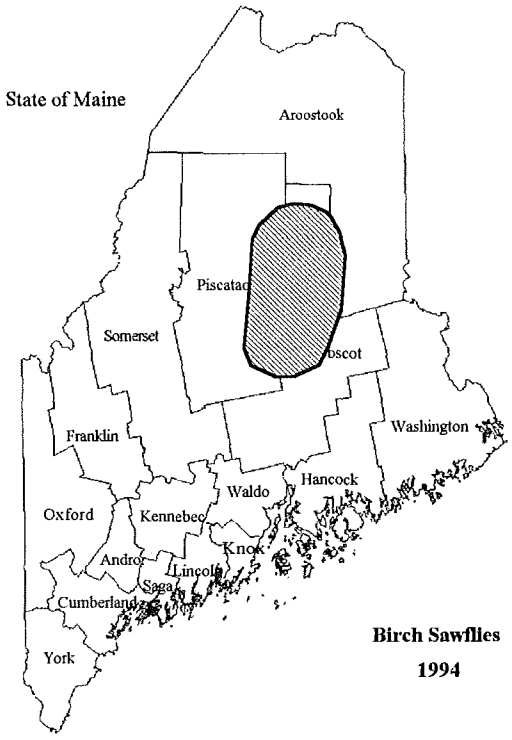
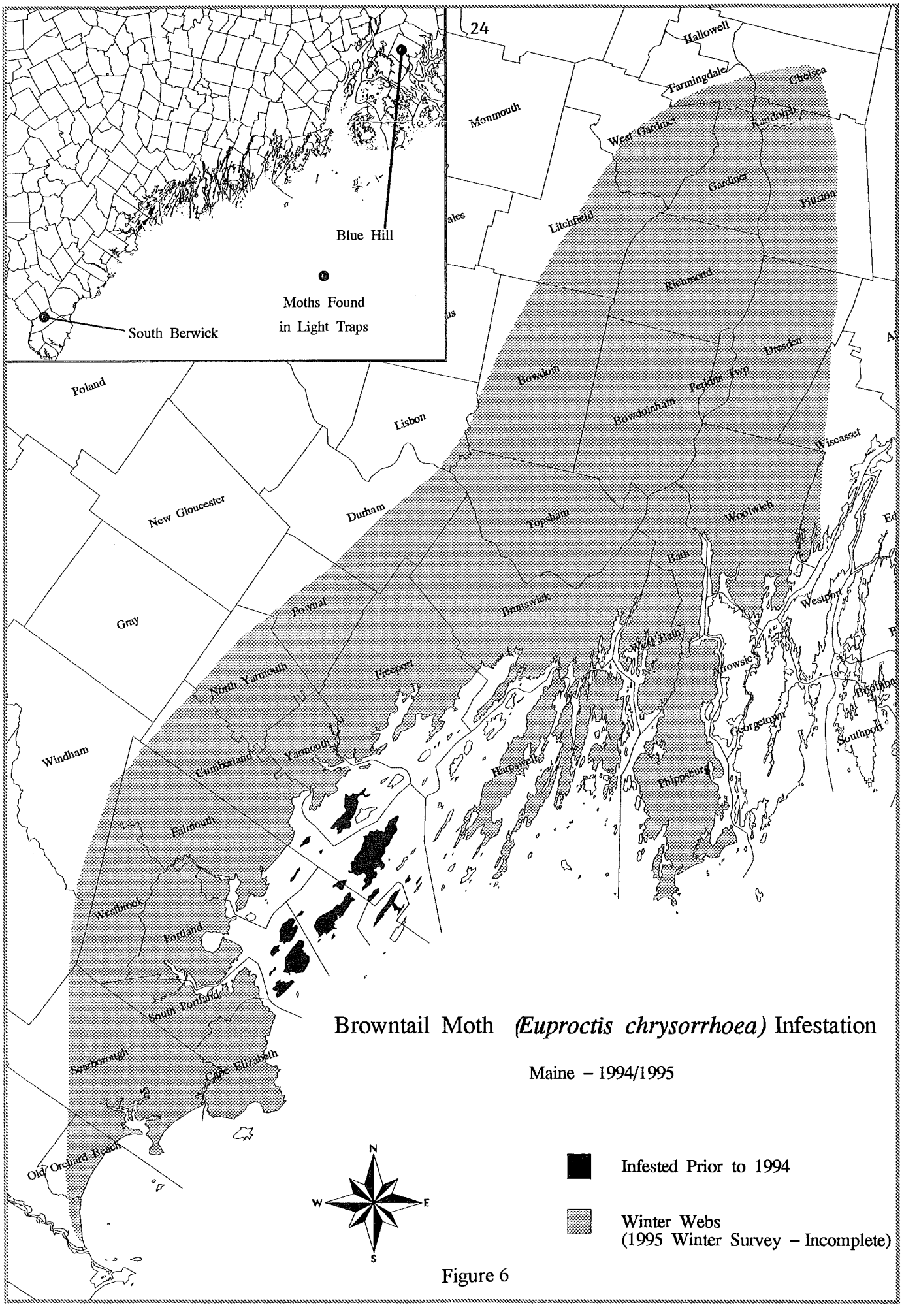


Figure 5

Birch Skeletonizer (*Bucculatrix canadensisella*) - Off-color foliage resulting from larval feeding of this species was evident by September in forested areas wherever birch occurs across the state. Larval numbers dropped, however, from the high 1993 levels and defoliation fell from heavy to light or moderate in most stands.

Bronze Birch Borer (*Agrilus anxius*) - Dead-topped birch showing characteristic results of *A. anxius* infestations continue to show up throughout the birch resource especially where stress factors have pushed birch to the "brink." This and other problems have been responsible for what has often been termed **birch decline**. Although dead topped birch which are the result of bronze birch borer attack are often striking, our continuing birch decline surveys do not show any distinct resurgence of the problem as experienced in the 1940's.

Browntail Moth (*Euproctis chrysorrhoea*) - The browntail moth population is on the upswing. Established populations have been confined to a few islands in Casco Bay (Cumberland County) for many years but since 1989 the insect has been expanding its range and increasing in density. The oaks, apple, *Amelanchier,* and Rugosa rose on a number of islands were completely defoliated in the spring of 1994. The residents and visitors in these areas felt the impact of the browntail moth as well. The hairs of browntail moth cause a painful **rash** similar to poison ivy and it is easy to come in contact with the hairs in an infested area (see Medical Entomology - rashes page 39). A summer aerial survey followed by a



Browntail Moth *(Euproctis chrysorrhoea)* Infestation

Maine – 1994/1995

Infested Prior to 1994

Winter Webs
(1995 Winter Survey – Incomplete)

Figure 6

ground (boat) survey identified 23 islands in Casco Bay that contained significant numbers of browntail moth (Figure 6). The 1994 mainland survey for overwintering webs picked up low numbers of webs from Harpswell to Cape Elizabeth. These webs were confined to low shrubs and apple trees adjacent to the coast and any webs that were found by the crews were clipped and destroyed. There were no reports of damage resulting from browntail moth activities on the mainland in 1994.

The Maine Forest Service and the city of Portland conducted an aerial control project using the insect growth regulator Dimilin (diflubenzuron). The spray helicopter was equipped with special nozzles designed to limit off-site drift of the chemical. The control level achieved in 1994 was not as high as a anticipated. A final test of this product is scheduled for 1995 using modifications in the application techniques. Other populated islands are contemplating instituting control projects using ground applications by licensed pesticide applicators.

The situation in 1995 may present an entirely different scenario. Preliminary results from the winter survey (currently underway) have shown a dramatic increase in the number of overwintering webs on the mainland. While the survey has only begun, coastal portions of Cumberland, Falmouth, and Yarmouth have been surveyed and found to be locally heavily infested. More areas will most likely be added to this list before the survey is concluded. Light traps in Blue Hill and South Berwick each caught a browntail moth indicating the potential for a much wider area of infestation. Transport to uninfested areas via recreational and commercial boating activities in the region has become a concern as reports have been received of moths being attracted to lights on vessels.

The encroachment of the browntail population on heavily populated areas is a concern because the increased contact between residents and the insects will result in greater numbers of "browntail rash" cases. Even low levels of browntail populations in residential areas can cause problems. Some measure of control can be achieved by clipping and destroying the webs where the tiny larvae spend the winter. Residents living along the coast should learn to identify the webs and clip and destroy them before May first.

Browntail moth control sheets may be obtained by contacting this office. A detailed report on the browntail moth situation and a report of the 1992-93 B.t. control project will be available this spring.

Bruce Spanworm (***Operophtera bruceata***) - Defoliation of understory beech and, to a lesser extent, sugar maple and trembling aspen, could be seen to a limited degree in many northern hardwood stands in northern and western Maine as the leaves unfurled in the spring. Most of the damage was light and barely detectable. However, roughly 10,000 acres of moderate defoliation occurred in Penobscot (2,500 acres), Piscataquis (2,500 acres) and Somerset (5,000 acres) counties (Figure 7).

Moth activity in the fall of 1994 appeared to decline from 1993 levels.

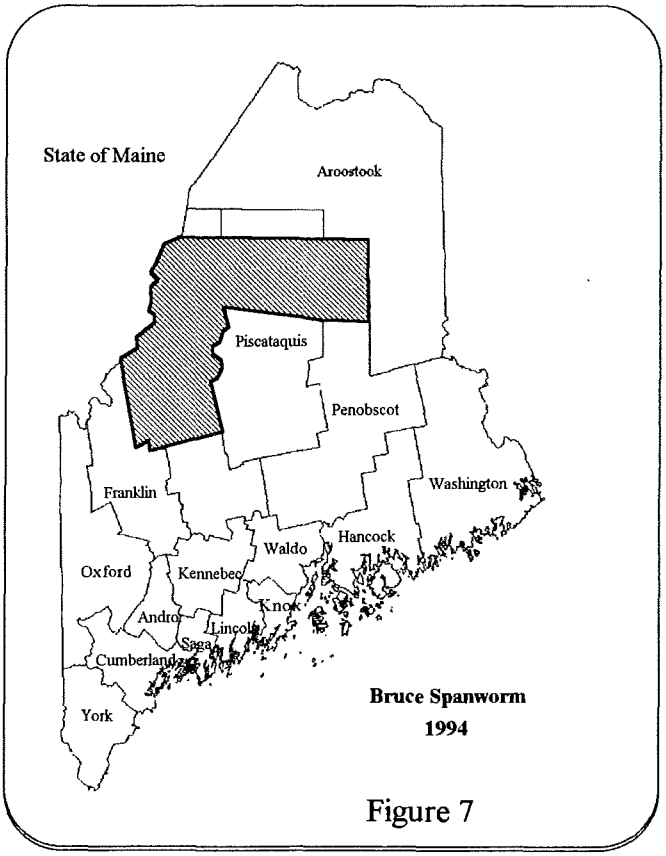


Figure 7

Butternut Woollyworm (*Eriocampa juglandis*) - Several reports and collections of these very fascinating sawfly larvae were received during July. Although they can be very abundant on individual trees, causing noticeable defoliation, they are more often a curiosity. The larvae are covered with a white waxy "wool" which often occurs in long strands or curls. Populations appeared to be up overall in 1994.

Calosoma Beetles (*Calosoma sycophanta*) - These large (>1" long) bright green predacious beetles were brought into this country in the early 1900's to combat the **gypsy** and **browntail** moths. Although they are apparently established locally in southwestern Maine, their numbers are very low compared to points further south. Recent interest in rearing and re-releasing the species for biological control purposes has prompted interest in its level of establishment. Tree traps were set out at four locations in southwestern Maine in 1994 to try to determine its presence or absence there. Although no beetles were caught in the traps, the species was collected in Kennebunk. We are exploring possibilities for using *C. sycophanta* in biological control projects here in the future.

Cottony Maple Scale (*Pulvinaria innumerablis*) - This scale which resembles tiny cotton balls or popcorn kernels on twigs of red and silver maple was reported from the Bangor and Portland areas in 1994. Although it has seldom been a problem in Maine, one outbreak in Scarborough in 1989 was fairly extensive.

Eastern Tent Caterpillar (*Malacosoma americanum*) - Tents of this species were abundant and appeared to be nearly everywhere in southwestern Maine (especially Androscoggin, Cumberland, Kennebec, Oxford and York counties) in 1994. Defoliation of cherry and apple especially in brushy or roadside situations was heavy. Tents were abundant and visible elsewhere across the state but populations were not as heavy.

Elm Flea Beetle (*Altica carinata*) - Lower branches and small trees of many of those remaining American elms "browned up" in July across central and southern Maine from feeding by the blue-black larvae of this species. This was unexpected but not surprising since monitoring of elm is not as extensive as it used to be. Most larvae had dropped to the soil to pupate by early August. As expected the metallic blue, purple or green adults appeared in September about the same time as the slightly larger **alder flea beetle** adults. Populations of the **elm leaf beetle** (*Pyrrhalta luteola*) appeared to be low in 1994 as they have been for several years.

Fall Cankerworm (*Alsophila pometaria*) - The area exhibiting the heaviest infestation by this species appeared to shrink slightly in 1994 from 1993 levels while the intensity within that area rose noticeably. Defoliation of boxelder in eastern Aroostook County north of Mars Hill was extremely heavy in 1994 (Figure 8). Moths and eggs were extremely abundant everywhere throughout the area in the fall and several homeowners expressed concern over how to deal with eggs coating the sides of their homes. The potential is there for heavy populations again in 1995. Defoliation of other hardwoods by this species was negligible outside of Aroostook County.

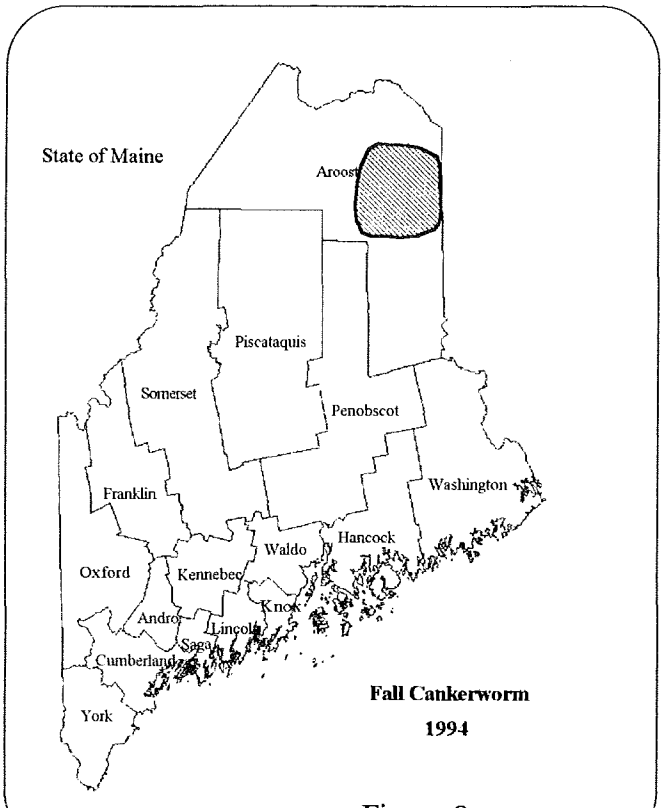


Figure 8

Fall Webworm (***Hyphantria cunea***) - The mid season tents of this species were not difficult to find throughout most of Maine in 1994 although populations were variable. Numbers of moths and tents were generally lower than in 1993 in southern Maine while there was a slight rise in frequency in Aroostook and northern Penobscot counties.

Forest Tent Caterpillar (***Malacosoma disstria***) - Populations of the forest tent caterpillar appeared to be higher than expected this past season, at least in developed areas of southern Kennebec (Augusta and surrounding towns), Penobscot (Bangor) and York (The Berwicks) counties. Wind and heavy rain in mid June knocked large numbers of caterpillars from the trees which then caused some concern as they wandered over walkways and into homes. Much of this population seemed to be associated with sugar maple and oak rather than poplar as has been our experience in Maine in the past. Defoliation was light and very local and did not show up in aerial surveys. Forest tent caterpillars appear to like company and were often found with, and in the nests of, the very abundant **eastern tent caterpillar** and also with **gypsy moth** caterpillars.

Moths of this species have increased in frequency in light trap collections since 1990 (Table 9) and in 1994 rose in numbers caught at 16 out of 24 trap stations. Field surveys so far have not detected appreciable woodland populations.

Table 9. Total number of forest tent caterpillar (*Malacosoma disstria)* moths collected at light

	Year					
Location	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Allagash	155	65	39	54	78	64
Arundel						82
Ashland	163	110	122	124	169	117
Blue Hill	4	20	27	43	47	221
Brunswick	155	54	69	17	9	35
Calais		7	11	23	279	52
Chesuncook		0	0	1	0	2
Clayton Lake	11	7				
Dennistown	34	45	37	58	44	89
Elliotsville	39	36	49	78	55	53
Exeter	5	1	1	2	1	8
Greenbush	67	44	56	24	30	87
Guerette	12	20	28	8	12	32
Haynesville	68	45	56	36	45	176
Kingfield	16	1	4	18	20	97
Matagamon	175	46	63	126	56	
Millinocket	20	14	20	43	7	73
Mt. Vernon	54	39	32	107	39	187
No. Bridgton	289	90	115	153	297	223
Rangeley	8	1	81	47	48	57
Shin Pond						124
South Berwick	198	245	352	324	377	371
St. Aurelie	1	6	18	13	9	28
Steuben	11	8	9	0	2	169
Topsfield	84	33	28	45	102	178
Washington	27	31	23	36	53	111
Total Number of Moths	**1,596**	**968**	**1,240**	**1,380**	**1,779**	**2,636**
Total Number of Traps	**22**	**24**	**23**	**23**	**23**	**24**

Greenstriped Mapleworm (***Dryocampa rubicunda***) - Populations of this species remained low again in 1994 with no noticeable defoliation observed. There were, however, a couple of unconfirmed reports of noticeable larval feeding in Washington and central Penobscot counties. This species is primarily a feeder on red maple in Maine. Numbers of the medium-sized, attractive, pink and yellow moths (the **rosy maple moth**) rose in 1994 for the third consecutive year (Table 10). Numbers increased at 14 out of 24 trap stations.

Table 10. Total number of greenstriped mapleworm (*Dryocampa rubicunda*) moths collected at light

Location	Year 1989	1990	1991	1992	1993	1994
Allagash	0	0	0	0	2	0
Arundel						468
Ashland	0	0	0	0	1	0
Blue Hill	82	115	24	46	104	46
Brunswick	12	20	13	16	4	27
Calais		20	7	4	13	29
Chesuncook		10	4	1	3	8
Clayton Lake	1	0				
Dennistown	0	1	0	1	1	5
Elliotsville	8	58	7	11	14	30
Exeter	11	6	1	1	3	9
Greenbush	15	16	10	12	13	14
Guerette	0	0	0	0	0	0
Haynesville	2	5	8	2	8	12
Kingfield	1	0	0	0	0	0
Matagamon	0	0	0	0	0	
Millinocket	43	61	8	27	38	66
Mt. Vernon	3	2	24	18	5	11
No. Bridgton	3	2	4	6	2	6
Rangeley	0	0	0	0	1	0
Shin Pond						0
South Berwick	16	95	41	373	340	189
St. Aurelie	0	0	0	0	0	0
Steuben	28	14	42	84	22	33
Topsfield	25	17	20	12	31	37
Washington	70	7	89	48	90	101
Total Number of Moths	**320**	**449**	**302**	**662**	**695**	**1,091**
Total Number of Traps	**22**	**24**	**23**	**23**	**23**	**24**

Gypsy Moth (*Lymantria dispar*) - Populations of gypsy moth larvae and resultant defoliation continued their rapid decline in 1994 reaching the lowest level since 1988 (Table 11). Aerial surveys delineated 1,706 acres of defoliated forest type (296 acres of moderate defoliation, and 1,410 acres of light defoliation), all in York County. This is the third consecutive year of decline from the high 1991 levels. Although no significant defoliation was detected elsewhere, the frequency of reports of low numbers of gypsy moth caterpillars seemed to increase slightly across southern Maine especially toward the east.

Due to a decline in population, overwintering egg mass samples of the gypsy moth were collected only in the towns of Berwick, Wells, and Millinocket in 1994. Twenty egg masses (ten above and ten below snow-line) were collected from each of the towns during early April and reared indoors. The resulting egg hatch (Table 12) and parasitism by the parasitic wasp, *Anastatus disparis* (Table 13) was again highly variable. Evidence of the parasite *Ooencyrtus kuvanae* was also commonly observed at many sites, especially in York County. It was also noted that egg masses seen and collected in the 1994 sampling were larger on average than those collected in 1993.

Table 11. Total acres defoliated by gypsy moth in Maine during the current outbreak (1988-1994)

Year	Acres Defoliated
1988	100
1989	34,280
1990	270,432
1991	620,933
1992	278,485
1993	50,694
1994	1,706

Table 12. Gypsy moth overwintering survival results, spring, 1994

	Above Snow		Below Snow	
Location	% EM* Showing Hatch	Survival Index**	% EM* Showing Hatch	Survival Index**
Berwick	17	8.2	92	42.7
Wells	100	31.5	100	49.5
Millinocket	0	0	67	56.0

* EM = Egg Masses

** The survival index is an average of the individual median egg hatch levels (% hatched) for all masses collected at that site and height.

Table 13. Parasitism by *Anastatus disparis* of gypsy moth egg masses, spring, 1994

	Mean No. Egg Masses Parasitised		Percent Egg Masses Parasitized	
Location	Above Snow	Below Snow	Above Snow	Below Snow
Berwick	0	0	0	0
Wells	1.4	6.1	53.8	63.6
Millinocket	0	0	0	0

The first gypsy moth egg hatch was reported on April 28 in South Berwick and hatching there was complete by mid May. General egg hatch in areas outside of York County was not underway until the second week of May and continued until the first of June. Pupation in all areas began during the last week of June and moths were active throughout July and into August. Moth activity was monitored using light traps (Table 2) and pheromone traps. Moth activity confirmed larval activity and was generally down in 1994. The pheromone trapping program in 1995 will be adjusted somewhat to more closely reflect the quarantine (page 56) boundaries (Figure 9).

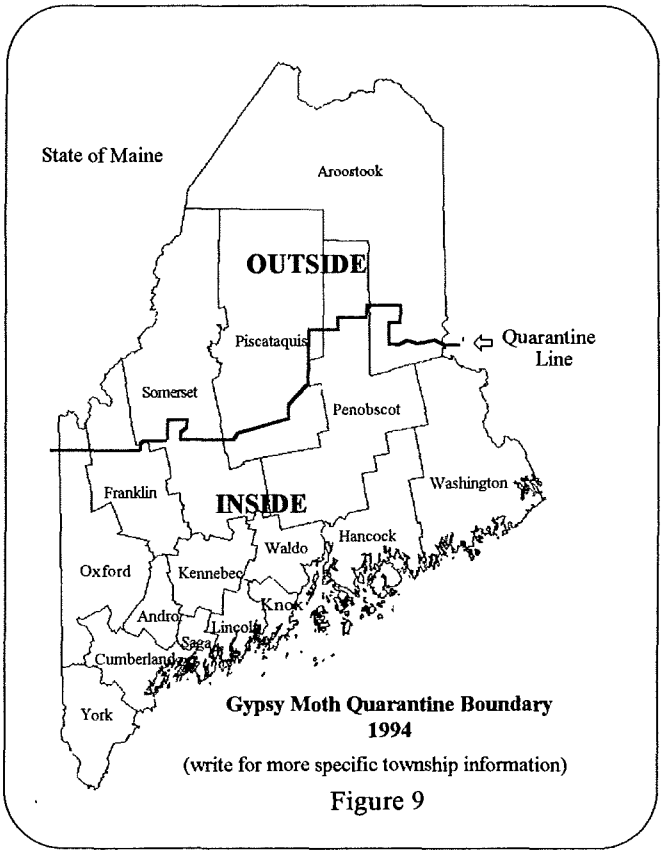


Figure 9

Larval mortality was again very high within many of the heavily infested forest stands contributing to the complete collapse of the gypsy moth populations in many of these areas. The principal pathogen in these epizootics appeared to be the **nucleopolyhedrosis virus** which causes **"wilt disease"**. The larval fungal disease caused by ***Entomophaga maimaiga*** was also observed in many locations but did not appear to cause any widespread plunges in the population levels. *Entomophaga maimaiga* was also found in Washington County for the first time in 1994 in a local gypsy moth population at Burke Hill in Cherryfield. Larvae killed by the fungus were fairly common and wilt disease did not appear to be present. This is the furthest east that this fungus has been found in Maine.

Although limited sampling for gypsy moth larval parasites was conducted at Wells (York County) in 1994, the samples were contaminated by the wilt disease. All larvae died after collection and as a result; no parasites emerged.

Very few egg masses were found during preliminary fall surveys and we anticipate little in the way of significant defoliation in 1995.

The **Asian gypsy moth** has not yet been found in Maine. Because it has been detected on the east coast, possibly as close as Connecticut, there has been an extra effort to closely monitor Maine populations especially around ports of entry.

Hardwood Defoliators - A wide variety of interesting hardwood defoliators was observed and collected in 1994 in the course of surveys for the **variable oakleaf caterpillar**. Most were collected as larvae on their host plants and with some exceptions caused only minor defoliation on individual trees. Table 14 highlights those which were common enough to mention but most of which are not discussed elsewhere in this report.

Table 14. Miscellaneous defoliators collected from hardwood forest stands in 1994*

American Dagger Moth, *Acronicta americana*	Luna Moth, *Actias luna* (Bi)
Big Poplar Sphinx, *Pachysphinx modesta* (P)	Orangehumped Mapleworm, *Symmerista leucitys* (M)
Birch Sawfly, *Dimorphopteryx* sp. (Bi)	Pale Tussock, *Halysidota tessellaris* - **hairs can cause rash**
Dagger Moth, *Acronicta* spp.	Polyphemus Moth, *Antheraea polyphemus* (Bi)
Elm Sawfly, *Cimbex americana* (Bi)	Prominent, *Heterocampa biundata*
Flat Leaftiers, *Psilocorsis* spp. (Be)	Redhumped Oakworm, *Symmerista canicosta*
Four-horned or Elm Sphinx, *Ceratomia amyntor* (Ba)	Spotted Tussock, *Lophocampa maculata*
Great Ash Sphinx, *Sphinx chersis* (A)	Sphinx Moths, *Paonias* spp. and *Smerinthus* sp.
Green Comma, *Polygonia faunus* (Bi, W)	Spiny-elm caterpillar, *Nymphalis antiopa* (P, W)
Greenstripped Mapleworm, *Dryocampa rubicunda* (RM)	Unicorn Caterpillar, *Schizura unicornis*
Hairstreak Caterpillars	Unicorn Caterpillar, *Schizura ipomoeae*
Hickory Tussock, *Lophocampa caryae* - **hairs can cause rash**	Webworms, *Tetralopha* spp.
Lacecapped Caterpillar, *Oligocentria lignicolor* (Be, Bi)	Yellowlined Caterpillar, *Nadata gibbosa* (Bi)
Laurel Sphinx, *Sphinx kalmiae* (A)	Yellownecked Caterpillar, *Datana ministra* (Bi)

* Collected from a variety of host trees in 1994 unless otherwise specified.
A=Ash, Ba=Basswood, Be=Beech, Bi=Birch, M=Maple, RM=Red Maple, P=Poplar, W=Willow

Hemlock Looper (*Lambdina fiscellaria*) - Populations of the hemlock looper were very low this season and no defoliation was reported. The results of the hemlock looper surveys in 1994 are discussed in the special reports section (page 58).

Hunter's Moths (adults of several species of cankerworms) - Each year we hear of moth activity in forested areas over the fall months. Over time these moths have come to be known here as **hunter's moths**. The moths of the **hemlock looper** are the first to fly from August through September. There are several other species of fall flying moths which begin their flight activities just after the hemlock looper moths finish theirs and these are the more familiar hunter's moths. These male moths (females are wingless) tend to fly from mid October through November (hunting season in Maine) and due to the colder temperatures at that time of year do so mainly on sunny days and on warmer nights. Of several possible species, the **Bruce spanworm** and **fall cankerworm** are the most common. All of these species are discussed separately in this report.

Large Aspen Tortrix (*Choristoneura conflictana*) - No defoliation by large aspen tortrix was detected with either ground or aerial surveys in 1994. The 900 acres defoliated by this species in 1993 did not have significant larval populations in 1994 and no other infested areas were found. The number of moths collected at our light trap stations substantiated our larval surveys. Moth numbers dropped strikingly in 1994 for the fourth consecutive year (Table 15).

Table 15. Total number of large aspen tortrix (*Choristoneura conflictana)* moths collected at light

	Year				
Location	**1990**	**1991**	**1992**	**1993**	**1994**
Allagash	13	1	0	5	0
Arundel					0
Ashland	10	0	0	0	0
Blue Hill	0	3	14	2	1
Brunswick	0	0	3	0	0
Calais	6	14	2	0	0
Chesuncook	0	0	0	0	0
Dennistown	974	0	0	2	0
Elliotsville	159	33	42	14	0
Exeter	0	5	4	15	6
Greenbush	2	25	28	29	0
Guerette	0	1	0	0	2
Haynesville	15	257	3	0	0
Kingfield	2	0	3	0	0
Matagamon	0	0	3	0	
Millinocket	11	14	5	0	0
Mt. Vernon	1	4	2	2	0
No. Bridgton	0	0	2	0	0
Rangeley	1	5	47	92	0
Shin Pond					1
South Berwick	0	3	4	0	0
St. Aurelie	8	0	0	1	0
Steuben	0	4	2	1	0
Topsfield	42	20	15	1	0
Washington	0	0	14	0	0
Total Number of Moths	**1,244**	**389**	**193**	**164**	**10**
Total Number of Traps	**23**	**23**	**23**	**23**	**24**

Locust Leafminer (primarily *Odontota dorsalis*) - Mining of black locust foliage primarily by this species was again fairly common and widespread in 1994. The mines of several other species of leafminers could be found in lesser degrees in most infested stands as well.

Maple Leafroller (*Sparganothis acerivorana*) - Populations of maple leafroller remained very low again in 1994 and little defoliation of red maple was observed even in areas of Hancock and Washington counties where defoliation has been heavy in the past.

Maple Problems (various) - Maple problems throughout the state annually generate a wide variety of requests for assistance and 1994 was no exception. Senescent lawn trees suffer a plethora of decline problems; the young, cultural problems and those in between a variety of less serious but "taxing" problems. Aside from those specifically identified with regard to maple separately or in Table 14, maple experienced defoliation by **Bruce spanworm**, **forest tent caterpillar** and **gypsy moth**. Others such as the **orangehumped mapleworm** and **maple leafcutter** (*Paraclemensia acerifoliella*) were only minimally involved.

Mountain Ash Sawfly (*Pristiphora geniculata*) - This introduced species is on our list of perennial problems affecting ornamental mountain ash. The 1994 season was no exception with the usual complaints in spite of the fact that control of the problem is easy to achieve. This sawfly is seldom a problem on native mountain ash in the wild.

Oak Apples (caused by several species of cynipid gall wasps) - We frequently received requests for information on what caused those ping-pong ball sized, variously colored formations on oak twigs, buds and leaves. Some were solid, some spongy and some fairly open. We were able to satisfy most curiosity seekers with what generalities we could provide. Although unusually abundant in many areas in 1994, no damage resulted to the hosts.

Oak Leafrolling Weevil (*Attelabus bipustulatus*) - These attractive little shiny black beetles with two bright reddish spots were very active on oak in 1994 especially in Bath (Sagadahoc County), Cherryfield

(Washington County), South Berwick and Arundel (York County). Their little, tied, leaf pellets, resembling animal feed, cut and rolled from the foliage, littered the ground beneath some heavily infested trees. A slightly larger, dull reddish species of **leafrolling weevil**, (*Himatolabus pubescens*) was extremely common on alder and to a lesser extent birch in coastal areas of Washington County in early July.

Oak Leaf Shot-Hole (caused by the fly, *Japanagromyza viridula*) - We had three areas of damage to red oak by this species this past season: Paris (Oxford County), Bath-Phippsburg (Sagadahoc County) and Cherryfield (Washington County). Defoliation in all of these areas was moderate to heavy and intermixed with that of the **oak leaftier** and **oak leafroller**. The last time that we had significant widespread foliage injury by this unusual pest was in 1991. Damage occurs early in the season as the new growth expands. Holes in flattening leaves resemble shotgun pellet holes. **Frost injury** which occurs at roughly the same time results in irregular holes and tears. When damage from either cause is heavy, foliage can become very deformed and appear "nested."

Oak Leaftier (Shredder) (*Croesia semipurpurana*) and Oak Leafroller (*Archips semiferana*) - Defoliation by these two species in 1994 was somewhat localized and most often associated with **oak leaf shot-hole**. Light infestations of the leaftier also continued to occur in Kennebec and Lincoln counties. The **Oak Skeletonizer** (*Bucculatrix ainsliella*) was not observed in 1994.

Oak Twig Pruner (*Elaphidionoides villosus*) - Populations of the oak twig pruner remained fairly stable at low levels for the eighth consecutive year. Damage to individual trees, however, was occasionally heavy.

Orangehumped Mapleworm (*Symmerista leucitys*) - Moderate to heavy defoliation of beech over roughly 250 acres in Talmadge and T6 R1 NBPP in northern Washington County was observed in 1994. Larvae elsewhere also appeared easier to find in 1994 than they have since 1990 but defoliation was generally not evident. Moth catches rose at ten of our light trap stations (Table 16) for the first time since 1989.

Table 16. Total number of *Symmerista* spp. moths collected at light

	Year					
Location	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Allagash	0	0	0	0	0	0
Arundel						4
Ashland	0	0	0	0	0	0
Blue Hill	2	0	0	1	6	32
Brunswick	31	4	8	0	1	5
Calais		5	1	3	0	0
Chesuncook		1	0	0	1	2
Clayton Lake	0	0				
Dennistown	0	0	1	0	0	0
Elliotsville	155	44	10	5	4	1
Exeter	20	0	1	0	1	3
Greenbush	70	3	0	0	0	0
Guerette	0	0	0	0	0	0
Haynesville	12	1	0	0	0	0
Kingfield	11	0	0	0	0	0
Matagamon	7	2	0	0	0	
Millinocket	211	9	0	0	0	0
Mt. Vernon	28	3	2	4	4	23
No. Bridgton	14	3	10	8	21	12
Rangeley	0	0	1	0	0	0
Shin Pond						0
South Berwick	32	18	13	30	4	1
St. Aurelie	0	0	0	0	0	3
Steuben	6	0	7	0	0	3
Topsfield	362	67	5	3	0	13
Washington	20	3	6	9	10	44
Total Number of Moths	**981**	**163**	**65**	**63**	**52**	**146**
Total Number of Traps	**22**	**24**	**23**	**23**	**23**	**24**

Oystershell Scale (*Lepidosaphes ulmi*) - Populations of this scale on beech remained endemic in 1994. Damage from this and other pests such as **beech scale**, however, continues to be obvious in most stands and is exacerbated by drought and defoliation.

Pear Thrips (*Taeniothrips inconsequens*) - No damage to sugar maple from pear thrips feeding was reported in 1994 and populations were barely detectable. Sticky traps placed at Carroll, Farmington, Mt. Vernon and West Paris during the spring emergence yielded very low numbers.

Saddled Prominent (*Heterocampa guttivitta*) - No damage or larvae were observed in 1994. Moth catches in the light trap survey dropped for the third consecutive season (Table 17).

Table 17. Total number of saddled prominent (*Heterocampa guttivitta*) moths collected at light

	Year					
Location	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Allagash	13	8	4	1	3	1
Arundel						0
Ashland	1	0	0	0	0	1
Blue Hill	0	6	2	1	1	2
Brunswick	10	42	34	0	0	0
Calais		2	4	3	0	0
Chesuncook		51	10	12	13	10
Clayton Lake	1	4				
Dennistown	4	1	3	0	0	0
Elliotsville	3	6	5	4	4	0
Exeter	13	29	5	10	0	0
Greenbush	1	0	1	1	1	4
Guerette	0	0	1	0	0	1
Haynesville	3	0	0	0	1	1
Kingfield	1	0	0	1	0	2
Matagamon	3	7	0	1	0	
Millinocket	13	10	21	10	5	2
Mt. Vernon	17	21	32	19	1	1
No. Bridgton	1	0	41	15	9	2
Rangeley	0	0	10	4	0	0
Shin Pond						1
South Berwick	5	29	15	53	3	0
St. Aurelie	0	3	0	0	0	0
Steuben		4	3	17	28	1
Topsfield	4	7	5	11	4	0
Washington	79	3	50	23	1	0
Total Number of Moths	**172**	**233**	**246**	**186**	**74**	**29**
Total Number of Traps	**22**	**24**	**23**	**23**	**23**	**24**

Satin Moth (*Leucoma salicis*) - Defoliation of aspen by satin moth caterpillars rose slightly from 1,430 acres in 1993 to 1,600 acres in 1994. The defoliated area was again in central Maine (Figure 10) in Penobscot (750 acres) and Piscataquis (850 acres) counties. The intensity of the defoliation, however, was down within the area surveyed and in other areas of the state as well. The frequency of homeowner requests concerning defoliation of eastern cottonwood and white poplar also declined. Moth catches in the light trap survey increased very slightly in 1994 (Table 18) but not enough to portend a problem in 1995.

Tussocks (various) - Tussocks are those fuzzy, variably-colored, caterpillars which often show up as defoliators of a variety of trees and shrubs. In most situations defoliation is light and the caterpillars are more of a curiosity. Occasionally, however, populations "boom" and defoliation becomes noticeable. The hairs of some species can also physically cause skin irritation (unlike those of the browntail moth which chemically cause a rash as well). This is especially true during periods of hot weather when **"caterpillar rash"** or **"tussockosis"** is not uncommon. Both the **hickory tussock (*Lophocampa caryae*)** and **pale tussock (*Halysidota tessellaris*)** were more common than usual on a variety of hosts in 1994 and several reports of rash induced by careless handling of these two were received. The **spotted tussock (*Lophocampa maculata*)** appeared locally but was not as abundant or widespread as it has been in the past. See Medical Entomology (page 39).

Table 18. Total number of satin moths (*Leucoma salicis*) collected at light

Location	Year 1989	1990	1991	1992	1993	1994
Allagash	11	3	3	2	2	0
Arundel						0
Ashland	5	5	0	7	3	5
Blue Hill	0	0	0	0	0	9
Brunswick	0	2	0	0	2	0
Calais		6	5	0	0	3
Chesuncook		0	0	0	1	0
Clayton Lake	0	2				
Dennistown	0	2	3	1	5	1
Elliotsville	0	0	1	5	2	0
Exeter	0	0	0	0	0	0
Greenbush	9	1	2	0	0	1
Guerette	24	4	3	3	16	7
Haynesville	1	3	0	2	18	5
Kingfield	0	0	0	1	0	0
Matagamon	0	0	0	0	0	
Millinocket	1	1	5	17	3	4
Mt. Vernon	0	0	0	0	0	0
No. Bridgton	0	0	0	0	0	0
Rangeley	0	0	4	1	0	0
Shin Pond						14
South Berwick	0	0	0	1	1	0
St. Aurelie	0	0	0	0	0	0
Steuben	4	41	22	2	2	8
Topsfield	2	1	3	0	3	18
Washington	0	0	0	0	0	0
Total Number of Moths	**57**	**69**	**51**	**56**	**53**	**75**
Total Number of Traps	**22**	**24**	**23**	**23**	**23**	**24**

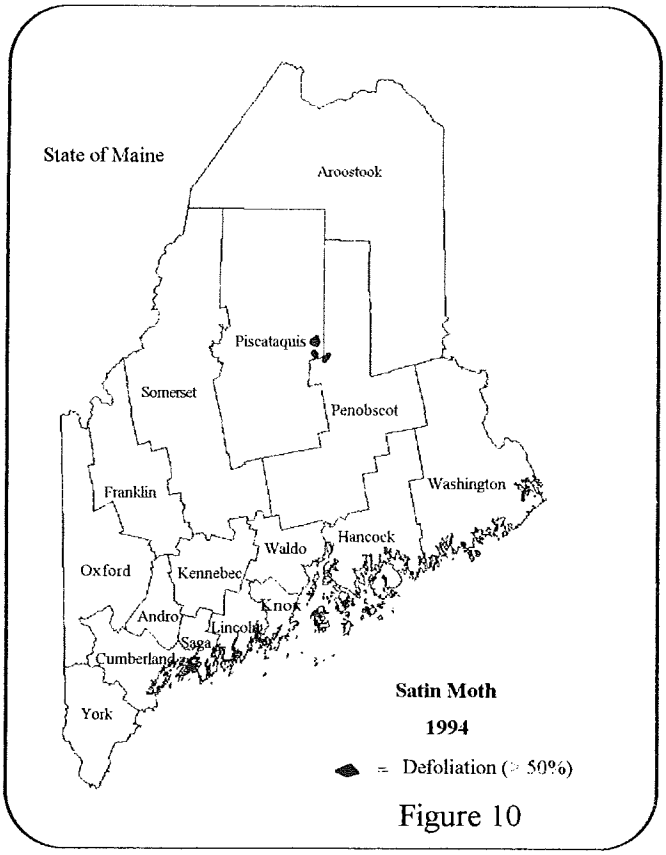
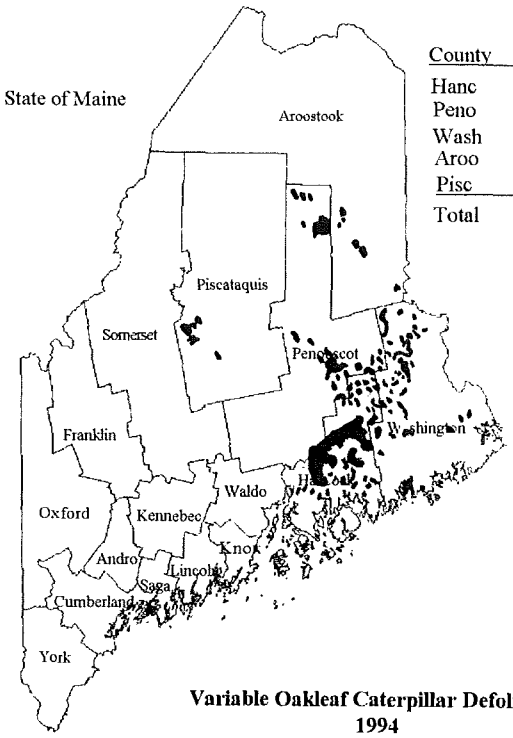


Figure 10

Variable Oakleaf Caterpillar (***Lochmaeus manteo***) - One of the biggest surprises of the 1994 season was the sudden resurgence of defoliation of beech by the variable oakleaf caterpillar. This species had dropped to nearly endemic levels in 1991 following several years of significant defoliation and defoliation was not expected in 1994. Only 45 acres of moderate defoliation had been mapped in 1993. Although the number of moths in light trap catches did rebound in 1994 (Table 19), the increase was not sufficient to predict the situation which actually developed in the field in August.

An aerial survey conducted in September of 1994 delineated more than 220,000 acres of heavy to severe defoliation of beech in Aroostook (11,000 acres), Hancock (121,000 acres), Penobscot (44,000 acres), Piscataquis (11,000 acres) and Washington (33,000 acres) counties (Figure 11). Low levels of defoliation or small pockets of heavier defoliation could be found in other areas of the state as well. Late season refoliation of beech was not observed in 1994 as it had been during the previous outbreak. As usual with such defoliation, a complex of other insect species was intermixed with the variable oakleaf caterpillar at times. The more common of these are listed under **hardwood defoliators** (page 30).



Variable Oakleaf Caterpillar Defoliation 1994

Figure 11

Willow Flea Weevil (***Rhynchaenus rufipes***) - Populations of this leaf miner were high in 1994 and damage was noticeable across the state by August. There did, however, seem to be some decline from the extremely high 1993 levels. Damage was again most noticeable on black and weeping willow and balsam poplar.

Willow Insects (various) - Aside from the willow flea weevil, there were a number of other species of defoliators that resulted in noticeable defoliation of willow locally in 1994. Of these the **green comma**, **spiny-elm caterpillar** (mourning cloak), and **satin moth** were the more common (See **hardwood defoliators**).

Woolly Alder Aphid (***Prociphilus tessellatus***) - Silver maple infestations were down in 1994 as was the population in general although alder stem infestations were not difficult to find.

Table 19. Total number of variable oakleaf caterpillar *(Lochmaeus manteo)* moths collected at light

	Year					
Location	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Allagash	0	0	1	1	0	0
Arundel						0
Ashland	0	7	10	6	0	1
Blue Hill	0	7	4	5	0	9
Brunswick	80	4	2	0	0	0
Calais		2	4	3	0	0
Chesuncook		0	1	0	0	10
Clayton Lake	2	0				
Dennistown	2	7	7	0	0	0
Elliotsville	37	87	175	42	5	0
Exeter	40	9	7	0	0	0
Greenbush	56	49	39	3	0	7
Guerette	1	2	1	0	0	3
Haynesville	15	94	86	21	6	39
Kingfield	70	192	158	14	0	7
Matagamon	10	17	13	1	0	
Millinocket	276	169	310	122	85	148
Mt. Vernon	9	0	2	0	2	12
No. Bridgton	4	5	6	0	0	3
Rangeley	1	5	3	0	0	0
Shin Pond						2
South Berwick	14	11	15	3	8	0
St. Aurelie	1	0	0	0	2	1
Steuben	8	3	3	0	0	2
Topsfield	114	316	302	250	83	235
Washington	21	23	2	1	0	2
Total Number of Moths	**761**	**1,009**	**1,151**	**472**	**191**	**481**
Total Number of Traps	**22**	**24**	**23**	**23**	**23**	**24**

(C) Ornamental and Miscellaneous Insect (and Other Arthropod) Pests

Ant Swarms - Annual massive flights of the cornfield ant (*Lasius alienus*) were sighted several times from mid to late August. The most notable of these were in northern and central Maine where they often formed dark funnel-shaped clouds. Less spectacular flights of this species or one of the **carpenter ants** (*Camponotus* spp.) were also spotted elsewhere.

Asian or "Halloween" Lady Beetle (*Harmonia axyridis*) - Each fall, as many of us try and finish up grounds activities just prior to the first freeze, one or more insect surprises appear. This year was the year of the lady beetle in southern Maine (Figure 12). A few lady beetles appear each year in and around homes and usually these are the **two-spotted lady beetle** (*Adalia bipunctata*). This year few two-spotted appeared but instead a larger, usually 19-spotted, introduced species, *H. axyridis*, took over. The Asian lady beetle is greatly variable and ranges from black to yellow in base color and from immaculate to many spotted. Both adults and larvae are predacious on aphids. The full impact of this rapid influx of a new species is not known nor can we speculate as to the population trend at this point.

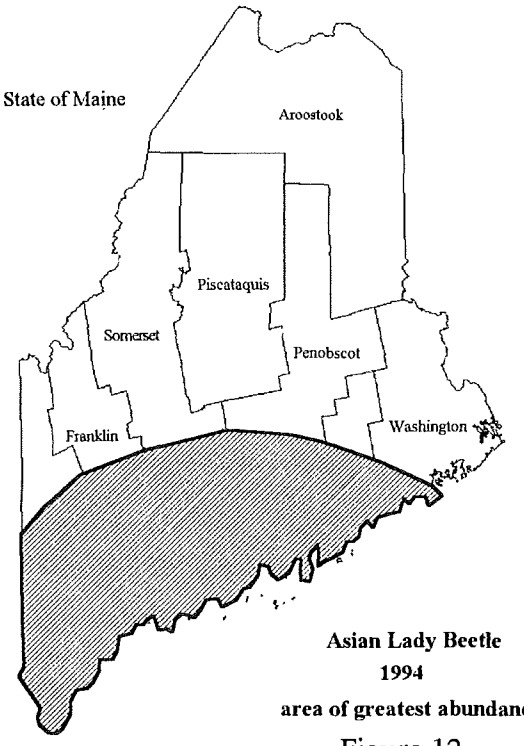


Figure 12

Most people like lady beetles but this species tried their patience. They entered homes, often in great numbers, getting into cupboards, beds, laundry, falling into aquariums and in general making a nuisance of themselves. What is especially interesting is the fact that this species has not been previously reported from Maine. Roughly 1,600 were released in T10 SD (Hancock County) in 1981 but no recoveries were ever made. The present population flush is apparently from established releases in the southern United States.

Bark Lice or Psocids - Those interesting "herds" of little gray insects on the bark of many trees in late July and August of this past year were most likely a species of psocid. By late August over fifty calls by concerned tree owners had been logged at the Augusta lab alone. This flush of annual activity was greater than anticipated especially in southern Maine. While a number of species have this aggregation habit, most of what was seen appeared to be *Cerastipsocus venosus*. Psocids are interesting little creatures that do no harm to the trees as they apparently feed on lichens and fungi.

Bee Moth (*Aphomia sociella*) - Two interesting reports of the activity of what may be this introduced species were received this past summer from Thomaston (Knox County) and South Harpswell (Cumberland County). Larvae of this species apparently associate with the nests of bumble bees and wasps (*Polistes*). They are gregarious and the very tough, often extensive, mats of their web-lined feeding tubes can be found between boards or in other tightly secluded spaces, especially in older structures. In South Harpswell, the mats had literally cemented old books together and to a bookshelf. It is possible that in this case the

larvae were feeding on book binding materials. Similar mats have also been seen in an old house in Mt. Vernon (Kennebec County).

Chinch Bug (*Blissus leucopterus hirtus*) - Chinch bugs had a good year in 1994 and local population explosions were reported from a number of southern Maine localities. Probably the most notable was in Bar Harbor where "millions" were seen swarming over everything - car, walk, house, etc. during a hot period in late July.

Chironomid Midge (*Chironomus plumosus*) - Several very alarmed camp owners along the east shore of Sabattus Pond in Wales (Androscoggin County) called frantically for assistance between June 15 and 20 of 1994 as to what to do with a phenomenal insect invasion. The pond surface along the shore, especially in coves, was covered with a dense mat, 4-6" thick, of pupae, pupal cases and adults of this aquatic midge. And they smelled! While the problem is more of a nuisance than a health hazard it did generate a lot of interest. This phenomenon is common in some parts of the country but it is rather unusual in Maine. Conditions were just right and the problem abated within a week or so.

Columbine Sawfly (*? Pristiphora aquilegiae*) - This introduced species now appears to be statewide and widespread. The relatively inconspicuous green larvae stripped many plants in 1994 and did it so quickly that it seemed to happen overnight.

Dogwood Sawflies (*Macremphytus* spp.) - Larvae of these sawflies, that are usually covered with a white waxy "wool", were often brought to our attention during July of 1994. These species prefer the low bushy native species of dogwood. While the defoliation of dogwood can be striking, it is the larval habit of boring into wooden porch timbers or house siding to pupate that causes the most concern! Fortunately outbreaks among this group of sawflies are usually very local in Maine and not normally a problem.

Euonymus Caterpillar (*Yponomeuta cagnagella*) - Larvae of this species were already active in early June of 1994 and stripping foliage from euonymus, especially tree forms. Populations appeared to be down somewhat from last year.

Golf Course "Worms" - We had a number of reports this past season of large worms wandering around golf courses! Most, if not all, of these involved one of the **hornworms** (Sphinx or hawk moth larvae - see **Hardwood Defoliators**). As fall approached and they reached maturity, they left the host trees (often ash) to seek a pupation site. Due to their large size (3"±) and often colorful marks they attracted attention, especially where grass was short and the foot traffic had their eyes on the ground.

Grasshoppers (various) - Grasshoppers and crickets seemed to be very abundant in many areas in 1994. Although not generally considered tree pests, they can and do feed on some ornamentals and have been suspected of feeding on the bark of tender leaders of balsam fir Christmas trees after dark.

Hydrangea Leaf-Tier (*Exartema ferriferanum*) - This pest seemed to be abundant again this year at least from the Bangor area south and west. The black-headed green larvae neatly tie two leaves edge to edge forming a pocket around the terminal flower buds. They proceed to feed on the flower buds and significant flower reduction can occur. Pupation began in most areas by early June and the small attractive moths began emerging by June 20.

Japanese Beetle (*Popillia japonica*) - Japanese beetle populations appeared on schedule this season. We had an unofficial report of activity of adults from South Monmouth (Kennebec County) as early as June 20-26. Our first official report was from Falmouth (Cumberland County) on June 29 and from Mount Vernon and Augusta (Kennebec County) on July 2. Populations were variable in 1994, up in some areas and down in others. This introduced species is still a widespread pest of ornamentals and small trees in parts of Androscoggin, Cumberland, Kennebec and York counties. The species occurs in much lower numbers

elsewhere as well at least as far north as Bangor (Penobscot County) and east as far as Mount Desert Island (Hancock County).

Populations of the often associated but more widespread **rose chafer** (*Macrodactylus subspinosus*) appeared to be down in 1994. The **oriental beetle** (*Anomala orientalis*) has still not been detected in areas other than Gorham (Cumberland County) and Winthrop (Kennebec County).

Loosestrife Sawfly (*Monostegia abdominalis*) - Light defoliation by what appears to be this species was again observed on flower garden loosestrife in the Augusta area (Kennebec County).

Medical Entomology - Maine state government does not have a designated medical entomologist position. As a result MFS-I&DM staff receive requests for advice and assistance in dealing with an array of insect and other arthropod related problems. Included in these requests are questions relating directly to such things as **black flies**, **bot flies**, **deer flies**, **horse flies**, **mites**, **mosquitoes**, **spiders**, **stinging insects** and **ticks**. Also included are vector related disease problems such as **eastern equine encephalitis**, **heartworm** and **lyme disease** and a series of **allergies**, **rashes** and **reactions**. The actual numbers of requests are not high but individual concern is often great. Disease questions *per se* are referred to specialists.

Biting fly populations throughout most of the state were variable but generally seemed to be lower than in 1993 except in coastal areas from the Penobscot Bay south and west where **saltmarsh mosquito** (*Aedes sollicitans*) populations rose to the highest levels seen in many years. Frequent high-run tides and adequate breeding stock favored this unusual flush of activity. Similar conditions were reported from most coastal areas of New England and New York. Although present in eastern Maine, salt marsh mosquito populations there seemed more normal. Concerns for health and comfort prompted many requests for remedial measures.

The number of requests for information on **stinging insects** remained roughly the same as in 1993.

Concern over insect related **rashes** rose in 1994 primarily in response to expanded activities of the browntail moth in the Casco Bay area (Cumberland County) and the hickory and pale tussock populations elsewhere. The browntail moth (page 23) rash is by far the more serious concern. This rash is chemically and physically induced and the high populations of this species within concentrated areas (Casco Bay Islands) generated a serious level of dermal and respiratory discomfort. Although most residents in the infested area are now somewhat familiar with the problem, it is nearly impossible to avoid the urticating hairs completely. While susceptibility to the rash varies somewhat, most individuals are affected. Rash caused by the **hickory** and **pale tussocks** (page 33) on the other hand is mechanical and tends to be worse when individuals actually handle the caterpillars or contact their hairs when hot and sweaty. The worst case reported in 1994 involved a youngster who "towelled off" following a swim using a towel bearing a **hickory tussock**. The youngster ended up with a large area of rash and the caterpillar became suddenly bald. Both survived, however. Both of these tussocks are general feeders on a number of trees and shrubs. The "fuzz balls" formed as cocoons are also a source of hairs and should be avoided.

Spiders (various) - Spiders continue to generate interest - mostly from individuals who just don't like them. We continue to stress the point that nearly all Maine spiders are beneficial and avoid humans more than we avoid them. No poisonous spiders were received for identification during 1994. Most of our requests this past year involved occasional home invaders such as the **barn spider** (*Araneus cavaticus*), **parsons spider** (*Herpyllus ecclesiasticus*), **grass spiders** (*Agelenopsis* spp.) and the large hairy **fishing spider** known as the **dark Dolomedes** (*Dolomedes tenebrosus*). We did, however, receive a very interesting request for assistance involving spiders from Albion (Kennebec County) in late October. An excited homeowner in a new development in a field adjacent to a wooded area called on October 24 wanting to know what to do about the abundance of spiders and mats of webbing that were covering everything in the area. They had been there for a day or so and the problem seemed to be spreading.

Visits to the site on both October 24 and 25 yielded a number of spiders but not much webbing was evident. A visit early on the morning of October 25 with Dr. Daniel Jennings while dew was still on the webs did, however, reveal extensive **gossamer** webbing. Dan collected and identified many spiders and stated; "Although all of these species spin draglines which may have contributed to the observed shrouds of silk, I suspect that most of the gossamer was a result of ballooning erigonids. These small spiders disperse by ballooning on warm, sunny days during the fall. This phenomenon has been observed and recorded from ancient times; i.e., early Greeks and Romans were familiar with aerial dispersal by spiders."

Ticks (Ixodidae) - The number of ticks received for identification in 1994 (250) was up from 1993 (202) and involved higher numbers of the **lyme** or **deer tick** (*Ixodes dammini/scapularis* as you will). Numbers of the **American dog tick** (*Dermacentor variabilis*) were still high but our clients appear to be more sure of the identification of this species and tend to report it less frequently. Populations of both of these species seem to be spreading slowly north and east. Larvae of the **moose** or **winter tick** (*Dermacentor albipictus*) were still common in November in some areas and seemed to spread closer to habitation. Besides plaguing hunters these tiny annoying ticks even came in on individuals visiting the woodpile and clothesline in rural areas. Ticks in Maine are more common in the southern part of the state (Figure 13).

Lyme disease in Maine - The lyme disease status rose slightly in 1994 (from 18 confirmed cases in 1993 to 32 in 1994). Roughly 105 cases in total have now been officially recognized from Maine since recording began in 1986. Several cases from inland areas in Androscoggin and Kennebec counties failed to meet CDC requirments for verification. Five counties have been designated Maine counties of exposure (Figure 14).

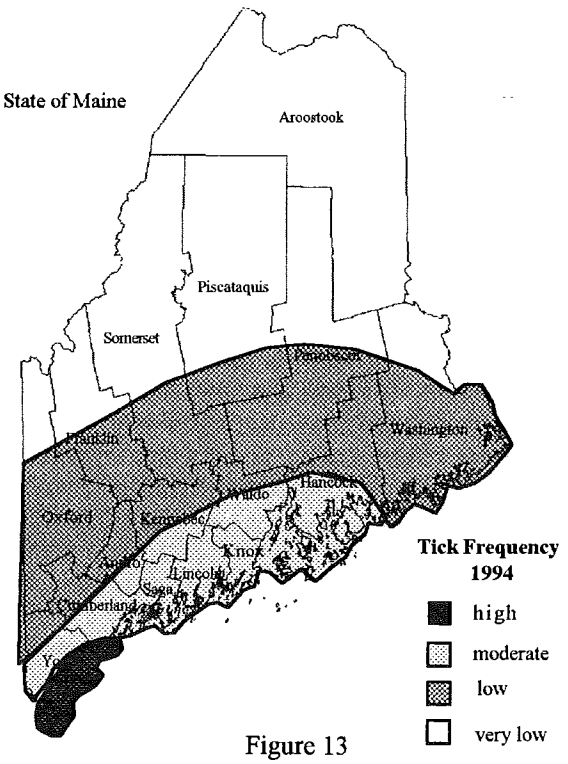


Figure 13

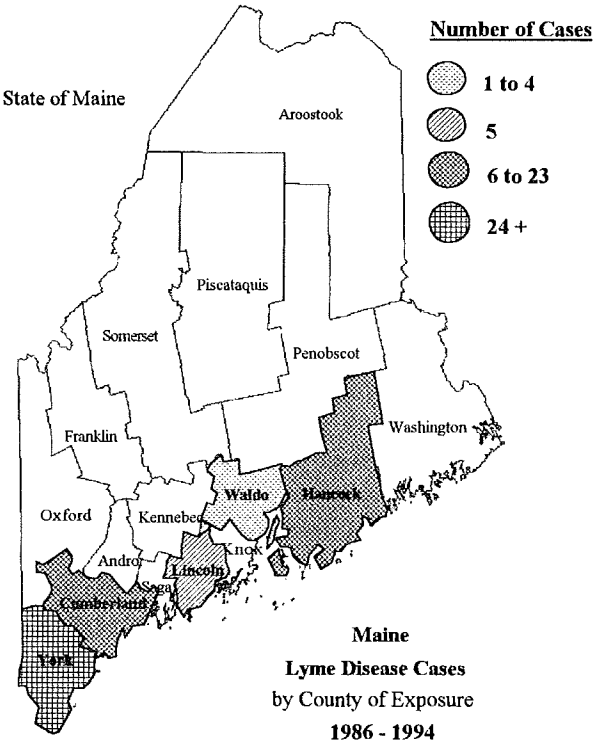


Figure 14

Miscellaneous Fall Nuisance Problems - There is often a surge of insect activity at this time of year much of which appears to be more in the line of nuisance or curiosity than damage. Some of the more common problems which have not already been discussed but which we encountered were:

Clusterflies, **crickets** and **paper wasps** as they searched for winter quarters and **bees** and **yellow jackets** which became restless and obstreperous prior to breakdown of their colonies. **Milkweed bugs** (*Lygaeus kalmii*) and the similar (in appearance) **boxelder bugs** (*Leptocoris trivittatus*) as well as the **Asian lady beetle** (page 37) and the **birch catkin bug** (page 22) as they moved to homes attempting to seek hibernation sites. The birch catkin bug was especially abundant on some birch with a heavy seed crop and several reports of thousands of individuals swarming over fallen leaves and sides of buildings were received. While they do no damage in homes they are considered unwelcome guests. Various **leaf** and **flea beetles**, and **root weevils** also became a problem in and around homes in some areas.

Miscellany - Sometimes we receive reports of interesting insects which have somehow strayed into Maine along with storm fronts or with vehicles. On July 28, 1994 one of our constituents, Gale Flagg, reported that the large (6" wingspan) dark brownish **black witch moth** (*Ascalapha odorata*) from the Gulf States flew into the St. John Valley Times office in Madawaska (Aroostook County). This certainly generated a lot of local comment and some press. After a while it flew off not to be seen again. This species has occurred here before but not often.

Public Assistance - Each year the I&DM staff handle well over 1,000 different requests for advice and assistance in addition to specific surveys and project work. Table 20 gives a breakdown of many of the problems handled by Augusta I&DM staff in 1994 showing some of the diversity of requests.

Table 20. Number of requests received in 1994 for advice and assistance about forest, shade tree, and ornamental pests.

PROBLEM	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Aphids	1					3	5	1		1	1		12
Balsam twig aphid					2	1							3
Bark beetles								3			1		4
Bark lice	1							18					19
Birch leafminers					2	1		1					4
Browntail moth	1	1	2	1	2	11	6	3		1			28
Dutch elm disease							1			1			2
European larch canker			1							1			2
Galls			1	2		5	3	2				1	14
Gypsy moth				1	3	2	2		2	1			11
Hemlock looper		1						1	1				3
Hemlock wooly adelgid			1							2		1	4
Japanese beetles							3	5					8
Mites						1	2			1			4
Sawflies	2			1	3	7	13	11	5				42
Spruce budworm		1						1			1		3
Tent caterpillars					1	5							6
Variable oakleaf caterpillar	1						1	18	6				26
White pine blister rust						1	1	2					4
White pine weevil	1			1			1	1	1				5
Woodborers				1	1	2	4	9	4	4			25
Other requests	22	34	29	53	65	122	100	88	63	61	20	8	665
Total	**29**	**37**	**34**	**60**	**79**	**161**	**142**	**164**	**82**	**73**	**23**	**10**	**894**

Viburnum Leaf Beetle (*Pyrrhalta viburni*) - The first report of activity by this species in Maine was received this past season on maple-leaved viburnum in the Portland (Cumberland County) area. Populations were already very heavy when first seen and many shrubs had already been stripped. This was very likely the second or third season of such activity according to local reports. Later in the season additional reports of larvae, adults and damage were received from viburnum (high bush cranberry-a viburnum) in Saco (York County) and in the Fairfield-Waterville (Kennebec County) area.

DISEASES and INJURIES Associated With Trees in 1994

Air Pollution Injury (caused by various air contaminants, especially ozone) - There was much less ozone damage to susceptible species of forest trees in 1994 compared to previous years. No trees in the forest health monitoring plots exhibited ozone injury symptoms although low level damage was noted on white ash in China.

Air pollution injury to forest vegetation in general is much less pronounced now than it was in the sixties and early seventies, probably due to a general reduction in sulfur dioxide emissions by industry in the northeastern United States. But there is still the potential for high levels of ozone injury to vegetation due to the capriciousness of weather systems. Unlike sulfur dioxide which acts directly and tends to be produced in finite amounts by industry, ozone is produced over time by the action of sunlight on certain by-products of combustion. Weather conditions can vary to produce either relatively little or great quantities of ozone depending on the sunlight, humidity, and temperature regimes which exist as air masses pass through the state during the growing season.

Acid Rain (caused by certain pollutants entering the atmosphere and reacting to form sulfuric and nitric acids) - This subject has received much play in the popular media over the years but most reports of damage are unfounded, easily attributable to other causes. But the misconception persists that acid rain is significantly destructive to forest vegetation. Each year we receive a few calls about the effect of acid rain on Maine forests. In June we were contacted by a sports writer from Wyoming who was writing a story about outdoor experiences in Maine but wanted to warn readers in advance to be ready for the devastation caused by acid rain! We hastened to assure him that overall our forests appear to be perfectly normal.

Recent research has concluded there is no evidence of general, widespread decline of forest species due to acidic deposition, though there may be local effects due to acid fog at certain coastal or high elevation sites in the northeast. And there may be subtle effects of acid deposition such as increased nutrient leaching from soils which may negatively impact tree growth. Conversely, it is possible the nitrogen component of acid rain may actually stimulate tree growth.

Annosus Root Rot (caused by *Heterobasidion annosum* syn. *Fomes annosus*) - Every year we seem to confirm the presence of annosus root rot at one or more previously unreported sites. Last year was no exception. A small plantation along Rt. 91 in York with developing "fomes holes" was brought to our attention by a concerned homeowner.

This is primarily a disease of plantation pine in Maine. To date we have recorded infected plantations in the following counties: Androscoggin, Cumberland, Franklin, Kennebec, Lincoln, Oxford, Penobscot, Piscataquis, Sagadahoc, Somerset, Waldo, and York (Figure 15).

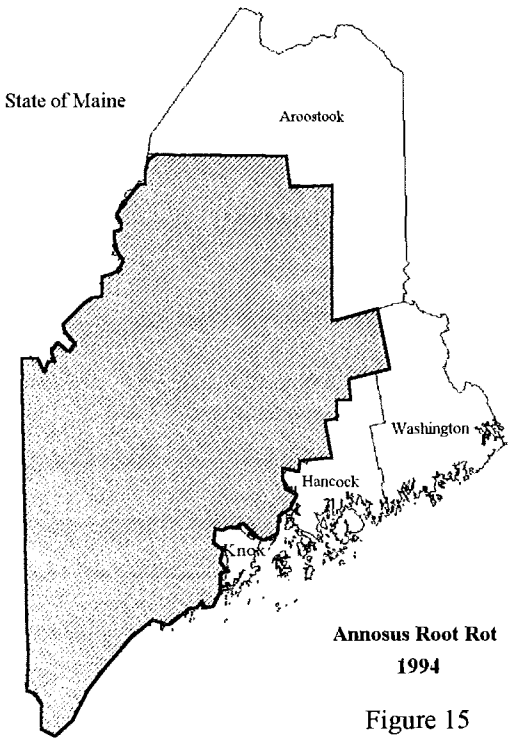


Figure 15

Apple Scab (caused by *Venturia inaequalis*) - One of the most common non-forest diseases we encounter when responding to calls from the public is apple scab. Perhaps the most serious disease in commercial apple orchards, apple scab also defoliates and causes lesions on leaves, stems, and fruits of ornamental crabs. This is a fungal disease which is generally worse during moist seasons.

Control by spraying fungicides is possible, but the repeated applications which must be timed 7-10 days apart during wet weather become tedious even for commercial growers. A more practical approach for homeowners involves the raking and destruction of fallen leaves and fruits in the autumn, and the planting of resistant varieties. Among those types said to be resistant are the cultivars 'Adams', 'Baskatong', 'Beverly', 'Bob White', 'David', 'Dolgo', 'Donald Wyman', 'Henry Kohanke', 'Liset', 'Ormiston Roy', 'Professor Sprenger', 'Red Jewel', and 'Sugartyme', and the species *Malus floribunda*, *M. sargentii*, and *M. tschonoskii*.

Armillaria Root Rot (caused by *Armillaria* spp.) - This disease, known also as **shoestring root rot**, is caused by an opportunistic fungus which may attack and kill hardwood and softwood trees of all ages. This organism frequently infects balsam fir, black spruce, and red spruce in Maine, and is a contributing factor to the "sudden death" of balsam fir known as **Stillwell's Syndrome**.

Not exclusively a forest problem, we often find *Armillaria* spp. affecting trees in Christmas tree plantations and trees and shrubs in urban settings as well. In addition to many observations of Armillaria root rot causing damage in forest settings in 1994, we noted it killing arborvitae in an ornamental hedge in Yarmouth and yews in a foundation planting in Troy.

Ash Anthracnose (caused by *Discula* sp.) - Reports of ash anthracnose were down again this year, probably the result of dry weather during normal infection periods. We received no reports of infection from any of our forest health monitoring plots which are located throughout the state, nor did we receive any specimens at the lab.

Ash Leaf and Twig Rust (caused by *Puccinia sparganioides*) - No specimens of this disease were received in 1994 and infection levels appeared to remain low. However, this disease tends to become epiphytotic (epidemic) in Maine every ten years or so and we are now about due for another flare up.

Despite the fact that this disease has been "quiet" in recent years, it is still of concern. We received a call in May from the conservation commission of a coastal, southern Maine community whose members wanted to plant white ash but remembered the severe disease outbreaks of the early 1980's. Once they were assured that the disease hadn't gone away, but was merely at a low point in a long disease" cycle", they opted instead to plant oaks.

Ash Yellows (caused by a mycoplasmalike organisms) - We have never observed typical ash yellows symptoms in Maine and have long presumed the disease is not present here. However some of the symptoms of brown ash decline (see page 45) are similar enough to those of ash yellows to persuade us to test symptomatic brown ash for the possible presence of the ash yellows organism. That work is now underway in a cooperatively funded research effort between the Maine Forest Service and the University of Maine in Orono (see page 4). We will report study findings in our Insect and Disease Conditions Report as soon as they are available.

Atropellis Canker (caused by *Atropellis tingens*) - Atropellis canker is a relatively uncommon fungal disease of pines in Maine which is occasionally a problem in Scotch pine plantations and natural stands of pitch pine, particularly in the southwestern part of the state. This disease is characterized by sunken, perennial cankers on twigs, stems and branches. Wood beneath cankers is darkly stained bluish black in color.

While we know of several plantations where this disease is continuously present, we rarely encounter it at new locations. However this year we located a new area of infestation, a five acre plantation of Scotch pine in Cornish. Infection levels were light to moderate.

Bird Damage (caused by various avian species) - Bird damage to trees can take many forms and is often serious. In recent years we have noted the extensive damage to trees caused by sapsuckers, other species of woodpeckers, and pine grosbeaks. We have noted the less extensive but still significant damage caused by various species of songbirds in Christmas tree plantations where they break potential leaders from trees when they attempt to perch on tender, emerging growth in the late spring.

But in 1993 and again in 1994 we received several calls which turned out to be apparent songbird damage to balsam fir in the vicinity of bird feeders. Homeowners occasionally set feeding stations among branches of balsam fir trees rather than placing them in the open. Songbirds flit about, breaking open seeds, traumatizing branchlets with sharp little feet, and defecating seemingly everywhere. Branches and branchlets in the vicinity of these feeding stations often turn brown, leading some homeowners to believe some strange disease is threatening the health of their trees. We wish all problems were this easy to solve.

Black Knot of Cherry (caused by *Apiosporina morbosa*) - This disease is common in forest situations throughout the state on wild cherry trees and is particularly conspicuous on black cherry where galls a foot or more in diameter may occur. Where these galls occur on the main stem the value of cherry for lumber is considerably reduced. In 1994, we recorded this disease as present in 9 of 87 forest health monitoring plots. Frequently we receive reports of black knot infections on cultivated peach, cherry or plum trees in landscape or home orchard situations. All too often by the time we are consulted the disease has progressed to such an extent that the usual control practice of pruning knotted twigs and branches to remove infected tissue would essentially reduce the tree to a stump. It is important to diagnose this disease early, prune any knotted twigs each year before April 1, and spray if necessary with the fungicide thiophanate methyl in order to maintain healthy, productive fruit trees.

Brown Ash Decline (cause unknown but probably stress related) - This disease, which causes dieback and mortality of brown (black) ash (*Fraxinus nigra*), continues to generate attention. While brown ash constitutes less than one percent of the forest trees in Maine, its wood is the preferred raw material for the production of baskets by Native American Indians. Additionally, there is concern that these symptoms may indicate a more pervasive underlying stress to the ecosystem.

We have studied this disease since we first became aware of the present outbreak in 1989, and reported findings to date in May of this year (I&DM Tech. Rep. No. 33, available upon request). Brown ash continues to be in a state of severe decline throughout the state, although the quality of brown ash foliage appeared to be somewhat improved in 1994. See also page 4 and ash yellows, page 44.

Bud Abortion of Balsam Fir (caused by low ambient air temperatures prior to budbreak) - This symptom was uncommon during the spring of 1994 due to relatively mild temperatures throughout the period of bud expansion prior to budbreak.

Butternut Canker (caused by *Sirococcus clavigignenti-juglandacearum*) - Butternut canker, a disease which has virtually eliminated butternut in the Carolinas, was first found in Maine in 1993 when we located the disease in Kennebec, Lincoln, Sagadahoc and Waldo counties. We continued to survey for this disease in 1994 and were successful in locating it in Androscoggin, Cumberland, Franklin, Knox, Oxford, Piscataquis, Somerset and York counties (Figure 16). We will continue to survey Aroostook, Hancock, Penobscot and Washington counties in 1995 to determine if the disease is present statewide.

Although the butternut canker organism is extremely virulent on butternut (*Juglans cinerea*), other *Juglans* species are apparently much less susceptible. Black walnut (*Juglans nigra*) is said to be susceptible only if inoculated artificially, and other *Juglans* species have become infected only when

grown in close association with severely infected butternut.

Butternut canker is characterized by dying branches and dead tops, epicormic branches, discolored bark which may ooze a thin black inky fluid in the spring, and cankers on the main stem, buttress roots, and branches. When bark in cankered areas is physically stripped away, the sapwood beneath exhibits dark brown, spindle-shaped, stained areas.

No effective controls are available to halt the spread of this disease at this time. Logging injuries should be minimized when harvesting. In nurseries, and perhaps in some homeowner situations, application of fungicides may be appropriate. In some states, butternut harvesting guidelines and even harvesting moratoriums are now in effect. There is considerable evidence that resistant individual butternut trees exist within the native population and researchers are now beginning to develop strategies to exploit that resistance to protect the species.

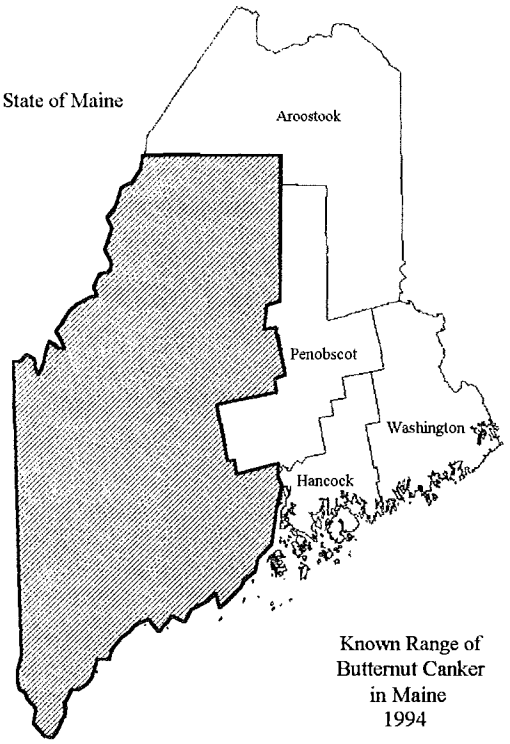


Figure 16

Caliciopsis Canker (caused by *Caliciopsis pinea*) - This is a generally minor, but occasionally important disease of eastern white pine which is often overlooked. Though we have known about this disease for many years, we are only now becoming aware of its significance and widespread occurrence in Maine. Every year we receive a few inquiries about cankered trees in stagnated white pine stands, and frequently we diagnose Caliciopsis canker as the cause.

Cankers may occur anywhere on tree trunks or suppressed branches and usually occur only in small numbers on a single tree. However, severely attacked trees may contain as many as several hundred cankers. Cankers may be superficial or they may extend into the cambium, killing it.

This is primarily a disease of stagnated stands or suppressed trees in dense stands. It may be effectively managed through judicious and timely stand thinnings.

Cedar Apple Rust (caused by *Gymnosporangium juniperi-virginianae*) - This disease, which alternates between eastern red cedar and apples or crabapples, was once an important disease in commercial apple orchards, especially in areas south of Maine where the alternate host plant (red cedar) grows abundantly in the wild. In fact at one time, several eastern states had laws similar to Maine's present white pine blister rust control program, which required destruction of nearby alternate host plants. Today cedar apple rust is controlled in commercial apple orchards by fungicidal sprays.

Eastern red cedar grows wild only in extreme southern Maine so it was somewhat of a surprise when in September specimens of infected red delicious apple trees arrived from Rangeley. We surmised that either someone was cultivating eastern red cedar nearby, or the apple trees had come to Maine during the 1994 growing season after they had become infected at a nursery south of here. It turned out to be the latter, one of very few calls we have received on cedar apple rust in recent years.

Chemical Injury (phytotoxicity due to chemical pesticide application) - Growers and landscape managers should be alert to the possible phytotoxic effects of certain pesticides when applied to tender, emerging plant foliage. Certain evergreens are quite susceptible, especially when applications involve emulsifiable concentrates, mist blower applications, and/or treatment during hot weather. We have repeatedly warned balsam fir Christmas tree growers to be careful of Diazinon AG 500 and Lorsban 4 E when applying them during late May and early June.

One of our more challenging (and less important) calls in 1994 involved leaf spot injury to burning bush (*Euonymus alata* 'Compacta'). Leaf spots on the specimen submitted consisted of small, discrete, tan necrotic areas which looked as though they might be of fungal origin although no fungal fruiting bodies were apparent. Unable to make a positive determination, we visited the homeowner's residence and noted that the affected plants were near the recreational entrance, and that the spots were more abundant toward the steps than toward the house itself. A bit of questioning elucidated the cause: children were sent out to the entrance steps to spray deet insect repellant (Off®). Droplets of spray had found their way to euonymus foliage, killing plant tissue in the areas of contact.

Coral Spot Nectria Canker and Steganosporium Dieback (caused by *Nectria cinnabarina* and *Steganosporium* sp., respectively) - These two disease organisms often work in concert to cause dieback and decline in several species of forest and shade trees, especially sugar maple. As in 1993, we seem to have received more calls than usual regarding these diseases again in 1994. Inquiries were statewide, received from Ft. Kent to Hollis and many points between.

These are stress related diseases, and the causal organisms are opportunistic fungal pathogens which attack tissue weakened from other causes. Either fungus is capable of causing dieback, but frequently both are found together. Fruiting structures of coral spot Nectria canker are generally reddish orange to brown in color and often protrude from the lenticels of the bark. *Steganosporium* fruiting structures are black.

We recommend judicious pruning to maintain tree vigor and to remove disease-producing inoculum. Careful selection of planting sites to avoid environmental stress may retard decline in urban maples.

Cristulariella Leaf Spot (caused by *Cristulariella* spp.) - This disease, which caused extensive leaf spotting and defoliation especially of boxelder in south central Maine in 1990, has since all but disappeared. Apparently the weather conditions which favor this disease, consecutive hot, summer days and nights with high dew points, have not recurred in Maine since that time.

Dogwood Anthracnose (caused by *Discula destructiva*) - Dogwood anthracnose, a serious disease of native flowering dogwood in the northeastern United States since the late 1970's, was first found in Maine in 1992. Surveys for this disease since that time have failed to find the disease outside of York County (Figure 17). While it apparently does not occur in the only

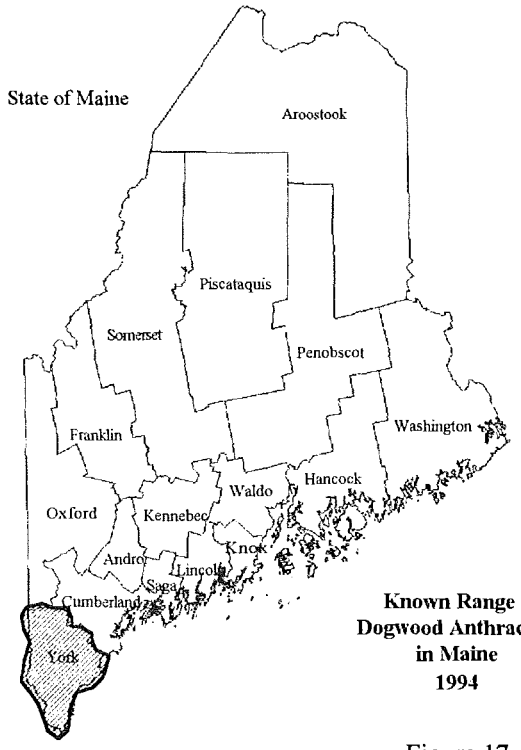


Figure 17

natural stand of flowering dogwood known to us in Maine (on Mt. Agamenticus in Kittery), the disease has been found to be present on ornamental flowering dogwood in York Village and in Kittery. Our native dogwoods other than *Cornus florida* appear to be resistant to this disease, so it seems unlikely that the causal organism will spread around the state on other species.

American flowering dogwood is a useful ornamental in Maine only in protected southern and south coastal locations. The lovely Chinese flowering dogwood (*Cornus kousa*) is somewhat hardier, and much less susceptible to dogwood anthracnose. We suggest it as an alternative, although it flowers a month or so later than *C. florida* and may have a bit of difficulty making it through its first Maine winter.

Dogwood anthracnose is characterized by small, purple-rimmed spots or larger tan blotches on leaves, and by watersprouts on trunks and larger branches. Control efforts are practical if trees are not heavily infected, and consist of pruning infected branches to reduce inoculum, repeated applications of fungicidal sprays, and conscientious cultural practices to enhance tree vigor.

Dutch Elm Disease (caused by *Ophiostoma ulmi* and *Ophiostoma novo-ulmi*) - Symptoms of Dutch elm disease were quite conspicuous throughout Maine during 1994 and generated numerous inquiries of our staff.

Many old elms which escaped the initial wave of infection are now succumbing each year, at least partially the result of the development of more aggressive strains of the disease organism. While protecting these older specimens is the concern of most of our clients, we occasionally receive calls regarding mortality of younger elm trees (4-8" dbh and 20-30 feet tall). Such trees are frequently numerous in old field areas, the progeny of susceptible old elms now long gone. The progeny are, of course, also susceptible to Dutch elm disease and, due to their high numbers and density, are extremely vulnerable to mini-epiphytotics (epidemics).

Problems arise when such areas become developed into residential lots. Often the predominant tree species on such sites, there is a tendency to include the small elms in landscape plans, sometimes with disastrous results. In one recent case, young elms were used to provide the sole canopy for a collection of shade loving plants, the planting having been completed just as Dutch elm disease became epiphytotic on the site. Hopefully the homeowner, through sanitation practices, will be able to stabilize the epidemic or retard tree loss long enough to establish a tree canopy of some alternate species.

Control of this disease remains a challenge for arborists and others in the green industry. Planting of resistant cultivars, derived from European or Asiatic sources, is a practical approach. While injections with systemic fungicides and sprays for bark beetle control may provide some level of protection, these techniques should be combined with a systematic program of sanitation (removal of nearby dead or dying trees) in order to be really effective.

Eastern Dwarf Mistletoe (*Arceuthobium pusillum*) - Severe damage as the result of infection by this parasitic plant is still occurring in stands of white spruce in coastal areas of Maine. Trees of landscape value succumb each year in the yards of coastal residences as this organism gradually drains trees of their vigor. Removal of witches' brooms (infected portions of branches), together with appropriate fertilization, generally helps to maintain the vigor of affected landscape trees.

Dwarf mistletoe also frequently occurs on black spruce, particularly in bogs, and on red spruce in forest situations. Brooms on red spruce are often more poorly developed than on white or black spruce and may be overlooked. However infected residual trees left during timber harvesting activity can result in the infection of spruce regeneration. Infected trees should therefore be identified if possible and removed during the harvesting operation.

During 1994, calls for assistance in controlling dwarf mistletoe in residential situations came from Bristol, South Bristol, East Boothbay, Boothbay Harbor and North Haven Island. It was also reported from a forest health monitoring plot in Cutler.

Entomosporium Leaf Spot (caused by *Entomosporium mespili* syn. *Fabraea maculata*) - We received only one specimen of this disease in 1994, from Falmouth. The host plant in this case was hawthorn, but we commonly find the disease on mountain ash as well.

Resistant hawthorns are available in the trade, the Washington hawthorn *(Crataegus phaenopyrum)* being among the best. English hawthorn is very susceptible and may require the application of fungicides for effective control. Mancozeb and chlorothalonil are registered in Maine for this purpose. Where this disease is a problem, cultural controls such as raking fallen leaves to reduce inoculum in subsequent years is often helpful. Sprinkler irrigation and summer pruning should be avoided.

European Larch Canker (caused by *Lachnellula willkommii*) - European larch canker is a fungal disease which originated in Europe and was first found on native larch (tamarack) in southeastern Maine in 1981. Information gathered from existing cankers indicates the disease has been present in Maine since at least the 1960's. This disease may infect any species of the genus *Larix* or *Pseudolarix*. Since larch canker has the potential for causing serious damage to both native larch stands and reforestation projects utilizing non-native larches in Maine and elsewhere, the disease is under state and federal quarantine (Figure 18 and page 56).

Each year we survey a few towns close or adjacent to known infested areas to check for evidence of disease spread. Surveys in 1994 in Blue Hill, Castine, Orland, Penobscot and Stockton Springs all proved negative, which suggests that no changes in the quarantine boundary are presently required.

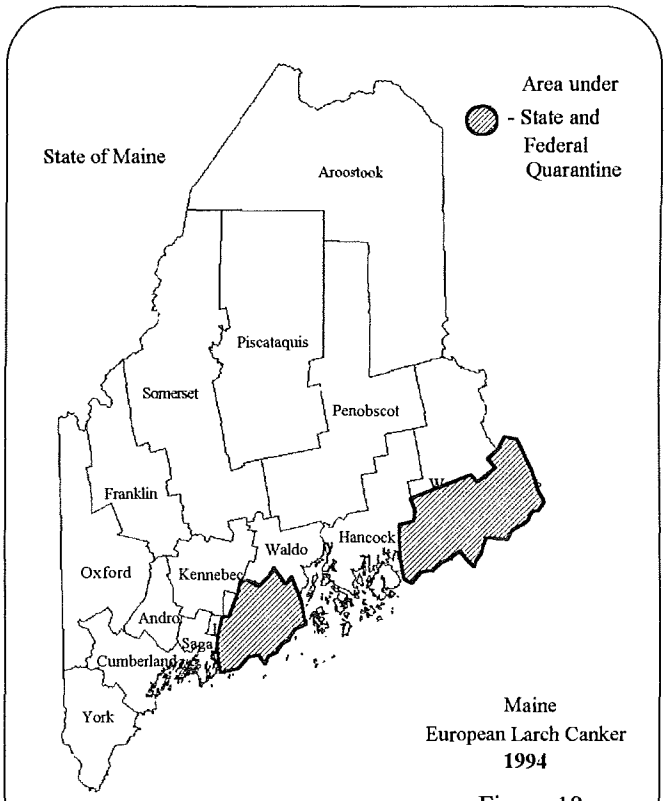


Figure 18

Fir-Fern Rust (caused by *Uredinopsis* sp.), and Fir Fireweed Rust (caused by *Pucciniastrum epilobii*) - We received relatively few reports of fir-fern rust and fir-fireweed rust from Christmas tree growers in 1994, perhaps due to the success of growers in eradicating alternate host plants. But successful infection periods apparently did occur last year, as we picked up one rust or the other in 9 of 87 forest health monitoring plots.

Hardwood Decline in Northwestern Maine (caused by multiple stressors) - A dieback and decline of hardwood species became conspicuous in much of NW Maine last season. The hardwood species most affected were beech, maple (especially red maple), and birch (especially yellow birch). Industry foresters and several large landowners expressed concern that the problem seemed to be increasing in severity. The dieback and decline is apparently of several years duration and affected areas did seem generally to have increased in both area and intensity during 1994 (Figure 19). Affected stands are primarily on hillsides and ridges, and are therefore conspicuous from quite a distance.

Our preliminary assessment is that this is a decline caused by multiple stressors, due to the cumulative and progressive impact of such factors as past drought, defoliating insects, frost, canker fungi, Armillaria root rot and in the case of beech, beech bark disease. It does not seem to represent any long term threat to forest health, as it is affecting primarily mature and overmature trees. Forest regeneration beneath affected trees appears healthy. Landowners affected by this decline syndrome are advised to accelerate harvesting of affected trees to the extent practicable. Hardwood declines such as this have occurred periodically in northeastern forests for generations.

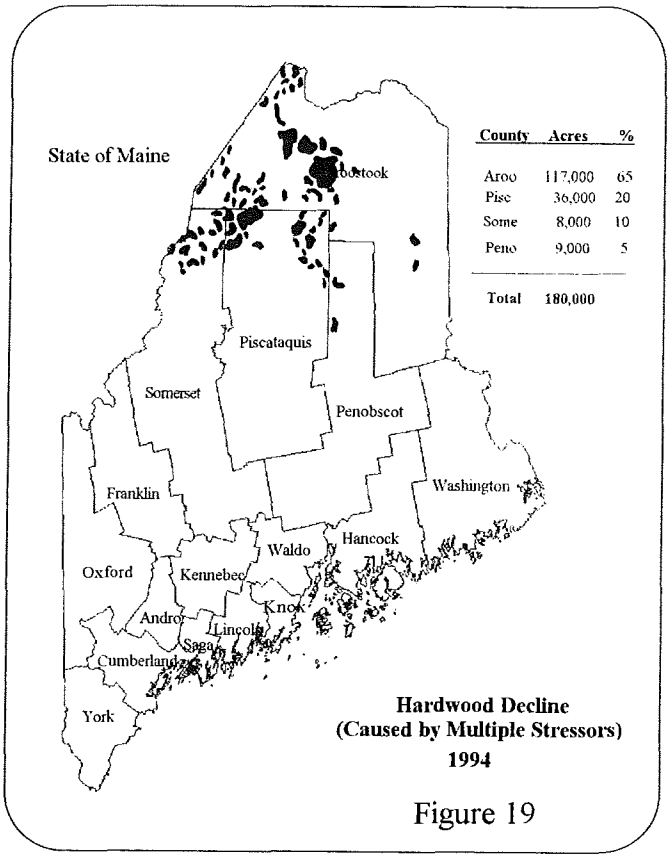


Figure 19

Heat Injury to Conifers (caused by the sudden onset of hot weather in the spring) - The extensive damage to tender emerging growth of balsam fir which was caused by the sudden onset of high temperatures in June of 1993 did not recur in 1994.

Heavy Seed Production - Many species of trees and shrubs produced seeds or cones in unusual abundance during 1994. In some cases this was expected, especially in the case of balsam fir, where we suggested that Christmas tree growers harvest as many trees as possible with large numbers of cone buds during the 1993 Christmas tree season to avoid cone problems in 1994. For certain other species, particularly the deciduous hardwoods and deciduous shrubs, we were caught off guard. We received many calls in 1994 of trees with thin crowns, particularly red maple where the heavy seed set had caused trees to divert most of their resources into maturing seed rather than pushing new foliage growth.

The heavy cone production in balsam fir, both male and female cones, caused inquiries throughout the season. Early in the season calls of odd growths on branches turned out to be male cones and, after male cones dried and withered leaving only basal cone remnants, calls came in remarking how heavy the "spruce gall aphid" was on balsam fir "this year." Then, late in the year we received a call about mushrooms in the tops of fir trees which turned out to be shattering cones with an exposed cone axis and a few cone scales attached at the top.

Herbicide Damage (caused by misapplication of registered weed killers) - We continued to receive many complaints in 1994 about desirable landscape plants being damaged by registered herbicides. Many of these herbicides are designed to eliminate broadleaved weeds from lawns but are easily taken up by tree roots growing beneath the lawn surface. Lawn care products containing dicamba (Banvel) are especially risky in the root zone of desirable trees. But some of the newer lawn care herbicide formulations seem to be causing problems as well, especially to hemlock hedges where hemlock borders fine turf areas.

We suggest that if such herbicides must be used near the root zones of desirable plants, that application rates in those areas be cut in half.

Horse-chestnut Leaf Blotch (caused by *Guignardia aesculi*) - This disease seems to occur every year wherever horse-chestnut grows in Maine. In 1994, the expression of disease symptoms was up a bit over 1993, but not extreme. Damage, although aesthetically objectionable, is not generally considered serious.

Hypoxylon Canker (caused by *Hypoxylon* spp.) - This is perhaps the most serious disease of aspen (poplar) in Maine and is present throughout the state. Cankers begin as sunken yellowish areas on the stem and enlarge rapidly. Bark frequently assumes a loose, blistered appearance at first then becomes gray-black and crusty as cankers age. Frequently trees break off at the point of cankers during ice, snow, or wind storms.

In 1994 this disease was reported from only 3 of 87 forest health plots, but is present in most poplar stands wherever they occur within the state.

Lichens - Lichens growing on dead and dying conifers are frequently and falsely accused of having a role in tree decline and death. We had several reports in 1994 from landowners concerned about lichens, particularly in downeast Maine. Lichens certainly look as though they ought to be parasitic and many people have a hard time believing that they are not. While they do grow profusely on declining and dead trees, those trees are almost certainly dying for other reasons.

Lichens are comprised of fungi and algae growing symbiotically. Since the algal component is a green plant, light is required for growth. Lichens grow more rapidly when exposed to full light, which explains their profusion on dead trees.

Mechanical Damage - Mechanical damage to trees and shrubs seemed to generate more inquiries than usual in 1994. The causes of this injury ran the gamut from snowplow damage in Randolph; construction damage around residences in Kittery, Kennebunkport and Winslow; stringtrimmer injury in Presque Isle; sewer line construction in Auburn; grounds maintenance equipment damage in Waterville and Machias, and careless handling damage to nursery stock near Portland.

Mouse Damage - During the winter of 1993-1994 heavy snows coupled with frozen ground and an abundant population of hungry rodents resulted in heavier than usual girdling damage to a wide variety of small trees and shrubs. Most of the damage was fairly local. While some damage occurred in plantations much more was reported from home grounds and orchards especially those in or adjacent to unmowed fields. While a number of species of mice or voles could have been involved, the **meadow vole** (*Microtus pennsylvanicus*) was the prime suspect in most cases.

A wide variety of hosts were affected and range from lilac, euonymous, and juniper to apple, larch, maple and oak. Even trees protected with plastic wrap were affected and, as the snows built up over the wrap, girdling often occurred above it. Several experienced nurserymen said that this problem was the worst and most widespread that they had seen in 15-20 years.

Nutrient Deficiences - The majority of requests to us for assistance with nutrient problems come from plantation owners, particularly Christmas tree growers. But occasionally we receive homeowner calls. In homeowner situations in 1994 the most common problems arose when trees and shrubs were planted on the wrong sites. Iron and manganese deficiencies were common on limey sites, especially near concrete foundations, and nitrogen deficiencies were common on excessively drained sandy sites or where large amounts of undecomposed organic matter (especially sawdust) had been used as mulches or soil amendments.

Oak Wilt (caused by *Ceratocystis fagacearum*) - To date there is no evidence that this disease occurs in Maine.

Phomopsis Galls (caused by *Phomopsis* sp.) - Every year we receive a few calls regarding the presence of galls on various species of hardwoods, especially red and black oak. These galls are often very conspicuous,

ranging from the size of a pea to the size of a basketball, and are especially evident when leaves are off trees. Typically only one or two trees will be affected in the landscape, with neighboring trees apparently not susceptible. Frequently galls will cause dieback of smaller branches, but generally trees seem to tolerate infection fairly well.

This is a difficult disease to diagnose with certainty because no fungal fruiting bodies are apparent on the galls. The fungus must be cultured from infected tissue and allowed to fruit before a positive diagnosis can be made.

Little is known about the etiology of this disease and it is therefore difficult to recommend effective control actions. However we suggest that in forest stands affected trees be harvested early or as encountered to reduce inoculum. In landscape settings affected trees should be diagnosed early so that attempts may be made to prune infected tissue from trees before the disease gets out of hand.

Pine-Pine Gall Rust (caused by *Endocronartrium harknessii*) - This disease occurs in natural stands as well as forest and Christmas tree plantations in Maine. We have found it in natural stands of jack pine in such diverse locales as Parlin Pond and Steuben, and in plantations of Scotch and jack pine from all over the state. It occurs especially frequently in Scotch pine plantations, even where no nearby infection is present in the wild, as the result of the planting of infected nursery stock.

Once established in a plantation this disease may be hard to manage. Removal of infected trees (or branches containing galls) early in the rotation and before the end of April each year will help keep the disease from spreading to healthy trees. It is important when establishing plantations of hard pines to plant only healthy nursery stock.

Pinewood Nematode (*Bursaphelenchus xylophilus*) - Pinewood nematode in Maine is primarily a problem of stressed trees, especially those stressed by being planted off site. But many plantations (including ornamental plantings) are in fact established off site and we suspect that pinewood nematode has played a role in the mortality of pine and perhaps other species in such situations, even though the presence of pinewood nematode was never confirmed. The pinewood nematode, which causes the most serious disease of pines in Japan (pine wilt), also ocurs in the United States in all states east of the Mississippi River. Although pinewood nematode (PWN) was not discovered in the United States until 1929, it is considered to be a native, not introduced, pest. There is no indication that PWN has ever caused large scale mortality of conifers in Maine or elsewhere in North America.

We have conducted limited surveys for pinewood nematode in Maine since 1983 but have found it infesting only three coniferous species: balsam fir, white pine, and red pine. However it may be present in the wood of other coniferous hosts here as well.

Porcupine Injury (caused by *Erethizon dorsatum*) - Last spring we revisited several landscapes, forest stands, and Christmas tree plantations where porcupines had caused heavy destruction during the previous winter (1992-93). We found that similar damage levels had occurred during the 1993-94 winter season, in the same areas, and often on the same trees. Porcupine populations tend to run in cycles of 10 to 20 years and we seem to be at a high point in one of those cycles.

Where porcupines are a problem they may be easily dispatched with a shotgun assuming they can be found. They are quite conspicuous on warm spring days sunning themselves or feeding in deciduous trees before leaves emerge. But they will also feed heavily on conifers and are often inconspicuous hidden within evergreen foliage. When feeding on evergreens, however, they cut quantities of partially chewed twigs from trees. These accumulate beneath trees and often make it possible to locate porcupines you might otherwise miss. Toward evening, porcupines tend to move about on the ground, especially at dusk, and during the night may often be found feeding or climbing about in trees in hedgerows. In 1994, porcupine damage was noted in only 1 of 87 forest health monitoring plots.

Salt Damage - We observed two distinct types of deicing salt damage to roadside conifers during the winter and spring of 1994. One type was caused by salt spray which was "whipped up" from salted roads by passing traffic and which drifted to nearby evergreen foliage. The other type was the result of root uptake of salt which melted from road surfaces. This latter effect generated numerous inquiries of our staff, particularly as it affected roadside hemlocks.

Browning of hemlock foliage was striking, and often occurred in drainages away from heavily salted roads for a considerable distance. In these drainages white pine and balsam fir also frequently showed symptoms of root uptake of deicing salts.

Foliage browning due to the action of passing traffic in generating salt spray was most severe on lower portions of tree crowns, decreasing in intensity toward the tops of trees. Browning caused by root uptake (and perhaps soil osmotic disturbances) tended to extend to all portions of tree crowns and was usually more striking. In some instances both types of injury were present on the same tree.

As the season progressed, many trees affected by root uptake of salt subsequently died. Trees browned due to salt deposition on foliage fared considerably better, in most cases simply casting injured foliage and replacing lost photosynthetic capacity with new growth.

Scleroderris Canker (caused by *Ascocalyx abietina*) - No new infestations of this disease were located during 1994.

Sirococcus Shoot Blight (caused by *Sirococcus conigenus*) - *Sirococcus conigenus* is a pathogen of many conifers, occurring in Europe and North Africa as well as in North America. We have reported it here in the past primarily as a pathogen of red pine, especially as it affects natural stands and plantations in northwestern Maine. It is also occasionally a problem in Maine on ornamental pines and blue spruce, and in forest nurseries, where it is sometimes introduced on infested seeds.

However in the spring of 1994 we observed a severe outbreak of shoot blight on eastern larch (*Larix laricina*) which extended over large portions of Washington, Hancock, and Penobscot Counties. We had observed similar outbreaks in 1988 and 1989 but were unable to determine the cause. In 1994, however, the fungus *Sirococcus conigenus* was fruiting abundantly on affected twigs, and it seems likely that *S. conigenus* was involved in the 1988 and 1989 outbreaks as well.

Efforts to delineate the precise boundaries of the 1994 outbreak through aerial surveys were frustrated by the heavy cone production of eastern larch in 1994 which masked shoot blight symptoms when affected trees were viewed from the air. But the problem clearly was most severe in the eastern Maine counties noted above, particularly east of the Penobscot River.

Site Disturbance - Many calls were received in 1994 involving trees which had been stressed or killed as the result of various types of site disturbance. Sometimes the causes were of recent origin, such as sudden changes in drainage patterns; in other instances the causes were chronic and cumulative, such as soil compaction due to years of repeated foot and vehicle traffic. Among the calls were fill over roots from West Bath, Springvale, and Boothbay; septic drain field construction in Kennebunkport; soil compaction on a college campus in Waterville as well as on an outdoor survival course in Ellsworth; and drainage problems resulting from poorly designed road construction in Harpswell.

Sphaeropsis Blight (caused by *Sphaeropsis sapinea* syn. *Diplodia pinea*) - This disease, primarily of two-and three-needle pines, seems to have increased in severity in recent years, especially on red pine in mid-coastal areas. Plantation pines seem especially hard hit with symptoms ranging from tip blight to the death of entire trees.

Other than in older red pine plantations in coastal areas, this disease is mostly a problem in landscape plantings around homes and estates, parks, along roadsides and on golf courses. It is generally not a problem in the natural forest environment.

Spring Frost - Frost early in the morning of May 28 damaged fir in the usual frost pockets statewide, and was particularly damaging in the Mars Hill-Presque Isle area of Aroostook County. While in general this frost was considerably less damaging than that of May 19, 1991, it was severe enough in many areas to affect the quality of Christmas trees.

Squirrel Damage - As snows accumulated in northern Maine during the winter of 1993-1994, heavy cone and pollen bud production on balsam fir provided ample food for hungry **red squirrels** (*Tamiasciurus hudsonicus*). In one area southwest of Fort Kent, cooperators reported a blanket of fir tips on the snow beneath some trees. They had observed red squirrels clipping off the tips and eating the buds as if the tips were ears of corn. This is a rare first-hand observation confirming what we had speculated to be the cause of this type of damage.

Squirrel damage was again apparent later in the season in southern Maine. High populations of hungry **gray squirrels** (*Sciurus carolinensis*) and an abundant acorn crop in September resulted in considerable oak twig pruning in some areas of Kennebec County. Pruned tips with acorns still attached often littered the ground. In some cases the squirrels exhibited poor judgment though , pruning tips which did not have acorns attached.

Stillwell's Syndrome (associated with *Armillaria* spp.) - The occurrence of this disease seemed unchanged from 1993. No new concentrations of red fir were found in any of the affected portions of the state. Even though new symptomatic trees appear each season, rates of occurrence remain generally low. Damage in 1994 was at a very low intensity (<2 percent) and was limited to scattered, individual fir trees.

White Ash Dieback (caused by heavy 1992 seed production plus likely cold weather stress) - Scattered individual white ash trees, particularly females which bore heavy seed crops in 1992, leafed out relatively late in 1993 and contained many dead shoots especially in mid to lower crowns. This phenomenon was not limited to Maine but was common throughout New Hampshire and Vermont as well.

As the 1993 season progressed, most affected ash improved somewhat in appearance, particularly at the tops of tree crowns, but a great many trees were still decidedly thin at the time of autumn coloration.

During 1994 crowns of affected trees continued to improve, although many still have not yet resumed a normal appearance.

White Pine Blister Rust (caused by *Cronartium ribicola*) - We continue limited control efforts to manage this disease in certain high value pine stands each year, but due to funding constraints we no longer are able to cover the entire resource in a timely manner. In 1994 a total of 4,221 acres of high quality pine timber were scouted for Ribes plants in Cumberland, Oxford, and York counties. A total of 5,594 Ribes were destroyed.

Each year we receive a few homeowner calls regarding blister rust infections in landscape trees, especially from older housing developments which were established in old fields which were then regenerating to white pine. Often regenerating pines were left to become landscape trees, even though many had been infected by the blister rust fungus. Now, as they begin to die, we get called in to try to "save" them, though it is often too late. While our control program to protect the white pine resource does not extend protection to landscape trees, we can and do recommend pruning or excision of cankers from infected landscape pines to eliminate disease infections once they have occurred, assuming we can catch them early enough. See also Quarantines page 56.

Winter Injury - The winter of 1993-1994 was unusually harsh, particularly in terms of record breaking low temperatures, but the season was also characterized by heavy snowfalls and heavy icing conditions. Some of the effects were apparent early on forest and landscape plants, while others developed as the season progressed.

Winter browning of red spruce foliage was again apparent in the western mountains of Maine, on Isle au Haut, and on scattered individual trees elsewhere in the state, but was less severe than the previous year. Snow and ice breakage of stems and branches of shrubs and trees was apparent statewide, particularly in parts of central and southwestern Maine.

Cold weather effects were wide and varied. Flowering shrubs did not blossom well and died back in many cases. Unheated greenhouses used to successfully overwinter conifer seedlings in containers in most years were not adequate to protect against cold temperature damage to root systems. Some plant varieties of marginal hardiness succumbed completely in landscape situations. By mid-season we had received reports of winter injury from Fryeburg, Lewiston, Lisbon Falls, Lovell, Rangeley, South China, Thorndike, Township D, and Upper Cupsuptic Township.

Compiled and Edited by Richard G. Dearborn and Clark A. Granger

95-1 Insect and Disease Management Division Augusta, Maine

Forestry Related Quarantines in Maine

There are four forestry related quarantines which are in effect in Maine. They are: White Pine Blister Rust, Gypsy Moth, European Larch Canker, and Hemlock Woolly Adelgid.

I. The White Pine Blister Rust Regulations and Quarantine are listed under Title 12 MRSA 1988, Subchapter III, §803:8305 Shipment Prohibited.

The director may prohibit, prevent or regulate the entry into or movement within the State, from any part thereof to any other part, of any plants of the genus *Ribes* or other nursery or wildling plants, stock or parts of plants which may cause the introduction or spread of a dangerous forest insect or disease. The director may issue the necessary orders, permits and notices necessary to carry out this section which shall not be considered to require or constitute an adjudicatory proceeding under the Maine Administrative Procedure Act, Title 5, Chapter 375.

Regulation: White Pine Blister Rust, Quarantine on Currants and Gooseberry Bushes.

A. The sale, transportation, further planting or possession of plants of the genus *Ribes* (commonly) known as currant and gooseberry plants, including cultivated wild, or ornamental sorts) is prohibited in the following Counties in the State of Maine, to wit: York, Cumberland, Androscoggin, Kennebec, Sagadahoc, Lincoln, Knox, Waldo, Hancock, and parts of Oxford, Franklin, Somerset, Piscataquis, Penobscot, Aroostook, and Washington.

B. The planting or possession of European Black Currant, *Ribes nigrum* or its varieties or hybrids anywhere within the boundaries of the State of Maine is prohibited. This quarantine is administered by the Insect & Disease Management Division of the Maine Forest Service, phone 287-2431 or 287-2791.

II. The Gypsy Moth Quarantine is listed under 7 CFR Part 301.45, United States Department of Agriculture, Animal & Plant Health Inspection Service, Plant Protection and Quarantine as printed in the Federal Register.

A. This quarantine designates the infested area in Maine as quarantined for the movement of regulated articles, which includes wood such as logs, pulpwood, trees, shrubs, firewood, Christmas trees, and chips, and requires the inspection and certification of such material if movement is to non-infested states and foreign countries. This is administered by the USDA-APHIS, PPQ in Bangor, Maine, phone 945-0479.

B. Inasmuch as Maine is not completely infested and quarantined, wood or regulated articles moving from the infested area of the state to the non-infested area must be accompanied by a certificate or go to a mill under state compliance agreement which allows the reception of such articles. Regulated articles moving from the non-infested area of the state to other non-infested states or non-infested parts of Canada must be accompanied by a state permit stating that the regulated article originated outside of the infested area of the state. This is managed by the Insect & Disease Management Division of the Maine Forest Service, phone 287-2431 or 287-2791.

III. The European Larch Canker Quarantine is listed under 7 CFR Part 301.91 of the United States Department of Agriculture, Animal & Plant Health Inspection Service, as published in the Federal Register, and also under Title 12 MRSA, §8305 of the Laws of the State of Maine.

A. This quarantines all parts of larch (*Larix* spp.) including logs, pulpwood, branches, twigs, etc., as regulated articles.

B. Also any other product, article, or means of conveyance whatsoever, when it has been determined by an inspector that it presents a risk of spread of the disease.

C. Designates parts of Hancock, Knox, Lincoln, Waldo, and Washington Counties as the quarantined area from which movement is restricted.

This is managed by the USDA-APHIS, PPQ in Bangor, Maine, phone 945-0479, and the Insect and Disease Management Division of the Maine Forest Service, phone 287-2431 or 287-2791.

IV. The Hemlock Woolly Adelgid Quarantine is listed under 7 MRSA, Chapter 409, §2301-2303 of the Laws of the State of Maine.

This quarantine was adopted to attempt to prevent the introduction of the Hemlock Woolly Adelgid (*Adelges tsugae* Annand) into Maine. This pest has been found to cause mortality of Eastern Hemlock (*Tsuga canadensis*) in infested states. Since hemlock is a major component of Maine's forest on over one million acres, protection of this valuable resource from damage by the Hemlock Woolly Adelgid is essential.

A quarantine is established against the following pest and possible carriers.

A. Pest: Hemlock Woolly Adelgid (*Adelges tsugae* Annand).

B. Area Under Quarantine: The States of Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Alaska, California, Oregon, Washington, and the District of Columbia.

C. Articles and Commodities Covered: Hemlock seedlings and nursery stock, logs, lumber with bark, and chips.

D. Restrictions: All articles and commodities covered are prohibited entry into the state from the area under quarantine unless specified conditions (listed below) are met.

1. Hemlock seedlings and nursery stock are: admissible into Maine provided each lot is accompanied by a certificate issued by the Department of Agriculture or Conservation of the State of the origin with an additional declaration that said material is free from Hemlock Woolly Adelgid.

2. Hemlock logs, lumber with bark, and chips are: admissible provided that said material is only shipped to preapproved sites within Maine. Such shipments must be made under a compliance agreement between the shipper and the Maine Forest Service, Department of Conservation. If said material is shipped to other sites, it must be accompanied by a certificate issued by the Department of Agriculture or Conservation of the state of origin affirming (a) the material was grown in the state of origin, and that either (b) the material is free from Hemlock Woolly Adelgid, or that (c) the material originated from an uninfested area in the state of origin.

This quarantine is administered by the Maine Department of Agriculture, phone 287-3891 and the Insect and Disease Management Division of the Maine Forest Service, phone 287-2431 or 287-2791.

From: Maine Dept. of Conservation, Maine Forest Service
I&DM Summary Report No. 9 - Mar. 1995

THE HEMLOCK LOOPER IN MAINE - 1994
and a
FORECAST FOR 1995

Prepared by
Henry Trial Jr.

INTRODUCTION

The infestation of eastern hemlock looper (*Lambdina fiscellaria*) that began in Maine in 1989 showed a near complete collapse in all surveyed areas in 1994. Observations during the summer of 1994 revealed that larval numbers were much lower than had been predicted by the 1993 egg survey in northeastern Washington and southern York Counties. These two areas were the only portions of the state where moderate to high looper egg densities had been recorded during the 1993 egg survey. Scattered pockets of larvae were seen in Washington and York Counties but larval feeding did not produce defoliation detectable by either aerial or ground surveys.

Surveys of the hemlock looper infestation and technical assistance to owners of looper damaged forest stands continued in 1994 but at a sharply reduced level due to the reduced infestation. MFS survey and evaluation activities in 1994 included response to a reduced number of technical assistance requests from private and industrial landowners, surveys of larval population density, aerial and ground defoliation and damage surveys, assessment of moth activity with light and pheromone traps, and a greatly reduced egg density survey to predict 1995 population levels.

Larval Observations

Population predictions generated from overwintering egg densities were checked in the spring of 1994 using a larval "beating" survey. The survey did not extend over the entire area that had been evaluated with egg sampling but many of the areas predicted to have moderate to severe larval density were checked. Many infested areas had far fewer second instar larvae than had been predicted by the egg survey. No larvae were found in some areas checked and when larvae were found, numbers were low and occurred in small clusters.

Defoliation

An aerial and ground survey of 1994 hemlock looper defoliation was conducted in September and October to map any moderate to severe defoliation. No defoliated areas meeting the mapping threshold were found in 1994. The lack of defoliated areas was certainly due to low larval numbers in most areas. Even in the few areas with higher larval numbers, larvae were too scattered to cause significant defoliation or larvae did not survive beyond the early instars. Moderate defoliation had been mapped on 42,000 acres in 1993.

Light Trap Survey

The MFS continued to use its light trap network to assess hemlock looper moth activity in 1994. As in 1993, the operating period of 12 traps in the MFS network (Figure 1) was extended to include the looper moth flight period. In 1994 the extended operation ran from August 17 through the end of September.

Looper moths were caught in 10 of the 12 light traps operated for looper in 1994 (Table 1) but the catch at all locations except Chesuncook was considered low. Moth catches at all other locations were either lower than the 1993 catches or in a few locations unchanged. The general trend in looper moth catch in light traps has been steadily downward since the peak of the looper infestation in 1991.

Table 1: Hemlock Looper Light Trap Moth Catch - Maine 1991 - 1994												
Location	1991			1992			1993			1994		
	#Male	#Fem	Total	#Male	#Fem	Total	#Male	#Fem	Total	#Male	#Fem	Total
Allagash				5	4	9	1	1	2	0	0	0
Arundel										0	2	2
Calais	318	5,084	5,402	78	1,338	1,416	11	32	43	2	4	6
Chesuncook	30	16	46	11	5	16	9	4	13	58	29	87
Greenbush	9	42	51	2	4	6	0	1	1	0	1	1
Haynesville	9	18	27	3	2	5	0	0	0	0	0	0
Mt. Vernon	13	19	32	9	25	34	1	4	5	0	1	1
N. Bridgton	76	17	93	93	15	108	52	15	67	20	2	22
S. Berwick				244	159	403	156	130	286	9	3	12
Steuben	12	375	387	8	21	29	2	2	4			26
Topsfield	31	111	142	35	50	85	5	8	13	7	6	13
Washington	59	32	91	63	10	73	22	13	35	35	5	40

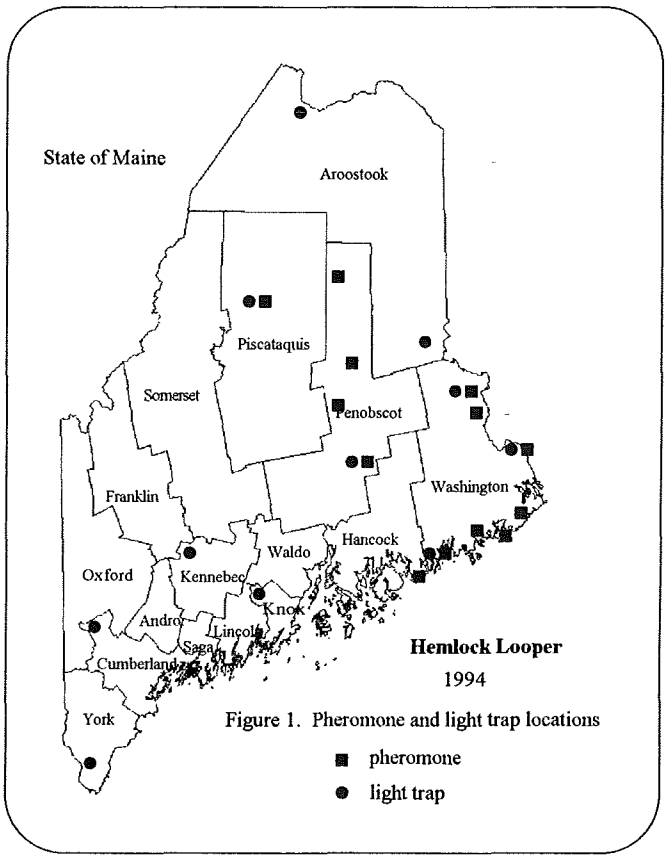


Figure 1. Pheromone and light trap locations

■ pheromone

● light trap

Moth Trapping With Pheromones

In addition to light traps, the MFS used pheromone baited traps in 1994 to assess looper moth activity. Thirteen locations were trapped in 1994 compared to 16 in 1993. Ten trap sites were the same in 1992, 1993, and 1994. Three looper pheromone baited traps were placed in a triangular pattern at each location (Figure 1). Moth catch was reported as the mean number of moths captured per trap (Table 2).

In contrast to very low levels of larval density and low moth activity as assessed with light traps, pheromone trapping produced relatively high numbers of moths at all locations. Moth catches in 1994 were much higher than the 1993 catch at the same locations and in some locations, more moths were caught in 1994 than had been trapped in 1992. The reasons for such a significant moth catch with pheromones when all other measures of population density declined are unknown. Weather during the looper moth flight period was extremely mild but mild weather should have also increased the light trap catch. The potency of the pheromone used in the traps may have been greater than in past seasons but the relative attractiveness of the lures is not known. A final possibility is an actual increase in looper moth activity which was detected with pheromones and not with light traps.

Table 2. Hemlock per Pheromone Trap Moth Catch - Maine - 1992, 1993, 1994

Location	Moths Per Trap			Location	Moths Per Trap		
	1992	1993	1994		1992	1993	1994
Allagash	**	6	****	Mars Hill	8	15	****
Bucks Harbor	226	49	217	Millinocket	236	7	123
Calais*	263	23	128	Mt. Vernon*	20	***	****
Chesuncook *	58	***	274	N. Bridgton*	37	***	****
Estcourt	15	5	****	Sebocis Pl.	59	16	128
Frenchville	2	0	****	Steuben*	195	25	84
Gouldsboro	54	29	360	Topsfield	**	***	274
Greenbush*	173	59	253	T6 R8	61	23	344
Jonesboro	74	27	179	Watte	**	109	189
Lincoln	53	12	****	Whiting	239	35	196

*near MFS light trap location, **not used in 1992, *** not used in 1993, **** not used in 1994

Predictive Egg Survey

Initially very little egg sampling for hemlock looper population prediction and been planned because of the apparent collapse of the looper outbreak. However, because moth counts in pheromone traps were very high in many areas, plans were changed and a reduced level of egg density sampling was conducted in areas near the pheromone trap locations with the higher moth catches. Egg samples were also taken in areas that had some level of larval activity in 1994. Areas with some larval activity in 1994 included northeastern Washington and southern York Counties.

The initial set of egg density samples for the 1994 -95 prediction was collected in January and processed in early February of 1995. Higher than expected egg density levels were found at several of the locations assessed. Samples collected in northern Penobscot County, near Matagamon Lake, showed significant egg densities for the first time. High egg counts were also recorded from areas near Topsfield. Pheromone catches in these areas were high in 1994. Several other areas that had high moth catches in 1994 did not produce any significant number of

eggs from samples collected nearby. These areas included Chesuncook, Gouldsboro, Jonesboro, Greenbush, and Bucks Harbor.

Several sample locations in north central Washington County were found to have moderate to high egg densities. These were some of the same locations found to have high or even extreme egg densities during the 1993 - 94 predictive survey. High larval populations did not materialize in 1994 from those eggs and this may be the case again in 1995. Also, egg levels recorded in the 1994 - 95 survey are significantly lower than 1993 - 94 levels. It is interesting to note that all areas sampled in Washington County this winter had only low levels of defoliation.

Scattered moderate, high, and extreme egg counts were also found in central Penobscot, Waldo, and southern York Counties. Waldo and southern York Counties had several areas of moderate to high egg density during last year's egg survey but high egg counts were not found in central Penobscot County last season. Some of this years egg samples from southern York County showed significant defoliation, but samples from Penobscot and Waldo Counties did not.

Because egg density was higher than expected in many areas originally assessed , a second round of egg sampling is planned for late February. These samples will be collected predominantly from towns near where high egg densities were recorded from the first sample . This reevaluation should be completed by early March and results will be given to interested clients.

Impacts

Two studies of the impacts of hemlock looper on eastern hemlock and spruce-fir forests were conducted in Maine and other New England states from 1992 through early 1994. The first study evaluated the impact of hemlock looper *(Lambdina fiscellaria)* on the Maine hemlock stands most severely damage during the recent outbreak is complete and has been published. A report of this study, THE IMPACT OF THE CURRENT HEMLOCK LOOPER, *LAMBDINA FISCELLARIA* (GUEN.), OUTBREAK IN SELECTED SEVERELY DAMAGED STANDS OF EASTERN HEMLOCK , is available from the Maine Forest Service, Insect and Disease Management Division (Technical Report No. 34).

This study of the most severely damaged areas showed that mortality to hemlock trees caused by hemlock looper was spotty and restricted to certain types of site conditions. While severely damaged stands were restricted in size and site, the impacts to these stands were extremely severe. On 28,319 acres mapped as meeting the study threshold for severely damaged stands, 51% of the hemlock stems and 56% of the hemlock volume were killed by looper. The total loss of hemlock in the mapped area was estimated at 440,000 cords. The 28,000 acres mapped as severely damaged represented about 10% of the total area defoliated by looper. Most of the severely damaged stands were located on ledgy sites and most were adjacent to lakes or other bodies of water. The intensity of looper impact was more closely related to these site factors than to more conventional factors associated with a forest pest such as pest density and duration of infestation.

The second impact study was the more general of the two studies and was started after the 1990 season on hemlock stands in Maine and was expanded to include fir stands in Maine and hemlock stands in other New England states in 1991. Stands in other states had been defoliated by *L. athasaria* whereas all stands in the Maine study area had been damaged by *L. fiscellaria*. All plots were remeasured after the 1992 season. Currently, data from this study are being analyzed and a final report will be prepared by March 31, 1995. Preliminary results show that the amount of looper caused tree and top mortality was more closely correlated with site factors than with the level of defoliation in stands. When exposed to similar levels of severe defoliation, stands on dry ledgy sites had significant tree and top mortality whereas stands on good sites had insignificant mortality.

Acknowledgments

The author wishes to thank the Insect and Disease Management Division Technicians, Jody Connor, Everett Cram, Mike Skinner, Grayln Smith, and Dave Stewart who gathered and evaluated most of data used in this report. Mike Devine provided aerial survey data for maps used here and supervised the collection and processing of field data. Finally, the author wishes to thank Don Ouellette for providing the light trap information.

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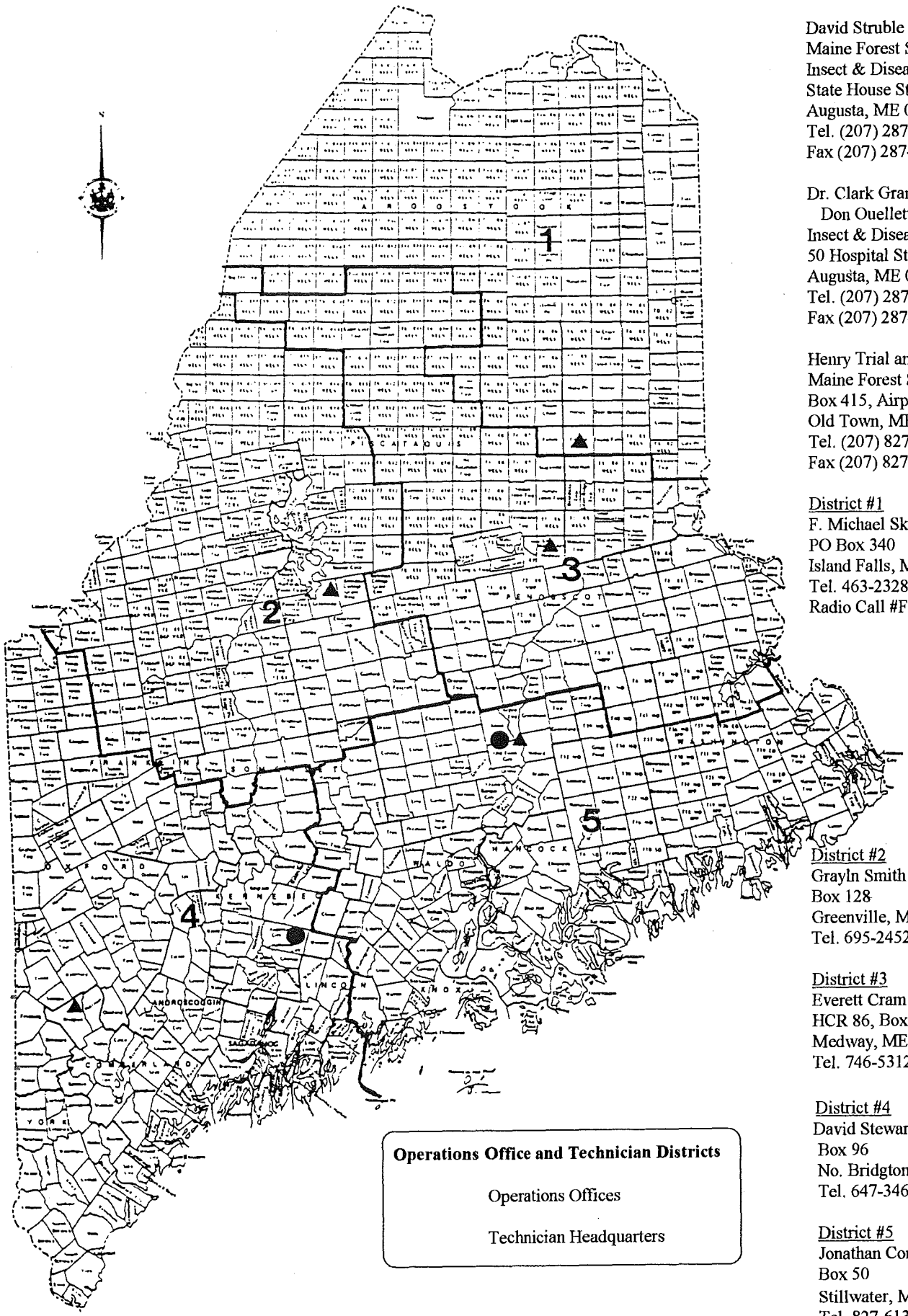

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Tel. 463-2328
Radio Call #F-181

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Tel. 695-2452 Radio Call #F-182

District #3
Everett Cram
HCR 86, Box 22
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Tel. 746-5312 Radio Call #F-183

District #4
David Stewart
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No. Bridgton, ME 04057
Tel. 647-3469 Radio Call #F-184

District #5
Jonathan Connor
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