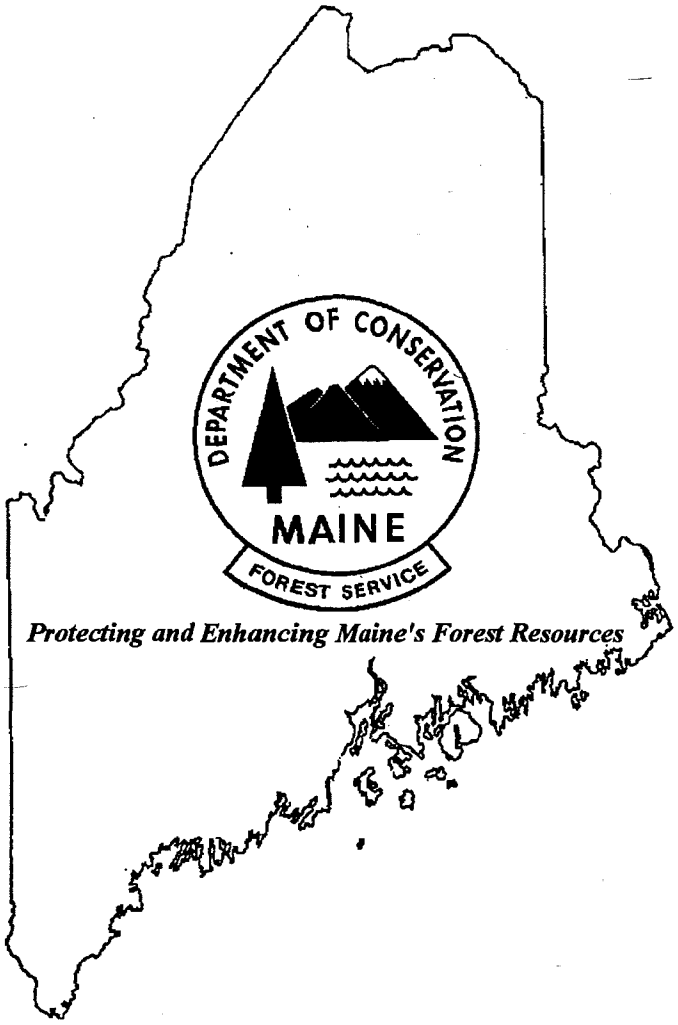
Forest & Shade Tree Insect & Disease Conditions

for Maine

A Summary of the 1996 Situation



Insect & Disease Management Division
Summary Report No. 11
March 1997

Maine Forest Service
MAINE DEPARTMENT OF CONSERVATION
Augusta, Maine

MAINE

Governor

Angus S. King, Jr.

Department of Conservation

Commissioner

Ronald B. Lovaglio

Maine Forest Service

Director

Charles J. Gadzik

Insect & Disease Management Division

State Entomologist

David Struble

Secretary
Marlene Athearn

Diagnostic Lab Operations

Insect Survey
Richard Dearborn

Disease Survey
Clark Granger

Secretary
Betty Barry

Library Aide
Dorothy Arbour

Field Operations

Forest Health Monitoring
Henry Trial

Field/Mapping
Michael Devine

District Assigned IDM Staff

North
F. Michael Skinner

West
Grayln Smith

Central
Everett Cram

East
Jonathan Connor

Cooperative Program Operations

Federal/State Quarantine
Donald Ouellette

Cooperative Pest Management
Richard Bradbury

Cooperative Projects
Charlene Donahue

Table of Contents

Issued 3/97

Printed under appropriation number 013-04A-2100-522 FHB6

Acknowledgements

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. 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: **Kathy Murray**, **Laurie Mann**, **Travis Willey**, 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. Our thanks go too to our clients who keep us apprised of what they see in the course of their work.

Suggestions for Quick Access to Particular Items

This season's report is set up in the same format used in last year's report. The Table of Contents along with the "Highlights" section and the Index should still provide most of the help you need in narrowing down your search for items of particular interest. We have again provided our very brief one-point assessment table for damage level trends for quick review for many of our common problems (Table 1, p. 9). 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** associated with both trees and shrubs in forest, plantation, shade tree and ornamental situations are broken down into only two categories. All **softwood (conifer) insect pests** are grouped in Section A (p. 12). All **hardwood insect pests** are in Section B (p. 22).
- **Miscellaneous insects and other arthropods of medical, nuisance or curiosity significance** have their own section (p. 34) which also includes a table showing the variety of **public assistance** requests received by I&DM.
- **Tree diseases and injuries** are listed alphabetically in a separate section beginning on page 38.

FOREST & SHADE TREE INSECT & DISEASE CONDITIONS FOR MAINE
A SUMMARY OF THE 1996 SITUATION

Comments from the State Entomologist

I would like to take this opportunity to reinforce the message that, in the midst of the public furor regarding the condition and management of Maine's forest resources, within the IDM division we remain committed supporting our core mission: to protect the forest and shade tree resources of the State from significant insect and disease damage; to preserve the overall health of the resource; and to provide pest management strategies for homeowners, municipalities, and forest landowners and managers. Beyond this, I want to use this forum to express my sincere appreciation for the very real contribution which you, our client cooperators, provide to IDM. I would also like to share my perceptions of issues that are looming on the horizon.

Regarding available resources: The present situation represents a continuation of recent trends. With the retirement of Entomology Technician Dave Stewart this past fall, our internal resources are reduced by another position. Offsetting this, we continue to be successful in attracting outside resources to support our program. I continue to actively pursue these opportunities.

In looking at how we have managed to meet the challenge of addressing our mission over the past few years, I am absolutely convinced that our collaborative approach has been key to our successes. The assistance we have received from individuals, other state and local agencies, our counterparts in surrounding jurisdictions, and the federal government has been crucial. Alone we could not have accomplished our goals. Beyond the resources provided, you our clients also provided input and a reality check for the activities we were engaged in, assuring that we remained focused on the most appropriate issues.

Regarding your input: Last year we conducted a poll of those who receive our conditions reports to see whether or not the services and information that we were providing via these reports were still relevant and adequate. We also asked how we might better serve you. Your responses were enlightening:

- From the 467 questionnaires that were sent out, we received 389 responses (83%). This level of response is, in itself, a strong statement of support.
- The vast majority of the respondents said that they read every report, and over half of them in its entirety.
- Approximately 40% of the respondents shared their copy with one or more persons, more than doubling the readership.
- Responses to questions regarding utility, timeliness and overall quality of this report were overwhelmingly positive. Eighty-three respondents made the effort to specifically comment as to the value of the publication in addressing their needs.
- Fourteen respondents made specific suggestions for improving utility: "...Email version of the report...", "...posted on the state's web page...", "...more graphics...".
- Over 50% of the respondents stated that they had utilized additional IDM pest management/damage prevention and control services within the past year.

I view these results as strong evidence that we are meeting a public need. Activities associated with our mission continue to be supported by cooperative efforts and outside grants, which also speaks strongly to the validity of our mission. We continue to investigate ways to improve delivery of an effective program.

In accordance with some of the suggestions from the poll, we are working to offer products via the Maine State Home page on the Internet. This effort is intended to augment, not replace, our current avenues of communication. As always, you should feel free to contact us with requests or suggestions by any means available.

Regarding specific upcoming forest health issues: In the current furor regarding forest sustainability and management practices, it is easy to forget that much of the situation presently being debated developed as a direct or indirect result of spruce budworm management strategies. Budworm will be back, and we need to be prepared to deal with it when it arrives. We are continuing to monitor our current low-level populations to give land managers as much lead time as possible. In the meantime, we are working with various specialists to develop tools to analyze the dynamics of the past outbreak, and try to determine which of the various management strategies for this pest proved to be most beneficial.

There are increasing concerns over the current and potential impact of "exotic pests". Exotics continue to pose a threat to our forest resources and to the forest based communities and industries that depend on those resources. Although we are reaching accommodation with some of these introduced pests, particularly those which seem to have become naturalized (e.g. gypsy moth), this in no way diminishes the fiscal or environmental costs that accrued over the naturalization period. Similar costs will be associated with any new introduced pests.

Two insects of particular concern currently are Hemlock Woolly Adelgid and Asian Cerambycid (Long-horned) Beetle (ALHB). Both are covered elsewhere in this summary report. Pest Alerts describing these species are available. In the case of ALHB, we will be providing the Alert later this spring, to more nearly coincide with adult emergence. I would ask that folks be sensitive to the possibility of accidentally introducing such pests. Please contact us immediately if you suspect that you have encountered these species. Only by quick response do we have any hope of preventing or delaying establishment locally.

While this annual summary captures many of the activities conducted as part of IDM's core functions, it is not an exhaustive summary of Division activities and accomplishments. The activities conducted by Division staff in support of other operations, both within the Maine Forest Service and outside are not well captured. 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

David W. Stewart - On September 30, 1996 Dave Stewart retired as a member of the I&DM team after roughly 45 years of service (two of which he served in the military). Dave, who is a life-long resident of Bridgton, began work as a seasonal field scout with the White Pine Blister Rust (WPBR) program after graduation from high school in 1952. At that time WPBR was a federal program. Dave moved up through the ranks of the WPBR program to Blister Rust District Leader in October of 1963 a position which he held until a departmental reorganization was implemented in August of 1987. Dave then served as an entomology technician until his retirement.

A retirement supper was held for Dave and his family, friends and coworkers at Cole Farms in Gray on October 30, 1996.

Cooperative MFS/USFS Projects

Forest Inventory and Analysis (FIA) Decennial Survey

The FIA resurvey of Maine's forests begun in 1994 was completed early in 1996. This is the fourth survey of the state's resources, begun in 1959. The time period for this inventory was 13 years. The U.S. Forest Service has a report summarizing the plot data with some inventory comparisons between 1982 and 1995 by Griffith and Alerich (see p. 7).

More comprehensive analyses of the data are being conducted as part of a joint project between the Maine Forest Service, FIA and the State and Private branch of the US Forest Service. The purpose of these analyses will be to identify long-term sustainable harvest rates for Maine's forest and major tree species groups.

In addition, there is an effort underway to understand the usefulness of the FIA data in assessing forest biological diversity trends. Trend analysis continues to emerge as the highest state priority for FIA data, making recent FIA decisions to further alter plot collection procedures problematic for it's future usefulness.

National Forest Health Monitoring Program (NFHM)

The NFHM program has demonstrated the value of using a consistent set of criteria in evaluating national and regional forest health issues. We are also using criteria developed through this program to augment our traditional pest survey and evaluation efforts, strengthening our in-state assessments and allowing valid comparisons to be made between situations in Maine and in neighboring jurisdictions. The I&DM Division continued as a cooperator in the NFHM program in 1996. In the fall of 1995 the I&DM Division had been told by NFHM management that plot measurement in Maine and other New England states would be suspended for 1996 and perhaps longer due largely to a withdrawal of most EPA funding in 1995. However, in the spring of 1996, the U.S. Forest Service was able to identify funding sufficient to reinstate plot measurements in the Northeast on a reduced sampling grid. Thanks to diligent efforts by the U.S. Forest Service and participating states a reduced 1996 remeasurement was undertaken to insure continuity of measurements taken since 1990. Fortunately, some measure of funding stability was reestablished in the program later in 1996 and NFHM is expected to continue in 1997 on a reduced sampling grid and new states will be added to the network (Washington and Oregon).

The program sampling grid did change significantly in 1996 driven largely by the decrease in funding. The new sampling grid provided for sampling of approximately one third of the original 137 locations each year on a rotating four year cycle. Forty-two of the 45 plots visited in 1996 were forested. All plots were measured using measurement type 3 criteria meaning that the full suite of NFHM variables was assessed. A similar sampling grid with a new plot group is planned for 1997. As in 1996, all 1997 plots will be measurement type 3 and new assessment variables are not expected in Maine. A newly designed and simplified soils methodology is expected to be field tested in 1997 but Maine does not expect to be included in this pilot test.

An evaluation of insect and disease conditions was conducted by the assessment crew at each NFHM plot site in 1996 as has been the practice in recent years. These pest assessments include a checklist of common insects and diseases often seen in the forest type specified for each NFHM plot. NFHM crew personnel employed in 1996 were trained in pest identification and most also had considerable I&DM experience. Their insect and disease observations were a valuable supplement to ongoing survey and evaluation efforts of the Division.

North American Sugar Maple Project (NAMP)

The NAMP was formed in 1987 as a joint project between Canada and United States to address public concerns over the health of sugar maples in North America. The current program annually collects data from 233 plots distributed over ten states and four provinces addressing crown health and tree mortality. There are eighteen plots in the western portion of Maine divided equally between natural stands and managed sugarbushes. The specific objectives of this project are as follows:

- Determine the rate of change in sugar maple condition ratings.
- Determine if the rate of change in sugar maple condition ratings is different among:
    a. various levels of sulfate and nitrate wet deposition.
    b. sugarbush and non-sugarbush forests.
    c. various levels of initial stand decline conditions.
- Determine possible causes of sugar maple decline and the geographical relationships between potential causes and extent of decline.

To meet these objectives information is gathered on crown dieback reflecting the general, long-term health of individual trees and on crown transparency (a measure of light passing through the leaves of a tree crown) reflecting annual fluctuations in tree condition. The long term NAMP dataset also allows the natural mortality rate of sugar maples to be determined which may be used by land managers wishing to maintain or increase the level of this species within a stand.

The dataset resulting from this project is immense and necessitates the reporting of annual result with a one year lag. If an urgent need exists, specific information may be obtained in a more timely fashion by contacting this office. Data collected in 1995 show the sugar maple resource in Maine to be in good health with an average of 93.2 % of the sugar maple crowns in vigorous condition. A review of data show the crowns have actually improved slightly since 1988. The general health of maples in tapped versus untapped areas continues to be about the same in Maine reflecting the careful management practiced by most sugar producers.

Competitive Focus Funding Grants

Maine Forest Service Insect and Disease Historical Database - The current need to identify and catalog various natural resources within Maine as critical components of biodiversity and forest health studies prompted the MFS to develop electronic storage, manipulation and query capability for existing historical datasets. The IDM division has worked cooperatively with the USFS and UMO to develop this capability for the historical forest insect survey information. The historical database has been developed and a substantial amount of Forest Insect and Disease Survey (FIDS) data has been successfully loaded into it. At this time information can be retrieved from this system in a gross tabular form. The process of refining the retrieval capabilities and increasing the scope of information types that can be entered into the database is currently underway.

Over the summer of 1996 work-study students at the University of Maine, under the supervision of Dr. Kathleen Murray, entered the information from over 5,000 FIDS collection slips covering the time period from 1980 to 1995. Many of the slips had multiple insect and/or disease diagnoses on them which translates into over 10,000 insect and disease records. The data entry protocol that was developed has been successful and additional FIDS data are currently being entered. There is now a written protocol for FIDS data handling. The database is now also set up to handle light trap data and more data forms are currently under development. Despite the problems inherent in using old data, the project is moving forward satisfactorily towards a usable product.

The most important feature of an information storage system is easy retrieval of the material. This system has delivered a listing for any query posed to date. More standardized report forms now need to be developed to make it simpler for users to query the system.

The historical database was developed in Lotus Approach® and is now ready to be converted to Microsoft's Access® so that it will be more readily accessible to cooperating states. The database is relational and pieces can be added or subtracted to suit the needs of the user. There is nothing inherently applicable to Maine and variables can be adjusted to match the data collection system of the user.

A meeting was held in April, 1996 to discuss database needs with Vermont, another state that has been working on computerizing their insect and disease information. It was felt that the system they are using in Access® and the Maine developed system might be melded together to form a common 'engine' for data entry.

One of the key components of the historical database system is the list of insects and diseases. The list used in the database was obtained from the Canadian Forest Service (CFS). It has proved to be highly satisfactory and contains over 12,000 insect and 6,800 disease organism listings in a usable format. We are continuing to work with the CFS to update and coordinate use of the list.

A Reevaluation of Forest Regeneration in Spruce Budworm Damaged Stands Within Baxter State Park - The I&DM Division was awarded a grant by the USFS in 1995 to assist in the assessment of composition and condition of advanced regeneration in softwood and mixedwood stands in Baxter State Park. These stands were severely damaged by spruce budworm during the most recent outbreak. Stand composition and condition data has been collected from fir, spruce, mixed softwood and mixedwood stands within the Park beginning in 1977 on plots established by the USFS and the University of Maine and has continued to the current measurement. The recent grant will assist I&DM in comparing the present stand composition to the composition of the overstory prior to the budworm outbreak. The condition of surviving overstory stems will be assessed. The project report will also contain a comparison of the composition and condition of current regeneration with the regeneration status in 1989 when I&DM first assessed these plots.

The majority of the field work and data collection for this project was completed in the late summer and fall of 1996. Overstory crown condition data was not collected on one mixedwood block due to normal late season deterioration of hardwood foliage. Crews will revisit this block in the summer of 1997 to collect this data thus completing the project field work. Most data collected in 1996 has been processed and analysis will begin during the winter.

Brown (= Black) Ash Health Evaluation

A serious decline in the condition of black ash (called brown ash in Maine) *(Fraxinus nigra)* became apparent in Maine in 1992. Assessment of the condition of brown ash in 1992 and 1993 showed that this species was in an extreme state of decline throughout Maine. Overall, 50% of the trees assessed had more than 20% crown dieback and over 30% of these trees had more than 80% crown dieback. These levels of dieback were far greater than those of any associated tree species.

Extensive study of brown ash through 1996 did not reveal a biotic cause for the decline but rather suggested that the cause was more likely abiotic in nature. The most severe levels of decline were seen in trees that were subject to late fall flood and freezing events followed by low water conditions the following spring.

Brown ash tree condition was evaluated in 1995 and 1996 through a reassessment of 12 of the original 56 brown ash dieback plots established in Maine in 1993. National Forest Health Monitoring (NFHM) crown variables and other variables described specifically for the brown ash plots were used to assess tree condition. Data analysis from this plot subset revealed that the decline had ceased and that most trees were showing significant recovery (Fig. 1). Mean dieback for the 12 remeasured plots was 7.4 % in 1996 compared to 48.4 % in 1993 and 13.4 % in 1995. Leaf size and color and crown structure were also improved in 1996 resulting in an increase in the crown density (improvement) in most plots. The same factors resulted in a small decrease (improvement) in crown transparency that had shown a small increase in 1995 compared to the 1993 measurement. A small amount of additional tree mortality (3%) was recorded in 1996 but, overall the condition of brown ash was significantly improved as measured by crown condition categories defined for this study. Barring a recurrence of conditions that caused the original decline, brown ash condition is expected to show continued improvement in 1997.

A report is available on the 1995 resurvey of the brown ash decline plots (see publications p. 7).

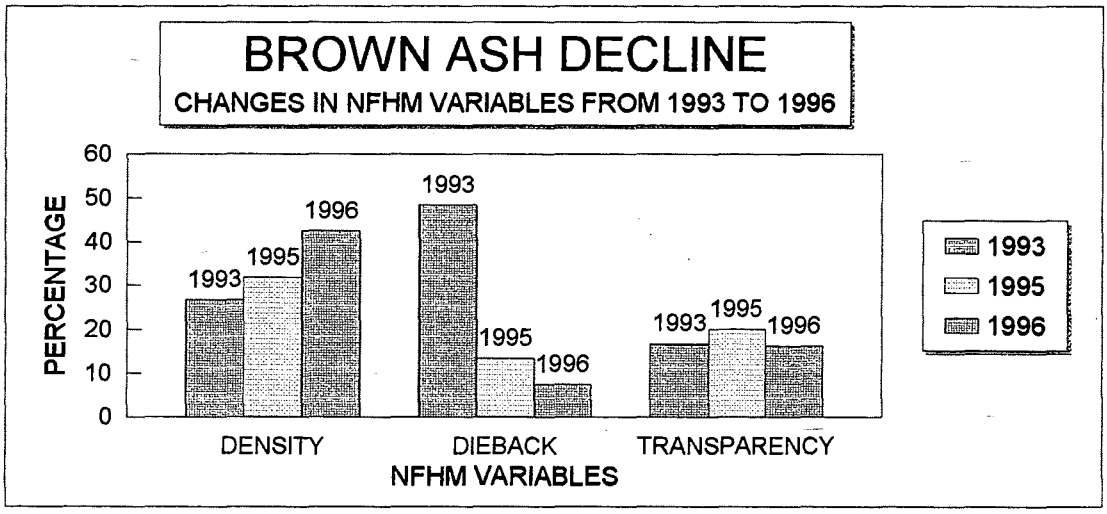


Figure 1

Management of Root Sprouting in American Beech to Enhance Numbers of Clones Resistant to Beech Bark Disease (*Dr. David R. Houston, Retired Principal Plant Pathologist, USFS, Principal Investigator*).

This cooperative study between the USFS, The Maine Bureau of Parks and 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 beech trees resistant or susceptible to beech bark disease. This study was conducted on the Seboeis Lake Maine Public Reserve Lot in T4 R9 between 1989 and 1995. Cutting was conducted in the winter-late spring of 1991. Data analyses and preparation of a final project report by Dr. Houston is well underway.

With a final report on the current phase of this cooperative project nearing completion, reevaluation of the study plots is not planned for several years (approximately 5 years). Study plots were marked and located when the project was initiated and markers were refurbished during subsequent measurements. To insure the opportunity for an accurate and efficient future evaluation of this project, the study area will be visited periodically during the next several years and plot documentation reestablished if necessary. Plot location using global positioning technology is likely in the near future.

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 37 (see list p. 55), are also still in stock for more detailed information on specific subjects. Extended conditions summary reports, such as this one, have been issued annually since 1987 (for the 1986 season). A limited number of sets of these summaries are still available.

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. 1996 (March). Forest & Shade Tree-Insect & Disease Conditions for Maine - A Summary of the 1995 Situation. MFS, I&DM Division. Summary Report No. 10. 65 pp. Compiled and edited by R.G. Dearborn and C.A. Granger.

____ 1996. Forest & Shade Tree-Insect & Disease Conditions for Maine. 8 seasonal issues from April 10 through October 16. MFS, I&DM Div. Compiled and edited by R.G. Dearborn and C.A. Granger.

Pechuman, L.L. and R. Dearborn. 1996 (March). The Horse Flies and Deer Flies of Maine (Diptera, Tabanidae). Me. Agr. & For. Exper. Sta. Tech. Bull. No. 160. 24 pp.

Trial, H. and M.E. Devine. 1996 (August). Forest Health Monitoring Evaluation: Brown Ash (*Fraxinus nigra*) in Maine - A 1995 Resurvey of Brown Ash Decline Plots Established in 1993. MFS, I&DM Div. Tech. Rpt. No. 37. 12 pp.

Our I&DM staff also cooperated with other agencies to produce the following items:

Childs, R.D., K.R. Hickey and E.A. Weeks (Eds.) 1996 (March). The 1996 New England Management Recommendations for Insects, Diseases and Weeds of Shade Trees and Woody Ornamentals. A publication from the Univ. of Mass. Extension Urban Forestry and Landscape and Nursery Programs. 199 pp.

Cooke, R.R., D.C. Allen, B. Pendrel and A.W. Molloy. 1996 (May). Condition of Sugar Maple 1995. USDA/FS and Canadian F.S. Foldout Leaflet NA-TP-04-96.

Gawler, S.C., J.J. Albright, P.D. Vickery and F.C. Smith (Eds.). 1996 (January). Biological Diversity in Maine - An Assessment of Status and Trends in the Terrestrial and Freshwater Landscape. ME DOC Maine Natural Areas Program - Two Parts. Maine Report. 90 pp. Appendices. 170 pp.

Griffith, D.M. and C.L. Alerich. 1996 (October). Forest Statistics for Maine, 1995. USFS. Resource Bulletin NE-135. 134 pp.

Hanson, T. and E.B. Walker. 1996. Field Guide to Common Insect Pests of Urban Trees in the Northeast. Vermont Dept. of For., Parks, and Recreation. 83 pp.

Forest and Shade Tree Insect and Disease Conditions for Maine

1996 at a Glance

The 1996 season was fairly normal or average for Maine with a few little bumps of the unusual sprinkled throughout. Weatherwise the season started out on the damp side but by August conditions were notably drier. With a few exceptions insect and disease conditions were also on the average side while abiotic problems seemed to steal the show at least early in the season.

Abiotic problems led the season with early reddening of roadside white pine forming a striking contrast to the green of balsam fir and spruce, especially in southern Maine. As deciduous foliage developed in June it became evident that beech and to a lesser extent birch across much of northern and eastern Maine was exhibiting serious yellowing and defoliation precipitated by the drought conditions which prevailed in 1995 and insect feeding. A combination of factors resulted in very thin foliage on poplars, especially trembling aspen, across much of the state and large coastal spruce experienced stress and mortality from another complex of problems. In addition to climate related problems, problems related to human activities seemed prevalent in 1996 as well.

Most of our regular pests continued to plague forest and shade tree managers with a variety of ups and downs. While some such as the browntail moth, larch sawfly, maple leaf cutter and yellowheaded spruce sawfly exhibited notable increases in 1996, others such as ash leaf and twig rust, Bruce spanworm, fall cankerworm, fall webworm and white pine weevil held their own at locally high levels. Birch casebearer, forest tent caterpillar, satin moth, and variable oakleaf caterpillar populations dropped in 1996. Some such as the gypsy moth, hemlock looper and spruce budworm remained relatively inconspicuous for the most part. And there was the usual flush of local problems throughout the year.

Although problems elsewhere in the Northeast, the Asian cerambycid beetle, Asian gypsy moth, common pine shoot beetle and hemlock woolly adelgid have not yet been found in Maine.

Table 1. Damage level trends for 1996

Those of special significance

Ash Anthracnose	↗*	moderate/high
Aspen Defoliation	↑	locally severe
Balsam Fir Sawfly	→	low endemic
Balsam Shootboring Sawfly	→	spotty and light
Balsam Twig Aphid	↗	plantations
Beech Defoliation	↑	severe N, C & E
Birch Skeletonizer	↘	low and scattered
Brown Ash Decline	↘	trees improving
Browntail Moth	↗	local, Casco Bay, 3,040 A.
Bruce Spanworm	→	<11,000 A. moderate
Bud Abortion (balsam Fir)	→	low
Butternut Canker	↑	15 counties
Cone Buds (balsam fir)	→	low to moderate
Dogwood Anthracnose	→	York County
Drought	↓	(residual 1995 impact ↑)
European Larch Canker	→	static
Fall Cankerworm	↘	spotty, Aroo Cty. boxelder
Gypsy Moth	↗	local <100 A.
Hardwood Decline	↗	180,000 A. high, north
Hemlock Looper	→	low/endemic
Larch Sawfly	↗	locally high, 5,000 A.
Late Spring Frost	→	low
Maple Leafcutter	↗	local >100 A.
Pinewood Nematode	↘	local
Rd. Salt Spray/Pooling Damage	↑	very high
Satin Moth	↓	scattered light
Spruce Beetle	↗	high, coastal >2,190 A.
Variable Oakleaf Caterpillar	↓	low/endemic
Winter Browning	→	low
Yellowheaded Spruce Sawfly	↑	high locally 1,500 A.

Perennial Problems

Air Pollution	→	low
Alder Flea Beetle	→	locally high
Annosus Root Rot	→	low
Arborvitae Leafminer	↑	locally high
Ash Leaf and Twig Rust	→	high locally
Balsam Gall Midge	→	local
Balsam Woolly Adelgid	→	locally high, coastal
Beech Bark Disease	→	high
Birch Casebearer	↘	scattered roadside
Birch Leafminer (*Messa*)	→	moderate, scattered
Boxelder Canker	↘	low
Coral Spot Nectria Canker	→	low
Cristulariella Leaf Spot	→	very low or absent
Dutch Elm Disease	→	high
Eastern Larch Beetle	→	local
Eastern Tent Caterpillar	→	locally high
Fall Webworm	↗	high locally
Fir-fern Rust	↘	moderate
Forest Tent Caterpillar	↘	low
Horse Chestnut Leaf Blotch	→	moderate
Introduced Pine Sawfly	→	low/endemic
Jack Pine Sawfly	→	moderate E coastal
Larch Casebearer	↘	spotty
Large Aspen Tortrix	→	low and local
Meadow Vole Damage	→	local
Mountain Ash Sawfly	→	high, local
Oak Leaftier/Skeletonizer	→	low and local
Pear Thrips	→	low/endemic
Pine Leaf Adelgid	↘	low
Pine Needle Rust	→	low
Pine Spittlebug	↗	locally heavy
Pitch Mass Borer	↗	locally high
Porcupine Damage	→	locally high
Rhabdocline Needle Cast	→	moderate
Saddled Prominent	→	low/endemic
Saratoga Spittlebug	→	low and local
Scleroderris Canker	→	low
Sirococcus Shoot Blight (Larch)	→	moderate
Spider Mites	→	high, local
Spruce Budmoth	→	low and local
Spruce Budworm	→	low/endemic
Stillwell's Syndrome	↘	local
White Pine Blister Rust	→	low
White Pine Weevil	↗	high

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

Light Trap Survey

The 1996 season was the 54th year of this ongoing seasonal light trap survey for monitoring and detection of lepidopterous forest defoliators at established sites throughout the state. A total of 24 traps were deployed at the same locations as in 1995 (Table 2). Late season trapping for the fall flying hemlock looper (*Lambdina fiscellaria*) was discontinued in 1996 because of reduced populations and also as a measure to offset increased survey costs due to a necessary change in procedure for hiring trap operators. Since the department can no longer hire trap operators on individual private contracts the I&DM Division is now required to contract out with a temporary employment agency. Trapping periods for all trap sites are summarized in Table 2. Light trap locations are depicted in Fig. 2.

Table 2. Location and period of operation of light traps in 1996

Location	Operation Dates	Location	Operation Dates
Allagash *	July 1-July 30 (30 nights)	Haynesville*	June 17-July 31 (45 nights)
Arundel	June 1-July 30 (60 nights)	Kingfield	July 1 -July 30 (30 nights)
Ashland	July 1-July 30 (30 nights)	Millinocket	June 17- July 31 (45 nights)
Blue Hill	June 17-July 31 (45 nights)	Mt. Vernon*	May 18-July 31 (75 nights)
Brunswick	June 17-July 31 (45 nights)	No. Bridgton*	May 18-July 31 (75 nights)
Calais*	June 17-July 31 (45 nights)	Rangeley	June 17-July 31 (45 nights)
Chesuncook*	June 17-July 31 (45 nights)	Shin Pond	July 1-July 30 (30 nights)
Dennistown	July 2-July 31 (30 nights)	So. Berwick*	May 18-July 31 (75 nights)
Elliotsville	June 17-July 31 (45 nights)	Ste. Aurelie	July 1- July 30 (30 nights)
Exeter	June 17-July 31 (45 nights)	Steuben*	June 17-July 31 (45 nights)
Greenbush*	June 17-July 31 (45 nights)	Topsfield*	June 17-July 31 (45 nights)
Guerette	July 1-July 30 (30 nights)	Washington*	May 18-July 31 (75 nights)

* Late season trapping eliminated (August 17 - September 30)

The trapping periods target potential forest pests for each specific site and forest type. Traps used to monitor spruce-fir insects were operated for thirty (30) days from July 1 to July 30; traps monitoring hardwood or hardwood-softwood insect pests were operated for forty five (45) days from June 17 to July 31; traps monitoring the spring hemlock looper (*Lambdina athasaria*) and other early hardwood or hardwood-softwood insect pests were operated for seventy five (75) days from May 18 to July 31.

With the exception of Steuben, all trap catches were processed at the I&DM laboratory during the season as they were received. The Steuben trap catches were processed at Steuben by Michael Roberts, the trap operator.

Roughly 25 pests are monitored on a fairly consistent basis and of these nine are compared annually (Table 3) Annual comparisons of particular species over a seven year period are included with the respective species discussions.

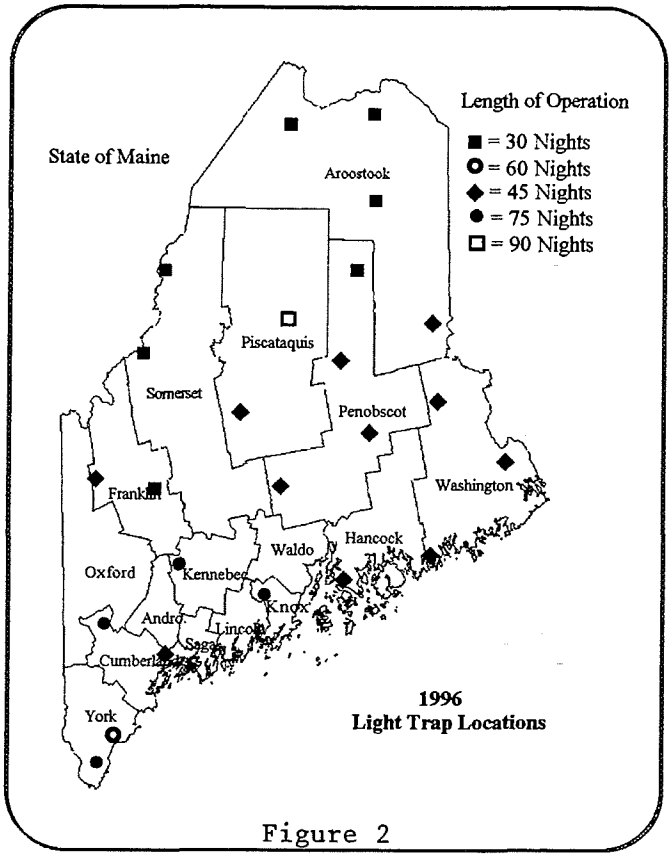


Figure 2

Table 3. Comparison summary of light trap survey collections of forest pest species, 1996

	Species								
Location	***Choristoneura conflictana***	***Choristoneura fumiferana***	***Dryocampa rubicunda***	***Heterocampa guttivata***	***Leucoma salicis***	***Lochmaeus manteo***	***Lymantria dispar***	***Malacosoma disstria***	***Symmerista spp.***
Allagash	1	0	0	0	2	0	0	8	0
Arundel	1	2	130	0	0	0	0	39	3
Ashland	3	0	0	0	0	0	0	57	1
Blue Hill	2	0	30	0	0	9	0	17	7
Brunswick	2	0	8	0	0	0	0	33	3
Calais	0	0	19	0	0	0	0	3	13
Chesuncook	0	0	3	18	0	27	0	0	3
Dennistown	0	0	2	0	0	0	0	10	0
Elliotsville	17	0	18	3	0	3	0	18	2
Exeter	3	3	2	1	0	4	1	0	7
Greenbush	0	0	34	0	1	4	0	149	3
Guerette	0	0	0	0	0	1	0	4	0
Haynesville	0	2	5	0	0	7	0	9	1
Kingfield	0	1	4	1	1	3	0	32	0
Millinocket	1	9	23	12	1	18	2	0	0
Mt. Vernon	2	12	16	6	0	0	0	46	42
No. Bridgton	0	0	20	0	0	0	0	51	7
Rangeley	14	0	0	2	0	0	0	3	3
Shin Pond	0	3	1	0	4	4	0	30	1
So. Berwick	2	0	171	0	0	0	1	91	3
Ste. Aurelie	0	0	1	2	0	0	0	6	0
Steuben	0	3	11	12	0	0	0	7	7
Topsfield	4	12	24	0	1	3	0	14	11
Washington	6	1	34	0	0	2	0	45	12
Total # Moths	**58**	**48**	**556**	**57**	**10**	**85**	**4**	**672**	**129**

INSECT Problems Associated With Trees in 1996

(A) Softwood Insect Pests

Adelgids (various) - These close relatives of the aphids are often incorrectly referred to as aphids. Adelgids are generally considered more serious tree pests than aphids and are more difficult to control as well. More than ten species of adelgids occur in Maine. Three of these; the **balsam woolly adelgid**, **eastern spruce gall adelgid** and the **pine bark adelgid** complete their entire life cycle on a single host. Most if not all of the others require two conifer hosts with a species of spruce being the gall bearing host. Among this second group it is the **Cooley spruce gall adelgid** and the **pine leaf adelgid** which generate the most concern, primarily in regard to the non spruce host. The infamous **hemlock woolly adelgid** has not yet been found in Maine.

Aphids (*Cinara* spp. and others) - Aphid populations held their own in 1996 but most of the striking populations experienced in 1995 did not reappear.

Arborvitae Leafminer (a complex of 4 species) - Populations rose unexpectedly again in 1996 and damage was especially noticeable locally in Kennebec, southern Penobscot, southern Somerset and Waldo counties. In some stands >50% of the trees exhibited moderate to severe defoliation.

Balsam Fir Sawfly (*Neodiprion abietis*) - Populations of this sawfly have now fallen to nearly endemic levels throughout, even in stands previously defoliated in Washington County.

Balsam Gall Midge (*Paradiplosis tumifex*) - While this pest may be a very serious defoliator of balsam fir and especially damaging to the wreath and Christmas tree industries of the state, it has been a problem only in very localized stands in recent years. The small (mosquito-size) orange midges will be seen in high numbers on warm late afternoons in late May laying eggs on expanding foliage if a problem exists within a lot. Since damaging populations of the gall midge are often very localized, growers of balsam fir are wise to watch individual lots in late May and early June to avoid finding any unwelcome 'surprises' later in the season.

Balsam Shootboring Sawfly (*Pleroneura brunneicornis*) - The damage caused by this insect was again spotty and light in 1996 in most locations although the Christmas tree growers who had it in their plantations were not pleased to see any level of damage. The adult sawflies emerged between April 24 and May 22 in both 1995 and 1996 in three central Maine locations. The only opportunity growers have to control damage from this insect is in the adult stage during this period. As the problem is often local in nature, growers should check to see if damage occurred in the plantation in preceding years. The eggs, and feeding larvae are well protected within the buds and overwintering pupae within the soil and thus would be much less affected by most treatments. Spray trials in 1995 and in 1996 had mixed results. Attempting to protect the foliage for a long enough period of time to prevent the adults from laying eggs may be very difficult and costly.

Date 1996	Bud Stage - Fraser Fir	Activity	
April 8 & 12	tight	set up traps	(snow on ground)
April 24	tight	first adults	Blue Hill
May 1/3	tight	" "	Garland/Newburg
May 16/20/22	¼ green	last adult	Garland/Blue Hill/Newburg
June 6	flare	larvae feeding	
June 14	lengthen		

Balsam Twig Aphid (***Mindarus abietinus***) - Populations of this pest were relatively low in wild stands but high in plantations in Maine in 1996. Aphids in plantations managed for Christmas tree production tend to fluctuate in population level regardless of the situation in nearby wild stands of balsam fir, possibly due to the use of high nitrogen fertilizers and insecticides. For this reason Christmas tree growers should carefully monitor aphid activity within individual lots under their care. Light to moderate damage within a stand in one year often times turns into economically damaging levels the following year. Check stands before May to assess previous damage levels and watch for the stem mothers in the second and third weeks of May in central areas of the State.

Balsam Woolly Adelgid (***Adelges piceae***) - Relatively light populations of the woolly trunk phase continued to show up with increasing frequency in 1996 in scattered stands across southern portions of Penobscot, Piscataquis and Somerset counties. The gout phase, however, remained heaviest in coast stands and only locally further north. It is the gout phase which has been most destructive in Maine to this point.

We have begun re-evaluating distribution records of both phases of this introduced insect across Maine.

Bark Beetles (various) - The incidence of bark beetles and woodborers in a variety of softwoods increased in 1996. Two of our more serious bark beetle pests, the **spruce beetle** and the **eastern larch beetle** are discussed separately as is the **red turpentine beetle**. Most reports of other bark beetle activity involved trees stressed by drought or cultural activities. In these situations the more common requests in 1996 involved the **balsam fir bark beetle** (*Pityokteines sparsus*), **northern cedar bark beetle** (*Phloeosinus canadensis*), **four-eyed spruce beetle** (*Polygraphus rufipennis*) and the **pine engraver** (*Ips pini*).

Surveys to detect new introduced species of bark beetles conducted by Me. Coop. Ext. Serv. personnel in cooperation with the USDA-APHIS-PPQ were dropped in 1996.

Common Pine Shoot Beetle (***Tomicus piniperda***) - This introduced European pest of pines sometimes called the **larger pine shoot beetle** has still not been found in Maine.

Conifer Sawflies (various) - Although there are more than fifteen different sawflies which may occur on conifers in Maine only two caused noticeable defoliation on more than a single tree here and there during the 1996 season. The **yellowheaded spruce sawfly** again dominated the scene followed by the **larch sawfly**. Most species produced only light or very local (single tree) feeding during this period.

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 continued to be a problem in 1996 as well.

Eastern Larch Beetle (***Dendroctonus simplex***) - This problem remained at relatively low levels in 1996 although stands exhibiting mortality are still very much in evidence.

Eastern Spruce Gall Adelgid (***Adelges abietis***) - This species is probably the most abundant and destructive spruce gall adelgid in Maine and annually causes heavy gall production and shoot mortality especially on white and Norway spruce in plantations and ornamental situations. Trees seem to exhibit varying degrees of susceptibility to this adelgid. The most susceptible trees may not die but growth will be greatly retarded and annual treatment necessary to maintain high aesthetic value. It may be best in the case of highly susceptible trees to simply remove and/or replace them.

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 1996.

Gypsy Moth (*Lymantria dispar*) - Gypsy moth populations were very low in 1996 and caused no reportable damage to softwoods. See p. 27.

Hemlock Borer (*Melanophila fulvoguttata*) - This opportunist attacks hemlock trees which are under stress for one reason or another and once established can kill trees of any size in a single season. Our staff are annually called upon to investigate causes of off-color and dying hemlock. Most if not all of these involve stressed trees which have been invaded by relatively high populations of the hemlock borer and/or infected with the **shoestring root rot fungus** (*Armillaria* spp. p. 39). While infested trees should generally be removed from the site, this may exacerbate the problem in some woodland situations especially where the residual hemlock are or could be placed under stress by such action (catch-22!!?).

Hemlock Loopers (*Lambdina athasaria* and *L. fiscellaria*) - An unprecedented outbreak of hemlock looper affected more than 500,000 acres of hemlock, balsam fir, and white spruce in east-central and southern Maine between 1989 and 1993. Losses from this outbreak were estimated at more than 400,000 cords on approximately 28,000 of the most severely infested acres. Several stress factors including shallow ledgy soils, proximity to water, long outbreak duration, and partial harvest contributed to high levels of tree mortality in about 10% of the infested area. Tree mortality on the remaining 90% of the infested area was generally very light.

The hemlock looper infestation in Maine has now ended. Larvae and moths are still seen frequently in survey and trap collections but no defoliation, caused by this pest, was recorded in 1995 or 1996. Evaluation of the fall flying hemlock looper moth occurrence through pheromone trapping and extension of the light trap season through September was discontinued in 1996 due to the low incidence of this pest. Light trap collections of the spring flying hemlock looper (*L. athasaria*) were monitored as a part of the regular light trap survey season however. Numbers of *L. athasaria* continued to climb for the third year in North Bridgton, one of five traps monitored for this pest (Table 4).

Table 4. Total number of spring flying hemlock looper *(Lambdina athasaria)* moths collected at light, 1992-1996

Location	Year 1992	1993	1994	1995	1996
Arundel	-	-	10	-	7
Mount Vernon	2	7	0	5	4
North Bridgton	81	34	49	152	272
South Berwick	1	0	6	0	2
Washington	0	0	0	6	0
Total No. of Moths	**84**	**41**	**65**	**163**	**285**

Hemlock looper defoliation certainly added to the stress load of numerous old, overmature, and largely unmanaged coastal spruce stands that are currently showing evidence of serious decline from a number of factors. Additional stressors are drought (1995) and wind damage. Several spruce stands on coastal islands and headlands that were heavily defoliated during the looper outbreak of 1990-1992 have recently experienced an increase in spruce beetle activity. Stress from looper defoliation may have contributed to this increased success of **spruce beetle** attacks although there is no hard evidence of a consistent link at this time. Hemlock looper caused stress complicated by drought in 1995 continued to take its toll of hemlock subsequently infested by the **hemlock borer**.

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** p. 54). 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., 28 State House Station, 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*) - Although it was not difficult to find the solitary, marbled, green and yellow larvae of this species on wwhite pine across the state in 1996, populations remained low and endemic.

Jack Pine Sawfly (*Neodiprion pratti banksianae*) - Populations of this species remained a chronic problem in 1996 as they have for the past several years. Defoliation of mature jack pine in infested coastal areas of Hancock and Washington counties from Mt. Desert to Steuben remained localized in 1996 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 **pine-pine gall rust** (p. 47).

Larch Casebearer (*Coleophora laricella*) - Defoliation by larch casebearer was spotty in 1996 but appeared to be generally down from 1995 levels. In some areas it was difficult to find casebearer larvae in previously infested stands. Locally, however, defoliation was heavy.

Larch Sawfly (*Pristiphora erichsonii*) - Larch sawfly populations rose noticeably in 1996 in larch stands statewide. Larvae were visible in many stands checked. Roughly 5,000 A. of moderate to severe defoliation was mapped aerially (and ground checked) primarily in five counties (Fig. 3, Table 5).

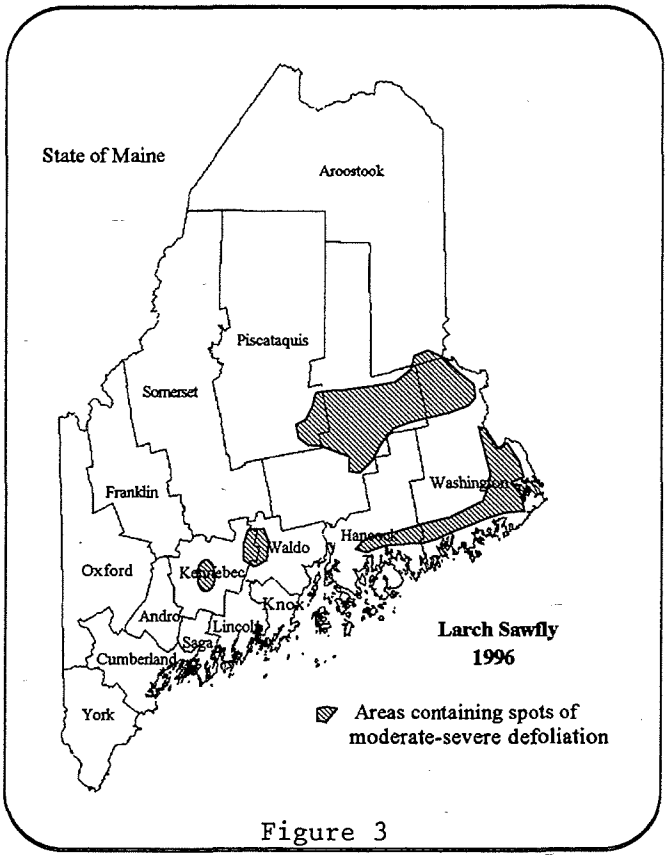


Figure 3

Table 5. Larch sawfly defoliation in 1996 by county

County	Acres	Defoliation Levels
Hancock	200	Spotty moderate-severe
Kennebec	200	Spotty moderate-severe
Penobscot	2,600	More extensive moderate-severe spots
Piscataquis	400	Fairly extensive moderate-severe spots
Washington	1,600	Spotty moderate-severe
Total	**5,000**	

Mites - (See **spruce spider mite** p. 20)

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 1996.

Pine Bark Adelgid (*Pineus strobi*) - This continues to be a local problem on some sites especially in urban areas following stress.

Pine False Webworm (*Acantholyda erythrocephala*) - This introduced species which has been very destructive to white and red pines over thousands of acres in upstate New York has still not appeared in Maine.

Pine Gall Weevil (*Podapion gallicola*) - This insect continues to show up wherever red pine is found. It is seldom a serious problem, however, branches of some trees may have sufficient numbers of galls to cause branch mortality.

Pine Leaf Adelgid (*Pineus pinifoliae*) - Little damage to white pine from this insect was observed in 1996 even in areas where 1995 galls on spruce were plentiful. This may in part have been due to high moisture levels which minimized desiccation.

Pine Needleminer (*Exoteleia pinifoliella*) - This species is primarily a pest of jack and pitch pine in Maine. Populations remained generally low again in 1996.

Pine Needle Scale (*Chionaspis pinifoliae*) - This species is a perennial pest on a wide variety of conifers. Populations always seem heaviest on Scots and mugo pine in Maine and thus the problem is more oriented to urban and occasionally plantation situations.

Pine Root Collar Weevil (*Hylobius radicis*) - What appeared to be feeding activity by larvae of this species on pine nursery stock was reported to I&DM by the Me. Dept. Agr. in 1996. This species has not yet been officially reported from Maine.

Pine Spittlebug (*Aphrophora parallela*) - Spittle masses containing the pale yellow and black nymphs of this species were abundant on a variety of conifers in southern Maine in 1996. Populations were up overall and locally heavy on mugo, Scots and eastern white pine. Some mugo pine in landscape situations appeared literally covered in foam. Damage was minimal.

Pitch Mass Borer (*Scynanthedon pini*) - Moderate to high populations of this messy pest of pines (especially white) and spruce (especially Norway) occurred across southern Maine in 1996. Trees which had been pruned, wounded or otherwise stressed seemed to have the highest numbers of masses. Infestation most often occurs at a branch junction or at a wound site. Scattered streams of pitch flowing down the trunk are one of the first signs of any infestation. Once established, the pitch tends to be worked into a cream colored to light tan, convoluted glob which protects the boring larvae. Older workings often attain the color of the tree bark. Although messy, this species does not often kill trees by itself. Control is not usually feasible.

Red Turpentine Beetle (*Dendroctonus valens*) - Although this bark beetle is known to infest all species of pine within its range, it appears to be most common in Maine on hard pines, especially red. Small infestations of one up to several trees have occurred in local stressed situations over the years but this turpentine beetle has not generally been considered a major problem in Maine. Reports were received in 1996 of large numbers of beetles actively flying around sawlogs in Mercer and an infestation of plantation red pine in Dover-Foxcroft. More reports of this type could occur around cuttings and stressed sites. This species can kill trees especially when aided by other species of bark beetles.

Saratoga Spittlebug (*Aphrophora saratogensis*) - No new infested areas were reported in 1996. Very limited areas are currently impacted by this pest in Maine.

Spruce Beetle (***Dendroctonus rufipennis***) - Spruce beetle populations on coastal islands off Waldo, Hancock, and Washington counties showed considerable resurgence and expansion from 1994 to 1996. Small pockets of spruce beetle infestation were first reported on coastal islands in eastern Maine in 1989 about the same time that the insect was killing large numbers of white and some red spruce in northern and western Maine. Beetle populations did not reach outbreak levels on the affected islands from these first attacks and only a few large white spruce were killed. New attacks were rare by 1990. In 1991, however, an early season wet snow storm followed by high winds resulted in blowdown on several islands. Wind thrown trees that were weakened but still alive provided an excellent breeding ground for resident spruce beetles. Large numbers of beetles reared from weakened trees attacked the largest white spruce near blowdown areas and pockets of mortality expanded rapidly. By late fall of 1994 many islands in Penobscot Bay and along the coast of Hancock County had a significant amount of white spruce mortality Fig. 4).

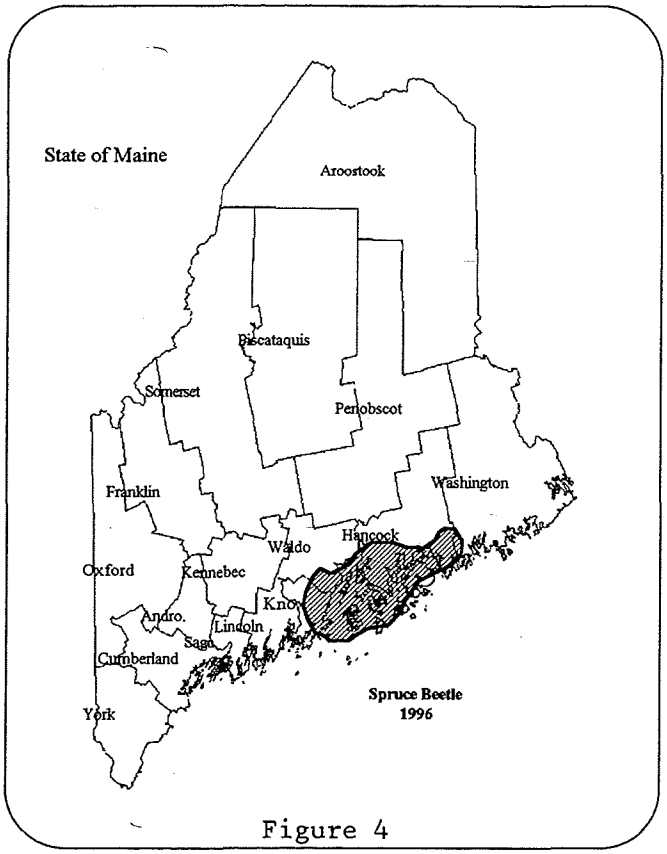


Figure 4

Areas of spruce beetle attack on islands continued to expand and intensify through 1996. Currently several islands in eastern Penobscot Bay and islands off Deer Isle and Stonington have more than 50 percent mortality to white spruce over 10 inches DBH. Thirty-seven pockets of infestation have been located on mainland coastal areas, mostly in Hancock County. As of November 1996, 1,910 acres of 30 to 50 percent mortality and 280 acres of greater than 50 percent mortality have been mapped. Significant populations of spruce beetle on red spruce were identified on Acadia National Park land on Isle Au Haut in July of 1996. The infestation in this red spruce area was very active and expanding at the time of its discovery.

Compared to the 80's spruce beetle outbreak in northern Maine, spruce beetle on coastal islands tend to attack smaller trees. In northern Maine, spruce beetle infestation pockets subsided after most trees over 15 inch DBH had been killed and trees under 12 inches were rarely attacked. On coastal islands, attack on 10 inch trees is common and even smaller trees may be killed. The island outbreak is similar to the northern outbreak in that the largest white spruce are the first to be attacked. Most islands that are heavily attacked were once cleared as pasture and are now forested predominantly with white spruce that is generally 80 to 120 years of age. Red spruce was the original cover species of many of these islands but is now rare on most of them. Spruce beetle attack on island red spruce was thought to be very rare until the discovery of the Isle Au Haut infestation. Many islands off Washington County are still predominantly red spruce and are not currently affected by the beetle outbreak.

Island spruces killed by spruce beetle decay soon after death and most are not suitable for salvage even after one year. The island environment is very moist and bark is usually retained on dead trees for several years. These factors provide excellent conditions for decay. In northern Maine, beetle killed trees lost

their bark quickly, trees dried, and decay progressed slowly, increasing opportunities for salvage. Salvage opportunity on Maine's coastal islands will be limited by rapid decay and logging and transportation difficulties.

See also **eastern dwarf mistletoe** (p. 43).

Spruce Budmoth (*Zeiraphera canadensis*) - This chronic problem affecting white spruce varies in intensity from year to year and from plantation to plantation. Although few hot spots were reported in 1996 it was not difficult to find signs of activity especially on landscape trees in Knox and Lincoln counties.

Spruce Bud Scale (*Physokermes piceae*) - This scale often remains inconspicuous until populations reach high levels and sooty mold and discoloration of growing tips draws attention to the problem. Populations continue to remain locally high throughout the state but especially in Hancock, Kennebec and Washington counties. Damage in 1996, however, was visibly light overall.

Spruce Budworm (*Choristoneura fumiferana*) - Since the late 1980s when the last spruce budworm outbreak in Maine subsided, low level populations of this insect have been monitored through field observations, a statewide light trap network, and pheromone baited traps. Twenty eight locations were evaluated for spruce budworm moth activity using pheromone baited traps in 1996. Nine of these were at light trap locations. Light traps were operated through the budworm moth flight period at 24 locations. Even though larval occurrence and moth catch in light and pheromone traps have been consistently very low throughout the 1990s, landowners remain interested in the status of this pest. This interest stems from the extremely destructive potential of the spruce budworm and the likelihood that outbreaks will occur again.

Very few larvae and no defoliation were detected in 1996. The total number of moths caught in the statewide network of light traps showed only a slight increase (Table 7) but budworm moths were caught at only 10 of the 24 light trap locations in 1996 (Table 6).

Moth catches in pheromone baited traps, however, did show an interesting deviation from the trend observed for the past several years. Several trapping locations on the western border and in northern Maine that had been consistently low, caught increased numbers of moths in 1996 (Table 8). One location, Ste. Aurelie, had a trap average of over 12 moths per trap. Ten moths per trap is considered a threshold level at which the number of trapping locations is increased in that area the following season. Increased catches were recorded only in the west and north with 13 of 17 locations producing a higher moth catch than in 1995. Increases in spruce budworm moth catch, especially in the west, correspond with increases in budworm population in portions of Quebec. All southern and eastern pheromone locations had catches of less than 1 moth per trap and were unchanged compared to 1995. Increased moth catch in an area or in general is not considered a trend unless the increases occur for two or more years or unless catches reach moderate or high levels. Pheromone catches in 1996 are still considered to be low but trapping will be intensified in 1997.

Table 6. Total number of spruce budworm (*Choristoneura fumiferana*) moths collected at light

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	3	0	1	7	0	2	0
Arundel					0	3	2
Ashland	0	0	0	0	0	0	0
Blue Hill	1	0	0	4	0	0	0
Brunswick	0	3	0	0	0	1	0
Calais	11	3	0	0	0	0	0
Chesuncook	0	1	0	1	0	0	0
Clayton Lake	4						
Dennistown	0	0	0	0	0	1	0
Elliotsville	0	0	0	2	0	1	0
Exeter	10	4	5	21	16	6	3
Greenbush	0	1	0	1	0	0	0
Guerette	0	0	0	0	0	0	0
Haynesville	1	0	0	0	2	0	2
Kingfield	0	0	0	2	2	0	1
Matagamon	0	0	1	2			
Millinocket	0	1	0	0	0	4	9
Mt. Vernon	1	0	0	2	1	2	12
No. Bridgton	0	0	1	0	0	2	0
Rangeley	1	0	2	8	0	1	0
Shin Pond					0	0	3
South Berwick	0	0	0	2	0	0	0
Ste. Aurelie	0	0	0	0	0	0	0
Steuben	73	8	0	0	5	0	3
Topsfield	0	0	0	0	0	1	12
Washington	2	0	6	0	0	0	1
Total Number of Moths	**107**	**21**	**16**	**52**	**26**	**24**	**48**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Table 7. Spruce budworm seasonal light trap summary - 1961-1996

Year	Total # Moths	# Traps	Average # Moths/Trap
1996	48	24	2
1995	24	24	1
1994	26	24	1.1
1993	52	23	2.3
1992	16	23	0.7
1991	21	23	0.9
1990	107	24	4.4
1989	731	22	30.7
1988	209	20	10.4
1987	464	20	23.2
1986	1,365	20	68
1985	13,233	20	661
1984	17,983	20	895
1983	144,673	18	8,037
1982	49,200	20	2,460
1981	39,724	20	1,986
1980	100,537	19	5,291
1979	95,811	16	5,988
1978	220,264	17	12,957
1977	24,212	15	1,614
1976	22,308	16	1,394
1975	149,874	23	6,516
1974	158,784	24	6,616
1973	39,069	24	1,628
1972	15,959	24	665
1971	20,653	25	826
1970	1,076	24	45
1969	5,415	27	201
1968	948	24	39.5
1967	120	26	4.6
1966	51	24	2
1965	83	24	3.5
1964	159	25	6
1963	133	24	5.5
1962	258	23	11.2
1961	763	17	44.9

Table 8. Spruce budworm pheromone trap catch in Maine - 1992 to 1996**

Location	*Year*					*Location*	*Year*				
	1992	*1993*	*1994*	*1995*	*1996*		*1992*	*1993*	*1994*	*1995*	*1996*
Allagash		5	<1	<1	1	Jonesboro	11	1	<1	<1	<1
Calais *	<1	<1	<1	<1	<1	NE Carry		<1		<1	<1
Chesuncook	6	2	<1	<1	<1	Princeton		2		<1	<1
Clayton Lake		2	<1	<1	<1	Steuben *	32	4	2	2	<1
Coburn Gore		1	<1	1	1	St. Pamphile		7	1	1	<1
Connor		<1	<1	<1	2	Topsfield *	1	<1	<1	<1	<1
Daaquam		<1	<1	<1	1	Waltham	25	2	4	<1	<1
Dennistown *	5	1	<1	1	2	Smith Pond *	6	3	<1	<1	<1
Dickey Brook *	<1	3	<1	<1	1	St. Francis Lake		1	<1	2	3
Duck Lake	<1	<1	<1	<1	<1	Oxbow	10	<1	<1	<1	1
Franklin			37	4	<1	Ragmuff		1			4
Garfield	6	2	<1	<1	2	Rangeley		1	2	<1	3
Greenbush *	3	<1	<1	<1	<1	Ste. Aurelie *	2	<1	<1	1	12
Haynesville *	4	1	<1	<1	<1	Matagamon ***	18	4	1	1	2

* Light trap locations ** These figures reflect a per trap average from a cluster of three traps *** A light trap this location only in 1992 and 1993

Spruce Spider Mite (*Oligonychus ununguis*) - Mites, and in particular the spruce spider mite, are present to some degree on most conifers every year and the characteristic mottling often detracts aesthetically from otherwise lush green foliage. Populations remained chronic in 1996 but were locally heavy enough to warrant control on ornamental arborvitae, hemlock and spruce and in some balsam fir Christmas tree plantings.

White Pine Weevil (*Pissodes strobi*) - The white pine weevil is undoubtedly the most economically damaging pest of white pine in Maine rivaled only by **white pine blister rust**. This is one of those chronic problems in most areas and seriously limits growth of good straight white pine unless controlled. Young trees (three to 30 feet in height) normally bear the highest incidence of attack. Although weevil populations remain fairly stable at high levels; annually visible new damage to high value stock fluctuates, due in part to limited availability or improper use of effective, registered pesticides. Corrective pruning will help in the case of ornamental white pine as well as Colorado blue and Norway spruce.

Yellowheaded Spruce Sawfly (*Pikonema alaskensis*) This is a native insect whose population level fluctuates over time. It has been on the increase since 1990 and dieback and mortality of young, open grown trees has become more evident in the past couple of years. Roadside, ornamental and plantation trees scattered all over the state have been affected. The damage can be spotty with one particular tree or group of trees repeatedly attacked while other nearby trees will have little or no damage. Although all species of spruce are fed on by the yellowheaded spruce sawfly, black spruce have been the primary target during this outbreak. This holds true even when black, white and red spruce are growing in close proximity to one another. The feeding will be heavier on the black spruce than on other species.

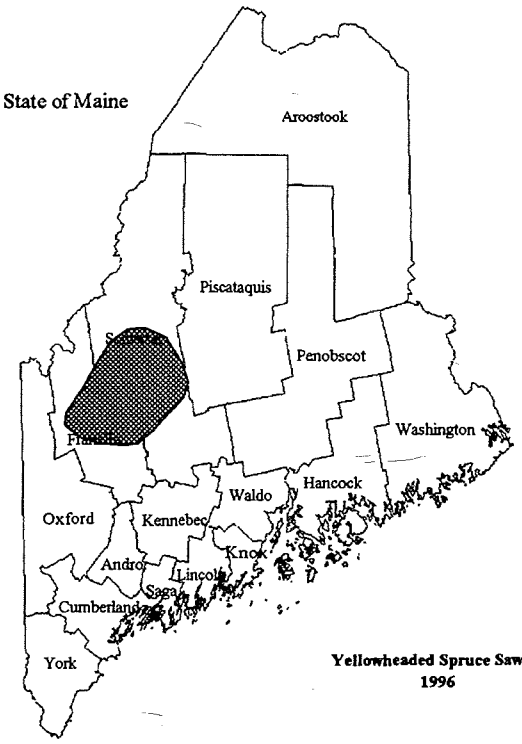


Figure 5

Aerial surveys for yellowheaded spruce sawfly picked up areas of heavy defoliation in western Maine that were confirmed on the ground (Fig. 5). Surveys of eastern Maine did not pick up any areas of heavy damage in that region. Plantations of black spruce in Franklin and Somerset counties have been most severely affected with 1500 acres of moderate to severe damage producing growth reduction and mortality. The sawfly population appears to still be on the increase in most areas although some locations with heavy damage had less feeding in 1996 than in preceding years. Young spruce are most often attacked by the yellowheaded spruce sawfly but mature trees that are growing in an open situation can be defoliated as well.

The Maine Forest Service will be monitoring the population level of this insect and assisting landowners with control measures in 1997. Maine, New Brunswick and Quebec are working cooperatively, all setting up plots to measure different aspects of the population dynamics and damage caused by the yellowheaded spruce sawfly.

(B) Hardwood Insect Pests

NOTE: This section now includes all insect pests of deciduous trees and shrubs in forest, ornamental and urban settings

Alder Insects - Alder thickets looked brown and thin locally in 1996 but insect defoliation appeared to be down somewhat. Flooding of many lowland pockets by expanding **beaver** populations caused much more noticeable damage. It was not difficult, however, to find pockets of local defoliation caused by; the **alder flea beetle** (*Altica ambiens alni*), **alder leaf beetle** (*Chrysomela mainensis mainensis*) and **alder sawfly** (*Arge* sp.).

Aphids (various) - Although aphids on deciduous hosts are present every year, we received few reports of unusually heavy activity in 1996. Heavy infestation of hawthorn by the interesting and attractive yellow **fourspotted hawthorn aphid** (*Utamphorophora crataegi*) was observed in Cape Porpoise in early October.

Ash Defoliators (various) - Ash throughout much of the state looked better in 1996 than in 1995 and pest populations appeared to be down. Noted exceptions were observed in coastal areas around the western shore of Penobscot Bay where **ash leaf** and **twig rust** in concert with a number of insect pests produced thinning and/or browning of foliage. Of the insects causing ash defoliation in 1996 the **fall webworm** (*Hyphantria cunea*) was the most predominant overall. One of the more interesting defoliators reported was the **promethea moth**(*Callosamia promethea*). Although not common, the caterpillars of this rather scarce native silkworm moth were observed very locally as far north as Millinocket in 1996.

Asian Cerambycid Beetle (*Anoplophora glabripennis*) - This potentially serious woodboring pest of deciduous trees HAS NOT BEEN FOUND IN MAINE. It is not known to be established any where in North America except in the New York City area. Early detection of any infestation by this beetle/woodborer is critical - so watch for it and report any signs of possible activity to the I&D Lab in Augusta. And do not import hardwood firewood from New York City!

Aspen Problems (various) - Thinning and defoliation of trembling aspen was striking in many areas in 1996 especially in central and southern Maine. Reports of concern were numerous and many areas checked revealed a complex of problems ranging from drought stress to foliage diseases such as **Septoria leaf spot** to a variety of **leafroller/tiers** and **leaf beetles**. There seemed to be few areas of defoliation that were solely attributable to insect activity however.

The areas affected by the **aspen leafroller** (*Pseudexentera oregonana*) in northern Maine in 1994/95 exhibited lighter and more diffused defoliation in 1996 and were not mapped. This leafroller did appear to be a "player" at low levels at least across much of southern Maine.

Bark Beetles (various) - The **native elm bark beetle** (*Hylurgopinus rufipes*) and the **smaller European elm bark beetle** (*Scolytus multistriatus*) continued to work on our residual elms and the **eastern ash bark beetle** (*Hylesinus aculeatus*) continues to be a firewood related problem in homes.

Bark Lice or Psocids - "Herds" of these interesting "little cattle" became very noticeable on the bark of various trees again this past season across much of southern Maine. The highest numbers observed were in coastal York County where the whitish silken mats covering overwintering eggs gave dark tree bark the polka-dot look in October. Although colonies are usually more abundant and evident on hardwoods, they also occur on a variety of softwoods as well. The psocid species most commonly noticed on tree bark in Maine is *Cerastipsocus venosus*.

Psocids appear first as patches of tiny tan specks on the bark in early July. As they approach maturity in late July they appear as small (3/16" long), gray insects with white cross banding. The adults have dark smoky gray wings with a triangular light spot on each forewing. Bark lice feed on lichens and fungi on

the tree bark and not on the tree itself so they do no harm. They disappear soon after the adults develop wings in August. Overwintering eggs are laid beneath patches of silk rods on the bark.

Beech Problems (various) - Many beech stands exhibited severe dieback in 1996 resulting from what appeared to be multiple stressors (see **hardwood decline** p. 44). Although drought and a variety of problems were involved, the **beech bark disease** component was still one of the more serious factors. **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 the **beech scale** (*Cryptococcus 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 this 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 scale populations. In addition defoliators such as the **variable oak leaf caterpillar** have added another layer of stress in recent years.

Birch Casebearer (*Coleophora serratella*) - Defoliation by the birch casebearer declined noticeably in 1996 even in roadside areas across northern and central Maine which were hit hard in 1995.

Birch Leafminer (*Messa nana*) - Although defoliation by this species was still visible throughout much of the area defoliated in 1995 (Fig. 6) it appeared to be generally lighter in intensity. Pockets of heavy defoliation were also more scattered.

The **grey birch leafminer** (*Fenusa pusilla*) seems to be making a comeback and populations were up slightly across much of the state in 1996.

Birch Skeletonizer (*Bucculatrix canadensisella*) - Populations and damage from this species remained low in 1996.

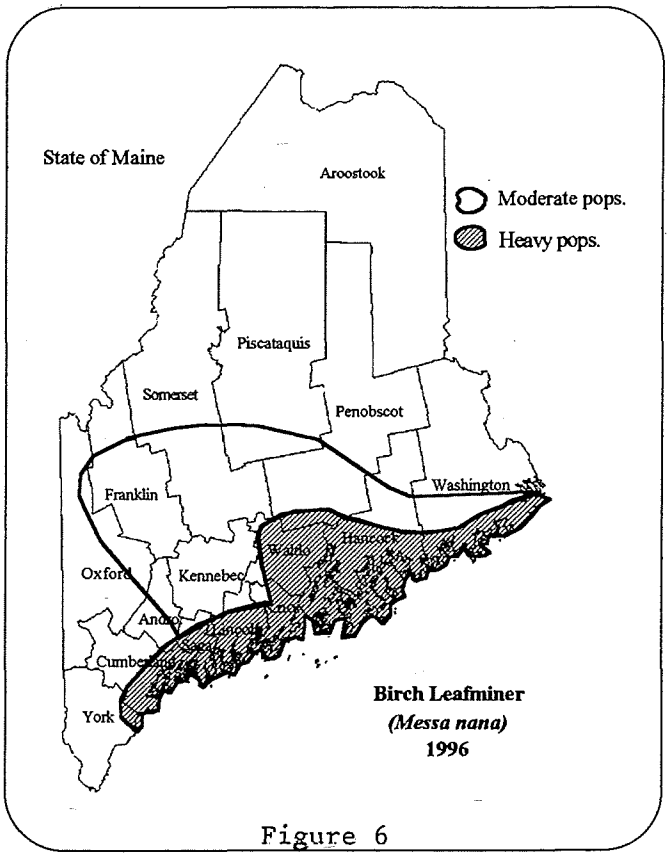


Figure 6

Bronze Birch Borer (*Agrilus anxius*) - Dead-topped birch resulting from stem boring activity of this insect continue to show up where stress of one kind or another exists. Birch on drought prone sites, recently thinned woodlots and "abused" landscape situations are most susceptible. Once birch are infested with this borer there is little that can be done to prevent eventual tree mortality.

Browntail Moth (*Euproctis chrysorrhoea*) -The current outbreak of browntail moth in Maine, which began in 1989, continued to expand in range and intensity in 1996. No longer confined to the islands of Casco Bay, the browntail can be found at very high levels on scattered locations on the mainland from Cape Elizabeth northward along the coast to Phippsburg. Low numbers of overwintering webs are likely to be encountered on suitable host type from Kittery to Rockland (Fig. 7) with the most eastern collection of webs this year from Port Clyde. Aerial surveys conducted in July of 1996 mapped 3,040 acres of hardwood type on coastal islands which were defoliated by this pest as compared to 2,420 acres in 1995. No mainland areas were extensive enough to be mapped from the air but numerous locations exhibited

light to moderate damage and many individual trees could be seen which were completely stripped of foliage. The browntail feeds on a very wide range of deciduous trees and shrubs; rugosa rose and *Prunus* spp. are favored when the populations of this insect are low, while oaks and shadbush are heavily utilized at high population levels.

Defoliation by the browntail causes a high stress level on trees and may lead to an increase in the number of dead twigs and branches in the tree crowns. Actual tree mortality in infested areas has been very low to date and has been restricted to trees which were under additional stress (i.e. poor site, etc.) prior to the infestation.

The larvae of this species have toxic hairs on their skin which are more frequently of concern to people entering infested areas than is the defoliation. These toxins increase as the larvae mature and contact with the hairs can cause a very **severe rash** or inhalation of the hairs may result in **respiratory distress**. A recent survey of individuals living in the infested areas found that 21% of the respondents experienced some respiratory discomfort which is 11% higher than state norms established by the American Lung Association. Medical reaction to the toxic hairs is most common from mid-June through July when the late instar larvae are molting to the final larval instar and during pupation.

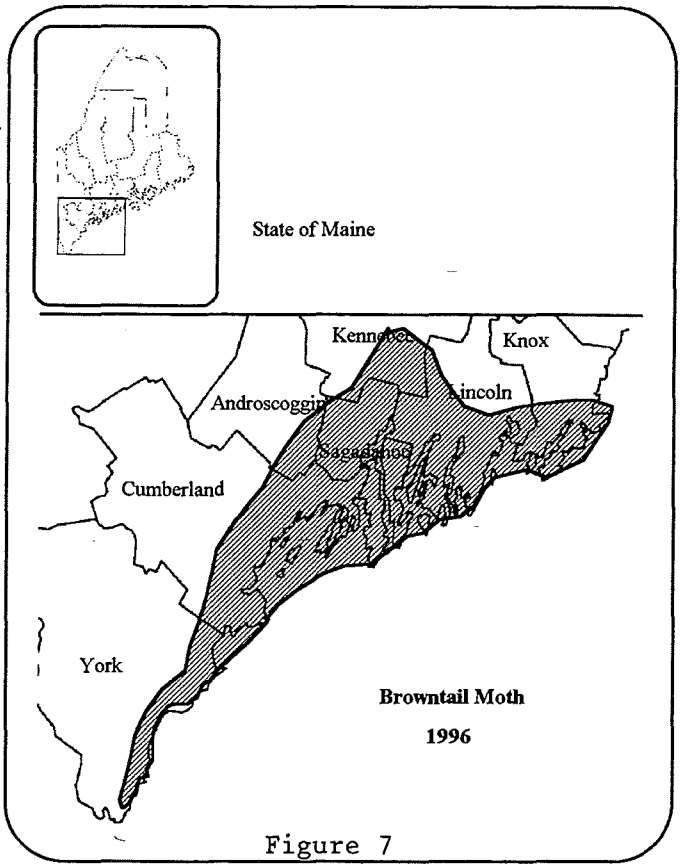


Figure 7

Aerial applications of Dimilin were done to limit the impact of this insect on five islands in Casco Bay and about 160 acres in Falmouth. Three of the islands, Cushing, Great Diamond and Peaks, were done in a project carried out by the City of Portland. The remaining acreage was done under a private contract through a local arborist. Maine Forest Service personnel monitored the applications and conducted testing to assess spray efficacy. Larvae within the spray areas had a mortality rate of 99.6 % whereas those monitored in untreated areas had a mortality rate of only 3.2 % during the same time period.

While very efficacious against the browntail, Dimilin has the potential to be very damaging to the ecosystem; particular concerns were raised by fishermen regarding the possible adverse impact of this product on lobsters should any off site drift occur during the applications. The Maine Departments of Marine Resources and Environmental Protection assisted in monitoring any adverse impacts resulting from the aerial control efforts in 1996. Caged lobsters and crabs were placed in waters adjacent to areas being treated prior to the actual application and were left for several days to allow them to be exposed to any Dimilin that might drift into the water. These animals were collected and maintained in tanks until molting took place after which they were released. No adverse affects which could be attributed to exposure to Dimilin were observed. Cards designed to detect the presence of the spray were also used to determine the accuracy of the treatment. Just prior to the application the cards were placed in a line from the high water mark across the 100 foot no-spray zone and into the actual spray area. While the cards within the spray area had high rates of spray deposit, no droplets were seen on cards within 50 feet of the water. This would indicate no direct contamination of the water adjacent to the treated areas occurred as a result of the aerial application.

Bruce Spanworm (*Operophtera bruceata*) - Populations and distribution of this early season looper remained relatively stable in 1996 and although low numbers could be found statewide, highest numbers occurred in north central and in western Maine (Figure 8). A total of roughly 11,000 acres of defoliation were observed in: Franklin (500 A.); Oxford (500 A.); Penobscot (2,500 A.); Piscataquis (2,500 A.) and Somerset (5,000 A.) counties. Although early larval parasitism was locally very high in portions of Somerset County, other populations were healthy. An expansion (1,000 A.) of the infested area was noted in Piscataquis County. The Bruce spanworm populations seem to be highest in stands with a substantial understory of either beech or sugar maple and defoliation is most often heaviest on the understory trees.

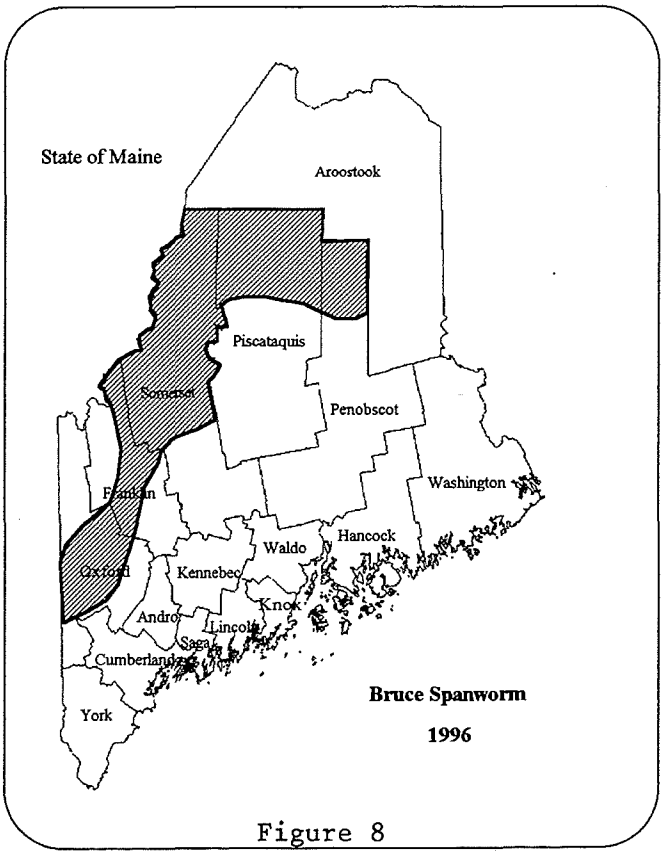


Figure 8

Butternut Problems (various) - The condition of butternut in Maine seems to have declined in recent years due to a number of problems. Although butternut occurs in all Maine counties, it reaches the northern limits of its range in this state. It is probably for this reason that most trees do not reach their full stature and suffer more from stress. The **butternut canker** (p. 41) has added a further burden compounded by insect depredations. The **butternut woollyworm** (*Eriocampa juglandis*) and **lacebugs** (*Corythucha* sp.) locally affect tree appearance on an annual basis. Over the past couple of years however, there have been increasing reports of heavier defoliation by **sawfly** larvae (? spp.), **tubemakers** (*Acrobasis* sp.) and at least two species of small **weevils** (unidentified Curculionidae). The most extensive defoliation affected trees over several acres along Rte. 150 north of Guilford. Many trees in this area were totally stripped in early June of 1996.

Eastern Tent Caterpillar (*Malacosoma americanum*) - Tents of this species were locally abundant across much of the state in late May and early June of 1996 but nowhere did they seem as excessive as they have in times past. The messy nests and defoliation of scrub cherry and apple were mostly a nuisance.

Elm Flea Beetle (*Altica carinata*) and Elm Leaf Beetle (*Pyrrhalta luteola*) - Defoliation of elm by either or both of these species was low and local in 1996.

Fall Cankerworm (*Alsophila pometaria*) - The only notable activity by this species continues to be on boxelder in eastern Aroostook County. This infestation dropped in size and intensity in 1996 becoming spotty.

Fall Webworm (*Hyphantria cunea*) - This species was abundant in many areas of the state in 1996 especially in northern and eastern Maine. Although it has been considered primarily a nuisance there is some evidence of at least some branch mortality on ash which have been heavily defoliated for two or more years.

Forest Tent Caterpillar (*Malacosoma disstria*) - The nature of the dynamics of this insect continues to elude us! There were indications in 1995 that populations were increasing but the trend went in the other direction in 1996 as populations collapsed. Although it was not difficult to find larvae in 1996, no areas of observable defoliation were mapped. Even urban/ornamental populations declined noticeably. Moth catches declined in the light trap survey as well (Table 9).

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

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	65	39	54	78	64	27	8
Arundel					82	150	39
Ashland	110	122	124	169	117	157	57
Blue Hill	20	27	43	47	221	62	17
Brunswick	54	69	17	9	35	32	33
Calais	7	11	23	279	52	28	3
Chesuncook	0	0	1	0	2	1	0
Clayton Lake	7						
Dennistown	45	37	58	44	89	79	10
Elliotsville	36	49	78	55	53	145	18
Exeter	1	1	2	1	8	4	0
Greenbush	44	56	24	30	87	95	149
Guerette	20	28	8	12	32	18	4
Haynesville	45	56	36	45	176	64	9
Kingfield	1	4	18	20	97	95	32
Matagamon	46	63	126	56			
Millinocket	14	20	43	7	73	75	0
Mt. Vernon	39	32	107	39	187	192	46
No. Bridgton	90	115	153	297	223	102	51
Rangeley	1	81	47	48	57	11	3
Shin Pond					124	217	30
South Berwick	245	352	324	377	371	195	91
Ste. Aurelie	6	18	13	9	28	15	6
Steuben	8	9	0	2	169	11	7
Topsfield	33	28	45	102	178	40	14
Washington	31	23	36	53	111	41	45
Total Number of Moths	**968**	**1,240**	**1,380**	**1,779**	**2,636**	**1,856**	**672**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Greenstriped Mapleworm (*Dryocampa rubicunda*) - Populations of this species dropped noticeably in 1996 and no defoliation was reported. This species is primarily a feeder on red maple in Maine. Numbers of the familiar pink and yellow adults, the **rosy maple moth**, dropped noticeably after four years of increasing numbers (Table 10).

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

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	0	0	0	2	0	0	0
Arundel					468	531	130
Ashland	0	0	0	1	0	0	0
Blue Hill	115	24	46	104	46	113	30
Brunswick	20	13	16	4	27	20	8
Calais	20	7	4	13	29	240	19
Chesuncook	10	4	1	3	8	51	3
Clayton Lake	0						
Dennistown	1	0	1	1	5	1	2
Elliotsville	58	7	11	14	30	103	18
Exeter	6	1	1	3	9	7	2
Greenbush	16	10	12	13	14	48	34
Guerette	0	0	0	0	0	0	
Haynesville	5	8	2	8	12	34	5
Kingfield	0	0	0	0	0	0	4
Matagamon	0	0	0	0			
Millinocket	61	8	27	38	66	93	23
Mt. Vernon	2	24	18	5	11	32	16
No. Bridgton	2	4	6	2	6	24	20
Rangeley	0	0	0	1	0	0	0
Shin Pond					0	1	1
South Berwick	95	41	373	340	189	276	171
Ste. Aurelie	0	0	0	0	0	0	1
Steuben	14	42	84	22	33	56	11
Topsfield	17	20	12	31	37	133	24
Washington	7	89	48	90	101	181	34
Total Number of Moths	**449**	**302**	**662**	**695**	**1,091**	**1,944**	**556**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Gypsy Moth (*Lymantria dispar*) - Populations of the gypsy moth and resultant defoliation rose slightly in 1996 from the 1995 low (Table 11). From a survey and management view, we have two populations of the gypsy moth in Maine - the southwestern population associated with red oak stands from Waterville south and west, and the eastern population associated in gray birch and poplar stands from Waterville toward the north and east. The southwestern population went through an outbreak phase from 1989 to 1993 and has remained at very low levels since that time. The eastern population began to rise in 1996 with about 100 acres of defoliation in poplar stands in northern Waldo and southern Penobscot counties. Field examination of late instar larvae found high mortality of the insects resulting from infection caused by the fungus, ***Entomophaga maimaiga*** in much of this eastern population. Similar findings have been reported all along the eastern range of the gypsy moth in North America. This fungus has effectively reduced stress on both people and forests in many areas but is making the prediction of population trends using traditional methods rather difficult.

Table 11. Total acres defoliated by gypsy moth in Maine during the current outbreak (1988-1996)

Year	Acres Defoliated
1988	100
1989	34,280
1990	270,432
1991	620,933
1992	278,485
1993	50,694
1994	1,706
1995	0
1996	100

Surveys of the overwintering egg masses of the gypsy moth in August of 1996 found very few in the southwestern area (2 egg masses in total) and low population levels in the east, all of which were in the Penobscot River area. Moths caught in the light trap survey also declined in 1996 (Table 12). These data would indicate that the population should remain at endemic levels and be of little concern in 1997.

Table 12. Total male gypsy moths *(Lymantria dispar)* collected at light.

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	0	0	0	0	0	0	0
Arundel					0	1	0
Ashland	0	0	0	0	0	0	0
Blue Hill	0	0	0	1	4	0	0
Brunswick	20	220	6	0	0	0	0
Calais	0	2	5	0	0	0	0
Chesuncook	0	0	0	0	0	0	0
Clayton Lake	0						
Dennistown	0	0	0	0	0	0	0
Elliotsville	0	0	0	0	0	0	0
Exeter	0	3	0	0	0	0	1
Greenbush	0	0	29	0	0	0	0
Guerette	0	0	0	0	0	0	0
Haynesville	0	0	0	0	0	0	0
Kingfield	0	0	0	0	0	0	0
Matagamon	0	0	0	0			
Millinocket	0	4	0	1	7	0	2
Mt. Vernon	15	142	78	1	27	12	0
No. Bridgton	156	213	17	1	2	0	0
Rangeley	1	0	0	0	0	0	0
Shin Pond					0	0	0
South Berwick	29	191	315	153	4	23	1
Ste. Aurelie	0	0	0	0	0	0	0
Steuben	0	1	3	0	0	0	0
Topsfield	0	2	1	2	0	0	0
Washington	0	13	19	0	0	0	0
Total Number of Moths	**221**	**791**	**473**	**159**	**44**	**36**	**4**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Hunter's Moths (adults of several species of cankerworms) - The adults of a number of species of loopers/cankerworms fly late in the season from September through November. Over the years these have come to be known as **hunter's moths**. During the fall of 1996 most of these seemed only moderately active. Species included in this group are: **Bruce spanworm, fall cankerworm** and **hemlock looper**.

Large Aspen Tortrix (*Choristoneura conflictana*) - No defoliation specifically attributable to large aspen tortrix was detected with either ground or aerial surveys in 1996. Larvae were, however, common in some stands defoliated by a complex of problems (see Aspen Problems p. 22). The number of moths collected at our light trap stations substantiated other surveys. Moth numbers remained low in 1996 (Table 13).

Table 13. Total number of large aspen tortrix (*Choristoneura conflictana*) moths collected at light

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	13	1	0	5	0	0	1
Arundel					0	12	1
Ashland	10	0	0	0	0	0	3
Blue Hill	0	3	14	2	1	5	2
Brunswick	0	0	3	0	0	0	2
Calais	6	14	2	0	0	0	0
Chesuncook	0	0	0	0	0	0	0
Clayton Lake	7						
Dennistown	974	0	0	2	0	1	0
Elliotsville	159	33	42	14	0	2	17
Exeter	0	5	4	15	6	12	3
Greenbush	2	25	28	29	0	0	0
Guerette	0	1	0	0	2	0	0
Haynesville	15	257	3	0	0	0	0
Kingfield	2	0	3	0	0	0	0
Matagamon	0	0	3	0			
Millinocket	11	14	5	0	0	3	1
Mt. Vernon	1	4	2	2	0	5	2
No. Bridgton	0	0	2	0	0	2	0
Rangeley	1	5	47	92	0	13	14
Shin Pond					1	0	0
South Berwick	0	3	4	0	0	0	2
Ste. Aurelie	8	0	0	1	0	0	0
Steuben	0	4	2	1	0	0	0
Topsfield	42	20	15	1	0	0	4
Washington	0	0	14	0	0	2	6
Total Number of Moths	**1,251**	**389**	**193**	**164**	**10**	**57**	**58**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Locust Leafminer (*Odontota dorsalis*) - Black locust throughout much of southern Maine south of Lincoln and west of Machias again showed varying degrees of rusty foliage, the result of leaf mining activities of this species, in 1996. Some stands appeared to be spared while others were "scorched." Overall the damage appeared to be lighter than experienced in 1995.

Maple Leafcutter (*Paraclemensia acerifoliella*) - A severe infestation of sugar maple by this species was reported in September in northern York County. Roughly 40 acres exhibited complete defoliation while another 60 acres or so suffered light to moderate defoliation. This was the first infestation of this magnitude seen in Maine in recent years although this leafcutter can be found in low numbers nearly every year. Scattered stands exhibiting lighter but varying degrees of defoliation were reported elsewhere in southern Maine as well.

Along with the maple leafcutter we also saw rising numbers of other late season defoliators of sugar maple such as the **maple trumpet skeletonizer** (*Epinotia aceriella*) and **maple webworm** (*Tetralopha asperatella*). Late season pests such as these usually are not a problem unless late refoliation occurs or if there are three or more successive years of high populations.

Maple Leafroller (*Sparganothis acerivorana*) - Populations of maple leafroller remained very low again in 1996 and little defoliation of red maple was observed.

Mountain Ash Sawfly (*Pristiphora geniculata*) - This introduced species is on our list of perennial problems affecting ornamental mountain ash. The 1996 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 Leaf Shot-hole Fly (*Japanagromyza viridula*) - Little foliage damage by this species was observed in 1996. Fly populations, emergence and bud expansion must be in sync for damage to occur.

Oak Leaftier (Shredder) (*Croesia semipurpurana*) and Oak Leafroller (*Archips semiferana*) - Defoliation by these two species in 1996 was again very local. Light infestations of the leaftier continued to occur in Kennebec and Lincoln counties. The **oak skeletonizer** (*Bucculatrix ainsliella*) was not observed in 1996 for the second consecutive season.

Oak Sawflies (various) - Oak sawfly larval activity seemed to drop somewhat overall in 1996. Although there were a number of species involved, the **spiny oak sawfly** larvae (*Periclista* spp.) again appeared to be the most common.

Oak Twig Pruner (*Elaphidionoides villosus*) - Damage caused by the feeding of this species on red oak appeared to be heavier throughout southern Maine in 1996 than in 1995. This species has a two year life cycle although brood emergence may overlap. The 1996 season was very likely the peak year for emergence in Maine. Mined twigs and small branches (up to 1-1/2" in diameter) break at the point of girdling and either hang as flags or drop to the ground. The larvae should be in the mined out center portion of these twigs. By collecting and destroying the fallen branches you may reduce populations for another year somewhat but this will not prevent reinfestation. Some trees seem to be hit every year and even though pruned branches may litter the ground beneath these trees, permanent injury seldom if ever results.

Orangehumped Mapleworm (*Symmerista leucitys*) - Populations of this colorful caterpillar dropped in 1996 from 1995 levels. Although solitary individuals could be seen in many stands, numbers and damage were low.

Moths of *Symmerista* spp. are monitored in our light trap survey but due to similarities in our three Maine species they are not separated. Collections of *Symmerista* spp. dropped noticeably in 1996 (Table 14) which was surprising in view of the noticeable rise in numbers in 1995.

Table 14. Total number of *Symmerista spp.* moths collected at light

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	0	0	0	0	0	0	0
Arundel					4	3	3
Ashland	0	0	0	0	0	2	1
Blue Hill	0	0	1	6	32	33	7
Brunswick	4	8	0	1	5	17	3
Calais	5	1	3	0	0	41	13
Chesuncook	1	0	0	1	2	20	3
Clayton Lake	0						
Dennistown	0	1	0	0	0	0	0
Elliotsville	44	10	5	4	1	50	2
Exeter	0	1	0	1	3	15	7
Greenbush	3	0	0	0	0	10	3
Guerette	0	0	0	0	0	0	0
Haynesville	1	0	0	0	0	2	1
Kingfield	0	0	0	0	0	5	0
Matagamon	2	0	0	0			
Millinocket	9	0	0	0	0	4	0
Mt. Vernon	3	2	4	4	23	141	42
No. Bridgton	3	10	8	21	12	73	7
Rangeley	0	1	0	0	0	2	3
Shin Pond					0	26	1
South Berwick	18	13	30	4	1	5	3
Ste. Aurelie	0	0	0	0	3	0	0
Steuben	0	7	0	0	3	13	7
Topsfield	67	5	3	0	13	152	11
Washington	3	6	9	10	44	322	12
Total Number of Moths	**163**	**65**	**63**	**52**	**146**	**936**	**129**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Oystershell Scale (*Lepidosaphes ulmi*) - Populations of this scale on beech remained endemic in 1996. Damage from this and other pests such as **beech scale** and **variable oakleaf caterpillar** exacerbated by drought is very likely responsible for much if not all of this season's deterioration and mortality of beech (see **Hardwood decline** p. 44).

Pear Thrips (*Taeniothrips inconsequens*) - No damage to sugar maple from pear thrips feeding was reported in 1996 and populations were again barely detectable.

Pigeon Horntail (*Tremex columba*) - This colorful wood wasp and its very large and striking parasites (***Megarhyssa* spp.**) continue to draw attention. The horntails infest sugar maple hosts and are followed by the large wasp parasites which are drawn to the larvae. The pigeon horntail continues to be primarily a problem on older and/or stressed trees. Reports of activity were fairly common in 1996.

Pinkstriped Oakworm (*Anisota virginiensis*) - Numbers of this species dropped off in 1996 from the unusually (for Maine) high numbers of 1995.

Redhumped Oakworm (*Symmerista albifrons/canicosta*) - Both of these species occur in southern Maine and due to similarities between the two in all stages, our surveys have not separated them. Larvae known as redhumped oakworms were not as abundant in 1996 as in 1995. The numbers of *Symmerista* spp. moths collected through our light trap surveys (Table 14) dropped in 1996.

Saddled Prominent (*Heterocampa guttivitta*) - Although scattered, individual larvae of this species were observed in 1996, no defoliation was detected and moth catches remained low (Table 15).

Table 15. Total number of saddled prominent *(Heterocampa guttivitta)* moths collected at light

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	8	4	1	3	1	1	0
Arundel					0	0	0
Ashland	0	0	0	0	1	0	0
Blue Hill	6	2	1	1	2	5	0
Brunswick	42	34	0	0	0	0	0
Calais	2	4	3	0	0	0	0
Chesuncook	51	10	12	13	10	37	18
Clayton Lake	4						
Dennistown	1	3	0	0	0	2	0
Elliotsville	6	5	4	4	0	0	3
Exeter	29	5	10	0	0	1	1
Greenbush	0	1	1	1	4	0	0
Guerette	0	1	0	0	1	0	0
Haynesville	0	0	0	1	1	1	0
Kingfield	0	0	1	0	2	0	1
Matagamon	7	0	1	0			
Millinocket	10	21	10	5	2	7	12
Mt. Vernon	21	32	19	1	1	13	6
No. Bridgton	0	41	15	9	2	0	0
Rangeley	0	10	4	0	0	1	2
Shin Pond					1	1	0
South Berwick	29	15	53	3	0	1	0
Ste. Aurelie	3	0	0	0	0	0	2
Steuben	4	3	17	28	1	3	12
Topsfield	7	5	11	4	0	7	0
Washington	3	50	23	1	0	0	0
Total Number of Moths	**233**	**246**	**186**	**74**	**29**	**80**	**57**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Satin Moth (*Leucoma salicis*) - Populations of this species dropped in 1996 and defoliation was light and scattered even in areas defoliated in 1994/95. Moth catches also remained low (Table 16).

Table 16. Total number of satin moth (*Leucoma salicis*) moths collected at light

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	3	3	2	2	0	0	2
Arundel					0	0	0
Ashland	5	0	7	3	5	1	0
Blue Hill	0	0	0	0	9	2	0
Brunswick	2	0	0	2	0	0	0
Calais	6	5	0	0	3	2	0
Chesuncook	0	0	0	1	0	0	0
Clayton Lake	2						
Dennistown	2	3	1	5	1	0	0
Elliotsville	0	1	5	2	0	0	0
Exeter	0	0	0	0	0	0	0
Greenbush	1	2	0	0	1	1	1
Guerette	4	3	3	16	7	9	0
Haynesville	3	0	2	18	5	1	0
Kingfield	0	0	1	0	0	0	1
Matagamon	0	0	0	0			
Millinocket	1	5	17	3	4	0	1
Mt. Vernon	0	0	0	0	0	0	0
No. Bridgton	0	0	0	0	0	0	0
Rangeley	0	4	1	0	0	0	0
Shin Pond					14	0	4
South Berwick	0	0	1	1	0	0	0
Ste. Aurelie	0	0	0	0	0	0	0
Steuben	41	22	2	2	8	5	0
Topsfield	1	3	0	3	18	12	1
Washington	0	0	0	0	0	0	0
Total Number of Moths	**69**	**51**	**56**	**53**	**75**	**33**	**10**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Spiny Elm Caterpillar (*Nymphalis antiopa*) - Although the familiar adults known as the **mourning cloak butterfly** were fairly common in 1996, larval feeding was light and scattered as compared to 1995.

Sugar Maple Borer (*Glycobius speciosus*) - This large colorful beetle has not been much of a problem in Maine. Like the pigeon horntail this status could change as the trees become older or stressed.

Tussocks (various) - Tussocks are 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 (not a tussock) which chemically cause a rash as well). This is especially true during periods of hot weather when "**caterpillar rash**" or "**tussockosis**" is not uncommon. The **hickory tussock** (*Lophocampa caryae*) **rusty tussock** (*Orgyia antiqua*), **pale tussock** (*Halysidota tessellaris*) and the **spotted tussock** (*Lophocampa maculata*) are the more common of the group in Maine. Although locally abundant in 1996, their numbers and complaints of rash were down from 1995 levels overall.

Variable oakleaf caterpillar (*Lochmaeus manteo*) - The recent variable oakleaf caterpillar outbreak in Maine has now completely subsided. Very few larvae of this species were reported from ground checks in 1996 and no defoliation was mapped from the ground or during aerial surveys. Numbers of moths from the light trap survey also declined strikingly (Table 17).

An evaluation of the impact of variable oakleaf caterpillar on beech stands that were heavily defoliated during the recent outbreak compared to undamaged stands was continued in 1996. A preliminary evaluation of the 1995 and 1996 plot data did not show any significant differences between plots defoliated by variable oakleaf caterpillar compared to plots that were not defoliated. Study plots used for this comparison were established and measured using National Forest Health Monitoring Program methods and variables.

Table 17. Total number of variable oakleaf caterpillar *(Lochmaeus manteo)* moths collected at light

	Year						
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Allagash	0	1	1	0	0	0	0
Arundel					0	1	0
Ashland	7	10	6	0	1	14	0
Blue Hill	7	4	5	0	9	30	9
Brunswick	4	2	0	0	0	3	0
Calais	2	4	3	0	0	3	0
Chesuncook	0	1	0	0	10	62	27
Clayton Lake	0						
Dennistown	7	7	0	0	0	5	0
Elliotsville	87	175	42	5	0	57	3
Exeter	9	7	0	0	0	6	4
Greenbush	49	39	3	0	7	11	4
Guerette	2	1	0	0	3	1	1
Haynesville	94	86	21	6	39	14	7
Kingfield	192	158	14	0	7	7	3
Matagamon	17	13	1	0			
Millinocket	169	310	122	85	148	185	18
Mt. Vernon	0	2	0	2	12	1	0
No. Bridgton	5	6	0	0	3	0	0
Rangeley	5	3	0	0	0	4	0
Shin Pond					2	15	4
South Berwick	11	15	3	8	0	4	0
Ste. Aurelie	0	0	0	2	1	0	0
Steuben	3	3	0	0	2	3	0
Topsfield	316	302	250	83	235	50	3
Washington	23	2	1	0	2	17	2
Total Number of Moths	**1,009**	**1,151**	**472**	**191**	**481**	**493**	**85**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**

Willow Flea Weevil (*Rhynchaenus rufipes*) - This perennial pest of willows again made its appearance in 1996 and caused the usual disturbance as adults dropped in on summer barbecues. The heaviest damage by adults and larvae was to black willow followed closely by weeping willow and balsam poplar. Trees defoliated year after year continue to survive with seemingly little permanent damage.

Miscellaneous INSECTS and other ARTHROPODS of Medical, Nuisance or Curiosity Significance in 1996

Ants (various) - There never seems to be a shortage of ants and 1996 was no exception. The **carpenter ants** (*Camponotus* spp.) were again the bane of homeowners as they threatened many domestic environments. Those pesky little mound forming lawn ants (several species) were also common and resisted many homeowner efforts at control.

For those who thought we might have true fire ants in Maine - we don't! But we do have a couple of species which are aggressive and pack a potent sting. Others may simply bite and inject formic acid into the wound producing a burning sensation. One of our more widespread stinging species is *Crematogaster lineolata* which often occurs in rough areas around gardens, in fields or the edge of woods. An introduced (from Europe) species, *Myrmica rubra,* inhabits coastal areas from Kittery to Eastport. This species is very aggressive and has a powerful sting and unfortunately appears to prefer nurseries and areas which have been landscaped. Highest populations seem to occur at Boothbay Harbor and on Mount Desert Island.

Ant flights involving the **cornfield ant** (*Lasius alienus*) were again reported in 1996 but did not seem as striking as in previous years.

Bark Lice or Psocids - (p. 22).

Euonymus Caterpillar (***Yponomeuta cagnagella***) - Defoliation was reported again in 1996 from a number of previously infested euonymus hedges and ornamental plantings but populations appeared to remain fairly stable at 1994 levels.

Japanese Beetle (***Popillia japonica***) - While numbers seemed to be up noticeably in 1996 in the more recently infested areas (especially along the coast), parasitism by what appeared to be the dipterous parasite, *Istocheta aldrichi* (identification based on the presence of white eggs on the beetle pronotum) reduced populations in some older infestations inland by 30-50%. Feeding damage in these areas was noticeably reduced.

Populations of the often associated but more widespread **rose chafer** (*Macrodactylus subspinosus*) remained relatively low in 1996. No new areas of infestation by the **oriental beetle** (*Anomala orientalis*) were reported in 1996.

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**, **bird mites**, **mosquitoes**, **no-see-ums**, **spiders**, **stinging insects** and **ticks**. Also included are insect 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 medical professionals.

Biting Flies (various) - Wet, overcast weather favored most of our biting fly species this past season. Coastal residents have perennial summer visits from the **salt marsh mosquitoes** and **greenhead flies** but residents in upland areas usually receive a breather during dry weather in July and August. In 1996, however, many upland areas experienced a second and even third wave (generation) of **mosquitoes** and they were hungry! And to make matters worse the tiny **no-see-ums** were at the highest level seen in many years and even screens didn't stop these fiery biters. **Horse flies** (including the infamous **salt marsh greenhead fly**), **deer flies** (including the infamous **copper-heads**) and **stable flies** (those biting house flies) were also after a blood meal where they could get it and often added to the problem. Late season

black fly populations were also worse along the Penobscot River and its tributaries lasting well into September.

Stinging insect populations in Maine were down strikingly overall in 1996. The most notable reductions involved populations of **bumble bees, honey bees** and **yellowjackets.** Some **ground nesting solitary bees** and **paper wasps** (*Polistes*) seemed to fare better. Several colonies of a very attractive and interesting greenish, fuzzy, ground nesting bee (*Agapostemon* sp.) were reported from southern Maine in 1996.

While a lot of concern was expressed by fruit and vegetable ground about noticeable reduction in pollinators, campers and picnickers welcomed the reduction in yellowjacket populations.

Rashes related to insects prompted increased concern in 1996 in response to expanded activities of the **browntail moth** (p. 23) in the Casco Bay area (Cumberland County) but less in response to reduced populations of **tussocks** elsewhere.

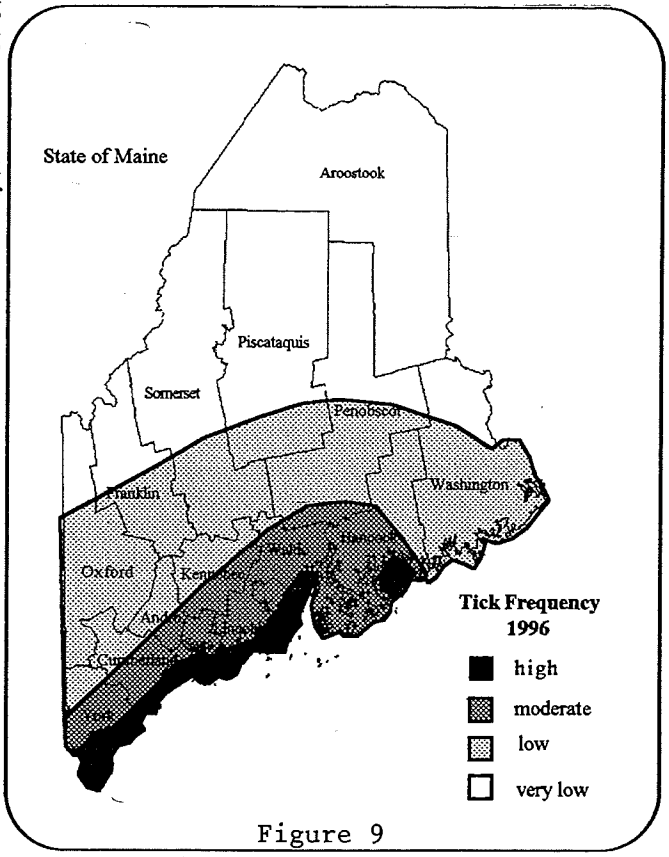


Figure 9

Spiders were not a source of concern in general in 1996 as they were in previous years. Fewer calls were received concerning spiders in produce than previously. No poisonous spiders were reported.

Ticks (Ixodidae) - The number of ticks received in 1996 (292) was up from 1995 (264) and again involved relatively high numbers of the **lyme** or **deer tick** (*Ixodes dammini/scapularis*). Numbers of the **American dog tick** (*Dermacentor variabilis*) were still high but 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 still seem to be spreading slowly north and east. Larvae of the **moose** or **winter tick** (*Dermacentor albipictus*) were still common in November and December in some areas. Roughly thirteen species of ixodid ticks occur in Maine but the highest numbers and greatest diversity occur in southern Maine (Fig. 9).

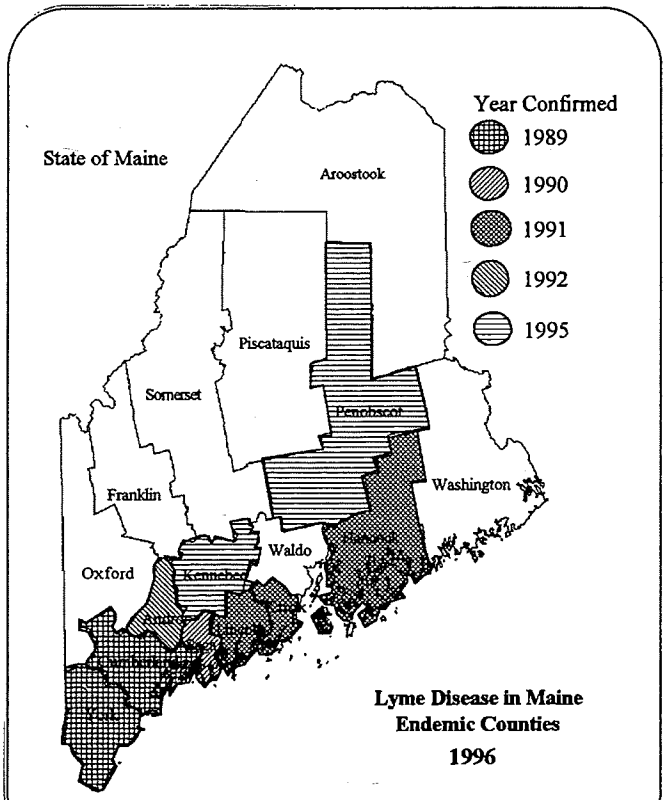


Figure 10

Lyme disease in Maine - It is still somewhat difficult to define the nature of this problem in Maine due to confusing qualifying criteria and data gathering problems. Suffice it to say that the incidence of lyme disease remains relatively low in Maine and is highest primarily in coastal areas. Of 51 cases reported to the Maine Bureau of Health in 1996, 35 were Maine acquired which is up slightly from 1995. Only 123 cases of Maine acquired lyme disease have been reported since monitoring for this disease began in 1986. Fig. 10 has been prepared by the Maine Lyme Disease Task Force to present the current status of the disease in Maine. Please note that any records for a county characterize the entire county as endemic (i.e. the records for Penobscot County are all from the Old Town area thus in reality only southern Penobscot County is endemic). It is also almost certain that Waldo County should also be considered endemic.

Multicolored Asian Lady Beetles (*Harmonia axyridis*) - All stages of this familiar introduced pest have now been seen in the field on a wide variety of hosts. Larvae have been observed eating aphids on balsam fir, beech, birch, larch, pines and spruces and undoubtedly occur elsewhere as well. At least they have a good side.

Numbers of adults of this species seemed to focus on particular sites for overwintering in the fall of 1996 and fewer calls concerning this nuisance side of this lady beetle were received than expected. As usual there were exceptions and a few horror stories emerged but there seemed to be fewer of them in 1996 than in 1995. Things may stabilize yet.

Pinching Bug (*Pseudolucanus capreolus*) - What appears to be the first report of this **stag beetle** in Maine was received in 1996. A call was received from a homeowner in Portland asking for information about stag beetles that were coming out of the ground by the hundreds on a tiny in-town lot. A visit from one of our staff confirmed that there was indeed a large population of stag beetles in her yard. The adults were emerging from 1/2-2" holes in the ground, pinchers first, exposing roots of garden plants and digging up the lawn (apparently multiple beetles sometimes emerge from one location leaving a large hole). Stag beetles are large and spectacular as Maine beetles go. Adults range from 1 to 1 3/8" long and 1/2" wide, are heavy bodied and dark chestnut brown and males have a pronounced set of mandibles (pinchers or antlers as some say). The females have shorter but stronger "chompers."

The homeowner first saw a couple adult beetles in late May hanging on to lily rhizomes while digging up the plants then did not see them again until they began emerging en masse at dusk on June 29th. There were reportedly hundreds of beetles that night and they continued their activity at a slower rate over the next two weeks. A closer look of the ground revealed 1/2" tunnels throughout the top 8" of soil leading down to a lower layer 8-14" below ground that was loose and friable as though it had recently been tilled. A cursory check of the soil did not bring to light any other life stages of the beetle other than adults in tunnels leading down to the loose soil. Stag beetle larvae feed on decaying wood, and the soil contained large chunks of wood throughout the area checked - probably from a tree that had reportedly been taken down from that site 10-12 years ago. Stag beetles are uncommon and usually found one or two at a time. They are not considered a pest but a step in breaking down dead trees to release nutrients back into the soil although hundreds in your tiny city yard could be distressing to some.

There have been several other unconfirmed reports from the Portland area and from Sanford. One person noted that they had known about this beetle in Maine for several years. An early report of a specimen from Augusta has also not been verified.

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 18 gives a breakdown of many of the problems handled by Augusta I&DM staff in 1996 showing some of the diversity of requests. In addition to these tree oriented requests, I&DM staff also handled roughly 816 requests for assistance on ticks and other non-tree problems in 1996.

Table 18. Number of Requests Received in 1996 for advice and assistance about forest, shade tree, and ornamental pests.

PROBLEM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Aphids	1		2		9	11	5	5	2			4	39
Balsam twig aphid	1			1	15	4	1	4	1		1		28
Bark beetles			1	1	3	1	7	7	3	1	3	4	31
Bark lice							2	8	1				11
Birch leafminers				1		2	4						7
Browntail moth			3		14	42	7	4		1	1	3	75
Dutch elm disease	1					3		1	2	1			8
Eastern dwarf mistletoe	2								1				3
European larch canker					1	1	2						4
Fall webworm								4					4
Forest tent caterpillar						3							3
Galls	1		1	3	2	4	3	1	1			1	17
Gypsy moth		1			2	5	6		1				15
Hemlock looper	2		1			1	2	1	1				8
Japanese beetles					1		4	4					9
Mites						4	2	2					8
Satin moth						3							3
Sawflies					1	4	12	10	6	2		1	36
Spruce budworm	2	1		2	1	2	1	1		1	1		12
Tent caterplillars					3	5							8
Variable oakleaf caterpillar							2	4	3				9
White pine blister rust			1	1	5	4	1	2	2	1			17
White pine weevil					1	1	7	13	3			1	26
Woodborers			1		1		7	7	3	2	1	1	23
Other requests	**36**	**15**	**28**	**28**	**49**	**110**	**98**	**110**	**74**	**35**	**12**	**12**	**607**
Total	**46**	**17**	**38**	**37**	**108**	**210**	**173**	**188**	**104**	**44**	**19**	**27**	**1,011**

Rose Stem Girdler (***Agrilus aurichalceus***) - This serious introduced pest of roses continued to show up in plantings of rugosa rose at a number of locations in Androscoggin, Cumberland, Lincoln and Sagadahoc counties in 1996. Damage was severe in some plantings. This species can also infest raspberry crowns as well.

Viburnum Leaf Beetle (***Pyrrhalta viburni***) - This species was reported from Brewer in 1996 where larvae and adults had stripped foliage from arrowwood (*Viburnum dentatum*) in highway plantings along I-395. Prior to this year the furthest north and east we had seen this insect was the Waterville area.

DISEASES and INJURIES Associated With Trees in 1996

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 and easily attributable to other causes. But the misconception persists that acid rain is significantly destructive to forest vegetation. Each year we receive calls expressing concern about the effect of acid rain on Maine forests.

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. There may also be subtle effects of acid deposition such as increased nutrient leaching from soils which may negatively impact tree growth. And there is the possibility that effects of acidic precipitation may increase the susceptibility of trees and other plants to certain diseases.

When acid rain first commanded national attention in the 1970's and 80's, it was common for weather forecasters to announce the acidity of precipitation events as part of local weather broadcasts. This practice has now largely ceased, but we recently asked our state Department of Environmental Protection about trends in acid precipitation in recent years. We were interested to note there were no trends. The mean pH of precipitation statewide has held steady at about 4.6 since 1982.

Air Pollution Injury (caused by various air contaminants, especially ozone) - Ozone damage to forest vegetation was light in 1995 for the third consecutive year. Of 28 forest health monitoring plots checked for ozone damage in 1996, only four (Auburn, Freeport, Medford, and Parkman) displayed symptoms.

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.

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. An infected plantation along the Swamp Road in Lovell was brought to our attention by a concerned landowner. Disease was rated "severe" over a 5 acre area.

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 (Fig. 11).

When harvesting pines in red pine plantations, it is important to treat stumps with borax immediately following tree harvest. *Heterobasidium annosum* is a pioneer organism that colonizes only freshly cut stumps, and borax must be present on the stump before the organism has a chance to invade.

We recommend borax treatment of freshly cut stumps at all times of year, but clearly the hazard is greatest in the fall when spores of the causal organism are being abundantly released. If possible, it is best to

schedule harvest for other times of the year. But if managers must harvest in the fall, we strongly recommend stump treatment. Infection hazard is probably much reduced during winter months, but stump treatment even then is still possibly worthwhile.

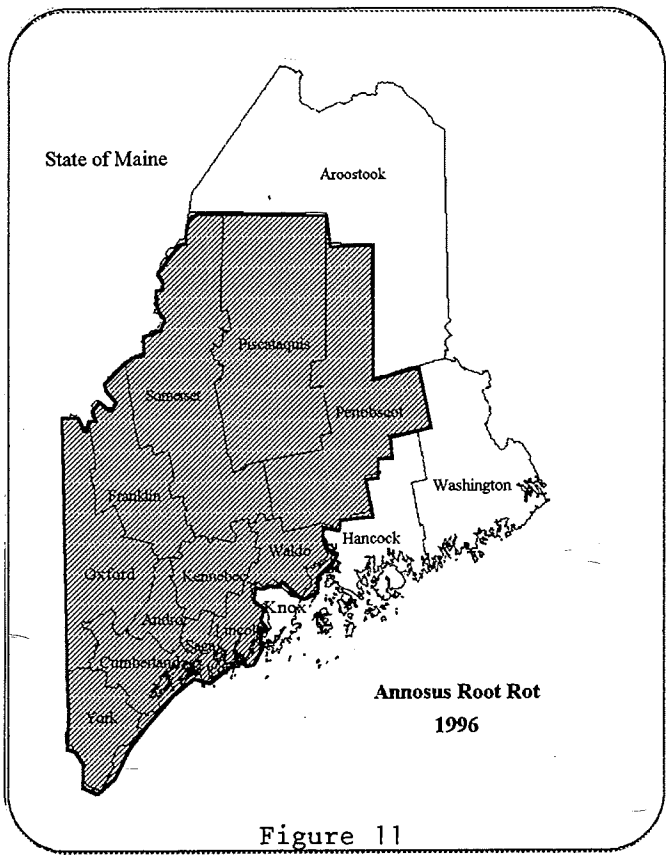


Figure 11

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** (see p. 50).

Trees and shrubs affected by Armillaria root rot at first show a decline in vigor, then exhibit yellowing or browning of foliage, followed by defoliation (in hardwoods) and death. Evergreens usually die with brown needles still attached. Beneath the bark at the base of infected trees a white mycelial (fungal) "fan" may often be observed. Shoestring like fungal strands may also be observed by peeling away bark and often, in the early fall, honey colored mushrooms may be observed at the base of affected trees.

Ash, Birch, Catalpa, Maple, and Oak Anthracnoses (caused by *Apiognomonia errabunda, Marssonina betulae, Glomerella cingulata, Kabatiella apocrypta,* and *Discula quercina* respectively) - These diseases, which cause irregular tan or brown spots or blotches on leaves often followed by defoliation, were much more prevalent than normal in 1996. Of the five diseases, maple anthracnose was the most commonly reported.

Ash Leaf and Twig Rust (caused by *Puccinia sparganiodes*) - This disease, which was last epiphytotic in Maine from 1982-1984, is apparently again on the rise. We noted a moderate to severe outbreak of this disease in 1995 in the Stockton Springs/Frankfort/Winterport areas of midcoast Maine and had expected that area to enlarge significantly during 1996. That expansion did not occur, but disease reappeared at similar levels in the same areas again in 1996. Elsewhere along the coast, we noted trace infection of white ash

in Freeport, and light to moderate levels on parts of Georgetown Island. In Kittery, where trace infection was noted in 1995, no symptoms could be found in 1996.

We still feel the trend for this disease is up, and if weather conditions are favorable for infection next June, this disease could be epiphytotic in many coastal areas of Maine by July of 1997.

Ash leaf and twig rust is a spectacular disease when it occurs in epiphytotic situations, often totally defoliating trees. It only occasionally kills trees, but may weaken them so that they succumb to other causes, especially where the disease strikes heavily in successive years.

Ash Yellows (caused by a mycoplasmalike organism) - Ash yellows apparently does not occur in Maine. Recent surveys for this disease conducted by the University of Maine have proved negative.

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. The bluish black stain often appears wedge-shaped when branches are cut and cankers are viewed in cross-section. Affected branches flag and needles turn brown in spring and early summer.

We received no new reports of this disease in 1996. The disease is potentially damaging to pines in Christmas tree plantations but usually is not much of a problem in Maine where relatively few pine species are now grown for Christmas trees. Where pines are planted, Atropellis-free planting stock is generally used and plantations are rarely established near infected natural stands, so chances for infection are low.

Balsam Fir Tip Blight (caused by *Delphinella balsameae* syn. *Rehmiellopsis balsameae*) - This disease, which was unusually severe in 1995 in some plantations of Colorado white fir (*Abies concolor*), was a problem also on native fir in certain coastal situations in 1996, though the damage was primarily aesthetic.

The trend for this disease had been up in recent years, especially in older white fir plantations.

Balsam fir growers may in most cases safely ignore this disease, but once it becomes epiphytotic in a concolor fir plantation, growers need to employ stringent fungicide programs or perhaps even give up culture of the species.

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.

Sapsucker damage is easily recognizable by the regular, evenly-spaced holes the birds have pecked through the bark. Holes are characteristically pecked in rows which may be both horizontal and vertical. Mountain ash (*Sorbus* spp.), hemlock, and birch are very commonly attacked, but many other species are utilized by sapsuckers as well.

Pine grosbeaks damage trees in winter by feeding on buds in the terminal bud cluster of pines, often causing trees to fork when growth resumes the following spring. This may reduce their utility as future saw logs unless corrective pruning is employed.

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. Damage often extends internally well beyond the galled area, because the gall canker serves as an entry point for wood decay organisms which spread internally over time.

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.

Bud Abortion of Balsam Fir (caused by low ambient air temperatures prior to budbreak) - This symptom was relatively uncommon during the spring of 1996 due to relatively mild temperatures throughout the period of bud expansion prior to budbreak, but was apparent in a few cold pockets in central Aroostook County and on scattered plantation trees elsewhere in the state.

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 County. We continued to survey for this disease in succeeding years, and have now located it in all Maine counties except Washington County (Fig. 12).

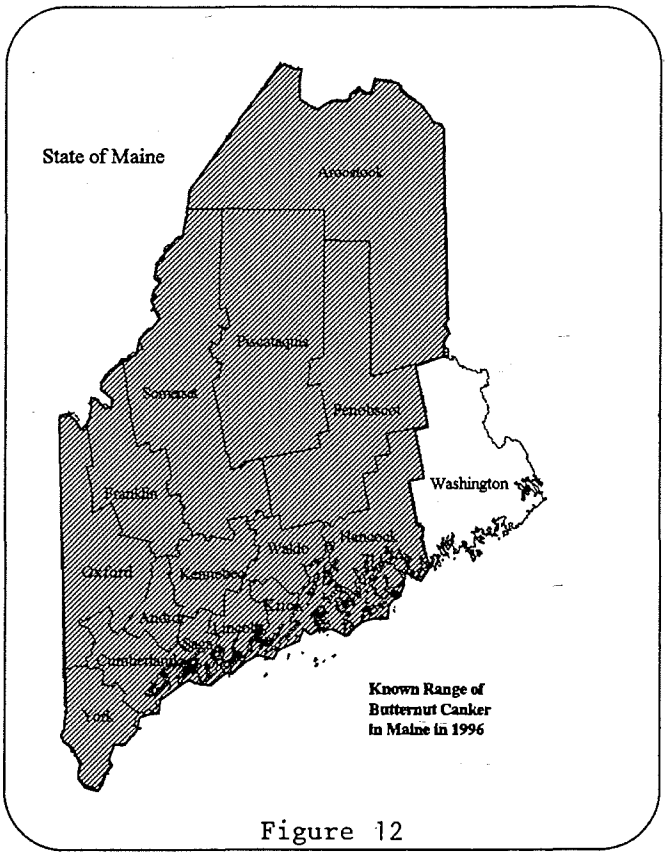


Figure 12

Butternut canker is characterized by dying branches and dead tops, development of 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.

The upward trend of this disease is expected to continue into the foreseeable future.

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.

Chemical Injury (phytotoxicity due to chemical pesticide application) - We received many reports of chemical injury to trees and shrubs in 1996. Growers and landscape managers should be especially 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.

Causes of chemical pesticide injury are many and varied. During 1996 we received a specimen of fir from Levant where kitchen detergent used to attempt control of balsam twig aphid burned tender, emerging foliage and ultimately rendered Christmas trees unsaleable for that year. From Augusta came a call of severe cankers on maple tree stems which were caused by the application of tree tanglefoot a decade earlier to tender bark. Lowbush blueberries are becoming increasingly popular as ground covers and from Brunswick came a call where hexazinone (Velpar), applied to control weeds in the blueberry planting, had run downgrade to injure arborvitae shrubs. From Gardiner came a call where herbicide residue in a garden sprayer contaminated an insecticide mixture, injuring all garden vegetables and rendering the entire crop inedible for the season. From Kittery came perhaps the most interesting herbicide related call of the season. Chemical injury to crops was apparent adjacent to a right-of-way (ROW) herbicide spraying. When it came time to place blame and sue for damages, it became apparent that two separate ROW applications had been made by different applicators: one of triclopyr (Garlon) for a power line ROW, plus another different herbicide mixture for a railroad ROW spray. Sorting out who was responsible for what was a challenge. More conventional herbicide calls came to us from Corinth, Fryeburg, Mars Hill and Presque Isle.

Chestnut Blight (caused by *Cryphonectria parasitica*) - This disease, which was introduced to North America around 1900 on nursery stock of oriental chestnuts, subsequently spread into Maine and quickly destroyed our native American chestnut resource. A few infected trees persist, often sprouting from old stumps, and occasionally a seedling will grow to considerable size in the woods before succumbing to the disease. American chestnut trees planted as landscape specimens also frequently attain considerable size before fatal infections develop.

Recently considerable interest has been expressed in support of an effort to reintroduce the American chestnut into Maine forests. The expectation is that resistant trees may be available for distribution within a few years.

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.

Dutch Elm Disease (caused by *Ophiostoma ulmi* and *Ophiostoma novo-ulmi*) - Symptoms of Dutch elm disease (DED) were quite conspicuous throughout Maine during 1996 and generated numerous inquiries of our staff.

Many old elms which escaped the initial wave of infection now succumb 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). Increasingly we are asked to comment on the suitability of 'American Liberty' elms for planting in Maine. Residents of many communities long to restore the elm-canopied streets they remember from their youth or have viewed in historical photographs. They wonder if the extensive planting of DED resistant 'American Liberty' elms is an appropriate means to restore yesterday's urban landscapes.

We don't think so, for several reasons, but would not discourage limited elm plantings in selected areas.

The 'American Liberty' elm is not one clone but a group of six selections. Collectively they exhibit some resistance to DED but are not immune. Almost certainly some of those six selections are more resistant than others, but to line city streets with elms that are only partially resistant to DED is a risky proposition at best. And while 'American Liberty' elms are perhaps the best known and most available of the resistant sorts, they are not necessarily the most resistant.

Two resistant cultivars recently released by the U.S. National Arboretum, 'New Harmony' and 'Valley Forge,' are attracting considerable attention but are not yet available for retail sale. Of these 'Valley Forge' may be the more resistant but 'New Harmony' may be more cold tolerant, an important consideration for Maine. Another resistant cultivar is said to be close to release by the U.S. National Arboretum.

We would encourage limited plantings of resistant cultivars in areas where trees could be easily removed if they become diseased such as in park areas away from utility lines and structures. But we don't feel that the development of resistant cultivars has reached the point where large scale elm restoration along city streets is yet appropriate.

Eastern Dwarf Mistletoe (*Arceuthobium pusillum*) - Severe damage as the result of infection by this parasitic plant continues to occur in stands of white and red spruce in coastal areas of Maine as well as islands off the coast. 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 inland 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.

Dwarf mistletoe was encountered on several coastal islands this past summer during the course of spruce beetle surveys (p. 17), among them Isle Au Haut, Islesboro, Deer Isle and Eagle Island. As on the mainland, damage is more severe on white than red spruce, with significant mortality occurring on Deer Isle (northeast side).

The trend for this disease is upward.

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 this 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.

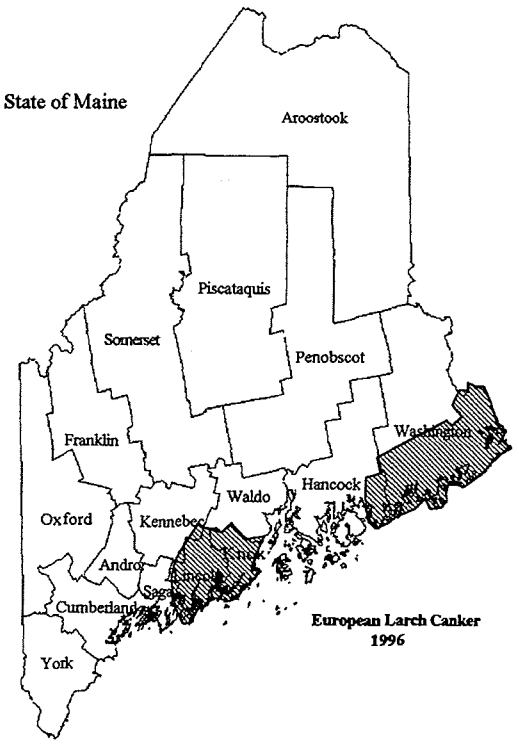


Figure 13

Each year we survey one or more towns close or adjacent to known infested areas (Fig. 13) to check for evidence of disease spread.

MFS surveys in 1996 in Lamoine proved negative; no other coastal towns were surveyed. Commercial larch seed orchards in the towns of Unity and Howland were checked for evidence of larch canker, but no disease was found.

The trend for this disease is static.

Fir-Fern and Fir-Fireweed Rusts (caused by *Uredinopsis mirabilis* and *Pucciniastrum epilobii* respectively) - After an unusually high infection year in 1995 incidence of these two diseases dropped off dramatically in 1996. Fir Christmas tree growers should not become complacent, however, because these diseases can reappear at outbreak levels suddenly and without warning.

If you have sensitive fern or fireweed within 50-100 feet of susceptible fir, we suggest you make plans to eradicate these alternate host plants next summer, during July. Eradication may be accomplished through use of glyphosate (Roundup) at two oz. per gallon of water applied in July to all sensitive fern and fireweed within 50-100 feet of fir to be protected. Retreatment may be required the following year for complete control.

Fir at distances greater than 100 feet may become infected but infection levels are usually tolerable. Most affected needles drop during the course of the summer and, except for very heavily infected trees, merchantability is not affected.

Hardwood Decline (caused by multiple stressors) - Areas of hardwood decline mapped in northwestern Maine in 1994 and 1995 did not expand or intensify significantly in 1996. The condition of American beech in Maine did decline in 1996 but mappable areas were not visible from the air. Extremely wet conditions in 1996 apparently contributed to an improvement in the appearance of the crowns of some species (especially ash and sugar maple) but beech continued to decline despite the more favorable moisture regimes.

The deterioration of beech crown condition can be attributed to several factors. Probably the most significant recent stress on beech stands was the severe drought of 1995. Dry conditions caused premature leaf drop and increased branch dieback in many stands. Most of the affected stands were on ledgy ridge tops. Other stress agents affecting beech are beech bark disease, the recently ended outbreak of variable oakleaf caterpillar, and a mild resurgence of oystershell scale.

Data from a system of twelve forest health monitoring plots, established in Maine beech stands, were used to refine the assessment of beech decline (Table 19). Mean crown dieback on these plots increased significantly from 12.3 percent in 1995 to 15.8 percent in 1996. Both the 1995 and 1996 levels were much higher than mean beech dieback on the National Forest Health Monitoring plot system (7.6 percent) and the six year (1990 to 1995) average for beech in Maine (9.8 percent). The six year average dieback for beech is several percent higher than the level of dieback on associated species in Maine beech stands with the exception of paper birch, which also exhibited high levels of dieback.

Mean transparency and density did not change significantly on Maine beech plots from 1995 to 1996. In addition to increased dieback, a 6.6 percent increase in the number of dead beech trees was recorded and 71 percent of all beech in plots were found to have beech scale, nectria cankers, or both.

Table 19. Maine beech plots 1995, 1996 - FHM crown variable summary

PLOT #	*DENSITY*		*DIEBACK*		*TRANSPARENCY*	
	1995	*1996*	*1995*	*1996*	*1995*	*1996*
1	39.0	42.8	9.5	12.5	13.0	14.8
2	44.7	46.3	7.3	12.4	13.1	13.7
3	36.9	40.6	13.1	23.4	14.2	20.6
5	43.5	48.3	5.2	7.0	16.3	15.2
6	31.8	35.9	17.3	22.1	18.9	17.8
7	38.1	36.7	15.5	18.3	15.5	15.4
8	42.1	40.8	12.7	13.3	13.3	15.8
9	34.8	36.1	14.8	16.1	16.0	15.5
10	44.1	43.2	16.3	20.0	13.6	14.5
11	48.1	43.7	8.1	8.3	11.0	11.9
12	41.8	38.3	18.5	18.5	18.8	20.5
13	45.4	43.4	9.8	10.2	12.2	15.8
ALL DATA	40.9	41.1*	12.3	15.8**	14.9	16.0*

* Changes in density and transparency between 1995 and 1996 were not significantly different ($p = 0.05$)
** Dieback in 1996 significantly higher than dieback in 1995 ($p = 0.05$)

Heat Injury (caused by the sudden onset of hot weather in June) - This phenomenon, which was severe in June of 1993, and appeared again in 1995, was not in evidence in 1996.

Heavy Seed Production - Some years are noted as seed years, where one or more species of trees produce fruit in unusual abundance.

During 1995 seed production on most species was relatively sparse but that situation reversed dramatically for many species in 1996. Red maple (*Acer rubrum*) set extraordinary quantities of seed during the spring of 1996, prompting predictions of sparse foliage in tree crowns by mid-summer. However ample spring and summer rains pushed considerable of amounts of lush new growth and the thin crown symptom was much reduced.

Many conifers produced abundant seed crops as well, especially black, red, and white spruce, and white pine which, at this writing (February, 1997), is still shedding quantities of empty cones upon the snow during every windstorm.

Cone numbers were relatively low in balsam and fraser fir Christmas trees in most plantations in 1996, though a few growers had problems. It now looks as though cones in balsam fir trees during 1997 will be generally more abundant than 1996, but not a "banner" cone year.

Horse-chestnut Leaf Blotch (caused by *Guignardia aesculi*) - This disease seems to occur every year wherever horse-chestnut grows in Maine. In 1996, the expression of disease symptoms was conspicuous, but not extreme. Damage, although aesthetically objectionable, is not generally considered serious.

Lachnellula Canker of Balsam Fir (caused by *Lachnellula ? agassizii*) - We rarely note the occurrence of this minor disease of balsam fir, but it was found causing cankers in a restricted area of a single plantation in Rangeley last summer. Various species of the fungal genus *Lachnellula* are common in the Maine woods, but except for the larch canker fungus (*Lachnellula willkommii*), they are of minor importance and usually saprophytes.

The fungus in the Rangeley plantation (which we have tentatively identified as *L. agassizii* but it may be *L. arida* or *L. gallica*) did appear to be parasitic, possibly colonizing wounds caused by snowmobile traffic passing over small trees during a previous winter. *Lachnellula* could not be found outside a 20 foot wide swath through the plantation.

The plantation owner was advised to rogue infected trees but no additional disease management practices were deemed necessary.

Christmas tree growers and forest land managers generally need not be concerned about this disease.

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 1996 from landowners concerned about lichens. 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.

"Mouse" Damage (caused by several rodent species, esp. *Microtus pensylvanicus*) - Meadow vole damage generated relatively few calls during the winter of 1995-1996, mirroring 1994-1995 inquiries, and damage was down considerably from 1993-1994. But we did receive calls from residents in York and Thomaston where damage was sufficient to warrant attempts at control (traps, poisons, and destruction of habitat).

Needlecast Diseases of Balsam Fir (caused by *Lirula nervata, L. mirabilis,* and *Isthmiella faullii*) - These diseases, which are commonly found on native balsam fir in the Maine woods, are occasionally a problem for Christmas tree growers. In recent years we have received calls from growers in China and Waldoboro as this disease has spread from natural areas into their plantations.

These needlecast diseases are distinct from those caused by fir-fern and fir-fireweed rusts, which cause symptoms on current year needles, needles which fall from trees the same season they are infected.

Lirula and *Isthmiella* needle cast fungi also infect needles in their first growing season, but no symptoms are apparent until the second growing season. So typically second (and third) year needles are brown,

while present year foliage remains green. Third year foliage is apt to age to a straw-like color before falling from trees.

Infected needles begin to discolor in the spring of their second year and by summer a conspicuous black line (fungal fruiting structure) appears on the upper surface of each infected needle (later both surfaces are affected).

Usually these diseases are more conspicuous on plantation trees adjacent to natural fir growth but occasionally scattered trees throughout a plantation will be infected.

Growers with these diseases should rogue infected trees from their plantations in late fall or early spring, taking care to remove all brushy green growth from stumps. These diseases are worse in closed, damp areas so plantations should be managed to promote good air drainage through wider spacings, good weed management, and cutting back encroaching native vegetation, especially fir.

An excellent bulletin on this subject, How to Identify and Manage Needlecast Diseases on Balsam Fir, is available from the USDA Forest Service, 1992 Folwell Avenue, St. Paul, MN 55108.

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 *Endocronartium 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 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.

We had only one call regarding this disease in 1996. That was from Farmington, where a mature hedge of Scotch pine had large galls on many branches. Probably the hedge was established from infected stock, and the disease has been repeating in that hedge for years.

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 occurs in the United States in all states east of the Mississippi River. Although pinewood nematode was not discovered in the United States until 1929, it is considered to be a native, not introduced, pest. There is no indication that pinewood nematode 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. We received no reports of this problem in 1996.

Poplar Shoot Blight (caused by *Venturia tremulae* syn. *Pollaccia radiosa*) - This disease was prevalent statewide last spring and was confused by some observers with frost damage. Affected leaves exhibited black spots and blotches, while affected shoots drooped, died, and turned black. Infected shoots and leaves quickly dried and became brittle.

Porcupine Damage (caused by *Erethizon dorsatum*) - Reports of porcupine damage to forest trees, evergreen plantations, and ornamental plantings continue at high levels statewide. It is uncertain whether porcupine populations have actually increased in recent years or whether the more numerous reports simply reflect an increasing acreage of higher value conifer plantation and seed orchard trees, situations where porcupine damage is less easily ignored.

In an attempt to define whether porcupine populations are indeed on the rise throughout Maine, one of our staff members has undertaken a count of porcupines killed by vehicles along roadsides in the course of his travels. This survey, known as SPLAT (Special Porcupine Lethal Automobile Tire survey), does not pretend to be scientific, but it may over time provide a rough approximation of porcupine population trends. The staff member undertaking the count consistently drives about 50,000 miles per year and covers the entire state, although the survey is weighted to the Central Maine area where relatively greater travel occurs.

The SPLAT survey is now only two years old and no trends are yet apparent. In 1995, 99 dead porcupines were encountered; in 1996 the total was 93.

Rhabdocline and Swiss Needlecasts of Douglas Fir (caused by *Rhabdocline pseudotsugae* and *Phaeocryptopus gaeumannii*) - In recent years we have experienced a gradual reduction in calls related to these two diseases as growers of Christmas trees have cut back or curtailed production of Douglas fir. But a few plantations persist, and where they are established on new sites where Douglas fir was not previously planted, transplants typically grow to almost Christmas tree size before disease becomes epiphytotic.

Such was the case with a grower from Lovell. Until this year the trees were not so symptomatic that he expected anything was wrong. But by the time we arrived, it was apparent that most of the trees should be rogued, and the few more resistant individuals remaining sprayed with chlorothalonil. About one acre (1,000) trees were affected.

Many Maine Christmas tree growers lost interest in Douglas fir some time ago because of its extreme susceptibility to Rhabdocline and Swiss needle cast fungi under Maine conditions. And in the landscape not only is Douglas fir frequently attacked by these two disease fungi, but it also serves as a powerful alternate host for the buildup of Cooley spruce gall adelgid on Colorado blue spruce when it is planted nearby. So its liabilities often exceed its assets, though it does make a handsome Christmas tree when disease and adelgids are under control.

Rhabdocline and Swiss needle casts appear similar to the casual eye, and while they have slightly different life cycles, the same spray program if broadly applied will control both diseases. For more information on diagnosis and control of these and other Christmas tree pest problems, you may wish to request our Circular No. 11, Integrated Crop Management Schedule for the Production of Christmas trees.

Salt Damage (caused by movement of deicing salts from road surfaces to susceptible plant species) - Symptoms of salt damage to the foliage of roadside white pine trees was striking in southern Maine last spring. While we observe this phenomenon every year, symptoms were somewhat atypical in 1996. Not only was damage to white pine more conspicuous than usual, it seemed to extend higher into the crowns of trees and to greater distances from road surfaces. Also, severe damage was generally confined to white pine, having largely spared the normally very sensitive Eastern hemlock and moderately sensitive balsam fir.

We checked with the Maine Department of Transportation to see if different deicing products or new methods of application might explain the atypical symptoms, but aside from a 5% increase in the use of sodium chloride on southern Maine highways during the winter of 1995-1996, little else changed. (Northern Maine required the use of 5% less salt). Calcium chloride was used at some locations on Interstate 95, but was not used on other roads in southern Maine, which was consistent with recent past practice.

The winter of 1995-1996 was characterized by frequent episodes of high winds, often blowing from the south. It seems likely that some of these strong, warm, southerly air flows may have transported salt droplets created by traffic passing over melting road surfaces to pine foliage at greater heights and greater distances than usual. This rationale seems strengthened by our observation that foliage is more extensively browned on the north sides of highways which run in east-westerly directions.

Despite severe browning symptoms, tree mortality was rare, though lower branch mortality was common on white pine trees growing proximally to travel surfaces. Occasionally entire trees did die from salt exposure, perhaps most conspicuously in a group along Interstate 95 in Bangor near the east end of a main runway at Bangor International Airport.

Many who reported the severe roadside browning last spring were anxious to blame the symptoms on reformulated gasoline (or its combustion by-products). We doubt that hypothesis for several reasons, including the fact that we noticed relatively little browning during the spring of 1994, the year reformulated gas was introduced. Also pine browning was also severe last spring in certain portions of the state where reformulated gasoline is not sold, which leads us to believe that the use of reformulated gasoline probably had no role in symptom expression.

Scleroderris Canker (caused by *Ascocalyx abietina*) - No new infestations of this disease were located during 1996. This disease remains static at very low levels.

Septoria Leaf Spot of Poplar (caused by *Mycosphaerella populorum* syn. *Septoria mussiva*) - Poplar leaves statewide became spotted in July as the result of infection by the Septoria leaf spot fungus. Leaves then turned progressively brown when viewed from a distance as the season progressed, generating many calls of concern from residents and interested observers. Heavily infected leaves dropped from trees prematurely.

Septoria leaf spot was more severe than usual in 1996 due to an unusually wet spring which provided ample infection periods. Those same weather conditions promoted heavy infection of leaves of other hardwood tree species by various other fungi, promoting a rash of calls this season regarding anthracnoses of maple, birch, ash, and catalpa.

Septoria leaf spot infects all species of poplar, but is not serious on native species. Hybrids, however, are often quite susceptible to stem cankers and young plantings of such hybrids can be devastated.

Sirococcus Blight of Red Pine (caused by *Sirococcus conigenus*) - Sirococcus blight of red pine seems to have increased in severity in Maine in recent years, especially in the Eustis-Flagstaff area, but also in plantations elsewhere in the state. Inquiries to us about this disease in managed forest areas generally fit into one of three categories: (1) infection of reproduction in thinned stands beneath infected overstory vegetation (2) infection of plantations established adjacent to infested natural stands or (3) infection within new plantations which were established in locations remote from known inoculum sources, due to the use of infested planting stock.

In many areas of Maine, serious infection of red pine reproduction beneath infected overstory trees is so probable that it is not cost effective to thin stands to allow for natural red pine regeneration. However white pine seems resistant and may perform well as an alternative regeneration species in such situations.

Infection of plantations established adjacent to infested natural stands is also highly likely, especially if tall overstory trees are left standing. Sirococcus often moves quickly into new plantations established under such circumstances, and by the time the disease is detected, it is often too late for sanitation pruning to be cost effective.

Infection of new plantations due to the use of infested planting stock is also a problem, since the disease is seed borne and seedlings are likely to be infected in nursery beds or greenhouses where container stock is produced. Use of disease free stock is paramount when establishing red pine plantations.

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 - We have received few reports of serious frost injury to gardens or forest plantations during the spring of 1996. Bud abortion of balsam and Fraser fir Christmas trees (caused by cold temperature injury prior to bud break) was also minimal.

Stillwell's Syndrome (associated with *Armillaria* spp.) - Aerial and ground surveys during 1996 showed a decreased incidence of Stillwell's syndrome, "red fir", in the spruce/fir forests of northern, western, and eastern Maine. Balsam fir trees showing the sudden reddening symptoms associated with Stillwell's were found to have a very high incidence of *Armillaria* spp. root rot. A variable incidence of Stillwell's has been recorded on balsam fir since the end of the most recent spruce budworm outbreak in 1986. The incidence of Stillwell's in some forest stands of balsam fir has been as high as 3 to 5 percent in the late 80's but during the 90's the condition rarely affects more than 1 percent of the fir even in heavily stressed stands.

Verticillium Wilt (caused by *Verticillium dahliae*) - This is primarily a disease of maples in ornamental situations but it affects other hardwood species in the landscape as well. Leaves yellow and wilt on branches of affected trees. The disease often progresses until wilt affects the entire crown. Greenish streaks or bands appear in sapwood beneath the bark. The green stain may appear as a partial or complete "ring" in the sapwood when a cut branch is viewed in cross section.

Affected trees may die or recover. Water and fertilizer may stimulate the growth of affected trees and improve prospects for recovery.

The causal fungus is soil borne, so replacing one tree which has succumbed to this disease with another susceptible species on the same site is a very risky proposition. Among trees known to be resistant to *Verticillium* include all the gymnosperms, plus apple and crabapple, mountain ash, beech, birch, butternut, oak, poplar and willow.

Although this disease is not uncommon in Maine, we recorded no inquiries regarding it during 1996.

Wet Site Problems - We received many calls during 1996, as we do every year, concerning problems with trees growing on wet sites. The most common problems we encounter on wet sites are frost heave in early years following plantation establishment, wind throw as trees achieve pole size, and slow growth throughout the rotation.

Trees on wet sites also suffer from root rots, nutrient deficiencies, low vigor, and increased susceptibility to drought. Wet sites promote shallow or surface rooting, and when drought causes water tables to drop, trees in swampy areas may suffer more than trees on drier sites which possess deeper, better developed root systems.

We encountered two interesting problems involving landscape plantings established on wet sites in 1996. Interestingly, both involved Swiss stone pine (*Pinus cembra*), a species that while perfectly hardy, is not tolerant of wet soil. In one case, in Newport, Swiss stone pine had persisted on a heavy clay soil for perhaps 25 years following outplanting in the landscape, but trees had grown slowly and as they aged and lost vigor, secondary factors (soil pathogens and bark beetles), began gradually taking them. Of about 6-8 trees originally planted, most had died and had been removed, two were in the process of dying, and one still looked all right. The owner was advised to replace the trees with other species, rather than simply replanting the site with more Swiss stone pines.

The other case involved the use of Swiss stone pines to replace native trees at the end of an airport runway in the town of Wiscasset. Native species were removed because their height violated Federal Aeronautics Administration guidelines. After they were removed, a homeowner complained of the loss of the privacy and noise screening which had previously been provided by the native vegetation.

The town responded by replanting the site with lower growing species, including Swiss stone pine. But the site was heavy to clay and poorly drained. The replacement species were balled and burlapped nursery stock for which substantial planting holes had to be excavated. Had no stock been planted in these holes they would shortly have become "cisterns" filled with water, due to the high water table present. So even though the planting holes were filled with good topsoil around tree roots, the root balls quickly became sodden and waterlogged. Conscientious, perhaps even overzealous, watering by the town fire department only exacerbated the situation. Most trees were dead within a few months.

Those involved with the situation had difficulty understanding why native vegetation could grow so well on a site where replacement vegetation failed so miserably. Only when they understood that the native vegetation had developed shallow root systems to cope with the wet site as it grew from seed, roots that never penetrated to the depths at which the replacement stock had been set, did they become convinced of the inappropriateness of their planting technique under such circumstances.

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. In 1996 a total of 2,235 acres of high quality pine timber were scouted for *Ribes* plants in Lincoln, Sagadahoc and York counties. A total of 14,640 *Ribes* were destroyed. Scouting was conducted in the towns of Arundel, Dresden, Kittery, Limerick, Richmond,

Topsham and Woolwich. Topsham and Woolwich were not completed, but are scheduled for completion in 1997. Work is also presently scheduled for 1997 in Lisbon, Bath, West Bath and Durham.

Triclopyr (Garlon 4) remains our herbicide of choice, mixed at the rate of 5 oz./gallon of water. In 1996 a total of 205 ounces of Garlon 4 was mixed to provide a total finished volume of 41 gallons.

White pine blister rust continues to be a problem of trees in the landscape as well, often involving trees which were infected when purchased as nursery stock.

Wind Damage - Maine experienced a variety of wind events early in 1996 which caused extensive damage to trees statewide.

Damage was especially severe in Kennebec County. Blowdowns in selectively harvested areas were often so extensive that presently recommended selective harvesting practices may need to be adjusted. That is the job of professional foresters, not entomologists and pathologists, but we have a few suggestions: (1) Thin stands relatively early, before stems become too crowded. Crowded trees develop restricted root systems and long, spindly stems. When trees are thinned so wind can enter a forest stand at speed, the leverage provided by crowns high in the air catching wind is more than restricted root systems can tolerate. Earlier and more frequent thinnings may increase windfirmness of residual trees by offering the opportunity for roots to develop more extensively before sails (crowns) get too high in the air. (2) Consider thinning softwoods from mixed wood stands. While the potential value of softwoods may mitigate against this recommendation, hardwoods as a group appear much more windfirm, at least during winter storms. (3) Plant nothing but well to moderately-well drained, deep soil sites. Trees must be deeply rooted to become windfirm.

Winter Injury - The colder, snowier (southern Maine only), and windier than normal winter season of 1995-1996 took its toll on trees and shrubs. Wind caused the most damage and while temperatures averaged below normal, the extreme low readings of some recent years did not recur. And the snow, while abundant, seemed not to cause more than normal amounts of branch breakage in most areas.

Foliage of the most tender evergreen ornamentals (especially dwarf Alberta spruce) exhibited considerable winter damage but damage to most other evergreen species was in the trace to moderate range last spring.

Rhododendrons and yews were relatively free of winter browning symptoms, as was higher elevation red spruce.

This disease remains static at moderate levels.

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. TheWhite 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. 11 - March 1997

Maine Forest Service
DEPARTMENT OF CONSERVATION
INSECT & DISEASE MANAGEMENT DIVISION PUBLICATIONS
Technical Report Series

No.	*Title*
1.	LaBonte, G.A. The Saddled Prominent Outbreak of 1970-1971 and Its Damages. March, 1978. 20 pp.
2.	Dearborn, R.G., H. Trial, Jr., D. Struble and M. Devine. The Saddled Prominent Complex in Maine with Special Consideration of Eastern Maine Conditions. March, 1978. 20 pp.
3.	Maine Forest Service, Entomology Division. Spruce Budworm in Maine: 1977. March, 1978. 80 pp.
4.	Devine, M.E., H. Trial, Jr. and N.M. Kotchian. Assessment of Spruce Budworm Damage in the Moosehorn National Wildlife Refuge. August, 1978. 32 pp.
5.	Struble, D., H. Trial, Jr. and R. Ford. Comparison of Two Rates of Sevin-4-Oil for Spruce Budworm Control in Maine: 1976. August, 1978. 28 pp.
6.	Morrison, T.A. and J.B. Dimond. Field Trials for Control of Spruce Budworm in Maine: A History and Bibliography. September, 1978. 13 pp.
7.	Bradbury, R. Spruce Budworm Parasitic Survey in Maine with Special Reference to the 1978 Season. December, 1978. **Unpublished**.
8.	Trial, Jr., H. and A. Thurston. Spruce Budworm in Maine: 1978. December, 1978. 109 pp.
9.	Trial, Jr., H., W. Kemp and D. Struble. Evaluation of Split Application and Reduced Dosages of Sevin-4-Oil for Spruce Budworm Control in Maine: 1978. November, 1979. 30 pp.
10.	Struble, D., W. Kemp and H. Trial, Jr. Evaluation of a Reduced Dosage of Orthene for Spruce Budworm Control in Maine: 1977 and 1978. December, 1979. **Unpublished**.
11.	Dimond, J.B., M. Kittredge, D. Schaufler and D. Pratt. *Bacillus thuringiensis*: Operational Project - Spruce Budworm Control in Maine 1978. 1978. 36 pp.
12.	Kemp, W.P., H. Trial, Jr. and D. Struble. Sampling and Analysis Design for Departmental Insecticide Monitoring. February, 1979. 32 pp.
13.	Connor, J.Y. and H. Trial, Jr. *Bacillus thuringiensis*: Operational Project - Spruce Budworm Control in Maine 1979. November, 1979. 20 pp.
14.	Trial, Jr., H. and A. Thurston. Spruce Budworm in Maine: 1979. March, 1980. 111 pp.
15.	Bradbury, R.L. and G.A. LaBonte. Winter Mortality of Gypsy Moth Egg Masses in Maine. November, 1980. 4 pp.
16.	Devine, M.E. and J.Y. Connor. Resurvey of Spruce Budworm Damage in the Moosehorn National Wildlife Refuge. February, 1981. 21 pp.
17.	Trial, Jr., H. and M.E. Devine. Spruce Budworm in Maine: Biological Conditions in 1980 and Expected Infestation Conditions for 1981. February, 1981. 64 pp.
18.	Trial, Jr., H. and M.E. Devine. Spruce Budworm in Maine: Results of the 1981 Project, Biological Conditions in 1981, and Expected Infestation Conditions for 1982. April, 1982. 83 pp.
19.	Trial, Jr., H. and M.E. Devine. Spruce Budworm in Maine: Results of the 1982 Project, Biological Conditions in 1982, and Expected Infestation Conditions for 1983. March, 1983. 76 pp.

20. Trial, Jr., H. and M.E. Devine. Spruce Budworm in Maine: Results of the 1983 Project, Biological Conditions in 1983, and Expected Infestation Conditions for 1984. May, 1984. 75 pp.

21. LaBonte, G.A. Control of the Red Oak Leaf-Mining Sawfly. August, 1984. 7 pp.

22. Dearborn, R.G., R. Bradbury and G. Russell. The Forest Insect Survey of Maine - Order Hymenoptera. May, 1983. 101 pp.

23. Trial, Jr., H. and M.E. Devine. Spruce Budworm in Maine: Results of the 1984 Project, Biological Conditions in 1984, and Expected Infestation Conditions for 1985. April, 1985. 75 pp.

24. Trial, Jr., H. and M.E. Devine. Spruce Budworm in Maine, Results of the 1985 Project, Biological Conditions in 1985 and Expected Infestation Conditions for 1986. August, 1986. 71 pp.

25. Bradbury, R.L. Efficacy of Selected Insecticides Against the White Pine Weevil (Coleoptera: Curculionidae). November, 1986. 8 pp.

26. Trial, Jr., H. and J.B. Dimond. An Aerial Field Trial Evaluating Split Applications and New Formulations of *Bacillus thuriengiensis* Against the Spruce Budworm, *Choristoneura fumiferana* in Maine. March, 1988. 20 pp.

27. Bradbury, R.L. An Economic Assessment of the White Pine Blister Rust Control Program in Maine. January, 1989. 17 pp.

28. Trial, Jr., H. Spruce Budworm in Maine: The End of the Outbreak, Biological Conditions in 1986, 1987, and 1988, and a Look at the Future. October, 1989. 50 pp.

29. Granger, C.A. Forest Health Research and Monitoring Activity in Maine 1989-90. April, 1990. 30 pp.

30. Trial, Jr., H. and J.G. Trial. The Distribution of Eastern Hemlock Looper {*Lambdina fiscellaria* (Gn.)} Eggs on Eastern Hemlock {*Tsuga canadensis* (L.) Carr} and Development of an Egg Sampling Method on Hemlock. February, 1991. 12 pp.

31. Trial, Jr., H. and J.G. Trial. A Method to Predict Defoliation of Eastern Hemlock {*Tsuga canadensis* (L.) Carr} by Eastern Hemlock Looper {*Lambdina fiscellaria* (Gn.)} using Egg Sampling. September, 1992. 12 pp.

32. Dearborn, R.G. and C.P. Donahue. The Forest Insect Survey of Maine - Order Coleoptera (Beetles). December, 1993. 101 pp.

33. Trial, Jr., H. and M.E. Devine. Forest Health Monitoring Evaluation: Brown Ash (*Fraxinus nigra*) in Maine - A Survey of Occurrence and Health. May 1994. 37 pp.

34. Trial, Jr., H. and M.E. Devine. The Impact of the Current Hemlock Looper, *Lambdina fiscellaria* (Guen.), Outbreak in Selected Severely Damaged Stands of Eastern Hemlock. December 1994. 16 pp.

35. Bradbury, R.L. Efficacy Trials of Foray 48B Against Early Larval Instars of the Browntail Moth, *Euproctis chrysorrhoea* (L.). May, 1995. 7 pp.

36. Trial, Jr., H. and M.E. Devine. The Impact of the Hemlock Loopers, *Lambdina fiscellaria* (Guenée), and *L. athasaria* (Walker) on Eastern Hemlock and Balsam Fir in New England. November, 1995. 24 pp.

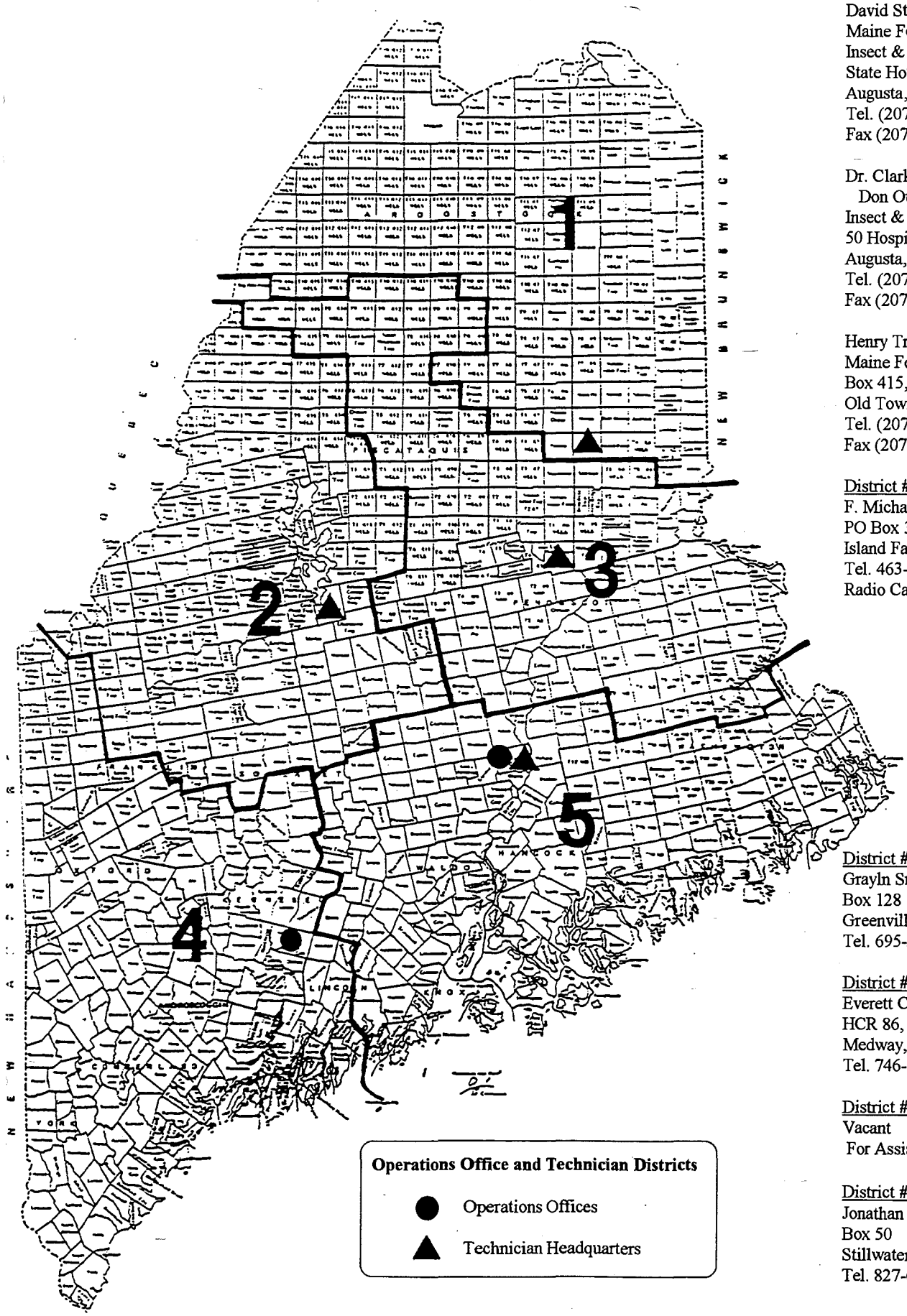
37. Trial, Jr., H. and M.E. Devine. Forest Health Monitoring Evaluation: Brown Ash (*Fraxinus nigra*) in Maine - A 1995 Resurvey of Brown Ash Decline Plots Established in 1993. August 1996. 12 pp.

Index

Index

Index

Index



David Struble and Richard Bradbury
Maine Forest Service
Insect & Disease Management Div.
State House Station 22
Augusta, ME 04333
Tel. (207) 287-2791
Fax (207) 287-2400

Dr. Clark Granger, Richard Dearborn,
Don Ouellette and Charlene Donahue
Insect & Disease Laboratory
50 Hospital Street
Augusta, ME 04330-6598
Tel. (207) 287-2431
Fax (207) 287-2432

Henry Trial and Mike Devine
Maine Forest Service
Box 415, Airport Road
Old Town, ME 04468
Tel. (207) 827-6191
Fax (207) 827-8441

District #1
F. Michael Skinner
PO Box 340
Island Falls, ME 04747
Tel. 463-2328
Radio Call #F-181

District #2
Grayln Smith
Box 128
Greenville, ME 04441
Tel. 695-2452 Radio Call #F-182

District #3
Everett Cram
HCR 86, Box 22
Medway, ME 04460
Tel. 746-5312 Radio Call #F-183

District #4
Vacant
For Assistance Call (207) 287-2431

District #5
Jonathan Connor
Box 50
Stillwater, ME 04489
Tel. 827-6133 Radio Call #F-185

MFS 1997