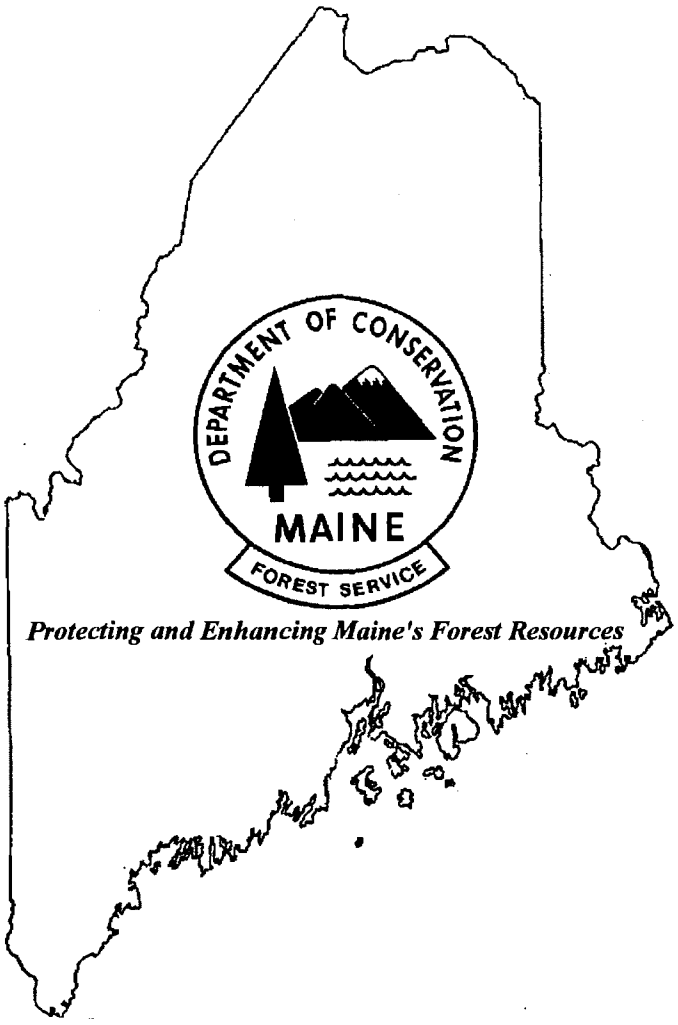
# Forest & Shade Tree Insect & Disease Conditions

# for Maine

## A Summary of the 1998 Situation




**Insect & Disease Management Division**
**Summary Report No. 13**
**May 1999**

**Maine Forest Service**
**MAINE DEPARTMENT OF CONSERVATION**
**Augusta, Maine**

# MAINE

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* Reflects staffing for the 1998 season

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Issued 5/99

Printed under appropriation number 010-04A-5211-522

## *Acknowledgements*

This summary has been compiled and edited by **Richard Dearborn** and **Clark Granger** from input received from the staff of the Insect and Disease Management Division and many cooperators. State Entomologist, **Dave Struble** contributed entries and proofread the final draft. **Dick Bradbury**, **Mike Devine**, **Charlene Donahue, Don Ouellette** and **Henry Trial, Jr.**, of our staff either wrote items or otherwise contributed to the compilation process. Our regular field staff, **Jody Connor**, **Skip Cram**, **Mike Skinner** and **Grayln Smith** 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: **Carly Del Signore, Laurie Mann, Kathy Murray, Stephanie Parady, Dan Pratt,** 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. **Darlene Stebbins** began work at the lab in July of 1998 on the MOHF grant to computerize insect collection specimen data and government intern **Dagan Loisel** assisted on the Shifting Mosaic biodiversity study.

A special debt of gratitude again goes to **Betty Barry** who had to put all of the pieces of the puzzle together for review and then integrate the multitude of changes and corrections necessary to produce this finished product. Betty and **Dot Arbour** are keepers of the mailing list and 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. Cross referencing within the text is used in the case of complex problems. We have again provided our very brief **one-point assessment table** (Table 1, p. 9) for damage level trends for quick review for many of our common problems. You should still 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. 13). 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. 35) which also includes an expanded series of tables showing the variety of **public assistance** requests received by I&DM (p. 38).
- **Tree diseases and injuries** are listed alphabetically in a separate section beginning on page 42.

# FOREST & SHADE TREE INSECT & DISEASE CONDITIONS FOR MAINE
# A SUMMARY OF THE 1998 SITUATION

## *Comments from the State Entomologist*

Last year in this opening section of the annual pest conditions summary I listed some of the success stories of the previous year, successes that were largely the result of cooperative ventures with our various client/cooperators. At that time I stated that I felt that future successes would accrue from continuing that cooperative approach. Without belaboring the point, I can report that those projects and this approach are continuing to evolve and service the needs of the taxpayers of the state.

The major division activity for the past year was assessment of damage resulting from the 1998 ice storms. We acquired high resolution aerial photo coverage and interpretation of approximately 3 million acres in the largest damage band. In addition, I&DM crews evaluated on-ground conditions on more than 1000 sites. Beyond demonstrating that the extent and intensity of damage to forest stands and urban green infrastructure well justify the $27,000,000 in forestry emergency response funds for ice damage mitigation that the state received from Congress, these data also serve as a baseline to assess long-term impacts of the storm. While much of our work has utilized our internal staff, we are also engaged in cooperative projects with the USFS, our neighboring jurisdictions, and UMO. The initial regional analyses are slated to come out this spring.

Other major accomplishments for 1998 include:

- Successful registration of new, more targeted pesticides to improve our range of options for dealing with browntail moth.
- Successful browntail moth and yellowheaded spruce sawfly management projects: 3,680 acres aerially-treated without incident
- Increased public recognition of the positive benefit of active forest management to address spruce beetle and dwarf mistletoe infestations in Maine's coastal spruce resource.
- Increasing availability and use of I&DM historical data via electronic databases and internet technology. (Currently the USFS in Morgantown, West Virginia is using this data to assess fluctuations in biodiversity and ecosystem resiliency. These data will better help us evaluate concerns about our local forest ecosystem's fragility.)
- Promising initial results from our cooperative effort with the Shifting Mosaic Project to assess ground beetle populations as an indicators of biodiversity and forest ecosystem resiliency.

While all of the above projects (and more) will continue this year, our major new initiative - driven by public concerns regarding the sustainability of Maine's forest resources - involves implementing in 1999 an annualized forest inventory as mandated by the 118th Legislature. Whereas the I&DM division is the de facto survey arm of the MFS, we have been assigned the task of developing and implementing this inventory to monitor trends in Maine's forest resources. In recognition of this expanded role, there is currently a bill before the Legislature to change the I&DM division name to "Forest Health & Monitoring Division". We have been working with the USFS-Forest Inventory & Analysis group to maximize the benefit from our shared mandates and activities. At the same time we have been meeting with an advisory group of within-state stakeholders to assure that the generated data will serve the needs of the larger client community.

Although we received funding from the legislature for a biometrician position and increased field staff to augment our existing capability, this new inventory mandate has also required commitment of most I&DM field staff. As we initiate this effort, it will strain our internal capacity to conduct all of the traditional activities and address all of the concerns that we have in the past. This is forcing us to reassess what we do and how we do it. Our staff are reviewing project work plans and are assessing some innovative approaches to accomplish the tasks at hand. One specific case in point: we anticipate a more ad hoc approach to field season pest condition newsletters and pest alerts this year. While we are planning an initial seasonal issue at the usual time, issues thereafter may be

more sporadic, as this activity competes with other projects for staff time. To offset this situation we are trying to provide improved self-help tools that the public can access as needed. I anticipate increasing use of the internet (last year our homepage had over 20,000 hits), especially for access to pre-generated information sheets and electronic databases. However, I still see a continuing need for the more traditional outreach tools such as the newsletter and pamphlets that we have used so effectively in the past and I am committed to maintaining this service to the extent possible.

Although the level of commitment required for the forest inventory is no more than we focused in the past on spruce budworm, it is not yet clear how and to what extent we can eventually incorporate into this survey effort those field activities associated with our other mandates. To maximize the probability of success of the inventory initiative during the initial year, I have deliberately curtailed additional assignments to field staff. This will increase our dependence on our client cooperators for on-ground support for field projects, and reports of new and expanded problems.

In particular, we continue to be concerned about the potential introduction of exotic pests such as Asian longhorned beetle and hemlock woolly adelgid This past year there have been reports of another new longhorned beetle on ornamental cedars in Connecticut. Although none of these pests have yet been found in Maine, they have established a beachhead in the region. Even if we weren't diverting field staff to address the forest sustainability issue, we would be asking you to be alert for signs of these or other new or expanding problems but this year it is even more crucial.

Although we try to acknowledge the contribution provided by our client/cooperators, it is difficult to convey how crucial this assistance is to the success of our mission. So often it is the "little" spur- of-the-moment assistence in response to a locallized or time critical situation that averts a crisis. Without you we would not be able to effectively gather information regarding pest and forest conditions; nor could we as effectively disperse it out to the larger public.

In recognizing the contribution of our various cooperators, I would like to pay special tribute to the late Dr. Normand Dubois of the USFS in Hamden, Connecticut, who died unexpectedly at home last May, shortly after a successful spray trial of an improved Bt formulation against browntail moth. In addition to his enthusiasm for his work in developing effective formulations of *B.t.* to manage forest and shade tree pests, Norm demonstrated a genuine empathy with the clientele that these products were aimed at helping. During the past few years he was a familiar and welcome presence in the island communities around Casco Bay. He personified the collaborative spirit and support that has enabled us to successfully address local needs and produce positive outcomes. We miss his expertise, but even more the always-ready assistance and camaraderie.

As always, I reiterate that it is critical that these Forest & Shade Tree Insect & Disease Condition Reports be useful to you. 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.

## *Cooperative MFS/USFS Projects*

**Competitive Focus Funding Grants**

***A Re-evaluation of Forest Regeneration in Spruce Budworm Damaged Stands Within Baxter State Park*** The I&DM Division continued an evaluation of regeneration of spruce budworm killed stands in Baxter State Park. The unaltered progression of the decline and recovery of budworm damaged stands in Baxter State Park has provided a unique setting for study of this natural system. During the 70's and 80's a severe outbreak of spruce budworm that covered most of Maine's spruce/fir forest type, caused extensive mortality to fir and spruce in Baxter State Park. Because of the "forever wild" mandate on most of the Park lands budworm mortality progressed unchecked in all but the scientific forestry section of the Park. Portions of the Park experienced fir mortality exceeding 95% and spruce mortality that ranged from 10 to 60%. These stands are now regenerating naturally and are providing an opportunity to further assess impacts of budworm on regeneration composition in stands not subject to conventional land management practices.

The potential of this unique study area was realized early in the outbreak and stand evaluation plots were established at that time by the US Forest Service (USFS) and the University of Maine, initially to assess expected stand decline. Stand composition and condition data was collected annually by the USFS from 1977 through 1986. In 1989 I&DM staff made the final measurement of surviving overstory and provided these data to the USFS thus completing the decline phase of the cycle. Beginning in 1989, I&DM established regeneration plots on a subset of the original plot network. The goal of this regeneration phase of the Baxter study was to document stand regeneration following unchecked damage by spruce budworm. Regeneration compositions will be compared to original stand composition as measured in the initial 1977 assessment to detect any species shifts. The overall health of regeneration and surviving overstory in assessment plots will be evaluated with National Forest Health Monitoring project variables. Overstory survival will be compared to the 1989 data set to determine any additional losses since the last assessment.

Partial funding for this project was provided in a grant by the US forest Service in 1995. Most of the data required for this project was collected on schedule in the summer of 1996. However, due to other commitments, crown condition ratings for one assessment block had to be delayed until the summer of 1997. These data were gathered in July of 1997 and the data set and data entry is now complete. Project analysis and reporting is now underway. A final report is anticipated during 1999.

***Maine Forest Service Insect and Disease Historical Database*** - The Maine Forest Service historical database program is in the final stages of conversion to Access®. The file structure has been recreated and the data input and report forms are being checked for proper design and safeguards. The program has a file of insect names that was supplied by the Canadian Forest Service for which we have obtained permission from them for distribution to other states. The program should be ready for distribution in early 1999. The program will not contain Maine's data, it will be set up for other states to use for their information. (It will be distributed on a ZIP disk or a set of diskettes.)

The Technical Report on the Historical database is now available (p. 59 #39).

***Phenology and Damage Relationships with Yellowheaded Spruce Sawfly (Pikonema alaskensis) in Black and White Spruce Plantations in Maine*** - All work on the phenology project has been completed. The data was presented at the 1998 Northeastern Forest Pest Council meeting in Fredericton, New Brunswick in March 1998. The material was also presented at the Entomological Society of America meeting in Los Vegas, Nevada. The report on this work is approaching completion and will be published in 1999.

**Forest Inventory and Analysis (FIA) Survey**

With passage of LD 2286, An "Act ... Regarding Enhancing Forest Resource Assessment", by the 118th Maine Legislature in 1998, the MFS was mandated to conduct, in cooperation with the US Forest Service, a forest inventory and analysis program. This inventory was to be "based on plot data collected annually in a manner that provides for the entire state to be inventoried on a cycle of not more than 5 years". This inventory is scheduled to begin in the spring of 1999. Previous inventory cycles were for ten years or more.

I&DM has historically been the de facto survey arm of the MFS. This involvement has evolved from earlier pest impact and risk assessment work (e.g. spruce budworm) to programs like the North American Maple Project (NAMP) and the National Forest Health Monitoring Program (NFHM). More recently I&DM was the lead liaison with USFS-FIA on the 1994-5 resurvey of Maine's forest resources. Because of this previous involvement, familiarity with monitoring protocols, and acknowledged staff expertise, I&DM was assigned the task of working with the USFS and local stakeholders to develop and implement the mandated inventory. As part of this package we were provided additional staff and financial resources to augment existing capability and staffing levels.

At this time we have hired the Biometrician and 3 new Entomology Technicians with a Forest Survey option as approved by the Maine Legislature. Our staff have been working with USFS-FIA staff to finalize the work plan for 1999 season. We are presently anticipating initial training/certification to occur in April, with data collection beginning immediately thereafter. Approximately 680 plots will be revisited/established and measured during the 1999 season and a report on the initial season's results is planned for early next year (2000).

**National Forest Health Monitoring Program (NFHM)**

Measurement of the National Forest Monitoring detection grid continued in 1998. Since 1996, annual NFHM assessment has consisted of measurement of subset of the total sample grid of 137 permanent plots in Maine. Again in 1998, the sampling scheme included a rotating panel of one quater of the detection monitoring grid plus an additional twelfth of the grid where plots are measured for two successive years. Combination of the two grids equals approximately a third of the total plot network for sampling in a given season. In 1998, 41 forested and 4 non-forested plots were measured. Three, two person assessment crews were employed for NFHM measurement during the late May through September 1 season.

In addition to the usual NFHM sampling, all plots were evaluated for ice damage from the January 1998 ice storm. Ice evaluation on NFHM plots was accomplished either with aerial observation of the plot or with a ground visit. Plot assessed aerially and found to have ice damage were scheduled for ground visits. During ground visits, plots were either classified as undamaged (damage below NFHM threshold), lightly damaged (some damage above threshold measured during the visit), or significantly damaged ( these plots were scheduled for a leaf-on complete measurement). Plots regularly scheduled of measurement in 1998 were not visited during the ice evaluation and ice damage was subsequently measured during the normal summer visit. Of the 86 unscheduled forested plots evaluated for ice damage, seven had significant damage and were added to the 1998 measurement list, 37 were lightly damaged and were evaluated during the ice visit, and 42, mostly in northern Maine, were determined to have insignificant ice damage.

New variables were added to the standard set of NFHM variables (CORE4) in 1998. A new method of soils sampling was employed for all regularly scheduled 1998 plots. The new soils method and analysis was significantly simplified than a method used in a previous soils pilot project. Another former pilot variable, lichen assessment, was also added operationally in 1998. Due to difficulties in NFHM indicator leads training enough crew people for lichen assessment, only about half of the 1998 Maine plots were evaluated for lichens. Also last season, a pilot test of a method for assessment of the plot vegetation community was conducted in other cooperating states. Soils and lichen variables were evaluated after the 1998 season and will be used again with some modifications in 1999. Vegetation assessment required a major overhaul and a new pilot is planned for 1999.

NHFM methods and procedures continue to be widely employed in several aspects of Insect & Disease Management evaluations. NFHM variables were employed extensively in assessment of brown ash dieback, beech and birch health assessment, and damage caused by a past hemlock looper outbreak. The NFHM plot design, "foot print" has been adopted for use on future Forest Inventory Assessment (FIA) plots and several NFHM plot variables such as crowns and damage assessment techniques will be integral parts of a planned merger of the NFHM and FIA programs. and plot networks.

**North American Maple Project (NAMP)**

The NAMP program was established in 1987 as a joint Canadian/US effort. The project was formed to address concerns over a perceived decline in the health of sugar maple in North America. Data was collected annually from 1987 through 1997 on 223 plots distributed over ten states and four provinces. Plots throughout the cooperating region, were established in pairs consisting of a commercial sugar bush paired with a natural maple stand. In Maine, 18 plots (9 pairs) were established in the western portion of the State.

In 1997 NAMP completed its expected 10 year evaluation period and plans were made for completion of program summary reports. A summary of program objectives and results was provided in the 1997 I&DM conditions summary (Summary Report No. 12). However, the planned program termination was altered by the severe January 1998 ice storm that caused significant damage to sugar bushes and wild sugar maple stands in several cooperating states. In view of the significance of this ice "event," funding was made available through the USDA, Forest Service, Forest Health Protection, ice grant to evaluate ice damage on NAMP plots in the early spring of 1998 and to conduct a standard NAMP plot remeasurement during the normal summer assessment period. Because of the long history of data collection on the permanent NAMP plots, these plots were thought to be an excellent base for evaluation of ice storm effects on sugar maple and other hardwoods.

The spring assessment of ice damage on Maine plots revealed that 13 of the 18 plots had at least some ice damage. Four Maine plots were seriously damaged by the ice storm. Other jurisdictions that experienced ice damage on NAMP plots were Vermont and Quebec. Even though New Hampshire and New York both experienced substantial ice damage within the states and specifically on sugar maple, neither state had NAMP plots that were damaged by the storm.

Summer remeasurement of the Maine NAMP plots was conducted as planned and data was forwarded to program coordinators.

Preparation of NAMP program summaries and reports is currently underway and most program documentation should be completed in 1999. At a recent NAMP winter meeting, Vermont, New Hampshire, and New York agreed to remeasure plots in 1999 using ice grant funds. Annual measurements will continue in the four Canadian Provinces. Due to other I&DM commitments and a desire to allow damaged plots more time to show ice damage effects or recovery, remeasurement of Maine plots will be delayed until the 2000 season. Beyond 2000, NAMP plot maintenance and some periodic schedule plot remeasurement is likely.

## *Maine Outdoor Heritage Fund Grant - Computerization of Insect Collections*

**Progress Report for Developing Electronic Access to the Information in Public Insect Collections in the State of Maine**

The Maine Outdoor Heritage Fund (MOHF) project "Developing Electronic Access to the Information in Public Insect Collections in the State of Maine" got off to a slow start due to the need for legislative approval. The grant was awarded in November 1997, funds were released in March 1998 but the Maine Forest Service (MFS) project position for the person to perform the data entry could not be filled until July, due to the 90 day waiting period after the close of the legislative session. March through June was spent getting the contract with the University of Maine approved, developing the database and purchasing equipment. The Department of Environmental Protection (DEP) will begin their portion of the work in 1999 as it is a smaller project and they did not have the personnel on board to run the project in 1998.

The MFS data entry began in mid-July when Darlene Stebbins was hired and over 12,000 records have been entered to date. All of the Order Odonata (dragonflies) has been entered, checked and corrected. Data from specimen labels in the fifth and last cabinet of Coleoptera (beetles) are now being entered into the computer and that information is error-checked on an ongoing basis. Darlene has written up a procedural manual for entering data, error checking, and handling specimens. The MFS had planned on hiring work-study students during the summer but none were available. Despite this, 20% of the cabinets of insects have been done in 25% of the allotted time. Provided we can maintain this level of data entry and hire summer labor in 1999, we should be able to meet our goal of computerizing all the MFS insect label information by the end of the granting period.

A web page has been designed for the MFS web site and the records from order Odonata and the beginning of Coleoptera order have been sent to the DOC webmaster to be put up on the web in January. This is a preliminary design and will be improved upon as expertise in web browsers is developed (see our website p. 7)

The University also had difficulty with start up on this grant. They received their funding in July and could not find summer work-study students to hire for the data entry. Therefore they did not start work on this project until fall. The order Odonata has been entered, 625 entries, and dragonfly expert Paul Brunelle has gone over the information and updated nomenclature. The commercially available database Biota was chosen for their data entry and they ran into some initial problems with it - most of which have now been addressed. The Coleoptera are currently being entered by workstudy students and 1859 records were entered during the fall. They have still to set up error checking routines. The person that was overseeing the data entry process left the University in January but hopefully a replacement will get the project on track this winter.

The contract with DEP is in progress and they are ready to go as soon as the contract is signed. They are developing a new database that should meld nicely with the MOHF project.

In July a *Kennebec Journal* reporter called and asked to do a newspaper article on the MOHF Insect Collection project that he had read about in our last Summary Conditions Report (#12). In December 1998 another article appeared in the *Portland Press Herald* on the MOHF which quotes DOC Commissioner Ron Lovaglio as saying that the Insect Collection project is one of his favorites.

## *A Forest Biodiversity Project With the Manomet Center for Conservation Studies*

**A Preliminary Sampling of Terrestrial Arthropod Populations of Hardwood, Softwood, and Partially Cut Forest Stands**

Biodiversity issues, albeit under another name - our Forest Insect Survey (FIS), have long been the foundation of much of the I&DM work in Maine. In response to the recent rise in emphasis on forest biodiversity issues per se we are looking into how this might relate to forest sustainability. During 1998 we participated in the Shifting Mosaic Project coordinated by the Manomet Center for Conservation Studies in Brunswick. As the principle representatives on the invertebrate studies team we were encouraged to conduct a pilot soil invertebrate survey at three sites in T3 R8 WELS in 1998. The objective of this study was twofold. The first objective was to see if we could measure the population responses of key insect species to different wood harvesting scenarios. To achieve this, population sampling of terrestrial arthropods (specifically spiders, camel crickets, and beetles) was conducted in three different forest stands; mature hardwood, semi-mature softwood, and a heavy partial cut. Secondly, this being a pilot study, it was important to develop a workable protocol by which this population sampling could be conducted. Thus, the development, adjustment, and evaluation of the sampling methods was important, as well as estimates of time required for such sampling in order to develop a workable protocol which could be continued, and possibly expanded, in coming years.

The 1998 project involved one I&DM entomologist and a government intern. One set of nine pitfall traps were set out in a 4x4 meter grid at each of the three sites in June. These traps were sampled six times, at one week intervals from June 10th to July 22nd. The material from these traps was brought to the I&D lab in Augusta for processing. Although the results look promising, a complete analysis will not be available until the completion of a second season in 1999. A preliminary report of the 1998 project will be available some time in April 1999.

## *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. This file contains publications of our own plus many from other sources as well. We annually upgrade or prepare new fact sheets on a wide variety of the more common tree pest problems. Some of our larger publications such as: Bulletin #25 - Field Book of Destructive Forest Insects (1980) and Circular #9 - Insect Primer (1974) are currently out of print. Our popular Bulletin #10 (5th Revision) - The Planting and Care of Shade Trees (1985) is however, still available. Our Technical Report series, now numbering 39, are listed on page 58 and many are still available. 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 during 1998 by I&DM staff:

  Bradbury, R.L. 1998 (March). The Browntail Moth, *Euproctis chrysorrhoea*, Summary of Maine Activities for 1995. MFS, I&DM Division. Technical Report No. 38. 12 pages.

  Insect & Disease Management Division. 1998 (March). Forest & Shade Tree-Insect & Disease Conditions for Maine - A Summary of the 1997 Situation. MFS, I&DM Division. Summary Report No. 12. 64 pp. Compiled and edited by R.G. Dearborn and C.A. Granger.

  ____ 1998. Forest & Shade Tree-Insect & Disease Conditions for Maine. 7 seasonal issues from April 17 through September 23. MFS, I&DM Div. Compiled and edited by R.G. Dearborn and C.A. Granger.

- New items published in 1998 which may be of interest to our readers:

  Childs, R.D. and M.L. Petitjean. 1998 (June). Massachusetts Tree Wardens Guide to Common Insects and Diseases. Mass. Dept. of Environ. Mgmt. FHP. 122 pp.

  Gadzik, C.J., J.H. Blanck and L.E. Caldwell. 1998 (September). Timber Supply Outlook for Maine: 1995-2045. Dept. of Conservation, MFS. 39 pp.

  Leonard, D.E. and C.M. Burnham. 1998 (July). A History of Forest and Shade Tree Pest Management in Massachusetts. Mass. Dept. of Environ. Mgmt. 99 pp.

  McMahon, Janet. 1998 (July). An Ecological Reserves System Inventory. Augusta, Me. Me. State Planning Office. 122 pp.

- Try our website at: **http://www.state.me.us/doc/mfs/idmhome.htm**

## *Forest and Shade Tree Insect and Disease Conditions for Maine*

## *1998 at a Glance*

The 1998 season started out with a "bang" and a "pop" as back-back-ice storms raged across forested areas of southern Maine and the impact of weather related problems past (drought) and present (hail, wind, etc.) continued to dominate the scene throughout much of the rest of the season. The assessment of the present and long range impact of these weather events is being integrated into our I&DM survey strategy.

Other problems in 1998 seemed to be dwarfed by weather events but they were more varied than in 1997. Spruce beetle, yellowheaded spruce sawfly and dwarf mistletoe continued to plague spruce while introduced pine sawfly, white pine blister rust and decline problems still affected our state tree, eastern white pine. Christmas tree growers found 1998 quite vexing as they battled high populations of a complex of problems ranging from balsam gall midge, twig aphid and shootboring sawfly to yellow witches' broom. The browntail moth problem expanded slightly inland and to the east of Casco Bay in 1998 but declined to the south and west. Hardwoods in many areas were affected by an increased incidence of a variety of problems from anthracnose, fall webworm, horse chestnut leaf blotch, large aspen tortrix, oak skeletonizer, pear thrips and satin moth in 1998. And as usual I&DM dealt with a variety of forest related household pests such as the boxelder bug, multicolored Asian lady beetle and the western conifer seed bug which were much more of a nuisance in 1998 than in 1997. Ticks were also extremely abundant in some areas in 1998 while the incidence of tussocks was down. Table 1 presents highlights of many of our common pests which are discussed in more depth within this report.

Two new state records; a conifer-feeding clearwing moth and the garden bagworm, were found in 1998 and a somewhat unique manifestation of red-topped fir was noticed as well.

Exotic pests which often hit the news such as; Asian longhorned beetle, Asian gypsy moth, hemlock woolly adelgid, Japanese (Cedar) longhorned beetle and the pine shoot beetle have still not been found in Maine.

**Table 1. Damage level trends for 1998 (Compared to 1997 levels)**

| | | | | | |
|---|---|---|---|---|---|
| Air Pollution | → | low | Introduced Pine Sawfly | ↗ | high populations, 6,000 A. SW |
| Alder Flea Beetle | → | locally high | Jack Pine Sawfly | → | moderate E coastal |
| Annosus Root Rot | → | moderate | Larch Casebearer | ↗ | spotty |
| Arborvitae Leafminer | ↗ | locally high | Larch Sawfly | ↑ | locally high, >1,600 A. N,C&E |
| Ash Leaf and Twig Rust | ↘ | endemic | Large Aspen Tortrix | ↗ | spotty north, 125 A. |
| Balsam Fir Sawfly | → | low endemic | Late Spring Frost | → | low |
| Balsam Gall Midge | ↑ | high - 5,000 A. | Maple Leafcutter | ↘ | local, 135 A. |
| Balsam Shootboring Sawfly | ↑ | 5,000 A. widespread | Meadow Vole Damage | → | local |
| Balsam Twig Aphid | ↗ | 5,000 A. moderate to heavy | Mountain Ash Sawfly | → | high, local |
| Balsam Woolly Adelgid | → | locally high, coastal | Oak Leaftier/Skeletonizer | ↑ | locally high S., 8,000 A. |
| Beech Bark Disease | → | high | Oystershell Scale | → | spotty |
| Birch Casebearer | → | spotty roadside | Pear Thrips | ↗ | moderate-heavy south |
| Birch Leafminer (*Messa*) | → | up early but dropped out | Pine Leaf Adelgid | ? | on white pine |
| Bronze Birch Borer | → | local | Pine Needle Rust | → | low |
| Brown Ash Decline | ↘ | trees improving | Pine Spittlebug | → | local |
| Browntail Moth | → | <2,500 A. spreading inland | Pinewood Nematode | → | local |
| Bruce Spanworm | ↘ | <1,000 A. | Pitch Mass Borer | → | local |
| Bud Abortion (balsam fir) | ↗ | low | Porcupine Damage | → | locally high |
| Butternut Canker | → | 15 counties | Red-topped Fir | ↑ | common south central |
| Cone Buds (balsam fir) | ↓ | low | Rhabdocline Needle Cast | → | moderate to high |
| Coral Spot Nectria Canker | → | low | Road Salt Spray | ↗ | low |
| Cristulariella Leaf Spot | → | very low or absent | Saddled Prominent | → | low/endemic |
| Drought | → | residual 1995 impact | Saratoga Spittlebug | → | low |
| Dutch Elm Disease | → | high | Satin Moth | ↗ | spotty central, 150 A. |
| Eastern Larch Beetle | → | spotty | Scleroderris Canker | → | low |
| Eastern Tent Caterpillar | → | spotty and low | Spider Mites | → | high, local |
| European Larch Canker | → | static | Spruce Beetle | → | high central coast, 3,175 A. |
| Fall Cankerworm | ↓ | spotty, Aroo. Cty. boxelder | Spruce Budmoth | → | low and local |
| Fall Webworm | ↗ | high SW >5,000 A. | Spruce Budworm | → | low/endemic-may have bottomed out |
| Fir-fern Rust | ↗ | moderate | Stillwell's Syndrome | → | low and local |
| Forest Tent Caterpillar | → | low | Variable Oakleaf Caterpillar | → | low/endemic |
| Gypsy Moth | → | low/endemic | White Pine Blister Rust | → | low |
| Hardwood Decline | ↘ | improving | White Pine Drought Damage | → | highs - S - 1995 drought related |
| Hemlock Looper | → | low/endemic | White Pine Weevil | ↗ | high locally severe |
| Horse Chestnut Leaf Blotch | ↑ | high >5,000 A. SW | Winter Browning | → | low |
| Ice/Snow Damage | ↑ | 13,288,700 A. all cat. 2 events | Yellowheaded Spruce Sawfly | ↘ | scattered pockets, 3,500 A. |

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

- Especially notable in 1998

## *Light Trap Survey*

A system of light traps for detecting and monitoring lepidopterous forest pests has been in use in Maine since 1943. In 1998, the 56th year of this survey, a total of 26 Rothamstead (incandescent) and Green River (black light) type light traps were operated at established sites throughout the state (Fig. 1). Twenty four of the traps were run by contracted operators and one, in Ste. Pamphile, was run through a cooperative arrangement with Seven Islands Land Co. A 26th trap was run cooperatively in Acadia National Park by park service personnel. This trap was operated for a biodiversity survey and was run too late in the season to detect significant forest pests. Trap type and trapping period for each of the trap sites are summarized in Table 2.

**Table 2. Location, trap type, and period of operation of light traps in the 1998 light trap survey**

| Location | Trap Type | Operation Dates | Location | Trap Type | Operation Dates |
|---|---|---|---|---|---|
| Allagash | Rothamstead | July 1-July 30 (30 nights) | Haynesville | Rothamstead | June 17-July 31 (45 nights) |
| Arundel | black light | June 1-July 30 (60 nights) | Kingfield | Rothamstead | July 1 -July 30 (30 nights) |
| Ashland | Rothamstead | July 1-July 30 (30 nights) | Millinocket | Rothamstead | June 17- July 31 (45 nights) |
| Bar Harbor | black light | August and September | Mt. Vernon | black light | May 18-July 31 (75 nights) |
| Blue Hill | Rothamstead | June 17-July 31 (45 nights) | No. Bridgton | Rothamstead | May 18-July 31 (75 nights) |
| Brunswick | Rothamstead | June 17-July 31 (45 nights) | Rangeley | Rothamstead | June 17-July 31 (45 nights) |
| Calais | black light | June 17-July 31 (45 nights) | Shin Pond | Rothamstead | July 1-July 30 (30 nights) |
| Chesuncook | black light | June 17-July 31 (45 nights) | So. Berwick | Rothamstead | May 18-July 31 (75 nights) |
| Dennistown | Rothamstead | July 2-July 31 (30 nights) | Ste. Aurelie | Rothamstead | July 1- July 30 (30 nights) |
| Elliotsville | Rothamstead | June 17-July 31 (45 nights) | Ste.Pamphile* | Rothamstead | June 30-Aug. 8 (40 nts) |
| Exeter | Rothamstead | June 17-July 31 (45 nights) | Steuben | black light | June 17-July 31 (45 nights) |
| Greenbush | Rothamstead | June 17-July 31 (45 nights) | Topsfield | Rothamstead | June 24-July 31 (21 nights) |
| Guerette | Rothamstead | July 1-July 30 (30 nights) | Washington | Rothamstead | May 18-July 31 (75 nights) |

* Intermittent operation due to scheduling difficulty

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 forty five (45) days from June 17 to July 31; traps monitoring the **spring-flying hemlock looper**, *Lambdina athasaria* and other early hardwood or hardwood-softwood insect pests were operated seventy five (75) days from May 18 to July 31.

With the exception of Mount Vernon and Steuben, all trap catches were processed at the I&DM laboratory during the season as they were received. The Mount Vernon trap catches were processed on site by Dick Dearborn and the Steuben trap catches were processed at Steuben by Michael Roberts, the trap operator. Trap catches of most of the major pests being monitored are summarized in Table 3. Further results of the light trap survey are included in summaries of various pests discussed in the body of this report.

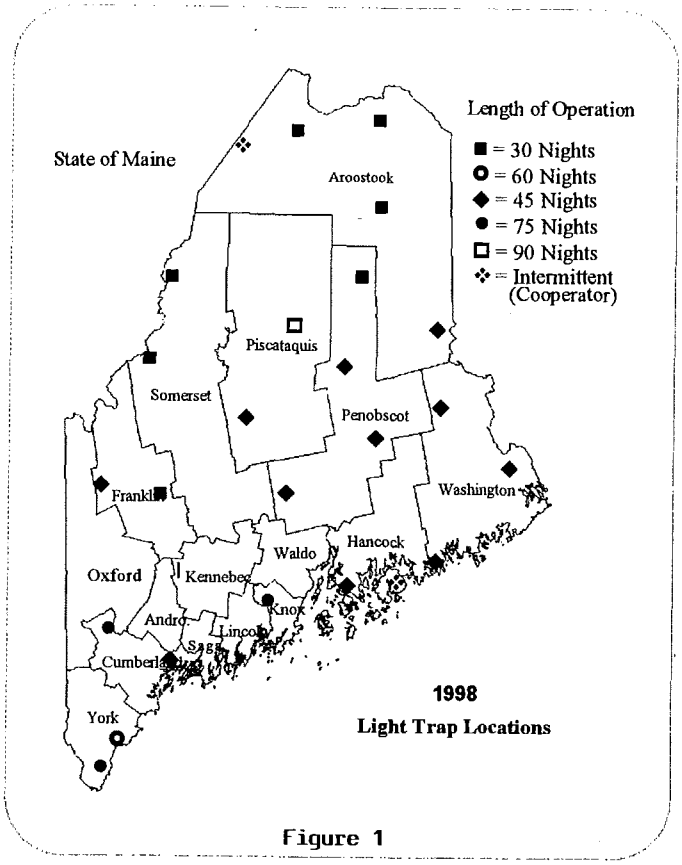


Figure 1

**Table 3. Comparison summary of light trap survey collections of forest pest species, 1998**

| | Species | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location** | *Choristoneura conflictana* | *Choristoneura fumiferana* | *Dryocampa rubicunda* | *Heterocampa guttivata* | *Leucoma salicis* | *Lochmaeus manteo* | *Lymantria dispar* | *Malacosma disstria* | *Symmerista spp.* |
| Allagash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arundel | 1 | 2 | 402 | 7 | 0 | 7 | 0 | 20 | 0 |
| Ashland | 0 | 2 | 0 | 1 | 0 | 3 | 0 | 51 | 0 |
| Bar Harbor* | | | | | | | | | |
| Blue Hill | 0 | 0 | 19 | 0 | 0 | 5 | 1 | 2 | 1 |
| Brunswick | 0 | 6 | 9 | 0 | 1 | 0 | 5 | 8 | 0 |
| Calais | 0 | 1 | 41 | 6 | 1 | 2 | 0 | 3 | 10 |
| Chesuncook | 0 | 2 | 2 | 18 | 2 | 2 | 0 | 0 | 2 |
| Dennistown | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 18 | 0 |
| Elliotsville | 2 | 5 | 12 | 2 | 0 | 1 | 0 | 3 | 1 |
| Exeter | 0 | 38 | 4 | 5 | 0 | 0 | 1 | 0 | 0 |
| Greenbush | 0 | 0 | 11 | 0 | 0 | 17 | 2 | 24 | 0 |
| Guerette | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 |
| Haynesville | 3 | 2 | 1 | 0 | 2 | 5 | 0 | 2 | 3 |
| Kingfield | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 13 | 0 |
| Millinocket | 0 | 1 | 0 | 1 | 1 | 23 | 1 | 2 | 1 |
| Mt. Vernon | 6 | 0 | 18 | 23 | 0 | 13 | 29 | 23 | 22 |
| No. Bridgton | 1 | 4 | 10 | 0 | 0 | 3 | 3 | 5 | 2 |
| Rangeley | 36 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Shin Pond | 0 | 0 | 0 | 0 | 3 | 5 | 0 | 110 | 0 |
| South Berwick | 2 | 1 | 189 | 12 | 0 | 6 | 27 | 26 | 13 |
| Ste. Aurelie | 2 | 6 | 0 | 0 | 0 | 1 | 0 | 16 | 0 |
| Ste. Pamphile* | 10 | 0 | 0 | 0 | 1 | 2 | 0 | 37 | 0 |
| Steuben | 1 | 0 | 27 | 4 | 1 | 0 | 0 | 4 | 2 |
| Topsfield** | 3 | 0 | 1 | 0 | 0 | 11 | 0 | 24 | 0 |
| Washington | 1 | 9 | 30 | 1 | 0 | 8 | 1 | 4 | 5 |
| **Total Moths** | **68** | **86** | **776** | **80** | **12** | **117** | **70** | **410** | **62** |

* Intermittent cooperator operation

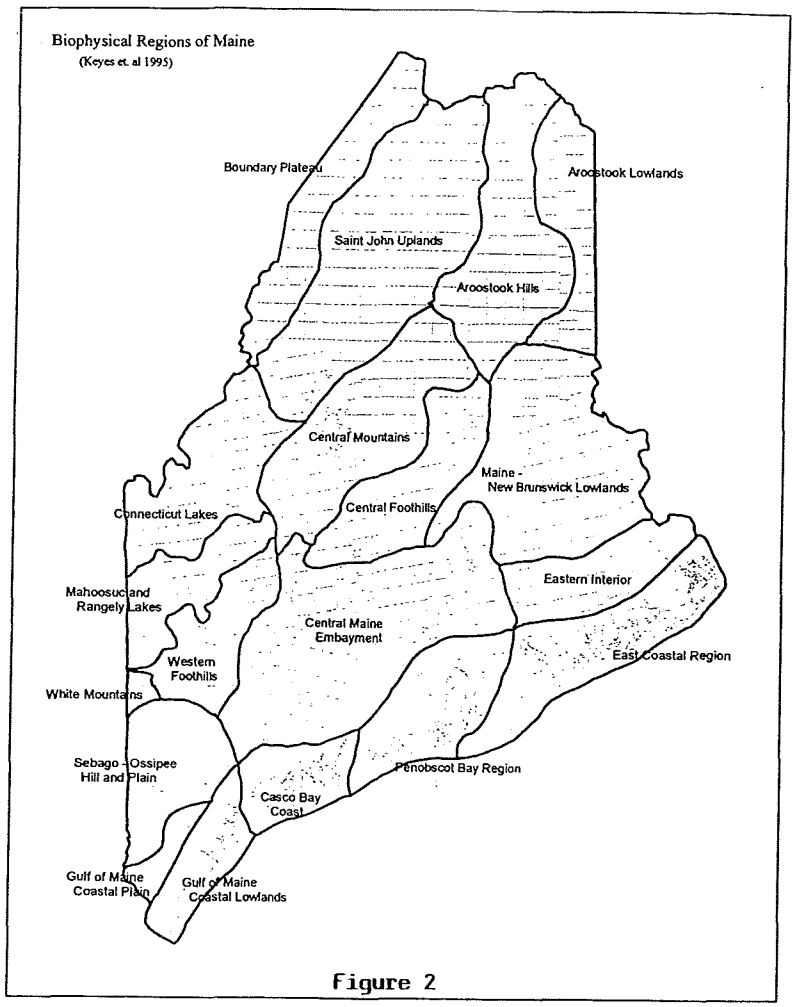


Figure 2

## *Phenology*

Tracking insect and disease development and trying to correlate this to host development and climatic events is at best a juggling game. Over the years we have kept records on a variety of items and now with computerization of many of our records some association may become evident. Although survey procedures are changing, there is increasing interest in assigning quantifiable impact assessment to climatic events. The drought of 1995 continues to leave its mark on some stands, especially white pine on sandy sites. The severe ice storm events of January 1998 are likely to have an impact that will take years to evolve as well. And wind and hail storms annually affect areas of the state.

In keeping with past practices we continue to use the biophysical region system in breaking the state into logical compartments. Although little change has occurred from the system developed by Janet McMahon in 1990 there have been some modifications to bring this system into line with a system proposed by Keys and Carpenter in 1995 and now adopted by the Maine State Planning Office (McMahon, 1998 - See Publ. p. 7) (Fig 2.). Future categorization of impacts will be correlated to this system which may then be useful when making further management decisions.

## *INSECT Problems Associated With Trees in 1998*

### (A) Softwood Insect Pests

**Adelgids (various)** - These insects are often incorrectly referred to as aphids with which they are closely related. 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 damage to the non spruce host. The infamous **hemlock woolly adelgid** has not yet been found in Maine.

**Aphids (especially *Cinara* spp.)** - These very gregarious, usually dark aphids were locally abundant in 1998 but did not appear to be as widespread. Most reports received in 1998 were from balsam fir, spruce and eastern white pine.

**Arborvitae Leafminer (a complex of four species)** - Stands exhibiting moderate damage were again prevalent in 1998 in Hancock, Kennebec, Waldo and Washington counties. Local hot spots and damage to ornamentals, however, could be found throughout much of southern Maine. Populations appeared to be slightly higher and more widespread than in 1997. Ornamentals exhibiting unusual damage should be inspected for a new pest, the **Japanese longhorned beetle** (p. 15).

**Balsam Fir Sawfly (*Neodiprion abietis*)** - Populations were very low and no defoliation was observed in 1998.

**Balsam Gall Midge (*Paradiplosis tumifex*)** - Populations of this gall midge, like those of the twig aphid, shot up in 1998 causing widespread damage and needle loss on balsam fir in the wild and in unsprayed Christmas tree plantations. To make matters worse, some shippers of trees and wreaths had items destroyed or returned due to the presence of infested needles. Growers who properly treated their trees did not seem to have much of a problem, however.

**Balsam Shootboring Sawfly (*Pleroneura brunneicornis*)** - Extremely high numbers of adults of this sawfly were observed around balsam fir statewide in early May in 1998. Christmas tree plantations, especially those containing Fraser fir, were affected and damaged tips were evident by mid June. Damage was prevalent in natural stands of balsam fir as well.

**Balsam Twig Aphid (*Mindarus abietinus*)** - Moderate to heavy needle twisting and distortion accompanied higher than expected populations of this aphid in 1998. Although this was a widespread problem in wild stands, most managed balsam fir Christmas tree plantations were successfully treated. "Tippers", however, found it very difficult to locate uninfested brush. Populations are expected to continue upward in 1999.

**Balsam Woolly Adelgid (*Adelges piceae*)** - Few reports of the balsam woolly adelgid were received in 1998 even though the gout phase of this perennial pest is extremely common especially along the eastern Maine coast. Where gouting is heaviest, partial or whole tree mortality is not uncommon. No trunk phase was observed in 1998.

**Bark Beetles (various)** - Bark beetle populations tend to fluctuate greatly in response to the availability of susceptible host trees. Following the January ice events some increase in populations was expected but so far only the **pine engraver** in damaged red pine stands seems to have responded. Other species may respond with time. The **eastern larch beetle** and **spruce beetle** continue to take out stressed or overmature trees in some areas. The introduced **pine shoot beetle** has still not been recorded from Maine.

**Cedar Longhorn - See Japanese longhorned beetle**

**Conifer Sawflies (various)** - Although there are more than fifteen different sawflies which may occur on conifers in Maine, only three caused noticeable defoliation during the 1998 season. The **yellowheaded spruce sawfly** again dominated the scene followed by the **larch sawfly** and the **introduced pine sawfly**. Most of the remaining species such as the **balsam fir** and **jack pine sawflies** produced only light or very local (often involving single trees) feeding during this period.

**Eastern Larch Beetle (*Dendroctonus simplex*)** - This problem remained at relatively low levels in 1998 although larch stands exhibiting mortality due to activities of this species are still very much in evidence.

**Eastern Spruce Gall Adelgid (*Adelges abietis*)** - This is a perennial and often severe problem 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*)** - No reports of activity were received in 1998.

**Fir Coneworm (*Dioryctria abietivorella*)** - Tip mining activity by this species was very local in 1998. Individual trees on less than ten acres were affected.

**Hemlock Borer (*Melanophila fulvoguttata*)** - The hemlock borer and **Armillaria root rot** continue to take out stressed hemlock locally but there was little change in the incidence of these secondary hemlock problems in 1998. Declining hemlock are also frequently infested with **carpenter ants** which are simply opportunists taking advantage of ideal nesting sites in the sapwood and heartwood.

**Hemlock Loopers (*Lambdina athasaria and L. fiscellaria*)** - Larval activity by both species was endemic and barely detectable in most areas in 1998. No defoliation was observed which was attributed to larvae of either the **fall-flying hemlock looper** (*L. fiscellaria*) or the **spring-flying hemlock looper** (*L. athasaria*). Moth activity of *L. athasaria* indicated by the light trap survey was also down (Table 4). **Hemlock needleminer** (*Coleotechnites* spp.) activity was also down.

**Table 4. Total number of spring-flying hemlock looper *(Lambdina athasaria)* moths collected at light, 1992-1998**

| | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| **Location** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** |
| Arundel | | | 10 | 0 | 7 | 1 | 1 |
| Mount Vernon | 2 | 7 | 11 | 5 | 4 | 3 | 2 |
| North Bridgton | 81 | 34 | 49 | 152 | 272 | 320 | 106 |
| South Berwick | 1 | 0 | 6 | 0 | 2 | 3 | 2 |
| Washington | 0 | 0 | 0 | 6 | 0 | 0 | 2 |
| **Total No. of Moths** | **84** | **41** | **76** | **163** | **285** | **327** | **113** |
| **Total No. of Traps** | **4** | **4** | **5** | **5** | **5** | **5** | **5** |

**Hemlock Woolly Adelgid (*Adelges tsugae*)** - This species has still not been found in Maine even though it occurs as near as northeastern Massachusetts. The Maine Forest Service and the Maine Department of Agriculture continue to closely monitor the status of this pest and maintain a joint quarantine regulating the importation of hemlock products from infested areas (**Quarantines** p. 57). Although an inspection survey was conducted during the winter of 1998, no adelgids were found. Since hemlock logs are regularly shipped from states that are quarantined to approved Maine sites under compliance agreements, the survey is conducted annually along major travel routes and around log yards as a means of detection in areas most at risk of introduction. It consists of visual checks of lower crowns of 3 eastern hemlocks in each of 1 to 7 locations per town along north bound travel lanes in each of major entry routes in southern and mid-coastal Maine. Forty two sites in the five counties of York, Cumberland, Sagadahoc, Lincoln and Knox were checked. Tree nurseries and landscapers have also been alerted to report this pest.

**Introduced Pine Sawfly (*Diprion similis*)** - Numbers of these usually solitary, marbled black, green and yellow larvae continued to rise in 1998 and by September, many white pine in southwestern Maine (Fig. 3) looked rather thin. Fortunately feeding was generally diffused and often heaviest on 1997 needles. Unfortunately many of the infested pine were already under stress from other causes (i.e. 1995 drought - White Pine Decline p. 54 ) Surprisingly feeding was not noted in most cases and little concern was expressed until the larvae descended. These larvae then wandered in great numbers over just about everything in sight in infested areas, falling or dropping their frass into swimming pools, boats, boat covers, etc. and sticking their small, tough, oval, copper-colored, cocoons to a variety of substrates. Once glued down, these cocoons were often difficult to sweep off. In many cases you could find cocoons of this sawfly stuck adjacent to the smaller, ribbed, elongate-white cocoons of the **oak skeletonizer**.

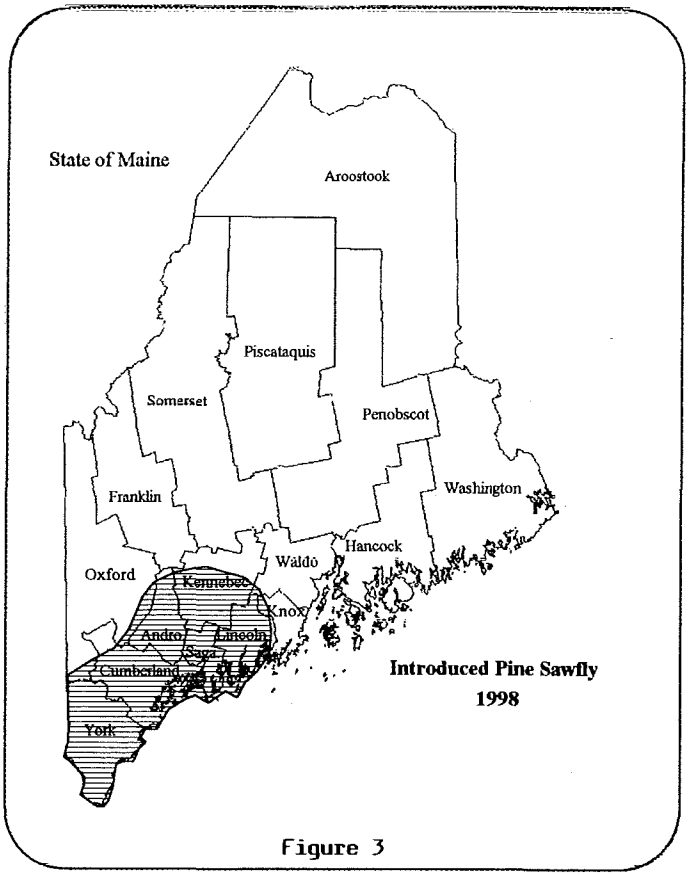

Figure 3

**Jack Pine Sawfly (*Neodiprion pratti banksianae*)** - Populations of this species remained a chronic problem in 1998 as they have for several years. Spotty defoliation of mature jack pine occurred in coastal areas of Hancock and Washington counties from Mt. Desert to Steuben. Most of the infested trees were again on rocky, poor growing sites and stunted. These trees frequently had other problems as well such as the **northern pitch twig moth** and **pine-pine gall rust** (p. 51).

**Japanese (Cedar) Longhorned Beetle (*Callidiellum rufipenne*)** - This introduced insect has not yet been found in Maine. Ornamental arborvitae should be monitored for this woodboring species especially if purchased from stock shipped in from out of state within the past five years. Suspected infestations should be reported to the State Horticulturist (Ph. (207) 287-3891) or the I&DM lab.

**Larch Casebearer (*Coleophora laricella*)** - Defoliation of larch early in the season by this species was more common in 1998 than it has been since 1994. While "scorching" of infested trees was spotty, yellowing of foliage by lower numbers of larvae was more widespread. The most notable changes occurred in Hancock and Washington counties where casebearer feeding mixed with that of other defoliators resulted in very thin larch.

**Larch Sawfly (*Pristiphora erichsonii*)** - Larch sawfly populations rose from 710 acres in 1997 to 1,605 acres in 1998. Some stands that had been defoliated for two or more years were harvested. Most infested stands were spotty, not contiguous, and less than 50 acres in size. Roughly 1,605 acres of defoliation were mapped in Aroostook (180 A.), Hancock (375 A.), Kennebec (50 A.), Penobscot (525 A.), Piscataquis (225 A.) and Washington (250 A.) counties (Fig. 4).

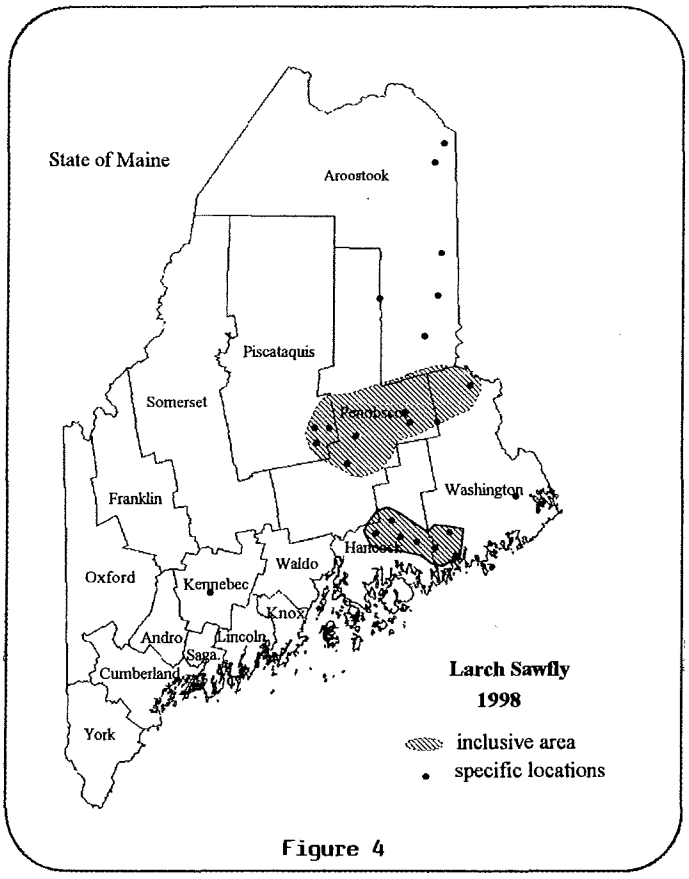

Figure 4

**Mites - See Spruce Spider Mite p. 20**

**Northern Pine Weevil (*Pissodes approximatus*)** - The northern pine weevil occurs throughout the state on a variety of pines and spruces. Normally considered a secondary problem, it can become more aggressive when numbers build following logging or storm damage. Several red pine stands in Belgrade, Chesterville, Newburgh and Readfield exhibited locally high populations during the 1998 season which had developed in pole-sized trees damaged in the January ice events. Adults will emerge in June and July of 1999 and could seriously impact nearby healthy trees. It is difficult (if not impossible) to separate adults of this species from those of the white pine weevil although their habits are quite different. The northern pine weevil and the pine engraver were often found together on red pine in 1998.

**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*)** - Few reports of pales weevil activity were received in 1998. Populations may rise in 1999 in or near stands of pine which have been logged or damaged by ice.

**Pine Bark Adelgid (*Pineus strobi*)** - This continues to be a local problem especially on stressed urban trees.

**Pine Engraver (*Ips pini*)** - This widespread species breeds in all species of pine and spruce in Maine and, being an opportunist, will take advantage of stressed trees. Heavy populations can successfully invade healthy trees. Pine engraver populations were elevated in red pine stands in 1998 which were infested with the **northern pine weevil**. Further increases can be expected.

**Pine Shoot Beetle (*Tomicus piniperda*)** - Formerly called the **common pine shoot beetle** in our reports and affectionately dubbed PSB, this species has not been discovered in Maine. It has, however, been discovered just east of Sherbrooke, Quebec so it is not far away. This is the closest infestation to Maine. Nursery stock will be watched closely to prevent its importation into Maine and pheromone traps will be placed in 1999 so as to detect possible introductions.

**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*)** - Damage to eastern white pine remained generally light across the state in 1998. Galls are expected on red and black spruce in 1999.

**Pine Needleminer** (***Exoteleia pinifoliella***) - This species is primarily a pest of jack and pitch pine in Maine. Although damage has been locally heavy in southwestern Maine in the past, populations remained generally low in 1998. With destructive populations developing south of Maine we will be watching this one in 1999.

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

**Pine Root Collar Weevil** (***Hylobius radicis***) - No further reports of activity by this species were received in 1998. It so far remains a relatively rare problem associated with Austrian, red and Scotch pine nursery stock in southwestern Maine.

**Pine Spittlebug** (***Aphrophora parallela***) - Spittle masses containing the pale yellow and black nymphs of this species were again abundant on a variety of conifers in 1998. Populations changed little from 1997 levels and were locally heavy on mugo, Scotch and eastern white pine.

**Pitch Mass Borer** (***Scynanthedon pini***) - Although infested white pine and Norway spruce were still not hard to find in 1998, most were again in urban or stressed settings in SW Maine. A pheromone trap survey for adults (moths) of the maple callus borer (p. 29) yielded another **conifer feeding clearwing moth**, *S. novaroensis* (p. 29) in Steuben in 1998.

**Red-topped Fir** - Our attention was drawn to investigate the cause of numerous red-topped balsam fir along I95 from Clinton to Dixmont in August. From one to three feet or more of the crown turned suddenly bright red as the summer progressed. Larvae of what appears to be the **balsam fir sawyer beetle** (*Monochamus marmorator*) had girdled the tops of all of the trees which were checked. This common but seldom seen longhorned beetle is an opportunist and attacks stressed trees. Several of the very attractive adults have been brought in to us for identification this season. The adults are nocturnal so are most often seen at light at night. Although damage seemed most striking along I95, similar symptoms were seen to a lesser degree throughout south-central Maine and north as far as Medway.

**Red Turpentine Beetle** (***Dendroctonus valens***) - This continues to be a low-key and very local problem affecting red pine in southern Maine.

**Saratoga Spittlebug** (***Aphrophora saratogensis***) - No new infested areas were reported in 1998. Very limited areas are currently impacted by this pest in Maine.

**Spruce Beetle** (***Dendroctonus rufipennis***) -The current spruce beetle infestation remains confined predominantly to the central Maine coast, especially in and around Penobscot Bay (Fig. 5). The area infested by spruce beetle increased slightly in 1998 but the intensity of attack in infested stands appeared to decline. As of November 1998 several Penobscot Bay area stands had lost more than 50% of all their red and white spruce over 15" in diameter. Spruce beetle activity in central and northern Maine is presently limited to individual trees or small pockets of trees and generally light.

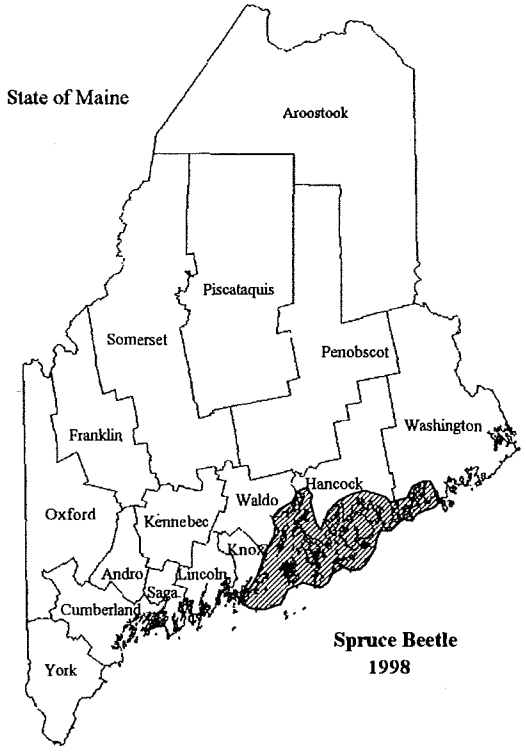


Figure 5

Eight newly attacked stands were found in 1998 in the Cape Rosier area, on Isle Au Haut, Islesboro, and on Vinalhaven. As of November 1998, 3,175 acres of spruce beetle infestation have been mapped.

| | Infested areas mapped | |
|---|---|---|
| County | 30 - 50% mortality | >50% mortality |
| Hancock | 2,110 | 395 |
| Waldo | 400 | 70 |
| Washington | 200 | 0 |
| Total | 2,710 | 465 |

Informational meetings, stand evaluations, and recommendations to landowners continued in 1998 but salvage opportunities remain limited by rapid decay and logging and transportation difficulties.

**Spruce Budmoth (*Zeiraphera canadensis*)** - This chronic problem affecting white spruce varies in intensity from year to year. No noticeable defoliation was observed in 1998 although larvae could be found in low numbers throughout the state.

**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 on plantation spruce throughout the state especially in Hancock, Kennebec, Waldo and Washington counties.

**Spruce Budworm (*Choristoneura fumiferana*)** - Monitoring of low level spruce budworm populations continued in 1998 through field observations, a statewide light trap network, and pheromone-baited traps. Pheromone traps were set out at 39 locations in 1998, 1 more than in 1997. Light traps were operated through the budworm flight period at 25 locations statewide (Fig. 1). Moth catch in light and pheromone traps remained low in 1998 as has been the case throughout the 90s (Tables 5 and 7). However, 1998 trap data showed a continuation of a three-year trend toward slightly increased moth catches and more widespread distribution of the locations where budworm moths were trapped. Even though moths were caught at many trap locations, no larvae or defoliation showed up through field observations. The infestation history and damage potential of budworm causes landowners remain interested in the status of this pest.

Spruce budworm moth activity in the statewide network of light traps (Table 6) was similar in magnitude and distribution to that seen in 1997. Budworm moths were caught at 15 of the 25 light trap locations in 1998 compared to catches in 17 of 26 traps in 1997. The number of budworm caught per trap increased from 2.6 in 1997 to 3.4 in 1998 but, this increase was largely due to an unusual catch of 38 moths in the Exeter trap. Excluding the Exeter catch, the 1998 catch per location was 2.25, a decrease compared to 1997. However, light trap catches of most common moth species were down significantly in 1998 due to severe rain and wind during the survey period. Considering the adverse 1998 weather during the moth flight period, and the number and distribution of budworm moths trapped, it seems safe to say the budworm moth activity as measured by light traps was at least at a level similar to that of 1997. The 1997 and 1998 catches (excluding Exeter in 1998) yielded the highest numbers of moths per trap since 1990.

Moth catches in pheromone-baited traps increased for the third straight season (Table 7). Budworm moths were caught in 92% of the traps deployed in 1998 compared to approximately 70% positive traps in 1997. In 1998, moth catch per trap was five or more in 15 locations compared to only seven locations in 1997 and one location with 5 or more moths in 1996. Traps in six locations caught 10 or more moths in 1998 compared to only one location that caught more than 10 moths in the entire survey area over the previous five years. The highest 1998 moth catches continued to be in western border locations that are closer to increasing budworm populations in Quebec.

Pheromone and light trap catches from the past season in Maine are still considered low with the exception of 3 locations that were low end moderates in 1998. Based on increased trap catches from 1996 to 1998, continued monitoring of the pheromone and light trapping grids is warranted for 1999. In addition to continued trapping, locations with catches of 10 or more moths in 1998 will be visited during the 1999 budworm larval development period to check for budworm activity.

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

| | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** |
| Allagash | 3 | 0 | 1 | 7 | 0 | 2 | 0 | 0 | 0 |
| Arundel | | | | | 0 | 3 | 2 | 0 | 2 |
| Ashland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Bar Harbor* | | | | | | | | 0 | |
| Blue Hill | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 8 | 0 |
| Brunswick | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 3 | 6 |
| Calais | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 1 |
| Chesuncook | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 2 |
| Clayton Lake | 4 | | | | | | | | |
| Dennistown | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Elliotsville | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 8 | 5 |
| Exeter | 10 | 4 | 5 | 21 | 16 | 6 | 3 | 4 | 38 |
| Greenbush | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Guerette | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Haynesville | 1 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 2 |
| Kingfield | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 1 | 0 |
| Matagamon | 0 | 0 | 1 | 2 | | | | | |
| Millinocket | 0 | 1 | 0 | 0 | 0 | 4 | 9 | 11 | 1 |
| Mt. Vernon | 1 | 0 | 0 | 2 | 1 | 2 | 12 | 2 | 0 |
| No. Bridgton | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 5 | 4 |
| Rangeley | 1 | 0 | 2 | 8 | 0 | 1 | 0 | 8 | 6 |
| Shin Pond | | | | | 0 | 0 | 3 | 1 | 0 |
| South Berwick | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 |
| Ste. Aurelie | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Ste. Pamphile* | | | | | | | | 0 | 0 |
| Steuben | 73 | 8 | 0 | 0 | 5 | 0 | 3 | 2 | 0 |
| Topsfield** | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 0 | 0 |
| Washington | 2 | 0 | 6 | 0 | 0 | 0 | 1 | 5 | 9 |
| **Total Number of** | **107** | **21** | **16** | **52** | **26** | **24** | **48** | **69** | **86** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Table 6. Spruce budworm seasonal light trap summary - 1961-1998**

| Year | Total # Moths | # Traps | Average # Moths/Trap |
|---|---|---|---|
| 1998 | 86 | 25 | 3.4 |
| 1997 | 69 | 26 | 2.6 |
| 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 7. Spruce budworm pheromone trap catch in Maine - 1993 to 1998****

| Location | Year | | | | | | Location | Year | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1993* | *1994* | *1995* | *1996* | *1997* | *1998* | | *1993* | *1994* | *1995* | *1996* | *1997* | *1998* |
| Allagash | 5 | <1 | <1 | 1 | 1 | <1 | Jonesboro | 1 | <1 | <1 | <1 | 1 | <1 |
| Calais * | <1 | <1 | <1 | <1 | 1 | <1 | NE Carry | <1 | | <1 | <1 | | 2 |
| Chesuncook | 2 | <1 | <1 | <1 | 1 | 3 | Princeton | 2 | | <1 | <1 | 1 | 1 |
| Clayton Lake | 2 | <1 | <1 | <1 | <1 | 2 | Steuben * | 4 | 2 | 2 | <1 | <1 | 2 |
| Coburn Gore | 1 | <1 | 1 | 1 | 3 | 11 | St. Pamphile | 7 | 1 | 1 | <1 | <1 | 4 |
| Connor | <1 | <1 | <1 | 2 | <1 | 1 | Topsfield * | <1 | <1 | <1 | <1 | <1 | 1 |
| Daaquam | <1 | <1 | <1 | 1 | <1 | 1 | Waltham | 2 | 4 | <1 | <1 | 1 | 4 |
| Dennistown * | 1 | <1 | 1 | 2 | 5 | 14 | Smith Pond * | 3 | <1 | <1 | <1 | 5 | 3 |
| Dickey Brook* | 3 | <1 | <1 | 1 | <1 | 1 | St Frances Lk. | 1 | <1 | 2 | 3 | 3 | 8 |
| Duck Lake | <1 | <1 | <1 | <1 | | 1 | Oxbow | <1 | <1 | <1 | 1 | 2 | 6 |
| Franklin | | 37 | 4 | <1 | 3 | 11 | Ragmuff | 1 | | | 4 | 1 | 18 |
| Garfield | 2 | <1 | <1 | 2 | <1 | 6 | Rangeley | 1 | 2 | <1 | 3 | | |
| Greenbush * | <1 | <1 | <1 | <1 | 5 | 10 | Ste. Aurelie * | <1 | <1 | 1 | 12 | 9 | 24 |
| Haynesville * | 1 | <1 | <1 | <1 | 3 | 7 | Matagamon*** | 4 | 1 | 1 | 2 | 1 | 6 |
| **NEW TRAPS IN 1997** | | | | | | | | | | | | | |
| Dallas Twp. | | | | | 2 | 6 | Magalloway | | | | | 3 | 3 |
| Edmonds | | | | | <1 | 1 | Parkertown | | | | | 9 | 6 |
| Grafton | | | | | <1 | 4 | Perry | | | | | 1 | 1 |
| Holeb | | | | | 7 | 8 | Round Pond | | | | | 2 | 3 |
| T11R9 | | | | | <1 | 3 | T5R16 | | | | | 1 | |
| T19R20 | | | | | <1 | <1 | T5R20 | | | | | 5 | 5 |
| Baker Lk. | | | | | 1 | 1 | | | | | | | |

*Light trap locations **These figures reflect a per trap average from a cluster of three traps ***A light trap this location only in1992 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 generally chronic in 1998 but were locally heavy enough to warrant control on some ornamental conifers and in some balsam fir Christmas tree plantings.

**Western Conifer Seed Bug (*Leptoglossus occidentalis*)** - Although formerly a pest of seed on western conifers, populations of this true bug seem to have "exploded" eastward over the past ten years and it is now found throughout southwestern Maine (Fig. 6). Our first Maine record was from Mt. Vernon in 1994 although the species was common there at that time. Most Maine records so far involve specimens collected in a variety of buildings from September throughout the winter months. The relatively large (3/4"+ long) and attractive adults are camouflaged

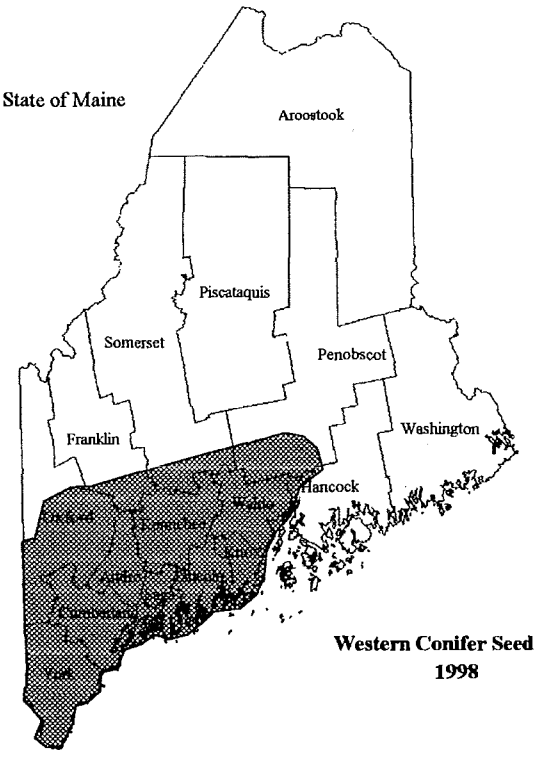


Figure 6

brownish in color and seldom seen out-of-doors, however, they become easily seen after they enter homes to spend the winter.

The western conifer seed bug can destroy a fairly high number of seeds within developing cones. Although their food (seeds) range is wide, they seem to like pines and Douglas-fir and are especially abundant in homes in or near pine stands.

**Whitemarked Tussock Moth (*Orgyia leucostigma*)** - Although this species continues to be somewhat of a problem in nearby Nova Scotia, Maine populations have continued to remain low. Reports in 1998 were limited to individual caterpillars or a few instances of light populations on a single tree or shrub. No significant defoliation was observed.

**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** (p. 55). 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. One area of extremely high populations was observed in Belfast in early August. Severe weevilling with as many as three current season attacks on laterals as well as terminals was found on understory natural regeneration under thinned, mature white pine over about fifty acres.

**Woodborers (various)** - Each season we receive a number of calls which are woodborer related. Some such as **carpenter ants** (p. 35) and **powder post beetles** (p. 38) are almost entirely household problems. Others such as the **white spotted sawyer** (p. 22) draw attention as adults. Woodborers such as the **cerambycid**, *Stictoleptura canadensis* (p. 41) may be either. Most other species included in this report are more bark or shoot oriented.

**Yellowheaded Spruce Sawfly (*Pikonema alaskensis*)** - The yellowheaded spruce sawfly remains at moderate levels in Franklin and Somerset counties with scattered pockets in central Penobscot and southern Aroostook counties. Approximately 300 A. of spruce plantations in Franklin and Somerset counties were treated with Sevin in 1998 (Fig. 7). The plantations that were treated in 1997 are recovering from the sawfly damage and remained uninfested in 1998. The trees in heavily infested plantations that were not sprayed continued to decline and sawfly numbers remained high. An additional 500 A. of plantations will be treated in 1999.

Sawfly attacks on ornamental and roadside trees could still be found throughout the state in 1998 but were not as numerous as in the preceeding years. Populations are expected to decline in 1999 and will continue to be monitored by I&DM staff.

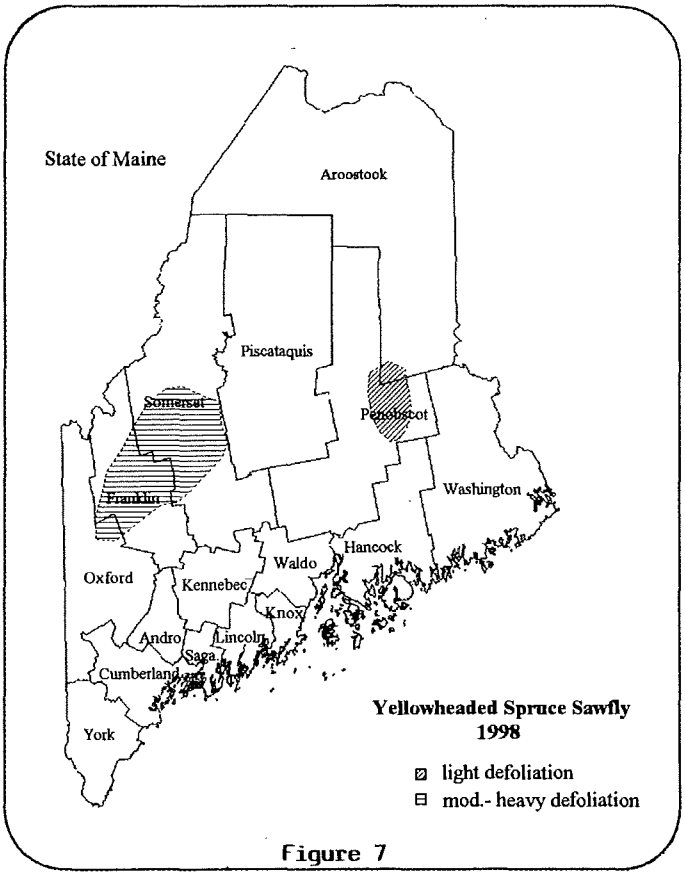


Figure 7

## (B) Hardwood Insect Pests

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

**Alder Insects** - Browning of alder was spotty in 1998 and defoliation generally lighter than in 1997. The most common defoliator was again the **alder flea beetle** (*Altica ambiens alni*). Associated species such as the **alder leaf beetle** (*Chrysomela mainensis mainensis*), **Alder sawfly** (*Arge* sp.) and the **spotted tussock** (*Lophocampa maculata*) did not seem to be as abundant and destructive as they were in 1997.

**Aphids** - Aphids on deciduous trees are seldom noticed until your recently clean car appears to be covered with sticky spots as it sets in the shade. Aphid populations appeared to be down in 1998 with locally higher numbers although sticky cars were not uncommon!

**Asian Longhorned Beetle (*Anoplophora glabripennis*)** - This potentially serious woodboring pest of deciduous trees, especially maples, has not yet been found in Maine. Due to the destructive potential of this species a special alert was sent out to our constituents in 1998. Included in this process were arborists, foresters, hardwood sawmill operators, nurseries, sugarbush operators and others including the press. The infamous "Wanted" posters were included in this process. As a result of this campaign we received many samples of our native softwood feeding, **white-spotted sawyer beetle** (*Monochamus scutellatus*). In response we sent out the identification sheet which shows how to separate the two species. Public awareness in Maine was certainly enhanced.

The Asian longhorned beetle (now dubbed ALB) was found at two new locations in 1998, the Queens section of New York City (6-7 miles from previously infested sites) and Chicago. Staff from the USDA/FS and USDA/APHIS are working with the two states to deal with the two new problem areas as well as the original sites in New York City and Amityville, New York.

Please notify the I&D Lab of any suspected infestations. Any beetles suspected of being this species should be retained for confirmation.

**Aspen Problems (various)** - Aspen stands were generally fairly green in 1998 except where the ice events occurred or local defoliation was evident. Aspen was one of the most severely impacted tree species in areas affected by the January ice storms (p. 48) and although some recovery was evident, many trees snapped completely and died. Those trees which exhibited "tufty" growth may also succumb. Other problems affecting aspen were **large aspen tortrix** and **satin moth**.

**Bark Beetles and Ambrosia Beetles (Scolytidae)** - Damage to standing hardwood trees by species of Scolytidae has been generally low in Maine over the years with the notable exception of that caused to American elm by the **native elm bark beetle** (*Hylurgopinus rufipes*) and the **smaller European elm bark beetle** (*Scolytus multistriatus*). Degrade of birch, maple and oak lumber due to activities of several species of **ambrosia beetles** occurs but the reported incidence has been spotty. Following the 1998 ice events monitoring of hardwoods, especially maples, for bark and ambrosia beetles was stepped up. Although not ice related, damage by the **eastern ash bark beetle** to standing trees also became more evident in 1998.

**Barklice or Psocids** - "Herds" of these interesting "little cattle" are often very noticeable on the bark of various trees across much of Maine. 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 in numbers on tree bark in Maine is *Cerastipsocus venosus*. Barklice feed on lichens and fungi on the tree bark and pose no threat to the trees themselves. Many reports of this phenomenon were received in 1998.

**Beech Problems (various)** - Beech continues to suffer from the attack of a variety of pests which continued their onslaught in 1998. **Beech bark disease**, an introduced problem, is one of the more notable components of the pest complex and involves an insect/fungus complex (Insect scales/*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** (p. 31), has added another factor to this complex. Fortunately, some relief comes from the feeding activities of the black, red-spotted, **twicestabbed lady beetle** (*Chilocorus stigma*) whose hunger for scales helps to significantly reduce scale populations. Populations of defoliators such as the **variable oakleaf caterpillar** (p. 33), which have added another layer of stress in recent years, were low in 1998.

**Birch Casebearer (*Coleophora serratella*)** - Defoliation by the birch casebearer in 1998 was spotty and heaviest on roadside trees and ornamentals in central, eastern and northern Maine.

**Birch Leafminer (*Messa nana*)** - Mines of the birch leafminer were very evident early in 1998 in much of the same area infested in 1997 (Fig. 8) but appeared to drop out before larvae matured or mines developed very far. No cause was determined for this subsidence. Populations of the **gray birch leafminer** (*Fenusa pusilla*) were up slightly in some areas for the second year.

**Birch Skeletonizer (*Bucculatrix canadensisella*)** - Populations and damage from this species remained low in 1998.

**Bronze Birch Borer (*Agrilus anxius*)** - Dead-topped birch resulting from stem boring activities of larvae 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. We are monitoring birch affected by ice damage and expect to see increases in bronze birch borer populations in some stands by 1999. No estimate of the degree of increase has been determined.

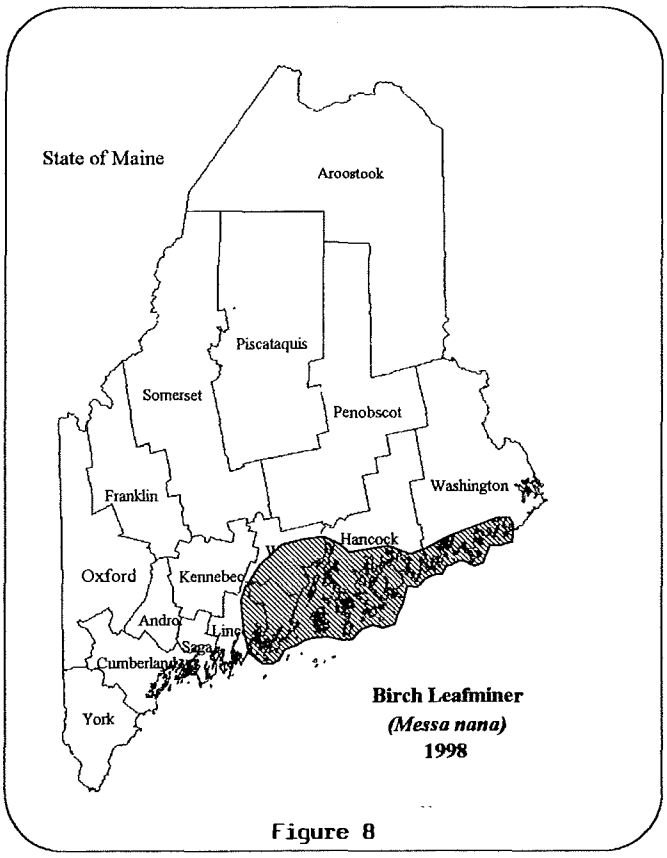

Figure 8

**Browntail Moth (*Euproctis chrysorrhoea*)** - Populations of the browntail moth continued to cause discomfort for residents of the islands and coastal mainland areas along Casco Bay (Portland north to Small Point). The browntail infestation continued to slowly shift northward in 1998 with the highest infestation levels found on the Cumberland mainland and Great Chebeague Island (Fig. 9). Low numbers of overwintering webs were found outside of the Casco Bay area as far south as Kittery and east as Gouldsboro in the 1997-98 winter survey. Reports of health problems arising from contact with the browntail have been very limited from any locations other than in or around Casco Bay. (**See rashes** p. 37)

Municipal control projects were conducted in 1998 on 3,500 acres in the Towns of Brunswick (200 A.), Cumberland (1,500 A.), Falmouth (300 A.), Portland (300 A.) and Yarmouth (1,200 A.). Dimilin 4L was applied from fixed wing aircraft in all but Brunswick which opted to use *Bacillus thuringiensis* (Bt.) applied from a truck mounted mistblower. High levels of control were achieved in all the municipal projects.

Aerial sketch mapping of defoliation resulting from larval feeding is done annually to define size and location of the most intense browntail moth infestation. This mapping was not done in 1998, not for lack of trying, but rather due to the rapid development of a second growth of foliage. Larvae of this insect feed from the top of the tree canopy and move down as the foliage is depleted. Conditions May and June of 1998 were very good for the refoliation process and the top of the canopy of many heavily infested red oaks developed a second set of leaves before the larvae finished feeding on the lower canopy.

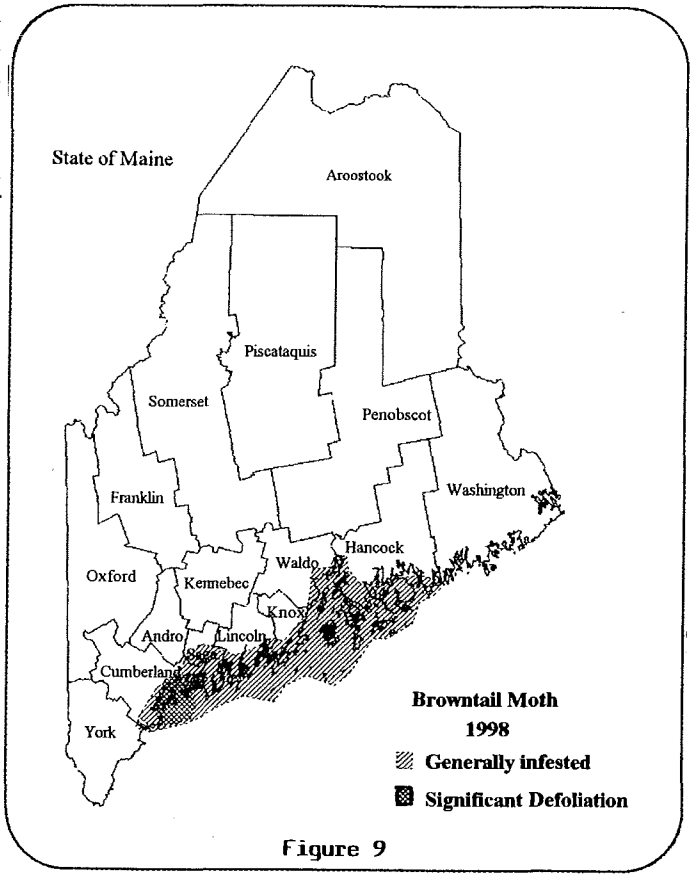

Figure 9

Research continued in 1998 with two formulations of tebufenozide and Bt. in an effort to find a replacement for Dimilin in control work against the browntail. While Dimilin is very efficacious against the browntail it is potentially harmful to marine animals. An aerial application of Confirm 2F (tebufenozide) was tested because it has a much narrower spectrum of animals it will kill (some families of Lepidoptera and Diptera) and had provided high kill rates on browntail in 1997 work done with a truck mounted mistblower. Data from a control block on Great Diamond Island (150 A.) in 1998 show the product to provide a very high level of control (97+% mortality). A test of Bt. (Foray 48B and MVPII at a ratio of 4 to 6) was conducted from the air in 1998 on Peaks (120 A.), Little Diamond (20 A.) and Cliff (10 A.) islands. Mortality of browntail larvae from this trial varied in test cages from 38 to 100% with the overall control within the treated area deemed adequate by the residents. Work will need to be done to dampen the variation through better application technique and to reduce the cost which is presently is about $29 per acre for the chemical alone.

The winter survey of webs of 1998-1999 has been completed and results show the heaviest population levels in 1999 will likely remain along the coast from Falmouth northeast to Harpswell. In much of the area from Cape Elizabeth to Kittery, populations of browntail have fallen below detectable levels and should be of little concern for residents this year. Light to moderate populations can be expected in cherry, oak and apple trees from Phippsburg to Rockland and very localized infestations may be found from Rockland east to Gouldsboro.

Planning is underway to conduct municipal control projects in Falmouth, Cumberland, Yarmouth, Freeport and Harpswell. Confirm 2F will be used for the bulk of the work but some Dimilin remains from past projects and this will be used up in blocks not abutting the ocean. The best acreage estimate is around 5000 ac. in total but this obviously may vary significantly over the coming months.

**Bruce Spanworm (*Operophtera bruceata*)** - While it was not difficult to detect larvae, defoliation in 1998 was generally light with moderate spots on less than 1,000 acres in north central Maine. Moths were again fairly common in late fall (see **Hunter's moths** p. 27).

**Eastern Ash Bark Beetle (*Hylesinus aculeatus*)** - This species has long been recognized as a nuisance in homes where ash firewood is stored because of its prolific nature and messy habits. In wood products industries using ash this beetle has also been recognized as producing noticeable degrade due to boring activities. During 1998 several instances of damage, and possibly even mortality, was observed in managed stands of ash. In these cases standing trees were invaded by beetles in search of hibernation sites. Where the damage was several years old, discoloration (flecking and pockets) in the wood was observed. Newer fall 1998 infestations exhibited only entrance holes and sawdust. In one case, ash bolt wood from thinnings was piled within the stand and great numbers of beetles which had emerged were the source of the problem. In one other case, slash was the source of the problem. Normally this type of a problem is local and short-lived but some concern has been expressed regarding populations which may breed in slash in ice damaged stands. Some monitoring was done in 1998 but damage to ash stands checked appeared minimal.

**Eastern Tent Caterpillar (*Malacosoma americana*)** - Early season tents of this species were evident across the state in June as usual but, except for a very few hot spots, numbers were low in 1998

**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 1998.

**Fall Cankerworm (*Alsophila pometaria*)** - The only notable activity by this species continues to be on boxelder in eastern Aroostook County. This infestation was low and spotty in 1998. See **Hunter's moths** (p. 27).

**Fall Webworm (*Hyphantria cunea*)** - Although fall webworm nests were a nuisance throughout the state in 1998, defoliation by this species was most severe in southwestern Maine (primarily Cumberland and York counties) where many host trees were completely stripped in July and August and nests festooned every host tree in sight. Populations this high haven't been seen for several years.

**Forest Tent Caterpillar (*Malacosoma disstria*)** - Populations of the forest tent remained low again in 1998 and no defoliation was observed. Moth catches rose only very slightly (Table 8).

**Table 8. Total number of forest tent caterpillar (*Malacosoma disstria*) moths collected at light**

| | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Allagash | 65 | 39 | 54 | 78 | 64 | 27 | 8 | 4 | 0 |
| Arundel | | | | | 82 | 150 | 39 | 18 | 20 |
| Ashland | 110 | 122 | 124 | 169 | 117 | 157 | 57 | 33 | 51 |
| Bar Harbor* | | | | | | | | 0 | |
| Blue Hill | 20 | 27 | 43 | 47 | 221 | 62 | 17 | 4 | 2 |
| Brunswick | 54 | 69 | 17 | 9 | 35 | 32 | 33 | 6 | 8 |
| Calais | 7 | 11 | 23 | 279 | 52 | 28 | 3 | 1 | 3 |
| Chesuncook | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 |
| Clayton Lake | 7 | | | | | | | | |
| Dennistown | 45 | 37 | 58 | 44 | 89 | 79 | 10 | 10 | 18 |
| Elliotsville | 36 | 49 | 78 | 55 | 53 | 145 | 18 | 15 | 3 |
| Exeter | 1 | 1 | 2 | 1 | 8 | 4 | 0 | 1 | 0 |
| Greenbush | 44 | 56 | 24 | 30 | 87 | 95 | 149 | 41 | 24 |
| Guerette | 20 | 28 | 8 | 12 | 32 | 18 | 4 | 5 | 14 |
| Haynesville | 45 | 56 | 36 | 45 | 176 | 64 | 9 | 6 | 2 |
| Kingfield | 1 | 4 | 18 | 20 | 97 | 95 | 32 | 20 | 13 |
| Matagamon | 46 | 63 | 126 | 56 | | | | | |
| Millinocket | 14 | 20 | 43 | 7 | 73 | 75 | 0 | 0 | 2 |
| Mt. Vernon | 39 | 32 | 107 | 39 | 187 | 192 | 46 | 28 | 23 |
| No. Bridgton | 90 | 115 | 153 | 297 | 223 | 102 | 51 | 9 | 5 |
| Rangeley | 1 | 81 | 47 | 48 | 57 | 11 | 3 | 2 | 1 |
| Shin Pond | | | | | 124 | 217 | 30 | 72 | 110 |
| South Berwick | 245 | 352 | 324 | 377 | 371 | 195 | 91 | 31 | 26 |
| Ste. Aurelie | 6 | 18 | 13 | 9 | 28 | 15 | 6 | 5 | 16 |
| Ste. Pamphile* | | | | | | | | 25 | 37 |
| Steuben | 8 | 9 | 0 | 2 | 169 | 11 | 7 | 2 | 4 |
| Topsfield** | 33 | 28 | 45 | 102 | 178 | 40 | 14 | 0 | 24 |
| Washington | 31 | 23 | 36 | 53 | 111 | 41 | 45 | 16 | 4 |
| **Total Number of Moths** | **968** | **1,240** | **1,380** | **1,779** | **2,636** | **1,856** | **672** | **354** | **410** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Greenstriped Mapleworm (*Dryocampa rubicunda*)** - Larval populations of this species remained low in 1998 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 slightly in 1998 (Table 9).

**Table 9. Total number of greenstriped mapleworm (*Dryocampa rubicunda*) moths collected at light**

| | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** |
| Allagash | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| Arundel | | | | | 468 | 531 | 130 | 208 | 402 |
| Ashland | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Bar Harbor* | | | | | | | | 0 | |
| Blue Hill | 115 | 24 | 46 | 104 | 46 | 113 | 30 | 120 | 19 |
| Brunswick | 20 | 13 | 16 | 4 | 27 | 20 | 8 | 10 | 4 |
| Calais | 20 | 7 | 4 | 13 | 29 | 240 | 19 | 79 | 41 |
| Chesuncook | 10 | 4 | 1 | 3 | 8 | 51 | 3 | 20 | 2 |
| Clayton Lake | 0 | | | | | | | | |
| Dennistown | 1 | 0 | 1 | 1 | 5 | 1 | 2 | 1 | 0 |
| Elliotsville | 58 | 7 | 11 | 14 | 30 | 103 | 18 | 39 | 12 |
| Exeter | 6 | 1 | 1 | 3 | 9 | 7 | 2 | 2 | 4 |
| Greenbush | 16 | 10 | 12 | 13 | 14 | 48 | 34 | 60 | 11 |
| Guerette | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| Haynesville | 5 | 8 | 2 | 8 | 12 | 34 | 5 | 23 | 24 |
| Kingfield | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| Matagamon | 0 | 0 | 0 | 0 | | | | | |
| Millinocket | 61 | 8 | 27 | 38 | 66 | 93 | 23 | 120 | 0 |
| Mt. Vernon | 2 | 24 | 18 | 5 | 11 | 32 | 16 | 3 | 18 |
| No. Bridgton | 2 | 4 | 6 | 2 | 6 | 24 | 20 | 8 | 10 |
| Rangeley | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Shin Pond | | | | | 0 | 1 | 1 | 7 | 0 |
| South Berwick | 95 | 41 | 373 | 340 | 189 | 276 | 171 | 110 | 189 |
| Ste. Aurelie | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 |
| Ste. Pamphile* | | | | | | | | 2 | 0 |
| Steuben | 14 | 42 | 84 | 22 | 33 | 56 | 11 | 36 | 27 |
| Topsfield** | 17 | 20 | 12 | 31 | 37 | 133 | 24 | 0 | 1 |
| Washington | 7 | 89 | 48 | 90 | 101 | 181 | 34 | 24 | 30 |
| **Total Number of Moths** | **449** | **302** | **662** | **695** | **1,091** | **1,944** | **556** | **874** | **794** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Gypsy Moth (*Lymantria dispar*)** - Gypsy moth populations remained at endemic levels in all counties of Maine in 1998. Very low numbers of larvae, male moths (Table 10) and egg masses could be found locally throughout much of the infested area and no significant population increases are expected in 1999. The area infested on Mt. Desert Island in 1997 dropped out in 1998. Where larvae were seen in groups, the fungus disease, *Entomophaga maimaiga*, still appeared to be exerting some natural control. For your reference we have again included the table of defoliation history by gypsy moth in Maine (Table 11). The **Asian gypsy moth** has still not been found in Maine.

**Table 10. Total male gypsy moths *(Lymantria dispar)* collected at light**

| | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** |
| Allagash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arundel | | | | | 0 | 1 | 0 | 0 | 0 |
| Ashland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bar Harbor* | | | | | | | | 7 | |
| Blue Hill | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 1 |
| Brunswick | 20 | 220 | 6 | 0 | 0 | 0 | 0 | 0 | 5 |
| Calais | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chesuncook | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Clayton Lake | 0 | | | | | | | | |
| Dennistown | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Elliotsville | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Exeter | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Greenbush | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 2 |
| Guerette | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Haynesville | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kingfield | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Matagamon | 0 | 0 | 0 | 0 | | | | | |
| Millinocket | 0 | 4 | 0 | 1 | 7 | 0 | 2 | 0 | 1 |
| Mt. Vernon | 15 | 142 | 78 | 1 | 27 | 12 | 0 | 0 | 29 |
| No. Bridgton | 156 | 213 | 17 | 1 | 2 | 0 | 0 | 1 | 3 |
| Rangeley | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shin Pond | | | | | 0 | 0 | 0 | 0 | 0 |
| South Berwick | 29 | 191 | 315 | 153 | 4 | 23 | 1 | 0 | 27 |
| Ste. Aurelie | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ste. Pamphile* | | | | | | | | 0 | 0 |
| Steuben | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Topsfield** | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| Washington | 0 | 13 | 19 | 0 | 0 | 0 | 0 | 1 | 1 |
| **Total Number of Moths** | **221** | **804** | **492** | **159** | **44** | **36** | **4** | **10** | **71** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Table 11. Total acres defoliated by gypsy moth in Maine year from 1924 to 1998***

| Year | Acres Defoliated | Year | Acres Defoliated | Year | Acres Defoliated | Year | Acres Defoliated |
|---|---|---|---|---|---|---|---|
| 1924 | 0.71 | 1943 | 10 | 1962 | 5,198 | 1981 | 655,841 |
| 1925 | - | 1944 | 21,221 | 1963 | 1,970 | 1982 | 578,220 |
| 1926 | 1 | 1945 | 210,881 | 1964 | <100 | 1983 | 26,353 |
| 1927 | 4,985 | 1946 | 203,813 | 1965 | <100 | 1984 | 4,881 |
| 1928 | 5,575 | 1947 | - | 1966 | 30 | 1985 | 10,496 |
| 1929 | 15,187 | 1948 | 60 | 1967 | 825 | 1986 | 13,697 |
| 1930 | 55,174 | 1949 | - | 1968 | 777 | 1987 | 849 |
| 1931 | 20,938 | 1950 | 2 | 1969 | 460 | 1988 | 100 |
| 1932 | 42,298 | 1951 | 8,195 | 1970 | 1,080 | 1989 | 34,280 |
| 1933 | 19,718 | 1952 | 82,715 | 1971 | 820 | 1990 | 270,432 |
| 1934 | 60,403 | 1953 | 174,999 | 1972 | 40 | 1991 | 620,933 |
| 1935 | 92,630 | 1954 | 170,485 | 1973 | 490 | 1992 | 278,485 |
| 1936 | 80,944 | 1955 | 10,810 | 1974 | 860 | 1993 | 50,694 |
| 1937 | 140,026 | 1956 | 7,285 | 1975 | 110 | 1994 | 1,706 |
| 1938 | 120,432 | 1957 | 120 | 1976 | 100 | 1995 | 0 |
| 1939 | 202,193 | 1958 | - | 1977 | 2,010 | 1996 | 100 |
| 1940 | 204,041 | 1959 | 1,000 | 1978 | 4,120 | 1997 | <100 |
| 1941 | 122,386 | 1960 | 6,350 | 1979 | 23,350 | 1998 | 0 |
| 1942 | 850 | 1961 | 41,245 | 1980 | 223,810 | | |

* Acreage figures used in this table for 1924 to 1960 were taken from USDA/APHIS/PPQ records. From 1960 to 1997 records are from I&DM files. The presence of a hyphen (-) generally indicates no detectable defoliation for the year.

**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** as they are daytime fliers during hunting season. During the fall of 1998 activity was evident but spotty. Species included in this group are: **Bruce spanworm, fall cankerworm** and **fall-flying hemlock looper**.

**Lace Bugs (*Corythucha* spp.)** - Lace bug populations again remained at nuisance levels in 1998 especially on birches and butternut. The tiny nymphs, and lacy adults accompanied by an assortment of cast skins and waste material (frass) gave a messy appearance to the undersurface of infested leaves. Heavy feeding caused foliage to become yellow and mottled by July.

**Large Aspen Tortrix (*Choristoneura conflictana*) -** Spotty defoliation of aspen was visible around open areas of eastern Aroostook County from Littleton north to Ft. Fairfield (Fig. 10) in 1998. Although it was difficult to map due to its noncontiguous nature it was estimated to cover roughly 125 acres. Larvae were reported in low numbers from a number of additional Aroostook County sites as well. Moth counts dropped strikingly (Table 12) during the seasonal survey.

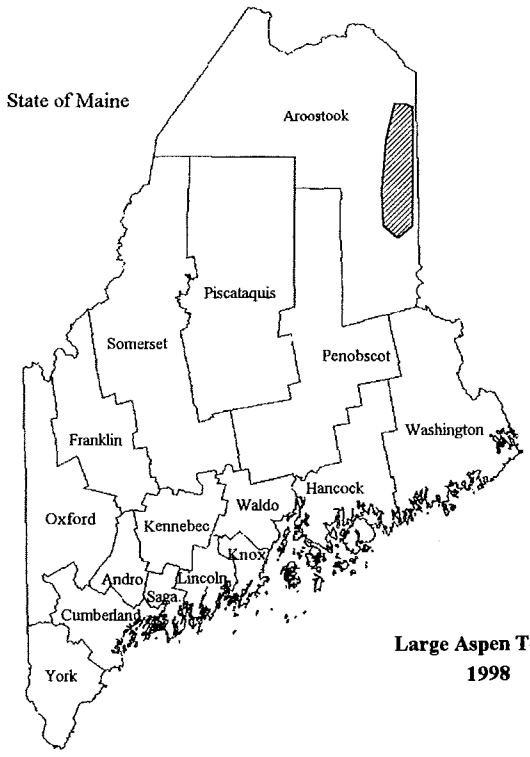


Figure 10

**Table 12. Total number of large aspen tortrix (*Choristoneura conflictana)* moths collected at light**

| | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** |
| Allagash | 13 | 1 | 0 | 5 | 0 | 0 | 1 | 1 | 0 |
| Arundel | | | | | 0 | 12 | 1 | 4 | 1 |
| Ashland | 10 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| Bar Harbor* | | | | | | | | 0 | |
| Blue Hill | 0 | 3 | 14 | 2 | 1 | 5 | 2 | 27 | 0 |
| Brunswick | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 31 | 0 |
| Calais | 6 | 14 | 2 | 0 | 0 | 0 | 0 | 10 | 0 |
| Chesuncook | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Clayton Lake | 7 | | | | | | | | |
| Dennistown | 974 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| Elliotsville | 159 | 33 | 42 | 14 | 0 | 2 | 17 | 19 | 2 |
| Exeter | 0 | 5 | 4 | 15 | 6 | 12 | 3 | 18 | 0 |
| Greenbush | 2 | 25 | 28 | 29 | 0 | 0 | 0 | 3 | 0 |
| Guerette | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Haynesville | 15 | 257 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| Kingfield | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Matagamon | 0 | 0 | 3 | 0 | | | | | |
| Millinocket | 11 | 14 | 5 | 0 | 0 | 3 | 1 | 0 | 0 |
| Mt. Vernon | 1 | 4 | 2 | 2 | 0 | 5 | 2 | 8 | 6 |
| No. Bridgton | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 14 | 1 |
| Rangeley | 1 | 5 | 47 | 92 | 0 | 13 | 14 | 44 | 36 |
| Shin Pond | | | | | 1 | 0 | 0 | 0 | 0 |
| South Berwick | 0 | 3 | 4 | 0 | 0 | 0 | 2 | 31 | 2 |
| Ste. Aurelie | 8 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| Ste. Pamphile* | | | | | | | | 29 | 10 |
| Steuben | 0 | 4 | 2 | 1 | 0 | 0 | 0 | 2 | 1 |
| Topsfield** | 42 | 20 | 15 | 1 | 0 | 0 | 4 | 0 | 3 |
| Washington | 0 | 0 | 14 | 0 | 0 | 2 | 6 | 5 | 1 |
| **Total Number of Moths** | **1,251** | **389** | **193** | **164** | **10** | **57** | **58** | **246** | **68** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Locust Leafminer (*Odontota dorsalis*)** - Black locust throughout much of southern Maine south of Lincoln and west of Machias continued to exhibit varying degrees of rusty foliage in 1998, the result of leaf mining activities of larvae of this species.

**Maple Callus Borer (*Synanthedon acerni*)** - A pilot pheromone trap survey was conducted for adult male moths of the clearwing maple callus borer in 1998. A total of nine traps were used, three each at three sites (Brooks, Mt. Vernon and Steuben) where ice damaged maples were present. Traps were baited with a general clearwing moth (Sesiidae) pheromone. Maple callus borer moths were collected at all three sites. The related **red maple borer**, *S. acerrubri* was collected at Mt. Vernon and a western **conifer feeding clearwing**, *S. novaroensis* was collected at Steuben. An assortment of other species were caught as well. This survey was set up to see if there were noticeable changes in populations of these bark boring sesiids in ice damaged stands. Field observations were cursory and yielded little. This survey will be modified and expanded somewhat in 1999.

**Maple Leafcutter (*Paraclemensia acerifoliella*)** - Populations of the maple leafcutter on sugar maple declined and became more dispersed in 1998. The total area of visible defoliation expanded from 100 acres in 1996 to nearly 200 acres in 1997. The heaviest defoliation in 1997 occurred in northern York County except for one isolated stand on Mt. Desert Island in Hancock County. A total of 135 acres were mapped in York County (down from 200 in 1997) and the infestation on Mt. Desert Island (Hancock County) included roughly ten acres.

Other late season defoliators of sugar maple such as the **maple trumpet skeletonizer** (*Epinotia aceriella*) and **maple webworm** (*Tetralopha asperatella*) were present in all areas checked as well but defoliation by these species was generally light or very spotty. 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 low again in 1998 and no defoliation of its preferred Maine host, red maple, was observed.

**Mountain Ash Sawfly (*Pristiphora geniculata*)** - This introduced species is on our list of perennial problems affecting ornamental mountain ash. The 1998 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*)** - A few spots in coastal Maine showing defoliation by this species was observed in 1998 but little damage was seen elsewhere. Fly populations, emergence and bud expansion must be in sync for damage to occur.

**Oak Leaftier (Shredder)** (*Croesia semipurpurana*), **oak leafroller** (*Archips semiferana*), **oak skeletonizer**, **oak trumpet skeletonizer** (*Epinotia tinidella*), **leaf galls** (various) and the **oak webworm** (*Archips fervidanus*) continued to turn up in calls and were locally abundant throughout southwestern Maine and locally elsewhere in August and September of 1998. Damage was generally light except locally heavier on individual trees. The skeletonizer again appeared to be the most serious culprit.

**Oak Sawflies (various)** - Oak sawfly larval feeding remained light and local in 1998.

**Oak Skeletonizer (*Bucculatrix ainsliella*)** - Second generation larval feeding by the oak skeletonizer produced noticeably heavier defoliation in 1998 than in 1997 over much of southwestern Maine. The area of high populations coincided with that of the **introduced pine sawfly** except that skeletonizer populations were higher further east (Fig. 11). Roughly 8,000 acres of non-contiguous defoliation was evident by early September (Table 13). In spite of the light to moderate feeding in many stands, it was the descending larvae which prompted most concern. Larvae were unwelcome guests at many cookouts and other outdoor activities and the tiny, white, ribbed, rice-like cocoons spun up by these larvae added a questionably, festive touch as they stuck to all objects beneath infested trees. The cocoons often lay side by side with the larger, tough, coppery cocoons of the introduced pine sawfly.

**Table 13. Oak skeletonizer defoliation in 1998 by county**

| County | Acres | |
|---|---|---|
| Androscoggin | 1,000 | |
| Cumberland | 1,500 | |
| Hancock | 500 | SW |
| Kennebec | 500 | |
| Knox | 500 | |
| Lincoln | 1,000 | |
| Penobscot | 500 | SW |
| Sagadahoc | 500 | |
| Waldo | 500 | |
| York | 1,500 | |
| **Total** | **8,000** | |

**Oak Twig Pruner (*Anelaphus* spp.)** - Infested branches of northern red oak began to droop in early July and were locally noticeable in 1998.

**Orangehumped Mapleworm (*Symmerista leucitys*)** - Populations of this species were low again in 1998 and no defoliation was observed. Numbers of moths of *Symmerista* spp. also remained low (Table 14).

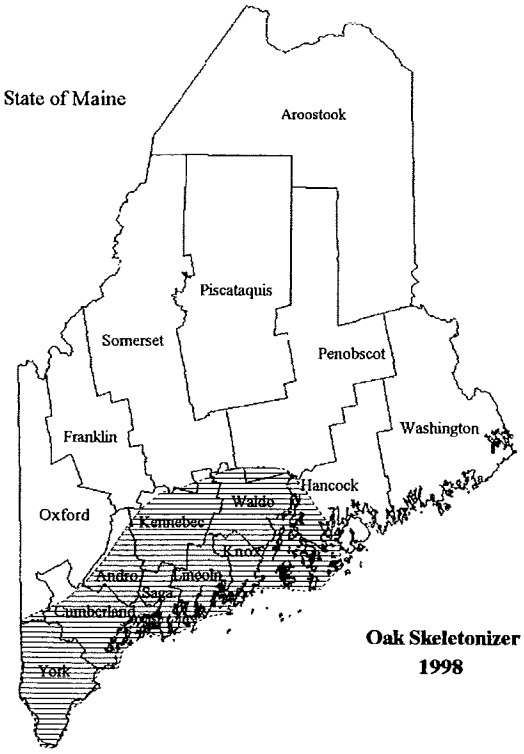


Figure 11

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

| | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** |
| Allagash | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arundel | | | | | 4 | 3 | 3 | 3 | 0 |
| Ashland | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 |
| Bar Harbor* | | | | | | | | 0 | |
| Blue Hill | 0 | 0 | 1 | 6 | 32 | 33 | 7 | 1 | 1 |
| Brunswick | 4 | 8 | 0 | 1 | 5 | 17 | 3 | 0 | 0 |
| Calais | 5 | 1 | 3 | 0 | 0 | 41 | 13 | 3 | 10 |
| Chesuncook | 1 | 0 | 0 | 1 | 2 | 20 | 3 | 7 | 2 |
| Clayton Lake | 0 | | | | | | | | |
| Dennistown | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Elliotsville | 44 | 10 | 5 | 4 | 1 | 50 | 2 | 5 | 1 |
| Exeter | 0 | 1 | 0 | 1 | 3 | 15 | 7 | 1 | 0 |
| Greenbush | 3 | 0 | 0 | 0 | 0 | 10 | 3 | 1 | 0 |
| Guerette | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Haynesville | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 |
| Kingfield | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| Matagamon | 2 | 0 | 0 | 0 | | | | | |
| Millinocket | 9 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 |
| Mt. Vernon | 3 | 2 | 4 | 4 | 23 | 141 | 42 | 9 | 22 |
| No. Bridgton | 3 | 10 | 8 | 21 | 12 | 73 | 7 | 10 | 2 |
| Rangeley | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 0 | 0 |
| Shin Pond | | | | | 0 | 26 | 1 | 1 | 0 |
| South Berwick | 18 | 13 | 30 | 4 | 1 | 5 | 3 | 6 | 13 |
| Ste. Aurelie | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| Ste. Pamphile* | | | | | | | | 0 | 0 |
| Steuben | 0 | 7 | 0 | 0 | 3 | 13 | 7 | 7 | 2 |
| Topsfield** | 67 | 5 | 3 | 0 | 13 | 152 | 11 | 0 | 0 |
| Washington | 3 | 6 | 9 | 10 | 44 | 322 | 12 | 0 | 5 |
| **Total Number of Moths** | **163** | **65** | **63** | **52** | **146** | **936** | **129** | **54** | **62** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Oystershell Scale (*Lepidosaphes ulmi*)** - Populations of this species and resultant damage on forest trees in Maine was again almost entirely on beech and was very spotty in 1998.

**Pear Thrips (*Taeniothrips inconsequens*)** - In recent years we have been following this species primarily in Kennebec and Franklin counties and early bud checks in the spring of 1998 indicated low populations. For the most part populations were low as expected and damage trace to very light in this area. What appeared to be classic heavy pear thrips damage did, however, manifest itself in June of 1998 on maples across much of southwestern Maine. The heaviest damage occurred as shown in Fig. 12. By the time most reports were received few thrips were found.

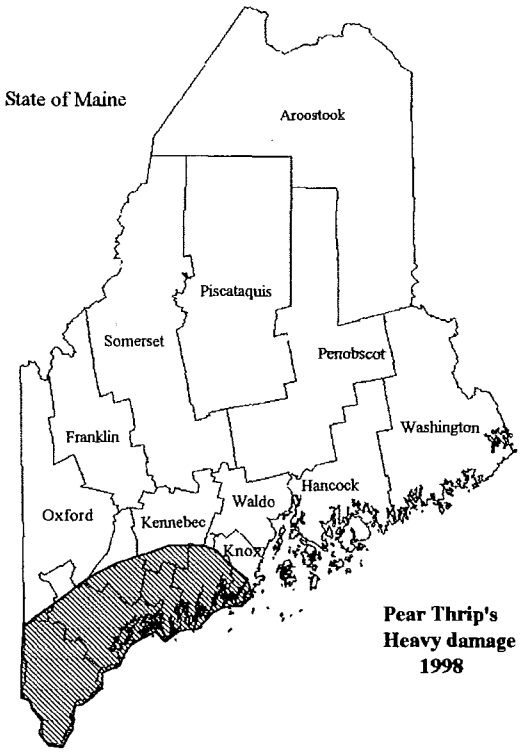


Figure 12

**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 woodboring larvae. The pigeon horntail continues to be primarily a problem in unsound wood on older and/or stressed trees. Reports of activity were again fairly common in 1998.

**Pinkstriped Oakworm (*Anisota virginiensis*)** - Numbers of this species remained very low in 1998.

**Redhumped Oakworm (*Symmerista albifrons* and *S. 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. Numbers of larvae remained very low in 1998. The numbers of *Symmerista* spp. moths collected through our light trap surveys (Table 14) dropped in 1998 as well.

**Saddled Prominent (*Heterocampa guttivitta*)** - No larvae of this species or defoliation was observed in 1998. Moth catches also 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** | **1997** | **1998** |
| Allagash | 8 | 4 | 1 | 3 | 1 | 1 | 0 | 0 | 0 |
| Arundel | | | | | 0 | 0 | 0 | 0 | 7 |
| Ashland | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| Bar Harbor* | | | | | | | | 0 | |
| Blue Hill | 6 | 2 | 1 | 1 | 2 | 5 | 0 | 0 | 0 |
| Brunswick | 42 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Calais | 2 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 6 |
| Chesuncook | 51 | 10 | 12 | 13 | 10 | 37 | 18 | 13 | 18 |
| Clayton Lake | 4 | | | | | | | | |
| Dennistown | 1 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Elliotsville | 6 | 5 | 4 | 4 | 0 | 0 | 3 | 0 | 2 |
| Exeter | 29 | 5 | 10 | 0 | 0 | 1 | 1 | 0 | 5 |
| Greenbush | 0 | 1 | 1 | 1 | 4 | 0 | 0 | 1 | 0 |
| Guerette | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Haynesville | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| Kingfield | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 0 |
| Matagamon | 7 | 0 | 1 | 0 | | | | | |
| Millinocket | 10 | 21 | 10 | 5 | 2 | 7 | 12 | 2 | 1 |
| Mt. Vernon | 21 | 32 | 19 | 1 | 1 | 13 | 6 | 2 | 23 |
| No. Bridgton | 0 | 41 | 15 | 9 | 2 | 0 | 0 | 0 | 0 |
| Rangeley | 0 | 10 | 4 | 0 | 0 | 1 | 2 | 0 | 0 |
| Shin Pond | | | | | 1 | 1 | 0 | 0 | 0 |
| South Berwick | 29 | 15 | 53 | 3 | 0 | 1 | 0 | 0 | 12 |
| Ste. Aurelie | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Ste. Pamphile* | | | | | | | | 0 | 0 |
| Steuben | 4 | 3 | 17 | 28 | 1 | 3 | 12 | 3 | 4 |
| Topsfield** | 7 | 5 | 11 | 4 | 0 | 7 | 0 | 0 | 0 |
| Washington | 3 | 50 | 23 | 1 | 0 | 0 | 0 | 0 | 1 |
| **Total Number of Moths** | **233** | **246** | **186** | **74** | **29** | **80** | **57** | **22** | **80** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Satin Moth (*Leucoma salicis*)** - The only woodland aspen defoliated by the satin moth in 1998 occurred in small pockets totaling 150 acres in central Maine just to the north and northwest of Millinocket (Fig. 13). While most spots fell along the Golden Road near River Pond, several areas were in and around the Togue Ponds and the northeast side of Millinocket Lake. As usual we received scattered reports statewide of defoliation on eastern cottonwood and white poplar. Moth catches remained low (Table 16).

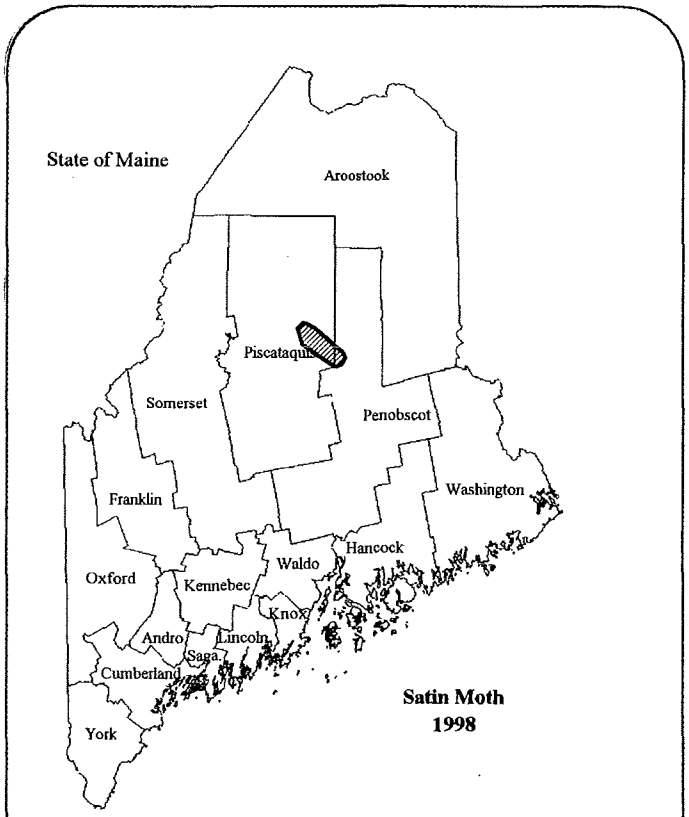


Figure 13

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

| | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location** | **1990** | **1991** | **1992** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** |
| Allagash | 3 | 3 | 2 | 2 | 0 | 0 | 2 | 0 | 0 |
| Arundel | | | | | 0 | 0 | 0 | 2 | 0 |
| Ashland | 5 | 0 | 7 | 3 | 5 | 1 | 0 | 0 | 0 |
| Bar Harbor* | | | | | | | | 0 | |
| Blue Hill | 0 | 0 | 0 | 0 | 9 | 2 | 0 | 0 | 0 |
| Brunswick | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 |
| Calais | 6 | 5 | 0 | 0 | 3 | 2 | 0 | 2 | 1 |
| Chesuncook | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| Clayton Lake | 2 | | | | | | | | |
| Dennistown | 2 | 3 | 1 | 5 | 1 | 0 | 0 | 0 | 0 |
| Elliotsville | 0 | 1 | 5 | 2 | 0 | 0 | 0 | 0 | 0 |
| Exeter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Greenbush | 1 | 2 | 0 | 0 | 1 | 1 | 1 | 3 | 0 |
| Guerette | 4 | 3 | 3 | 16 | 7 | 9 | 0 | 1 | 0 |
| Haynesville | 3 | 0 | 2 | 18 | 5 | 1 | 0 | 0 | 2 |
| Kingfield | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Matagamon | 0 | 0 | 0 | 0 | | | | | |
| Millinocket | 1 | 5 | 17 | 3 | 4 | 0 | 1 | 0 | 1 |
| Mt. Vernon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. Bridgton | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rangeley | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shin Pond | | | | | 14 | 0 | 4 | 2 | 3 |
| South Berwick | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Ste. Aurelie | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ste. Pamphile* | | | | | | | | 0 | 1 |
| Steuben | 41 | 22 | 2 | 2 | 8 | 5 | 0 | 1 | 1 |
| Topsfield** | 1 | 3 | 0 | 3 | 18 | 12 | 1 | 0 | 0 |
| Washington | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Number of Moths** | **71** | **51** | **42** | **58** | **75** | **33** | **10** | **12** | **12** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Sugar Maple Borer (*Glycobius speciosus*)** - This species has not been much of a problem in Maine in recent years, however, like the **pigeon horntail** this status could change as the trees become older or stressed. Several ice damaged stands are being monitored for changes in abundance of this species.

**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 *physically* cause skin irritation unlike those of browntail moth (not a tussock) which *chemically* cause a rash as well. "**Caterpillar rash**" or "**tussockosis**" is especially a problem during periods of hot weather. The **hickory tussock** (*Lophocampa caryae*), **rusty tussock** (*Orgyia antiqua*), **pale tussock** (*Halysidota tessellaris*) and the **spotted tussock** (*Lophocampa maculata*) have been the more common of the group in Maine. Numbers of incidents of tussock induced rash were relatively low overall in 1998. Populations of the **white-marked tussock** (p. 21), which were so abundant in 1997 in Nova Scotia, collapsed there in 1998 and only scattered individuals occurred in Maine.

**Variable Oakleaf Caterpillar (*Lochmaeus manteo*)** - Populations of this insect remained low in 1998 and no defoliation was observed. Numbers of moths from the light trap survey fell in 1998 as well (Table 17).

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

| Location | Year 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|
| Allagash | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arundel | | | | | 0 | 1 | 0 | 0 | 7 |
| Ashland | 7 | 10 | 6 | 0 | 1 | 14 | 0 | 0 | 3 |
| Bar Harbor* | | | | | | | | 3 | |
| Blue Hill | 7 | 4 | 5 | 0 | 9 | 30 | 9 | 0 | 5 |
| Brunswick | 4 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| Calais | 2 | 4 | 3 | 0 | 0 | 3 | 0 | 0 | 2 |
| Chesuncook | 0 | 1 | 0 | 0 | 10 | 62 | 27 | 2 | 2 |
| Clayton Lake | 0 | | | | | | | | |
| Dennistown | 7 | 7 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| Elliotsville | 87 | 175 | 42 | 5 | 0 | 57 | 3 | 1 | 1 |
| Exeter | 9 | 7 | 0 | 0 | 0 | 6 | 4 | 3 | 0 |
| Greenbush | 49 | 39 | 3 | 0 | 7 | 11 | 4 | 14 | 17 |
| Guerette | 2 | 1 | 0 | 0 | 3 | 1 | 1 | 2 | 0 |
| Haynesville | 94 | 86 | 21 | 6 | 39 | 14 | 7 | 4 | 5 |
| Kingfield | 192 | 158 | 14 | 0 | 7 | 7 | 3 | 4 | 3 |
| Matagamon | 17 | 13 | 1 | 0 | | | | | |
| Millinocket | 169 | 310 | 122 | 85 | 148 | 185 | 18 | 86 | 23 |
| Mt. Vernon | 0 | 2 | 0 | 2 | 12 | 1 | 0 | 5 | 13 |
| No. Bridgton | 5 | 6 | 0 | 0 | 3 | 0 | 0 | 1 | 3 |
| Rangeley | 5 | 3 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| Shin Pond | | | | | 2 | 15 | 4 | 20 | 5 |
| South Berwick | 11 | 15 | 3 | 8 | 0 | 4 | 0 | 0 | 6 |
| Ste. Aurelie | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 |
| Ste. Pamphile* | | | | | | | | 0 | 2 |
| Steuben | 3 | 3 | 0 | 0 | 2 | 3 | 0 | 2 | 0 |
| Topsfield** | 316 | 302 | 250 | 83 | 235 | 50 | 3 | 0 | 11 |
| Washington | 23 | 2 | 1 | 0 | 2 | 17 | 2 | 4 | 8 |
| **Total Number of Moths** | **1,009** | **1,151** | **472** | **191** | **481** | **493** | **85** | **151** | **117** |
| **Total Number of Traps** | **24** | **23** | **23** | **23** | **24** | **24** | **24** | **26** | **25** |

* Intermittent cooperator operation ** Intermittent operation in 1998 due to scheduling difficulty

**Willow Flea Weevil (*Rhynchaenus rufipes*)** - This perennial pest again made its appearance in 1998 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 1998

**Ants (various)** - There never seems to be a shortage of ants and 1998 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. One of our more widespread stinging species in Maine is one of the **acrobat ants**, *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 more open areas which have been landscaped and thus often comes in contact with human activities. Highest populations seem to occur at Boothbay Harbor and on Mount Desert Island.

Another species which may also occur in coastal areas and which may seem to sting is *Formica integra*. Rather than sting, this species bites and then injects formica acid into the wound producing a burning sensation. *Formica integra* is a close relative of our infamous **Allegheny mound builder ant** *(Formica exsectoides)*. All of these species were locally a problem in 1998.

Ant flights involving the **cornfield ant** (*Lasius alienus*) were again reported in 1998 but were not as striking as they have been.

**Barklice or Psocids - (p. 22)**

**Banded Woollybear (*Pyrrharctia isabella*) Winter Weather Prediction Survey** - Those familiar, fuzzy, red-banded, black caterpillars which children love to play with were again very abundant in the fall of 1998. The period of greatest activity when road crossings were at their peak fell during the first two weeks of October in both 1997 and 1998. A series of popular articles on predicting winter weather from the width of the red or middle band (the wider the red band the milder the winter) prompted one reporter in Augusta to gather information for local stories in both 1997 and 1998. As a result, a number of our staff picked up a sample of the fuzzy creatures as they crossed roads in early October. Unfortunately many did not make it! (This calls for a "splat" survey - p. 51).

Folklore has it that when the red makes up more than one third of the color, the upcoming winter will be milder. When the black makes up more than two thirds, the winter will be more severe. A one-third red and two-thirds black is considered an indication of a normal winter. The woolly bears predicted a mild winter in 1997 and last winter fit the prediction. To see how accurate the forecast would be this winter we again decided to pit the woolly bears against the various farmers almanacs and the woolly bears have again predicted an even milder winter. We'll see!!

Normal = 4.33 red segments on average based on 13 segments per caterpillar

1997/98 = 4.73 red segments on average - mild winter predicted

1998/99 = 5.05 red segments on average - milder winter predicted

**Boxelder Bug (*Boisea trivittata*)** - This colorful red and black true bug was found in high numbers again in traditionally infested areas of York County, especially Sanford. Low numbers were seen in Augusta (Kennebec County) for the first time in 1998. Although damage to boxelder was locally striking, these bugs attain their highest notoriety by their habit of entering homes in the fall in search of hibernation sites. This species may easily be confused with the **small milkweed bug** (*Lygaeus kalmii*) adults of which have a similar appearance and habit of entering homes to hibernate.

**Cockroaches (outdoor species - *Ectobius* spp.)** - Just a reminder that Maine does have several species of cockroaches which live outside year round. These are not generally considered filth roaches although they can sometimes be confused with domestic species. The group of **forest roaches**, *Ectobius* spp., consists of possibly three introduced species. All occur in coastal areas or at most a few towns inland and are attracted to light at some times of the year. Species in this group somewhat resemble the **German cockroach** but *Ectobius* spp. roaches generally prefer to stay outside of buildings, fortunately!

**Dogwood Sawflies (*Macremphytus* spp.)** - Dogwood, especially gray and red osier, are often stripped of their foliage by the larvae of one or more of these sawflies, and populations were again high locally in 1998. The larvae are basically yellow with black spots at maturity but as they feed in the early stages they are covered with a white, woolly wax. At maturity the larvae wander in search of a place to pupate and may bore into relatively soft wood (siding, decking, etc.) as much as one inch! It is this habit that frequently draws the quickest attention and when asked about defoliation in the area the landowners frequently did not notice stripped shrubs nearby!

**Euonymus Caterpillar (*Yponomeuta cagnagella*)** - Defoliation was reported again in 1998 from a number of previously infested and remaining euonymus hedges and ornamental plantings from the Bangor area south and west. Little change in abundance was noted from 1994 levels.

**Fall Insects** - As most homeowners prepared for the coming winter on warm fall days, many insects were doing the same. Some such as **ants**, **boxelder bugs**, **cluster flies**, **hunter's moths** (p. 27), **multicolored Asian lady beetle** (p. 38), **western conifer seed bugs** (p. 20) and **woolly alder aphids** are primarily a curiosity or nuisance. Others such as the **bumble bees** (*Bombus* spp.), **paper wasps** (*Polistes fuscatus*) and **yellow jackets** (*Vespula* spp.) can produce a painful experience. Fertilized queens of these stinging species are seeking winter quarters in protected locations (which in the case of paper wasps may be your home).

**Garden (or Snailcase) Bagworm (*Apterona helix*)** - This small introduced European bagworm was reported from the Sanford area this past spring (April 1998). This appears to be the first Maine record although this species has been reported as near as Massachusetts in the past. Richard Folsom of the Maine Department of Agriculture visited the area and noted massive numbers of the tiny (<5mm), sand-covered, grayish, snail-like bags firmly attached to a variety of substrates from white pine trees to fence posts and rails. The species has apparently been present in the area for at least a couple of years. Little current activity was noted. There are only three species of true bagworms (Lepidoptera : Psychidae) established in Maine and this will add a fourth. All of our species are very small and although their food habits include mostly low and inconspicuous plants, the numbers of bagworms attaching to pupate on such substrates as Christmas trees, fence posts, sides of buildings and so forth can cause aesthetic problems. The larger shrub-feeding bagworm (*Thyridopteryx ephemeraeformis*) which is more common further south is occasionally imported into Maine but does not overwinter here.

**Japanese Beetle (*Popillia japonica*)** - The first signs of activity in 1998 were noted in a number of southern Maine localities over the July 4th weekend pretty much on schedule. Populations in 1998 appeared less consistent than usual and ranged from extremely high to very low over relatively short distances. Parasitism levels by the parasitic fly, *Istocheta aldrichi*, were similarly variable.

High populations have been found as far north as Farmington, Newport and Old Town. Populations north of this or east of the Penobscot River are generally low. Aside from feeding on Japanese knotweed, "bamboo," the Japanese beetles love littleleaf linden. Infested linden street and specimen trees appear to have a brown "frosting" of skeletonized leaves.

Populations of the often associated but more widespread **rose chafer** (*Macrodactylus subspinosus*) remained relatively low in 1998. No new areas of infestation by the **oriental beetle** (*Anomala orientalis*) were reported in 1998.

**Lily Leaf Beetle (*Liliocerus lilii*)** - This introduced pest of true lilies (Liliaceae) has now been found at several sites in York County (Ogunquit, Wells and York) and now two sites in Cumberland County (Bridgton and Portland). The adults are striking red beetles with a black head and legs and the larvae are slimy and ugly. Damage to lilies can be severe.

**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**, **lice**, **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)** - Although the relatively wet spring led many to expect high numbers of our summer biters, we were generally pleasantly surprised. As the season dried out the usual **black fly** and mosquito seasons came and went with only minor inconvenience except in more stubborn areas. Coastal areas were the primary exception and there, **salt marsh mosquitoes** and the infamous **salt marsh greenhead fly** (*Tabanus nigrovittatus*) took their toll. Of those which need blood, the **horse fly/deer fly** group predominated inland where numbers were active through August. **No-see-um** populations were not as high or of as long duration in 1998 as in the high year of 1996.

**Stinging insect** populations in Maine seemed similar in 1998 to those of 1997 at least in southern Maine. Populations of **bumble bees**, **honey bees** and **yellow jackets** were still low. 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 again reported from southern Maine in 1997. And the beneficial **golden digger wasp** (*Sphex ichneumoneus*) was unusually common and active in southern Maine. While a lot of concern was expressed by fruit and vegetable growers about noticeable reduction in pollinators, campers and picnickers welcomed the reduction in yellow jacket populations.

**Rashes** related to insects were again of concern in 1998 in response to activities of the **browntail moth** (p. 23) in the Casco Bay area (Cumberland County) and but less so to populations of **tussocks** (p. 33) elsewhere.

**Spiders** did not seem to be as much a source of concern in 1998 as they have in past seasons although a number of calls were handled (Table 22).

**Ticks (Ixodidae)** - The number of ticks received for identification at the I&D lab rose strikingly from 204 in 1997 to 390 in 1998. This even surpassed 1996 when 292 were processed! Nearly half of the ticks received in 1998 were processed before July first. After a mid to late summer lag, numbers again picked up in the fall for another "slug" of identifications. Roughly half (193) of the ticks processed in 1998 were the **lyme** or **deer tick** (*Ixodes scapularis/dammini*). Numbers of the **American dog tick** (*Dermacentor variabilis*) were still high but our clients appear to be more sure of the identification of this species and tend to report it to us less frequently. Populations of both of these species continued to spread 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. 14).

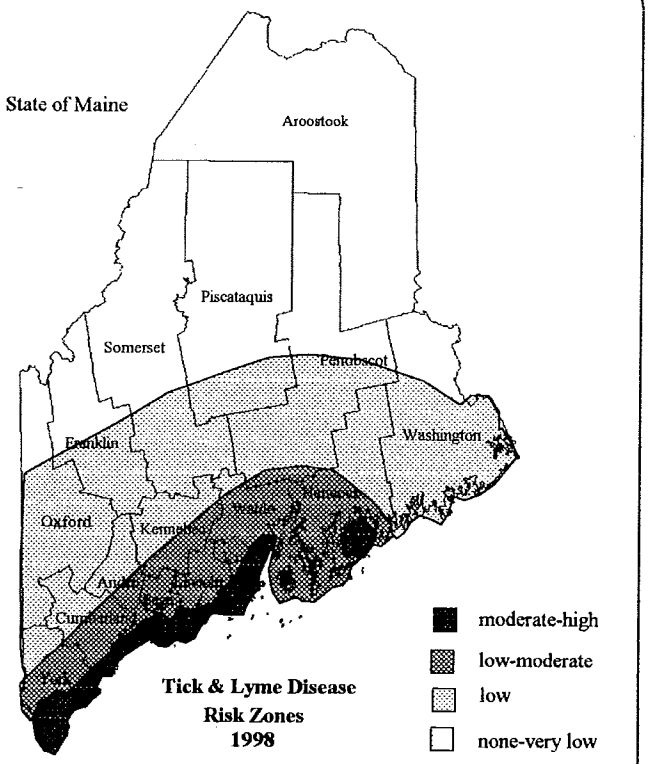


Figure 14

**Lyme disease** in Maine - It is still somewhat difficult to characterize the nature of lyme disease risk in Maine for a variety of reasons including a complex disease ecology, dramatic local variability in the distribution of infected deer ticks, and problems in clinical recognition and diagnosis. Suffice it to say that the incidence of lyme disease remains relatively low in Maine, and that most cases are concentrated in coastal areas, especially in southern York County. Lyme disease incidence has increased gradually since the late 1980's, with 51 Maine-acquired cases reported during 1998. From 1986 through 1998, a total of 330 Maine residents have been diagnosed with lyme disease, with 204 (62%) of these cases believed to have been acquired as a result of exposures within the state of Maine.

The map in Fig. 14 describes general zones of risk for acquiring lyme disease in Maine, although it is important to realize that even within those zones characterized as high or moderate risk, that there are wide areas where little or no risk exists.

A vaccine for lyme disease was licensed by the U.S. Food and Drug Administration in late 1998. Recommendations for the use of this vaccine will be published in April or May of this year by federal and local health authorities.

**Multicolored Asian Lady Beetle (*Harmonia axyridis*)** - These friendly but frustratingly pestiferous little beetles arrived pretty much on schedule with the warm fall weather. By mid October, we had received numerous reports from across the state and numbers were again locally high. In addition, calls continued through December as warm weather persisted. They were often accompanied in buildings by **cluster flies** (*Pollenia rudis*), **paper wasps** (*Polistes fuscatus*) and the **western conifer seed bug** (p. 20).

**Potato Leafhopper (*Empoasca fabae*)** - Basically not a problem for our constituents in 1998 as populations were virtually non-existent.

**Powder Post Beetles** - A number of powder post beetle infestations were investigated in 1998. Most were ongoing problems. It was especially interesting to note the rise in incidence and abundance of one species, ***Ptilinus ruficornis***. Adults of this small species are striking (feathery antennae) when observed.

**Public Assistance** - The Insect and Disease Management (I&DM) Division provides technical advice and assistance on pest identification, evaluation and control to landowners, resource managers, shade tree owners, and other concerned individuals seeking help with forest pests or forestry related quarantines.

The Division also responded to a growing number of requests about pests associated with human health problems, especially brown tail moth, a tree pest which can cause a skin rash, and the deer tick, the vector of Lyme disease. Members of the I&DM staff also gives talks and were involved in presentations, workshops, conferences, and other similar training activities to inform and educate the public about trees and tree pests.

The total number of pest inquiries and problems handled and recorded by I&DM office, laboratory and field staff during the year are summarized in Tables 18, 19, 20, 21 and 22. In 1998 the I&DM staff handled a total of 3737 requests, an increase of 379 in total number of calls received in spite of decreases in requests in two categories - quarantines and household insect pests. The decline in number of requests about forestry related quarantines is due to the change in the gypsy moth quarantine policy in New Brunswick. Six New Brunswick log importers became gypsy moth certificate exempt resulting in a drop in the number of requests for state permits. News releases and increased publicity about the multicolored Asian lady beetle, *Harmonia axyridis* may in part be responsible for a decline in calls about this new household invader.

Specific information about forest and shade tree problems encountered during the year can be found elsewhere in the Insect and Disease Conditions Summary Report.

**Table 18. Total number of requests for advice and assistance, 1997 and 1998**

| Problem | Total Requests | |
|---|---|---|
| | 1998 | 1997 |
| Forest, Shade and Ornamental Tree | 2,168 | 2,018 |
| Forestry Related Quarantines | 425 | 2,019 |
| Human Health Related Pests | 914 | 486 |
| Household, Nuisance and Miscellaneous | 230 | 288 |
| **Total** | **3,737** | **3,358** |

**Table 19. Number of requests received in 1998 for advice and assistance about forestry related quarantines**

| PROBLEM | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELC requests | 1 | 1 | 3 | | 3 | 1 | | | 1 | | | | 10 |
| Gypsy moth permits | 14 | 43 | 8 | 20 | 28 | 53 | 17 | 26 | 35 | 23 | 45 | 41 | 353 |
| HWA requests | 7 | 3 | 6 | | 3 | | 1 | 1 | 2 | | 2 | 6 | 31 |
| Compliance agreements | | | | 7 | 1 | | | | 1 | 1 | | | 10 |
| Gypsy moth requests | | 2 | 2 | 1 | | | | | 1 | 2 | | 1 | 9 |
| Ribes | | | | | | | | | | | | | 0 |
| Other requests | 1 | 1 | | | 2 | 2 | 1 | 1 | | 1 | | 3 | 12 |
| **TOTAL** | **23** | **50** | **19** | **28** | **37** | **56** | **19** | **28** | **40** | **27** | **47** | **51** | **425** |

**Table 20. Number of requests received in 1998 for advice and assistance about pests causing human health problems**

| PROBLEM | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Browntail moth | 31 | 35 | 40 | 92 | 103 | 8 | 14 | 8 | 12 | 15 | 10 | 5 | 373 |
| Ticks | 2 | 5 | 9 | 46 | 102 | 67 | 67 | 15 | 6 | 66 | 49 | 23 | 457 |
| Mosquitoes | 1 | 1 | | 3 | 7 | 8 | 8 | 6 | 2 | | | | 36 |
| Human health pests | | 1 | 1 | 3 | 4 | 5 | 3 | 7 | 2 | 4 | 3 | 5 | 38 |
| Biting flies | | | 1 | 4 | 3 | 2 | | | | | | | 10 |
| Blackflies | | | | | | | | | | | | | 0 |
| **TOTAL** | **34** | **42** | **51** | **148** | **219** | **90** | **92** | **36** | **22** | **85** | **62** | **33** | **914** |

**Table 21. Number of requests received in 1998 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Abiotic factors | 19 | 23 | 29 | 7 | 5 | 7 | 13 | 11 | 9 | 4 | 2 | 2 | 131 |
| Animal damage | | 2 | 3 | | | 1 | 2 | | 1 | | | | 9 |
| Anthracnose | | | | | 9 | 4 | 6 | 1 | 4 | | | | 24 |
| Arborvitae leafminers | | | | | 1 | 4 | | | 3 | | | | 8 |
| Asian long horned beetle | | | | 3 | | | 1 | 55 | 17 | 6 | 3 | | 85 |
| Adelgid galls on spruce | | | 1 | | | | | 2 | | | | | 3 |
| Annosus root rot | | | | | 1 | | | | | | | | 1 |
| Aphids | | | | | 7 | 6 | 3 | | | | | | 16 |
| Apple scab disease | | | | | | | 1 | | 2 | | | | 3 |
| Ash decline | | | | 1 | | | | | 1 | | 1 | 1 | 4 |
| Balsam needle gall midge | | | 1 | | 4 | 6 | | 3 | | 2 | 5 | 4 | 25 |
| Balsam shoot boring sawfly | | | | 2 | 6 | 5 | | | | | | | 13 |
| Balsam twig aphid | 4 | 2 | 6 | 5 | 13 | 3 | 1 | | 2 | | 2 | 4 | 42 |
| Balsam woolly aphid | | | | | | | | | 1 | | | | 1 |
| Bark beetles | | 1 | 1 | | | 1 | 11 | 5 | 2 | | | | 21 |
| Beech bark disease | | | 1 | | 1 | 1 | | | 3 | | 4 | 1 | 11 |
| Birch casebearer | | | | | 1 | | | | | | | | 1 |
| Birch leafminers | | | | | 1 | | | | | | | | 1 |
| Black knot of cherry | | | | | | | 1 | 2 | | | | | 3 |
| Bronze birch borer | | | | | 1 | 2 | 2 | | | | | | 5 |
| Brown ash decline | | | | | | | | | | | | 1 | 1 |
| Bruce spanworm | | | | | | | 1 | | | | | | 1 |
| Butternut canker | | | | | | | | | | | | | 0 |
| Cankers | | | | | | | 3 | 1 | | 1 | 1 | | 6 |
| Canker worms | | | | | 1 | 1 | | | | | | | 2 |
| Chestnut blight fungus | | | | 3 | 3 | 2 | 2 | | | | | | 10 |
| Dogwood anthracnose | | | | | | | | | | | | | 0 |
| Dutch elm disease | | | | | | 1 | 5 | 1 | 1 | | | 1 | 9 |
| Eastern dwarf mistletoe | | 1 | 1 | 3 | 3 | 4 | 15 | 10 | 6 | 1 | 3 | 2 | 49 |
| Eastern tent caterpillar | | | | | 1 | | | | | | | | 1 |
| Elm leafminers | | | | | | | | 2 | | | | | 2 |
| European larch canker | | | | | | | | | 1 | | | | 1 |
| Fall webworm | | | 5 | | | | | 17 | 12 | | | | 34 |
| Fir-fern rust | | | | | | 1 | | | | | | | 1 |
| Fir-fireweed rust | | | | | | | | | | | | | 0 |
| Fire blight | | | | | | | | | | | | | 0 |
| Forest practices | | | | | | 1 | | | | | | 1 | 2 |
| Forest tent | | | | 1 | | | | | | | | | 1 |
| Galls on deciduous trees | | | | | | 2 | | 3 | | 1 | | | 6 |
| Gypsy moth | | | 3 | 2 | 3 | 3 | 1 | 1 | 9 | 1 | | | 23 |
| Hardwood decline | | | | | | 1 | | 2 | 2 | 2 | | | 7 |
| Hemlock borer | 1 | | 2 | 1 | 1 | 1 | | | | | | 2 | 8 |
| Hemlock looper | | | | | 1 | | | | 1 | | | 2 | 4 |
| Hemlock wooly adelgid | | 1 | | | | | 1 | | | | | | 2 |
| Herbicide | | | | 1 | | 1 | 3 | 3 | 2 | | | | 10 |
| Horse-chestnut leaf blotch | | | | | | | | 2 | 3 | | 2 | | 7 |
| Hunters moths | | | | | | | | | | 3 | 3 | 2 | 8 |
| Ice storm damage | 30 | 31 | 18 | 40 | 33 | 36 | 78 | 47 | 52 | 10 | 9 | 10 | 394 |
| Introduced pine sawfly | | | | | | 2 | 11 | 41 | 27 | | | | 81 |
| Japanese beetles | | | | | 2 | 1 | | 1 | 1 | 1 | | | 6 |
| Jap. long horned beetle | | | | | | | | | | | 1 | | 1 |
| Eastern larch beetle | | | | | 1 | | 2 | 2 | 3 | | | | 8 |
| Larch casebearer | | | | | | | | | | | | | 0 |
| Leaf beetles | | | | | | 2 | 4 | | | 1 | | | 7 |
| Maple decline | | | | | 1 | | 3 | 1 | 1 | | | 1 | 7 |
| Maple trumpet skeletonizer | | | | | | | | 3 | 6 | 1 | | | 10 |
| Mites | | | | | 2 | 1 | 1 | 2 | | | | | 6 |
| Mountain ash sawfly | | | 1 | | 1 | | | | | | | | 2 |
| Needle cast disease | | | | 1 | 1 | 4 | | | | | | | 6 |
| Oak leafroller | | | | | | | | | | | | | 0 |
| Oak skeletonizer | | | | | | | | 2 | 11 | 4 | 1 | | 18 |
| Oak twig pruner | | | | | | 1 | 1 | 13 | | | | | 15 |
| Pear thrips | | | | | 6 | 6 | 5 | 5 | | | | | 22 |
| Poison ivy | | | | | 2 | | | | | | | | 2 |
| Psocids | | | | | | | 1 | 13 | 5 | | | | 19 |
| Root rot | | | | | | | | | | 1 | 2 | 1 | 4 |
| Root weevils | | | | 3 | 1 | 1 | | | | | | | 5 |
| Rose chafer | | | | | | 1 | | | | | | | 1 |
| Roundheaded appletree bor. | | | | | 1 | 3 | 1 | | | | | | 5 |
| Rusts | | | 1 | | | | | | | 2 | | | 3 |
| Sapsucker injury | | | 2 | | | | | | | | | | 2 |
| Salt injury | | | 2 | | | | 1 | | 1 | | | | 4 |
| Satin moth | | | | | | | 4 | | | | | | 4 |
| Sawflies | | | | | | | 5 | 9 | 14 | | | | 28 |
| Sawyer beetles | | | | | | | 8 | 6 | 5 | | 1 | | 20 |
| Scale insects | | | | | 2 | | | | | | | | 2 |
| Semi mature tissue needle blight | | | | | | | 8 | 3 | 2 | | 1 | | 14 |
| Spittlebugs | | | | | | 1 | 2 | | | | | | 3 |
| Spruce beetle | 4 | 2 | 1 | 4 | 6 | 5 | 24 | 17 | 14 | 5 | 5 | 4 | 91 |
| Spruce budworm | 1 | | 1 | 4 | 2 | 3 | 1 | 4 | 11 | | 2 | 3 | 32 |
| Spruce gall adelgids | | | | | 1 | | 5 | | | | | | 6 |
| Spruce health | | 2 | | 1 | 2 | 1 | 6 | 4 | 2 | 2 | 2 | 1 | 23 |
| Spruce needleminer | | | | | 1 | | | | | | | | 1 |
| Tar spot on maple | | | | | 1 | | | | | | | | 1 |
| White pine blister rust | 4 | 1 | 5 | | 3 | | 39 | 23 | 11 | 1 | 1 | 1 | 89 |
| White pine weevil | | | 3 | 4 | 8 | 3 | 7 | 5 | 3 | 1 | | | 34 |
| Woodborers | | | | 1 | | 1 | 3 | 2 | 2 | 1 | 2 | | 12 |
| Yellowheaded spruce sawfly | | | 2 | 1 | 1 | 8 | 11 | 1 | 1 | | | | 25 |
| Other requests | 12 | 22 | 18 | 38 | 51 | 59 | 72 | 66 | 55 | 89 | 34 | 37 | 553 |
| **TOTAL** | **75** | **88** | **107** | **126** | **192** | **197** | **375** | **391** | **309** | **140** | **87** | **81** | **2168** |

**Table 22. Number of requests received in 1998 for advice and assistance about household, public nuisance, and miscellaneous pests**

| PROBLEM | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ants | | | 2 | | 3 | 7 | 8 | | | 1 | 1 | | 22 |
| Asian lady beetle | | 3 | 5 | 1 | | | | | | 17 | 1 | 1 | 28 |
| Bees | | | | 1 | 3 | | 1 | | 1 | | | | 6 |
| Bird mites | | | | | | | | 3 | | | | | 3 |
| Booklice | | | | | | | | 1 | | | | | 1 |
| Carpenter ants | 1 | 2 | | 2 | 2 | 6 | 3 | 5 | | 1 | 1 | 1 | 24 |
| Clothes moths | | 1 | | | | | | | | | | 1 | 2 |
| Cluster flies | 1 | | | | | | | | | | | | 1 |
| Cockroaches | | | | 2 | | | 1 | | | | | | 3 |
| Crickets | | | | | | | | | | | | | 0 |
| Dermestid beetles | | | 2 | 1 | 1 | 2 | | 1 | 3 | 1 | | | 11 |
| Earwigs | | | | | | | 1 | | 1 | | | | 2 |
| Firewood insects | 4 | 1 | 1 | | | | | | 1 | | | | 7 |
| Fleas | | | | | | | | 1 | | | | 1 | 2 |
| Flies | 1 | | | | | 1 | | 3 | 1 | 1 | | | 7 |
| Fruit flies | 1 | | 1 | | | | | | | 1 | | | 3 |
| Fungus gnats | | | | 1 | | | | | | | | | 1 |
| Hornets and wasps | | | | | 1 | | 4 | | 2 | | | | 7 |
| House flies | | | | | | | | | | | | | 0 |
| Indian meal moth | 1 | 2 | 2 | 1 | 1 | | 1 | | 2 | 1 | | | 11 |
| Ladybird beetles | | | | | | | | | | | | | 0 |
| Mealworms | | | | | | 1 | 1 | | | 1 | | | 3 |
| Midges | | | | | | | | | | | | | 0 |
| Misc. insects* | | 1 | 1 | 1 | 1 | 2 | 1 | 1 | | | | 1 | 9 |
| Misc. non-insects** | 2 | 1 | 2 | 3 | 2 | 1 | 1 | | 1 | 1 | | 2 | 16 |
| Pantry pests | | | | | | | | 5 | | 1 | | | 6 |
| Powder post beetles | 3 | 1 | 2 | 1 | | 1 | 1 | | | 2 | | | 11 |
| Spiders | | | | | | 2 | | 2 | | 3 | 7 | 2 | 16 |
| Springtails | 1 | 3 | 4 | 1 | | | | | | | | | 9 |
| Western conifer seed bug | | | | | | | | | | 6 | 7 | 6 | 19 |
| **TOTAL** | **15** | **15** | **22** | **15** | **14** | **23** | **23** | **22** | **12** | **37** | **17** | **15** | **230** |

* include such things as silverfish and non powderposting woodborers ** include such things as house centipedes, millipedes and pseudoscorpions

**Viburnum Leaf Beetle (*Pyrrhalta viburni*)** - Larval feeding just about decimated many viburnum hedges throughout southwestern Maine in 1998 in the area south of U.S. Rte. 2 from Rumford to Old Town and roughly west of the Penobscot River. Egg laying by adults caused widespread twig mortality as well.

**Woodborers** - A common woodland **cerambycid beetle**, *Stictoleptura canadensis*, has often been collected in softwood forested areas and frequenting flowers where they feed on pollen. It has not generally been considered a pest in the past although the larvae are typical roundheaded borers in wood. However several calls were received in 1997 and 1998 involving the emergence of numbers of *S. canadensis* adults from softwood logs in service in log cabin construction. One cabin in Belgrade which was investigated in mid July, had been built for over five years and appeared to have been reinfested more than once. Most beetle activity occurred around areas of rough moist and unsound wood on the north or northeast side of the building.

## *DISEASES and INJURIES Associated With Trees in 1998*

**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 perception 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.

Most 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 plants and soils which may negatively impact tree growth or winter hardiness. And there is the possibility that effects of acidic precipitation may increase the susceptibility of trees and other plants to certain diseases. Studies are ongoing to elucidate these possible effects.

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.

**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 red pine plantation in N. Anson was brought to our attention by a concerned landowner.

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. 15).

When harvesting pines in red pine plantations, it is important to treat stumps with borax immediately following tree harvest. *Heterobasidion 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 infection hazard is greatest in the fall when spores of the causal organism are being abundantly released.

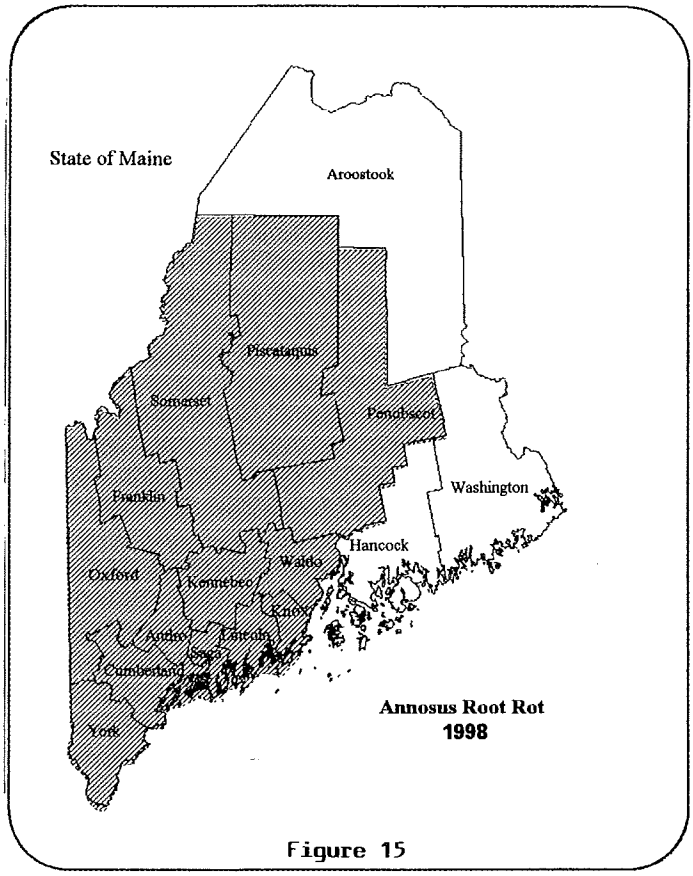


Figure 15

**Anthracnoses of Ash, Birch, Catalpa, Maple, and Oak (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 1998. Of the five diseases, maple anthracnose was by far the most commonly reported.

**Ash Leaf and Twig Rust (caused by *Puccinia sparganiodes*)** - This disease was last epiphytotic in Maine from 1982-1984. The moderate outbreak of this disease which began in 1995 in the Stockton Springs/Frankfort/Winterport areas of midcoast Maine has continued each year since but has not enlarged significantly, and in 1998 that outbreak diminished to endemic levels.

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.

The trend for this disease is presently downward.

**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. It is interesting to note, however, that this same phytoplasma is also capable of infecting common lilac *Syringa vulgaris* (Walla, J.A. and Y.H. Guo. 1998. Lilac Witches'-Broom in North Dakota. Plant Dis. 82:1404).

**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 1998. 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 Needlecasts (caused by *Isthmiella* and *Lirula* spp.)** - These needlecast diseases were more widespread and common on balsam fir Christmas trees in 1998 than any year we can remember. We received specimens last spring from Dover-Foxcroft to Calais, with many locations between. The causal organisms are generally common among stands of wild trees, but only occasionally a problem among cultivated trees.

Symptoms are generally confined to foliage two years old or older; current season growth, even when infected, remains green until the second season. But it is the infected third year growth upon which infective spores are generated and which in turn serve to cause infection of current season growth during the summer. Commonly a continuous dark line is noticeable on the undersides of infected third year needles, especially if *Lirula nervata* is the causal organism. Often trees infected by *Lirula* and *Isthmiella* needlecast fungi are attacked by other needlecast fungi as well, including species of *Rhizosphaera* and *Lophodermium*, which develop under the same sort of cool, moist conditions which favor the former pathogens.

No chemical controls are presently available to help manage *Lirula* and *Isthmiella* infection in Christmas tree stands. Cultural control suggestions revolve around practices to open stands to light and promote good air circulation, low branch pruning, and confining shearing to dry weather only.

An excellent booklet How to Manage Needlecast Diseases on Balsam Fir prepared by the United States Forest Service is available as single copies from this office. Supplies are extremely limited.

**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.

**Brown Ash Decline (caused by environmental stresses)** - The recovery of black ash, *Fraxinus nigra*, (called brown ash in Maine) from a state of serious decline, continued in 1998. The statewide decline first became apparent in Maine in 1992 and was studied and evaluated on 57 plots established in four geographical zones throughout Maine in 1993 (MFS Tech. report #33). In 1995, remeasurement of 31 of the original plots showed that apparently the decline had subsided and brown ash condition was improving (Tech. report #37). Meanwhile, studies at the University of Maine had shown significant correlations between reduced brown ash growth and high water and freezing events in the early winter followed by spring drought conditions. Studies by the MFS and USFS - FHP in the 90's had not shown any significant relationships between insect or disease agents and the decline.

Insect and Disease Management staff did not remeasure plot subsets in 1998, but plan to do so in 1999.

Barring a recurrence of conditions that caused the original decline, brown ash condition is expected to remain good in 1999.

**Bud Abortion of Balsam and Fraser Fir (caused by low ambient air temperatures prior to bud break)** - This problem was relatively mild in 1998, but more prevalent nonetheless than in recent years. The warm spell we experienced in late March may have contributed to a loss of winter hardiness among fir trees which would predispose them to bud abortion. Most Maine plantations had a few aborted buds, but nothing like the damage we experienced in the late 1980's, which rendered many trees unsaleable.

**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. 16).

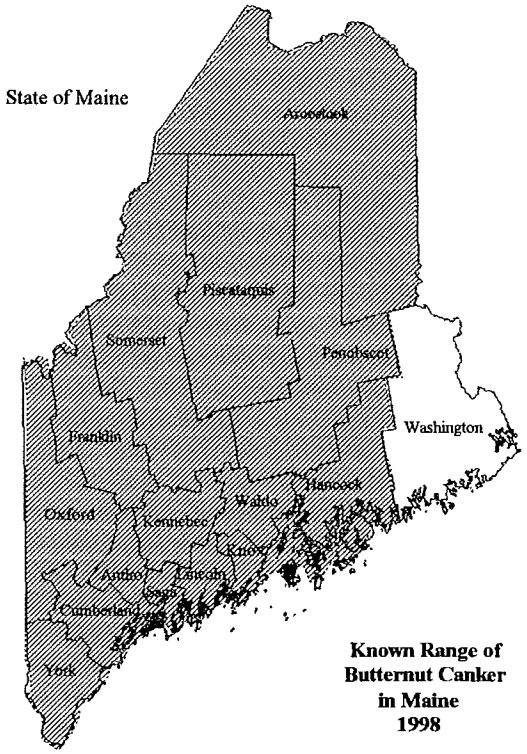


Figure 16

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.

Butternut canker has now been found in New Brunswick, Canada. A recent note in Plant Disease (Vol. 82 No. 11) describes findings at five locations in Carleton County, N.B., all within about 20 km of the State of Maine. One stem canker was dated at seven years, which indicates the disease apparently was present in New Brunswick at the time we first discovered it in Maine (1993).

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 1998. 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. Among the calls we investigated in 1998 were herbicide injury problems involving application of some of the newer formulations of Roundup over the top of small balsam fir Christmas trees, and various lawn herbicide applications being picked up by the roots of desirable ornamentals.

**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.

**Cone Year** - Nineteen-ninety-eight proved to be a big cone year for spruce and fir. The Maine Christmas Tree Association (MCTA) harvested hundreds of pounds of balsam fir seed from its seed orchards in Ashland and Norridgewock, enough to complete progeny testing and to serve to needs of MCTA members for many years to come. But for some Christmas tree plantation owners, the task of removing cones from balsam and fraser fir to be sold in 1998 proved quite tedious.

**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 conspicuous throughout Maine during 1998 and generated occasional 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 apparently are not yet generally 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 (caused by *Arceuthobium pusillum*)** - Severe damage as the result of infection by this parasitic plant continues to occur in stands of white spruce in coastal areas of Maine. Evidence of significant mistletoe infestation was noted in 1998 on coastal headlands and islands from Machias in the east to the Boothbay region in the west. 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. But such measures are impractical in woodland areas, and several islands in Friendship and Port Clyde have recently been extensively harvested in response to mistletoe damage.

Dwarf mistletoe also frequently occurs on black spruce, particularly in inland bogs, and on red spruce in many 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, and harvested areas revisited every ten years or so to remove any symptomatic trees missed during the initial harvest.

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 and perhaps much longer. 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.

Each year we survey one or more towns close or adjacent to known infested areas (Fig. 17) to check for evidence of disease spread.

MFS surveys in 1998 of previously uninfested areas proved negative. Commercial larch seed orchards in the towns of Unity and Howland were also checked for evidence of larch canker; no disease was found.

The trend for this disease is static.

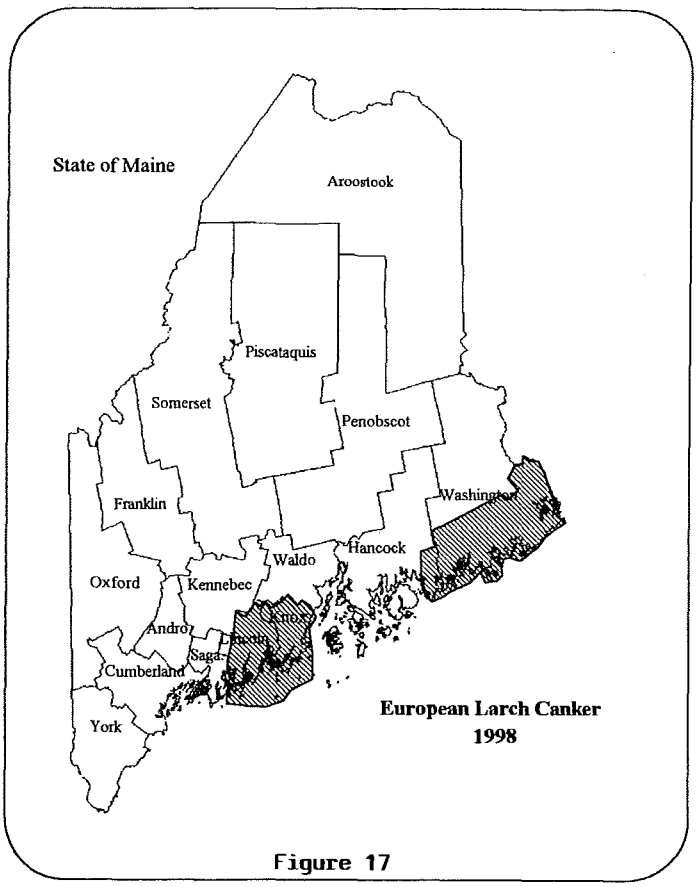


Figure 17

**Fir-Fern and Fir Fireweed Rusts (caused by *Uredinopsis mirabilis* and *Pucciniastrum epilobii*, respectively)** - These diseases were generally present at moderate levels statewide in 1998, despite the rainy weather which would have seemed adequate to promote higher levels of infection.

**Hail Damage** - Every summer we receive reports of damaging hail episodes around the state. While we don't attempt to track them all, a couple of significant events occurred in May. On Thursday, May 21 hail between marble and golf ball size was reported from the Crystal/Island Falls area which accumulated to several inches on the ground. Less damaging amounts were reported from Millinocket, Presque Isle and Sangerville on that date, and on Tuesday, May 26 small hail was reported from Bangor.

**Horse-chestnut Leaf Blotch (caused by *Guignardia aesculi*)** - This disease, which causes brown, irregular blotches on leaves often bordered by a yellow band, was unusually severe in 1998. While this disease is noticeable to some degree every year, leaf blotch has nearly totally defoliated horse-chestnut trees in many landscapes this past season.

Weather conditions which favor disease development were plentiful last year. Abundant wet weather early in the season as leaves emerged provided for heavy initial infection by sexual spores (ascospores), then more wet weather in June provided the opportunity for reinfection by asexual spores (conidia).

Despite these high infection levels, leaves persisted on trees for most of the growing season, providing sufficient photosynthetic activity to sustain tree growth. So despite their poor appearance, overall damage to trees was minor.

**Ice Damage to Trees (caused by several icing events during January, including the "Ice Storm of 1998") -** The winter of 1997-1998 will long be remembered for its warm temperatures and icing events. The "Ice Storm of 1998" which occurred January 7-10 caused by far most of the tree damage observed as well as most of the press coverage of this winter's storm events, but there were other significant weather events as well. An ice storm on January 23-24 affected portions of Maine south and west of the major ice event "footprint" of earlier in the month, and caused significant tree breakage and power outages over an area largely spared by the original storm. And still later a heavy rain event in Aroostook County saturated the top several inches of previously fallen snow with water which subsequently froze, then settled, causing substantial damage to young conifer outplants.

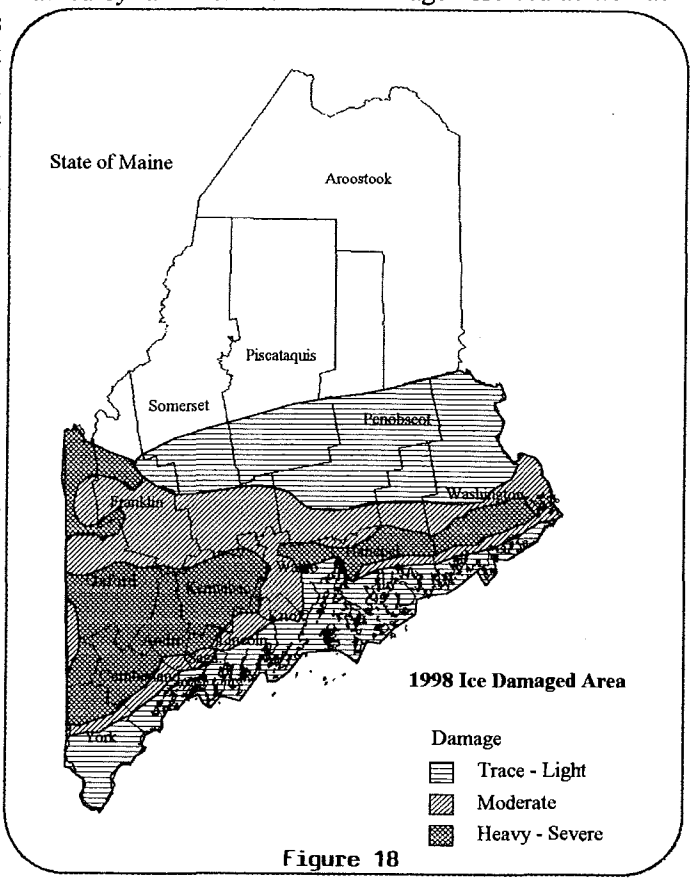

Figure 18

Acreage figures compiled by the Maine Forest Service showed a damage total of 13,288,700 acres from the two icing events with damage ranging from trace to severe. It is difficult to delineate areas on maps where damage to trees falls into just one category, because within broad areas trees display varying amounts of damage depending on species, elevation, aspect, stem size, and stocking level. Nevertheless, damage was clearly worse in some portions of the ice damaged areas than others, and our acreage estimates by damage category follow: 0-trace damage, 4,704,713 A.; trace to light, 1,632,365 A.; light, 1,230,199 A.; light to moderate, 1,618,206 A.; moderate 257,257 A.; moderate to high, 3,561,322 A.; and high (severe) 284,638 A. A map (Fig. 18) of ice damaged areas provides a visual representation of the areas of Maine generally affected.

Effects on individual trees depended greatly on species involved, but it was clear that some species were more resistant to ice damage than others. Birch, poplar and red maple among hardwood native species suffered the worst damage, while oak and sugar maple were more resistant. However, in the areas of the worst icing all hardwood species, including oak and sugar maple, were extensively damaged. Conifers generally fared better than hardwoods, especially spruce and fir. White pine lost many horizontal branches and occasional tops were snapped, but generally this species performed better than the hardwoods. However, larch and red pine exhibited considerable top breakage, and main stems frequently snapped at points which left trees devoid of lateral branches. This was especially apparent in plantations and also among native larch stands in eastern Maine. In general, non-native species suffered more than native types. Many introduced species such as *Zelkova* and Chinese birch were badly damaged and certain ornamental evergreen cultivars were severely stressed, especially the ornamental arborvitaes which commonly bent to 45° angles and never regained their normal upright form. Many native conifers also displayed significant stem deformation and never straightened completely.

Christmas trees generally were not severely damaged in Maine, but there were exceptions. Pine species bent at various angles and many did not straighten without staking. In some cases tops snapped completely from pine Christmas trees, rendering them unsaleable in 1998 and probably forever. In Aroostook County, the ice formed by rain saturated snow which subsequently froze and settled snapped many terminal shoots, tore whorl branches, and stripped lateral buds from young 2-4 foot fir trees in plantations.

The ice storm had a significant effect on maple syrup producers. Shortly after the ice storm, sugarmakers deluged us with inquiries regarding whether they should tap trees this year, and how intensively. Borrowing from the expertise of our colleagues in Vermont, we recommended tapping trees with less than 10% crown breakage normally. With 10-25% crown breakage we recommended reducing the number of taps. With 25-50% breakage we recommended trees not be tapped at all in 1998 and with 50-75% crown loss we suggested two years without tapping. For the most extensively damaged trees, over 75% crown loss, we suggested normal tapping followed by salvage since chances of survival were not good. But for many producers, storm breakage was so extensive that it would not have been cost effective to tap so selectively, and many opted not to tap at all in 1998. Much of the maple syrup produced in Maine, however, is derived from trees in northwestern Maine near the Canadian border, an area spared the most serious ice storm effects.

Ecological effects on the forest, both short and long term, are apt to be significant. The damage to the natural forest will undoubtedly have beneficial effects for certain species, while others may be negatively impacted. For example, woodpeckers and other cavity denizens may have nesting habitat improved for years, while species depending on mast from damaged tree crowns may find food in short supply for several years.

The urban forest suffered enormously as well. Not only were exotic species which are generally more susceptible to ice breakage represented liberally among most urban tree populations, but the broadly branching crown structure characteristic of well-spaced trees in landscape situations contributed to ice damage as well. In Augusta, ten percent of damaged trees were "take-downs," and the cost of repairing storm damage averaged $56 per tree.

Damage from the ice storm was particularly discouraging to the woodland owners who had most intensively managed their lands, thinning poorer trees from woodlots to favor those of good form and vigor. As the ice storm bent, snapped and broke those better quality residual trees, landowners found themselves left with understocked stands.

During the growing season most forest trees sprouted new growth to begin replacement of branches due to the ice storm. Some trees sprouted so profusely that they were dubbed "chia trees" by foresters. Other trees failed to sprout at all, but they were a minority. Sprouting was abundant in broken crowns but was often epicormic as well. Among the best sprouters were ash, willow, and red maple; among the poorest were poplar, beech, and white birch, though there were many exceptions. Some of the exotic larches surprised in their ability to resprout, sending many small shoots skyward along remaining portions of broken branches, especially on those trees which had also suffered snapped tops.

Trees which had bent to the ground for extended periods, especially birch but also smaller stems of other species, often never regained their upright form. We anticipate that trees with crowns remaining in the shaded understory will die, while many others which have partially straightened will always be "leaners" and will exhibit considerable "sweep" at harvest.

**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 1998 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.

**Needle Blight of White Pine (cause uncertain, but probably either fungal or weather related)** - Occasional white pine trees over large areas of southern and central Maine exhibited tipburned foliage during the summer of 1998, particularly in lower and mid-crown portions of trees. Typically, though not always, the uppermost portions of crowns were less affected. Not all trees were symptomatic, about one in ten was affected, but disease expression was commonly striking with foliage displaying a conspicuous brownish cast. An affected tree may have been sited immediately adjacent to a symptomless tree.

This phenomenon has occurred in Maine and elsewhere in the northeast and Canada for many years, and is easily confused with air contaminant injury. But we feel that this year's browning is due either to semimature-tissue needle blight (SNB), a physiogenic disease where partially hardened but still emerging young needles are especially susceptible to rapidly changing weather conditions, or to fungal infection. As young needles emerge in the spring from basal meristems the tissue toward needle tips is the oldest, while tissue near the needle sheath is youngest. Between is a zone of semimature tissue, and that is the region in which injury occurs if the SNB theory is correct. Tissue in this region collapses, tissue death extends distally toward the needle tips, then needle tips turn brown.

It is also possible that the damage noted early last summer was due to fungal infection, possibly by a species of *Pseudovirgella*. Positive diagnosis of *Pseudovirgella* infection is difficult during the growing season, because fruiting bodies are not apparent until fall or early winter, and even then they are not particularly conspicuous. By next spring, we may have a better handle on whether the symptoms noted were physiogenic or pathogenic.

This disease was of little consequence except to white pine Christmas tree growers, who found severely affected trees to be unmarketable. Even applied colorants often failed to effectively conceal browned needles. The possibility exists that trees may recover and become saleable another year without treatment.

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

**Ozone Damage to Forest Vegetation** - As part of the 1998 National Forest Health Monitoring Program in Maine, 27 plots on the NFHM grid were assessed for the presence of ozone symptoms on indicator plants. These indicator plants included milkweed, blackberry, black cherry, pin cherry, white ash, dogbane, and big leaf aster. Ozone sites are visited annually and the presence and severity of ozone injury recorded. In 1998, seven of the twenty-seven sites visited were found to have some level of ozone injury (Fig. 19). Injury was noted in the towns of Andover, Bowerbank, Chelsea, Embden, Medford, Parkman and Windham, and was light on most sites.

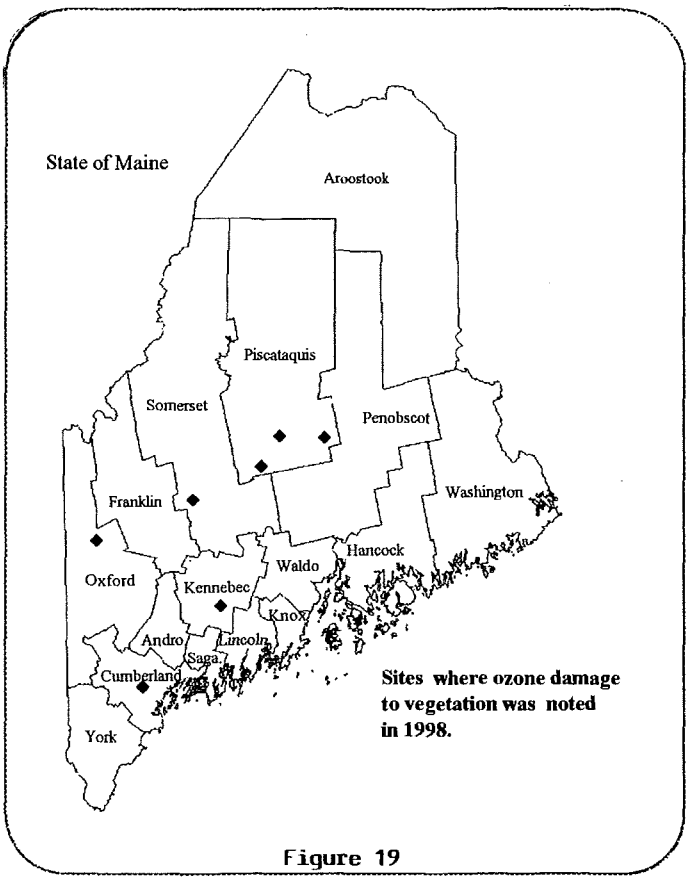


Figure 19

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

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

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

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

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

We had no calls regarding this disease in 1998, but observed the disease frequently on our travels, especially on jack pine in east coastal Maine.

**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.

**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 four years old and while no trends are yet apparent, there is also no indication that porcupine populations are declining. In 1995, 99 dead porcupines were counted, in 1996 the total was 93, in 1997 the total was 123 and in 1998, 109 porcupines were counted.

**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.

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.

**Root Rot of Balsam and Fraser Fir (caused by an unidentified fungus (perhaps *Phytophthora*) attacking trees planted off site)** - We received more calls than usual in 1998 regarding balsam and fraser fir doing poorly in wet areas. Typically, affected trees are at first characterized by slow growth and yellowish foliage, then exhibit mortality in subsequent years. But 1998, with its exceptionally wet spring, seemed to provide waterlogged soil conditions which were sufficient to cause trees to collapse and die in just one year.

Most established fir growers are aware that fraser fir must be planted on well-drained sites. But even balsam fir is susceptible to root rots on poorly drained sites. Early evidence indicates that Canaan fir is more tolerant of wet soils than either fraser or balsam fir, and for some growers may be worth a try on such marginal sites.

**Salt Damage (caused by movement of deicing salts from road surfaces to susceptible plant species)** - Symptoms of salt damage to roadside vegetation were less conspicuous than usual during the 1997-1998 winter season, perhaps a bit more noticeable than the previous winter season, but no where nearly as severe as the winter of 1995-1996 when salt damage made front page headlines. Salt damage to white pine was apparent at certain points on Interstate 95, especially along southbound sections just north of Waterville, and damage to white pine and hemlock was conspicuous along the airline (Rt. 9) and certain other well-travelled roads in Washington County. Damage was also quite noticeable along Route 27 in the Kingfield area. Elsewhere symptoms are generally trace to moderate and quite variable, despite the fact that considerable quantities of salt were applied early in the season and again during the Ice Storm of '98.

Symptoms faded as new growth emerged in May and June which masked the old, browned foliage still clinging to twigs at that time. Damage at the levels noted pose little long term threat to tree health, although browned needles on white pine were cast earlier in the season than normal.

**Scleroderris Canker (caused by *Ascocalyx abietina*)** - No new infestations of this disease were located during 1998. This disease remains static at very low levels.

**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.

For more information on diagnosis and control of this and other conifer plantation problems, you may wish to request our Circular No. 12, Integrated Crop Management Schedule for Softwood Timber Plantations and Conifer Seed Orchards.

**Site Disturbance** - Many calls were received in 1998 involving trees which had been stressed or killed as the result of various types of site disturbance. Sometimes the causes were of recent origin, such as sudden changes in drainage patterns; in other instances the causes were chronic and cumulative, such as soil compaction due to years of repeated foot and vehicle traffic. Most common last year were calls regarding problems caused by fill over tree roots. We received many such calls from the mid-coast area in particular, including Newagen, Harpswell, and Bath, among other locales statewide.

**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 Damage** - We received only a few reports of frost injury to gardens and forest plantations in 1998. There was a bit of damage to balsam fir plantations in south and east coastal sections of Maine and to white spruce in southern Aroostook County in late May, but overall damage was light.

**Spruce Decline** - The condition of many of Maine's coastal spruce stands continued a gradual decline in 1998. The most immediate cause of this spruce stand deterioration continues to be spruce beetle. Many of these coastal, turn-of-the-century, spruce stands are now badly overmature and are growing at an extremely slow rate. In many stands tree crowns exhibit signs of declining vigor such as a sharply reduced foliage complement, numerous dead or dying branches, and poor foliage color. In addition to this generally poor vigor, many stands of mature coastal spruce are increasingly becoming the victims of several biotic and abiotic stress factors. Major abiotic factors are recent blowdown events and **drought**. Several severe wind events occurred in 1996 and 1995 was extremely dry during most of the year. A relatively recent outbreak of **hemlock looper**, and stress from **dwarf mistletoe**, along with spruce beetle, add to the problem. From 1990 to 1992 hemlock looper killed spruce trees in some stands and significantly stressed other spruces in Hancock and Washington Counties. Dwarf mistletoe is currently killing some trees and stressing others on Hancock County islands. A **spruce beetle** outbreak that intensified after a significant early winter blowdown in 1991 remains active and is killing a high percentage of the large white spruce in some stands.

Most of the factors killing or causing stress to mature coastal spruce have become much more significant because most stands have had little or no stand management practices applied throughout their existence. Trees are old, tightly spaced, and are generally growing on poor sites. The age and maturity of many stands is causing a steady deterioration that is only now becoming apparent to some owners, while other owners have seen their lands affected by catastrophic events such as blowdowns or a severe attack by spruce beetle.

The development of specific control strategies for most agents involved in this **spruce decline** is very difficult. The only practical approach to maintenance of long term stand vigor in these stands is ongoing stand management. Removal of large, old trees will be essential in many stands. Fortunately most areas already contain younger vigorous trees and advanced regeneration will lessen visual impacts as these larger trees are removed.

**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 1998.

**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 1998 a total of 4,272 acres of high quality pine timber were scouted for *Ribes* plants in Androscoggin, Cumberland, Oxford and York counties. A total of 7,846 *Ribes* were destroyed. Scouting was conducted in the towns of Fryeburg, Gorham, Lisbon, and Wells. Work is presently scheduled for 1999 in Dayton, Fryeburg, Gorham, Lyman and Wells. In addition, we plan to map Auburn for work in the near future.

Triclopyr (Garlon 4) remains our herbicide of choice, mixed at the rate of 6 oz./gallon of water. In 1998 a total of 73.2 ounces of Garlon 4 was mixed with water to provide a total finished volume of 12.2 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.

This disease remains static at moderate levels.

Recently there has been intense interest by the commercial *Ribes* industry to relax quarantine efforts in many states to permit the culture of currants and gooseberries, especially for juice. The cranberry juice industry seems particularly interested in expanding its product base to include cranberry-currant juice. And many currant growers are eager to expand their operations in the northeastern United States, where conditions for *Ribes* culture are ideal.

This prospect is anathema to quarantine regulators in many state governments, who have spent careers attempting to eradicate and prohibit the sale of currants and gooseberries in white pine growing areas. *Ribes* advocates are convinced that *Ribes* and pine can co-exist as profitable crops, especially now that resistant cultivars are available. Pine growing interests are concerned that the resistance may be incomplete or may not carry into future generations of *Ribes* progeny distributed into the wild by birds or other vectors. Governments are concerned that the legal introduction of resistant varieties and the prohibition of susceptible varieties would be a nightmare to regulate.

The controversy is raging on the internet. You may follow it at:

www.cce.cornell.edu/columbia/smckay/wpbr.html.

**White Pine Decline (triggered by the summer drought of 1995)** - White pines in many forest stands in southwestern Maine continue to succumb to complications of the drought that area experienced during the summer of 1995. While the drought was the "trigger" which started many trees to decline, a variety of secondary factors have continued to extend the mortality to the present.

Symptoms of this problem are somewhat variable, but typically scattered co-dominant and understory trees develop a complete browning of the crown. Single, dominant pines with large crowns are less frequently affected. In early stages of decline, affected trees often exhibit thinning crowns, shortened needles, and an off-color, chlorotic appearance. Many affected trees exhibit resin flowing from multiple areas of the upper stem, but this symptom is not apparent on all trees. There are patches of dead phloem tissue associated with resin flow, but often no insect activity nor white pine blister infection is apparent. In some cases cankers enlarge and have blue stain associated with them. *Septobasidium* canker is often abundant in affected stands.

Despite the widespread nature of the 1995 drought, white pine decline is not noted in all stands. It is worse on gravelly, well-drained soils, especially along the Little Ossippe River in Acton, Limerick, Limington and Waterboro, but affected trees can be found as far north as Pittston and Skowhegan, even on heavier soils.

We anticipate mortality will subside over the next couple of years, and remaining trees will respond to the reduced competition with an increased growth rate.

**Wind Damage** - Powerful thunderstorms cut a path of devastation through portions of Cumberland County in the early evening of August 24. According to Dennis Brennan, our District Forester headquartered in Alfred, the storm entered Maine in Parsonsfield and caused serious destruction of forest trees and landscapes along a line running through Limerick, Limington, Standish, Hollis, Buxton, Gorham and Westbrook, then exited the state through Portland.

In Gorham, trees were flattened in one to four acre patches. While in most areas the storm only lasted for about 20 minutes, destruction was extreme. And for many residents, damage vastly exceeded anything they had seen resulting from the ice storm of 1998.

**Winter Injury** - Except for the ice storm, effects on trees and shrubs were generally mild during the winter of 1997-1998. Forsythia over much of southern Maine flowered right to the tops of shrubs indicating low flower bud mortality. Tender ornamental evergreens such as yews, rhododendrons and dwarf Alberta spruce showed much less browning than usual, although we did receive reports of significant browning of black spruce in forest plantations in portions of northwestern Maine.

**Yellow Witches'-broom of Balsam Fir (caused by *Melampsora caryophyllacearum*)** - These perennial, bushy yellowish growths on branches of fir trees have been unusually abundant in Christmas tree plantations throughout the state in recent years. Resulting largely from infections which occurred in 1995, and to a lesser extent in 1996, these growths have now attained significant size, up to a foot or more in diameter. Many are now sufficiently large to leave significant "holes" in the crowns of trees when removed, as they generally are prior to sale of Christmas trees. If growths are not removed a hole is of course not created, but the remaining brushy growths are devoid of needles which were cast earlier in the season, and not at all attractive.

This disease is caused by a fungus which uses chickweed as an alternate host plant. Elimination of the alternate host plant through use of selective herbicides in and around plantations may reduce infection, but most fir Christmas tree growers are content to simply prune brooms from trees while those growths are still relatively small.

## *Forestry Related Quarantines in Maine*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

This quarantine was adopted to attempt to prevent the introduction of the Hemlock Woolly Adelgid (*Adelges tsuga* 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.

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Additional information is available in the free fold-out leaflet:

Ouellette, D.E. (Compiler). 1997 (April). Regulations and Guidelines for Shipping Christmas Trees, Wreaths and Decorative Plant Materials - Twigs, Nuts & Fruits Used in Wreath Making. A public information guide from the Plant Industry Div., Me. Dept. of Agr. and the MFS, I&DM Division. A pocket fold-out.

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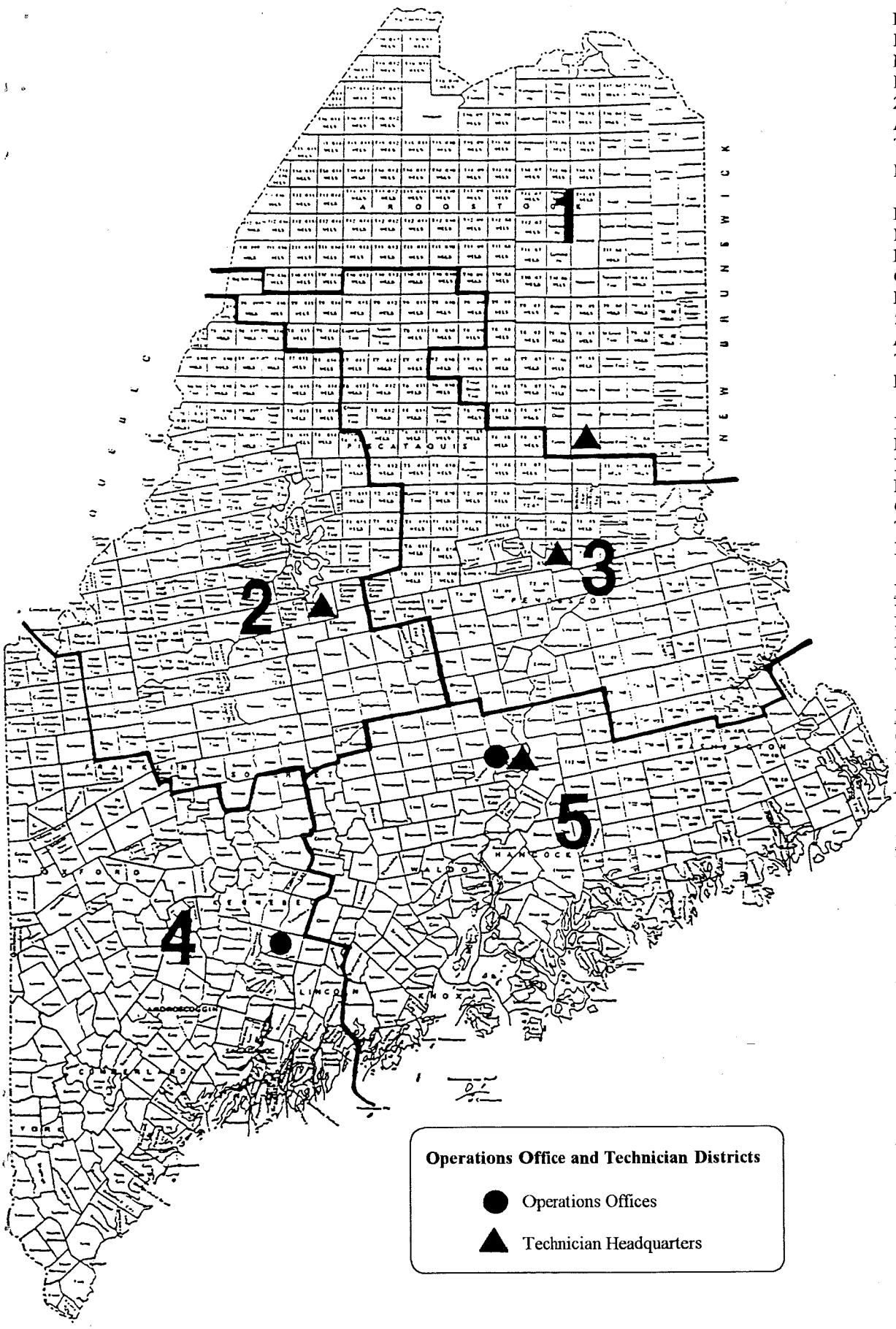


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