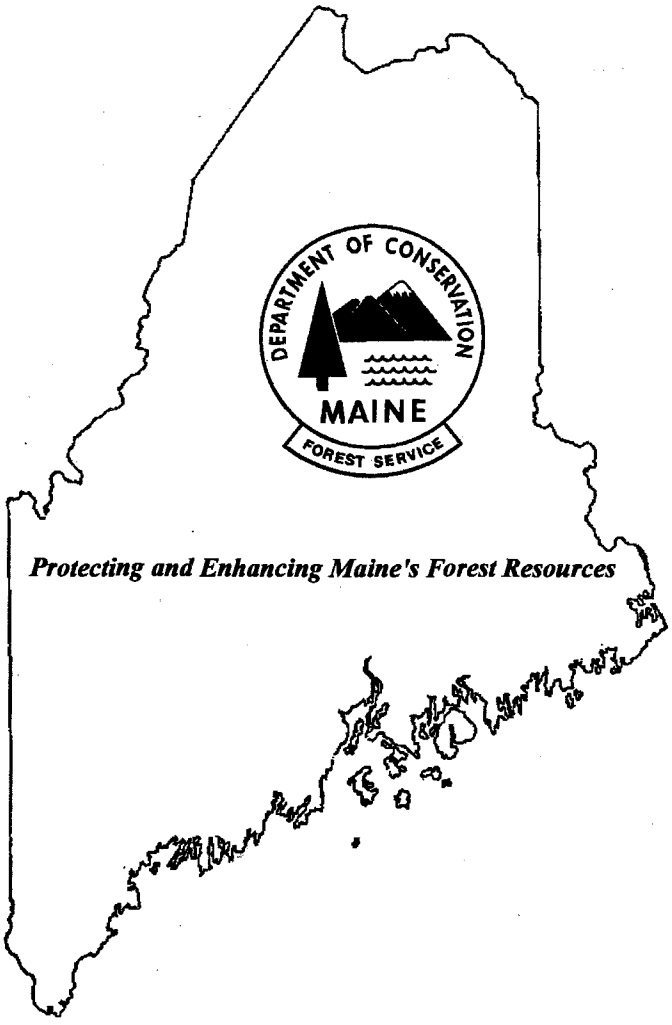
Forest & Shade Tree Insect & Disease Conditions for Maine

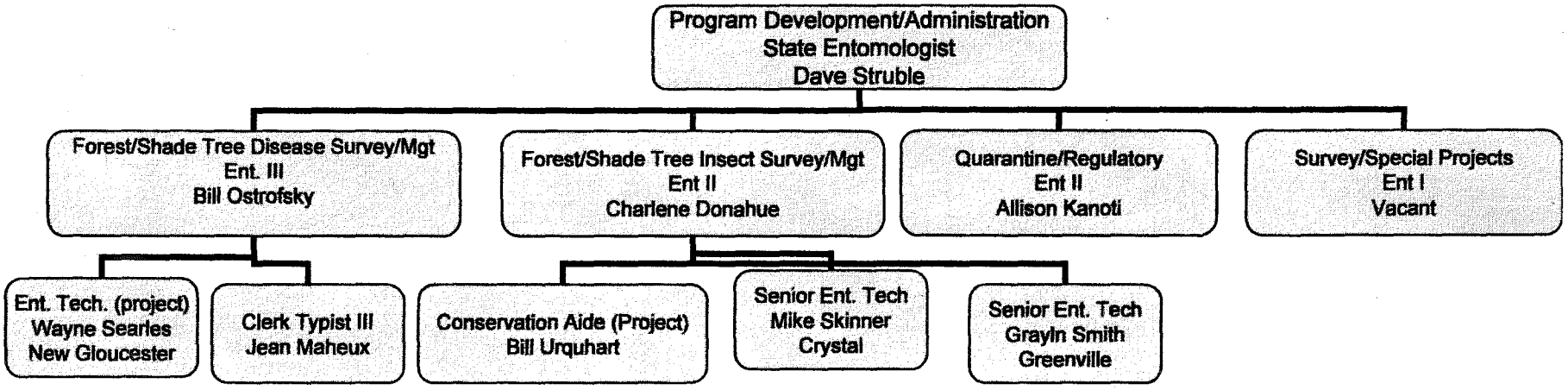
A Summary of the 2006 Situation



Forest Health & Monitoring Division
Summary Report No. 18
March 2007

Maine Forest Service
MAINE DEPARTMENT CONSERVATION
Augusta, Maine

Forest Health & Monitoring Division
Insect & Disease Management Unit



Advice and Technical Assistance

http://www.maine.gov/doc/mfs/idmhome.htm

The Maine Forest Service/Forest Health and Monitoring (FH&M) Division maintains a diagnostic laboratory staffed with forest entomologists and a plant pathologist. This expertise is available to provide practical information on a wide variety of forest and shade tree problems. Our technical reference library and insect collection enables the staff to accurately identify most causal agents. A stock of information sheets and brochures is available on many of the more common insect and disease problems.

Please contact the Insect and Disease Laboratory in Augusta for information or assistance. Should it be necessary to send or bring in material for diagnosis, this should be accompanied by as much information as possible including: host plant, type of damage (i.e., canker, defoliation, wilting, wood borer, etc.), date, location, site description, and information desired, along with your name, mailing address and day-time telephone number. (We encourage you to utilize the appropriate copy of our report blanks for this purpose). Samples mailed to the laboratory should be accompanied by all necessary information and insects should be in crush-proof containers (such as mailing boxes or tubes). Padded mailing envelopes may be used in the case of disease specimens. Large insects should be limited to six or less and provided with adequate host material for food. Disease samples should be enclosed in plastic bags. Mail containers for prompt shipment to ensure they will arrive at the Augusta laboratory on a weekday.

We can also provide you with a variety of useful publications on topics related to forest insects and diseases. Let us know your interest and we will try to supply you with relevant information.

Field staff can be contacted directly for homeowner assistance in their area of the state.

Insect & Disease Laboratory	**State Entomologist**	**Field Staff**
Charlene Donahue, Forest Entomologist Allison Kanoti, Forest Entomologist Bill Ostrofsky, Forest Pathologist 48 Hospital Street Augusta, Maine 04330-6514 Phone (207) 287-2431 Fax (207) 287-2432 Hours: M-F 7:30 a.m. - 4:30 p.m. (call before as we are often in the field)	David Struble 22 State House Station Augusta, Maine 04333-0022 Phone: (207) 287-2791 Fax: (207) 287-8422	Mike Skinner RR 1, Box 340 Island Falls, Maine 04747 Phone: 463-2328 Radio Call #F-181 Grayln Smith Box 128 Greenville, Maine 04441 Phone: 695-2452 Radio Call #F-182

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Acknowledgements

This summary has been compiled by Charlene Donahue, Allison Kanoti, and Bill Ostrofsky, but the information on the variety of projects and pests represents input generated by the entire staff (both current and retired) of the Forest Health and Monitoring Division's Insect & Disease Management Work Unit. Although individual Lab and Field staff had lead responsibility for certain projects and activities, almost everything reported represents the contribution of many - and not just from within IDM.

Much of information within this report is generated from cooperative projects supported by funds and staff from the USDA-Forest Service, USDA-APHIS, Maine Department of Agriculture, University of Maine at Orono, and other state agencies; and from cooperators in other New England States and Maritime Provinces of Canada. Administrative and field staff in the Forest Inventory Work Unit of the Forest Health & Monitoring Division as well as the overall Maine Forest Service provide critical input and support that facilitates and augments our work.

Most of all, our thanks go to you our clients; landowners and managers, arborists, Christmas tree growers, foresters, landscapers, nurserymen, etc. for your support in keeping us apprised of what you see on your property and in the course of your work.

FOREST & SHADE TREE INSECT & DISEASE CONDITIONS

FOR MAINE - A SUMMARY OF THE 2006 SITUATION

State Entomologist's Comments

As has traditionally been the case, I use this opportunity to reflect and comment on activities and challenges of the division since we last issued this "annual summary" report. And since there has been a five-year hiatus in this annual summary, there is much to reflect upon.

The mission of the Forest Health & Monitoring Division, "within the limits of funds available", continues to be to monitor and maintain the overall health and sustainability of Maine's forest, shade and ornamental tree resources, and to protect them from significant insect and disease damage. Beyond the specific mission, the FHM Division cooperates with other state, local, and federal collaborators to support the overall mission of the Maine Forest Service to protect and enhance the forest resources of Maine for the benefit of present and future generations.

Although we have maintained essential services across the period, providing forest insect and disease survey and management activities to Maine homeowners, landowners and businesses, we were not able to maintain the historic level of reporting on those activities. Selected pieces of this information (and analyses generated from it) have been included in a number of other MFS reports but, as one who regularly uses earlier iterations of this summary report of Insect & Disease Conditions to jog my memory, I am painfully aware of the void in the record since 2001. Moreover, I have heard from clientele who suggested that they felt a similar void; and asked that, in addition to the periodic conditions reports we generate during the growing season, we also reinstitute the Annual Summary Report.

While this report represents our response to that request from clientele, it is not an exhaustive summary of Division activities and accomplishments. If you have questions about some specific situation or pest, you should feel free to contact us. In most cases we can locate or generate specific information to address the query.

Regarding our significant accomplishments (beyond using our scarce resources to maintain critical monitoring and surveillance across the period), we:

- Resolved the dilemma regarding overly-restrictive federal regulations associated with Pine Shoot Beetle; removing a serious constraint to the economic viability of Maine's pine-processing industry.
- Instituted transition of Browntail Moth management from state-overseen municipal projects to local option. While the MFS remains committed to developing pest management tools, it is our position that, whenever possible, the process of making decisions and raising necessary resources for pest control projects is most appropriately dealt with on a local level.
- Cooperated with the Maine Bureau of Health to evaluate threat posed by two mosquito-borne diseases (West Nile Virus; Eastern Equine Encephalitis) that threaten Maine. This effort led to creation of a medical entomologist position within BOH, and a spin-off of our direct monitoring support responsibilities for health related threats.
- Cooperated with the Maine Dept. of Agriculture to conduct surveys and institute remedial eradication actions in response to nursery introductions of Sudden Oak Death and Hemlock Woolly Adelgid.
- Detected established hemlock woolly adelgid populations into extreme southern Maine sufficiently early in the infestation to allow effective management options. The former Exclusion and Eradication approach to deal with the HWA threat has been expanded to also incorporate Containment and Mitigation functions to deal with the established low-level populations; and is providing a successful model of the Slow-the-Spread program.
-

That these listed situations deal with non native pests is not a coincidence. For years we have warned that exotic pests were an emerging threat. It provides cold comfort to have been proven right. Moreover, in addition to the situations we have dealt with, there are other foreign pests that have not yet reached Maine that pose problems at least as serious.

- Emerald Ash Borer has killed millions of ash trees in the Midwest. To date there are no effective treatments, it is not yet contained, and populations are spreading east. When this pest gets to Maine it will be as devastating as Dutch Elm Disease was.

- Asian Longhorn Beetle populations continue in and around New York City. Although tens of millions of dollars have been spent on this pest, and there is reason to hope, it is not yet under control.
- Brown Spruce Longhorn Beetle is killing spruce trees in Nova Scotia. After years of apparent containment to a small area around Halifax, this exotic pest now appears to be spreading.
- European Wood Wasp, which has been a very serious pest of hard pines elsewhere in the world, was recently discovered in dying pines in New York. It has since been found in Ontario and Pennsylvania. It is unclear how serious a problem this pest will be, but at the very least it threatens to disrupt pine commerce across the region.
-

While the challenges posed by foreign (and native) pests appears to be growing, the same can not be said of the IDM Work Unit. Since the last iteration of this report, five of the six professional staff have retired. In all, 170 years of experience and institutional memory has departed. Two of those positions were eliminated to address budgetary shortfalls. It is sobering to realize that current staffing represents only a quarter of Division strength back in 1973 - *before* the staffing increases to address the spruce budworm outbreak.

That said, the situation is not quite so depressing as these statistics would suggest: our retirees continue to answer my phone calls and queries, and demonstrate remarkable forbearance and grace in the face of my impositions into their retirement. We have also been successful in attracting excellent replacements for those positions we have been authorized to refill.. Moreover, you our cliente/cooperators have continued to be a critical resource. Although we try to acknowledge you, the few words written here do not begin to convey the extent of our reliance or express our appreciation for your contribution. 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.

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

PERSONNEL NOTES

In the intervening period since our last summary report (September 2002) there have been a number of changes in staffing in the Insect & Disease Management Unit of the FH&M Division. As a chronology:

Marlene Athearn, who was clerk-typist/receptionist at the Entomology Lab retired in 2002. She was replaced by **Jean Maheux** who had worked for the IDM Division in the main office for many years before transferring to the State Forester's Office in 1989, and who took this opportunity to rejoin the Division.

Dick Dearborn was hired in 1966 to fill the gap anticipated when Doc Brower retired. Dick left a similar expertise gap with his departure in June 2003. Beyond serving as Maine's forest insect survey/taxonomic expert for all those years, Dick was also widely recognized and frequently consulted on a broad variety of entomologically related issues by associates throughout the region on both sides of the international border. Our taxonomic capacity was challenged after his departure and associated position loss.

However, one of Dick's legacies was to assemble and energize a critical mass of professional and amateur entomologists to create the Maine Entomological Society. The M.E.S and its members, as accessible sources of taxonomic expertise and survey support, have been critical to our ability to continue to provide service to our clientele in the face of downsizing and retirements. And Dick has remained an active cooperator (of whom we have availed ourselves frequently).

His departure and associated position loss, IDM Unit has retrenched staff positioning; the remaining entomologists and pathologist are stationed at the Augusta Lab, which serves as the nexus from which we address statewide pest survey and management activities.

Dick Bradbury, most recently famous for being the Maine Forest Service's browntail moth management expert, retired in May 2005 after 30+ years of service. Dick's pest management expertise and flair for effective communication across a range of publics is sorely missed. His knowledge of pesticides and their application is another loss to the FH&M. Dick also was one of the prime "go to" people on Christmas tree pest problems with hands on knowledge of the subject.

Although we lost Dick, we were able to retain the position count, using it to promote **Charlene Donahue**; thereby maintaining our entomological survey capacity and laying groundwork for rebuilding pest management service to Maine's landowners and municipalities. Charlene was originally hired as a federally funded Project Biology Aide in 1992, and more recently has been responsible for surveys for exotic pests. Charlene has expanded her taxonomic expertise to meet the needs of the Division. With this promotion she assumes responsibility for the Division's general and enhanced forest insect survey.

Clark Granger who, after retiring in September 2001, came back to work as staff pathologist for an additional 4+ years, *really* retired in April of 2006. Clark's departure left a large hole in our expertise but we were fortunate to be able to hire Dr. **Bill Ostrofsky** to fill the position.

Bill comes to the Division with 27 years of forest pest management and public outreach experience. For the past 24 years he has been at the University of Maine. There he served in both the Cooperative Forestry Research Unit and the Professional Development Office where he was responsible for dealing with a broad range of forest pathology issues. Many of our clientele have met Bill previously, either through University initiatives or on one of several UMO/IDM Cooperative forest disease management projects.

Don Ouellette retired August 2006 after 37 years with the Division. Don started with the Division in 1968 as Laboratory Biologist. Through the years he had direct involvement on most of the various Division projects, either in the field or cleaning up loose ends thereafter. In recent years Don was the linchpin in the Division's oversight and management of forestry quarantine efforts, dealing with both the federal government and the impacted landowners, shippers, and mills. Anyone who dealt shipping permits and/or compliance agreements for gypsy moth, European larch canker or pine shoot beetle in the recent past recognizes the level of effort that Don put into assuring

that the system worked to manage exotic pest threats while minimizing constraint of industry. Most recently Don also headed up the Division's efforts to manage hemlock woolly adelgid. Don's position was successfully retained and has been filled by **Allison Kanoti.**

Allison was originally hired by the Division in 2001 as a forest survey technician in the Forest Inventory Unit before downsizing in that Unit prompted her to return to the University of Maine to attain a MS in Entomology. Her thesis work, analyzing the balsam woolly adelgid situation in eastern Maine, is proving very germane - both for balsam woolly adelgid Downeast and for hemlock woolly adelgid in southern Maine. Allison started as an Entomologist in July and spent six weeks working with Don, before assuming responsibility for both HWA management and oversight of the forestry quarantines.

Henry Trial was originally hired in 1973 as Regional Entomologist for the Eastern Region, headquartered at Old Town. Thereafter he served as the head of the Maine Forest Service's Spruce Budworm Survey and Assessment Unit until that function was reabsorbed by the Division in 1987, whereupon he became responsible for oversight of IDM field operations. Henry retired in December 2003. With his departure and associated position loss, the IDM Unit has retrenched staff positioning; the remaining entomologists and pathologist are stationed at the Augusta Lab, which serves as the nexus from which we address statewide pest survey and management activities

Senior Entomology Technicians **Grayln Smith** and **Mike Skinner** remain field assigned (in Greenville and Crystal, respectively). Although they conduct field work throughout the state, they provide a local presence for core survey and public technical assistance in western and northern Maine.

The Division has been successful in attracting federal project funding which has allowed us to focus Project Seasonal Entomology Technician **Wayne Searles** on hemlock woolly adelgid survey (and other pests) in Southern Maine, and Project Seasonal Conservation Aide **Bill Urquhart** on field and lab support associated with the various exotic pest surveys.

Finally, we are currently seeking permission to fill the remaining vacant entomologist position and 2 project intern positions.

Softwood Insect Pests

Balsam gall midge (*Paradiplosis tumifex*) -This pest has caused very significant damage to the Christmas tree and wreath industries of Maine in the past, but currently population levels are very low throughout Maine. No control projects were necessary in 2006 and no reports of damage in commercial Christmas tree farms or in wild balsam stands used in the wreath industry were received. Expectations that population levels would increase in 2006 did not materialize.

Balsam shoot boring sawfly (*Pleroneura brunneicornis*) - No survey was conducted on this insect in 2006 and there were no reports of significant damage in Christmas tree plantations or in native stands.

Balsam woolly adelgid (*Adelges piceae*) - Balsam woolly adelgid populations continued at low levels in 2006. While mortality from past years is striking, the consistent rainfall of 2004 through 2006 coupled with low population levels of the adelgid allowed a number of the light to moderately damaged trees to recover. Trunk phase has been reported on scattered trees in northern reaches of the adelgid's distribution, perhaps related to the mild winter and spring temperatures. Mortality of heavily damaged fir continues to occur but it becomes less obvious as old stands are salvaged or fall to the ground. Patches, two to ten acres in size, of dead fir will remain a common sight in eastern Maine for several more years. Fir grown for Christmas production should be watched closely for signs of this pest.

Relatively mild winters (Sorry, even the cold snap this past February is still relatively mild as far as the insects are concerned) and a heavy cone crop in 2006 may lead to an upsurge in the adelgid population over the next few years. We will continue to monitor the situation.

Bark beetles – See Appendix 5.

Eastern larch beetle (*Dendroctonus simplex*) - Pockets of dead and dying larch infested with this species have been common since the mid 1970's and continue to be a common sight throughout the range of larch in Maine. Stands of larch in southern and central portions (including Downeast) of the state exhibit the highest mortality rates. Most tree mortality is in association with other stress factors, particularly extremes in water availability.

Hemlock borer (*Melanophila fulvoguttata*) - Hemlock borer is an insect that finishes off hemlock trees stressed by drought, site disturbance, hemlock looper or other factors. We frequently get calls with people asking why the hemlock(s) on their property died; although there are obvious borer signs, the underlying problems are what really killed the tree. That being said, once there is a large beetle population in a tree and the tree dies, the beetles will go looking for another tree to infest. So carefully - very carefully - remove the tree and dispose of the wood before the beetles emerge in the spring and move to a neighboring tree. Try to avoid damaging neighboring hemlocks, including driving over their roots as they do not like to be disturbed and this will set them up for infestation by the hemlock borers.

Hemlock looper, fall-flying, **(*Lambdina fiscellaria*)** - No significant hemlock looper populations were found in 2006. However, small pockets of defoliation were found in several Kennebec and Cumberland County townships. Loopers were also found feeding on oak and maple in the areas infested by the saddled prominent complex (Oxford, Franklin and Cumberland Counties). There had been no reports of defoliation by this insect since 2002. Low catches of adults in traps and no reports of large flights in the fall lead us to believe populations will remain low in 2007.

Hemlock woolly adelgid (*Adelges tsugae*) - Hemlock woolly adelgid was first detected in native hemlocks in Maine in 2003 and currently occurs in light infestations scattered over approximately 6,500 acres in five towns in the southernmost tip of the state (Kittery, Wells, York, Eliot and South Berwick). Perhaps due to the mild winter and spring of 2005-2006, hemlock woolly adelgid populations increased within the previously infested area, and new spot infestations were found scattered in an abutting area of 500 acres in South Berwick and York. Winter temperatures in 2006-2007 have not been adequately cold to significantly reduce overwintering adelgid populations. Dense populations of adelgid will probably continue to be found in known infestations and new spot infestations will be probably turn up in 2007.

Gerrish Island, where the adelgid was first detected in native hemlocks, has light to moderate populations throughout its hemlock stands. A series of predator releases have been made on Gerrish Island. These include: an initial release of 7,500 *Sasajiscymnus tsugae* in 2004 to establish this predator in a forested part of the island; an additional release of 10,000 *S. tsugae* in the spring of 2005; and in late October of 2006 a release of 300 *Laricobius nigrinus*. Beating samples for *S. tsugae* in 2005 and 2006 yielded larvae and adults.

The Maine Forest Service is carrying out an integrated slow-the-spread management program to reduce the spread and impact of established adelgid populations. One tool the Maine Forest Service is using to slow the spread is chemical control on infested native hemlocks in areas where the use pattern by the landowner is deemed to present a high risk of artificial spread of hemlock woolly adelgid. In October 2004, native hemlocks on nine sites in Kittery, York and Wells were sprayed with Talstar plus oil. In October 2005, three additional sites in Eliot, York and Kittery were similarly treated. Treated sites were monitored the year after treatment and all showed excellent control in the first year. Site visits in 2006 revealed that some trees treated in 2004 have been reinfested. Additional treatments were implemented in the fall of 2006 on five sites in Kittery, York and South Berwick. Nursery stock is an important carrier of the adelgid and can be responsible for accelerated spread of this insect. The Maine Forest Service continues to respond to reports of hemlock woolly adelgid on planted nursery stock outside the infested towns. As a result, in May 2006 one planted tree in Southport was treated and removed.

A second important tool in reducing long distance spread of hemlock woolly adelgid is regulation of the movement of potentially infested material. A quarantine addressing the movement of hemlock products from infested areas outside of the State has been in effect since 1988. The Maine Forest Service and Maine Department of Agriculture are working on developing a parallel quarantine for movement of potentially infested products within the State. This quarantine is expected to be in effect by the end of 2007.

Landowners should monitor their hemlock stands and shade trees for the presence of hemlock woolly adelgid. Suspected hemlock woolly adelgid specimens can be bagged in a Ziploc-style bag and mailed to the insect and disease lab (Allison Kanoti, Insect and Disease Lab, 48 Hospital Street, Augusta, ME 04330). Information that should be sent with samples includes: Contact Name, Address, Phone Number, E-mail and Tree Location (Latitude/Longitude coordinates and a map preferred).

Larch casebearer (*Coleophora laricella*) - Although larch casebearer seems to be a perennial problem in some areas of the State, it was not as pronounced this past year. Portions of central Maine, Hancock and Washington counties had patches of larch with a scorched appearance to the foliage in the early season.

Larch sawfly (*Pristophora erichsonii*) - The larch sawfly outbreak in the central and northern part of the State has subsided . Although, as with most pest species, there are places where it can still be found.

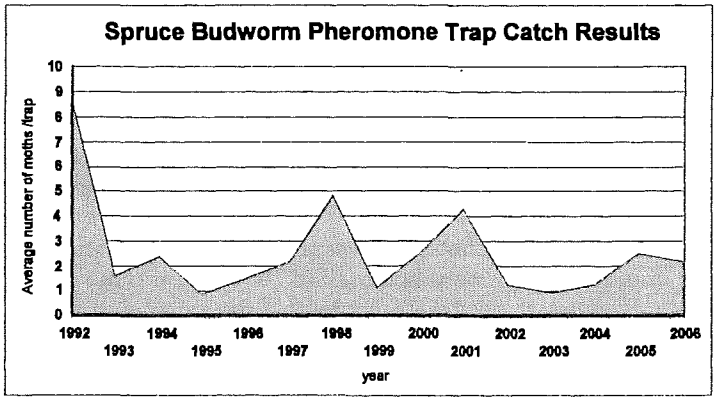
Pine shoot beetle (*Tomicus piniperda*) - The Maine Forest Service has trapped for pine shoot beetle, *Tomicus piniperda* in Maine since 1999. During trapping surveys performed between 2000 and 2003 pine shoot beetle was collected in Oxford and Franklin Counties (see table below). During 2006, trapping targeted specifically to PSB was conducted at 44 sites (22 pine processing sites, three log yards, and 19 plantations/natural stands with hard pines) in 11 counties. An additional 20 industrial locations were trapped for a suite of exotic wood borers and bark beetles, including pine shoot beetle. No adult pine shoot beetles were recovered from any of the traps in Maine in 2006 and none have been recovered in Maine since 2003.

Positive Pine Shoot Beetle Trap Catches 1999-2006				
Town (County)	**Adamstown (Oxford)**	**Rangeley (Franklin)**	**Carabasset Valley (Franklin)**	**Kingfield (Franklin)**
Year(s) captured (number)	2000 (1), 2001 (1), 2003 (1)	2001 (1), 2002 (3), 2003 (4)	2002 (1)	2002 (1)

The pine shoot beetle is a federally quarantined pest. To avoid having the entire state regulated, the Maine Forest Service implemented a parallel state quarantine in Oxford and Franklin counties in 2001. There is no indication that pine shoot beetle is a pest of any significance in Maine, nor that it is intensifying or expanding its presence in Maine. However, the regulatory constraints associated with the federal quarantine hamper the ability of Maine's pine industry to access a year-round supply of raw material to support their mills and landowners to sell their pine. To

address this situation, the area regulated for this exotic has been expanded to include all of Maine except Aroostook and Washington counties.

Spruce budworm (*Choristoneura fumiferana*) - Monitoring of low level spruce budworm populations continued in 2006. Traps were deployed at 64 locations throughout the northern part of the State. These traps were tended by Maine Forest Service, Irving Woodlands and Baxter State Park personnel. The population remains static at very low levels. The numbers of moths caught in pheromone traps this year were slightly up or down at individual locations but the average of 2.2 moths per trap was close to the 2005 level of 2.5 moths per trap. Moth catch numbers have been below 5 moths per trap since 1993. Light trap catches reflect this same low level population with catches of 1 to 3 moths in Ashland, Millinocket, T3 R11 and Topsfield. No larval activity or defoliation was observed during field surveys. The MFS will continue to monitor this serious pest.



White pine weevil (*Pissodes strobi*) - Stem deformities, resulting from the loss of the terminal leader, are very common on white pine and cause heavy economic losses to landowners annually. While this perennial problem continues to impact the growth of white pine as well as Colorado blue and Norway spruce in Maine, the situation appears static.

Hardwood Insect Pests

Ash defoliator (*Palpita magniferalis*) - Ash along the mid-coast has been impacted by a number of stressors over the past four years. One of these, a native pyralid moth, *P. magniferalis* (no common name) is a new problem. This insect has been reported in forest surveys for years and is relatively common. It has never been reported at damaging levels any where in North America until 2003 when severe defoliation was reported on Islesboro and Owlshead, Maine. In 2004 and 2005 *P. magniferalis* caused moderate to heavy defoliation on Islesboro with additional scattered reports of defoliation along the mid-coast of Maine. Islesboro and Owlshead had 1909 acres of heavy to moderate defoliation in 2005.

Defoliation from *P. magniferalis* was much reduced in 2006 as compared with the previous three years. Islesboro had less than 1000 acres light to moderate defoliation and there was only a trace amount of defoliation on the mainland in the mid-coast area.

See 2005 *Palpita magniferalis* report – Appendix 1.

Browntail moth (*Euproctis chrysorrhoea*) - The browntail moth (BTM) population in Maine continued to decline in 2006. Only 693 acres of defoliation was mapped in Topsham, Freeport and Brunswick this year. Late instar larvae again showed signs of disease and/or parasitism. Fewer properties were sprayed by homeowners and complaints have dropped off to a trickle.

The population that had spread from Kittery to Gouldsboro along the coast and inland as far as Lewiston and China has now collapsed back to a core area centered in the Brunswick area. Populations will continue to be monitored. Mike Skinner and Grayln Smith are working on the winter web survey right now - they have been surveying BTM populations for over 30 years! They are hard at it and so far have reported web numbers are still on a downward

trend in all locations. Most webs found to date are small and tend to be lower to the ground indicating a declining population.

Since the last summary report was written in 2001 there has been a dramatic change in the BTM population. The following is a brief summary of browntail moth activities by both the insects and people from 2002-05.

BTM Population

In 2002 the overall infested area was reduced in size from 2001 but population levels intensified in the Casco Bay region and expanded to inland sites in Cumberland, Pownal and Durham. Data from the annual winter survey indicated a continued reduction in total area infested by the BTM with very limited numbers of webs being located in Hancock or York counties. The BTM populations in the northern portions of Casco Bay showed some signs of a general decline in 2001 but rebounded and intensified from Portland to Phippsburg. Host trees refoliated before a plane became available for the annual defoliation aerial survey so no damage acreage figures were available.

The Casco Bay region northeast to the Penobscot River continued to support moderate to high population levels of BTM in 2003. Low winter temperatures slowed expansion to inland areas but coastal lands remained heavily infested. Webs collected to assess winter mortality showed that webs located five miles or more from the coast line exhibited 90% larval mortality while webs adjacent to the ocean had little if any winter losses.

The Casco Bay region northeast to the Penobscot River continued to support moderate to high population levels of BTM in 2004. Survey of overwintering webs in the fall of 2004 indicated the problem would continue. Webs collected to assess winter mortality showed that webs located five miles or more from the coast line exhibited 88% larval mortality while webs adjacent to the ocean had little if any winter losses.

The BTM population in Maine collapsed during the summer of 2005. There was a moderate to high population going into the spring, and larvae did emerge from overwintering webs and began feeding on new foliage. However, over the course of the cold, wet spring, the larvae failed to continue normal development. Many were found covered with fungal spores, most likely *Entomophaga aulicaie* (samples were sent off but no report has been returned to date.) Larval samples brought back to the lab had a high number of Diptera parasites in them as well.

Numerous properties in the Casco Bay area were treated with ground applications of pesticide for browntail before the collapse occurred, as effective treatment must be applied early in the life cycle.

BTM Control

Municipal aerial control projects against BTM covered a total of 2000 acres in 2002 using the insect growth regulator Dimilin. Projects were conducted by the towns of Falmouth, Cumberland, Yarmouth Freeport and Brunswick. A project was recommended for the Town of Harpswell but residents opposed the use of Dimilin and rejected the project at Town meeting.

Aerial control projects against BTM were not conducted by municipalities after 2002 due to mixed landowner acceptance of prior projects. Many lots were treated with ground-based applications using various pyrethroids in private projects.

At the request of the Lobstermen Association of Maine, the legislature asked the Board of Pesticide Control to research the effect of BTM control chemicals, in particular Dimilin, on lobsters and recommend spray restrictions. A law was enacted in 2005 to restrict spraying near coastal waters for one year (see Appendix 2.) That law is being considered for extension for another year which would keep it in effect through March of 2008.

Research

Researchers from the USDA-Forest Service and University of Massachusetts spent four years working with a baculovirus (*Euproctis chrysorrhoea* nucleopolyhedrovirus, EcNPV) as means of controlling BTM. The virus was grown in BTM larvae and then sprayed on infested trees during two growing seasons. Both efficacy of the virus and timing of application was tested. Two spring applications were made to see if early application, just after budbreak, or after leaf expansion was more effective. A fall application to winter webs was also tested. The results are promising with 70-88% BTM mortality in the treated areas. A paper on this work is expected out in 2007.

Unfortunately (or fortunately) the BTM population has diminished to a level where this line of research has been put on hold. When BTM resurges the virus will be taken out of the freezer and work resumed.

A mating disruptant in Exosect traps was first tested in 2001. A powder containing the female BTM pheromone is placed on the floor of a triangular, tent -type trap. The males are attracted to the scent, go into the trap, get covered with the powder and are then no longer attractive to the females who subsequently refuse to mate with them. This technique has been successfully used in Europe.

Trials of the BTM mating disruptant were run in 2001 and 2002 on approximately 100 acres in the Town of Freeport. Dispensers containing the pheromone were set out in June before the moths emerged. The trial was assessed by counting numbers of webs in late December after leaf drop. Analysis of the results showed no significant difference between treated and untreated areas in either year tested.

A limited test to determine moth activity at differing heights in the canopy was run at ten locations in Wolf Neck State Park. Two sticky traps baited with BTM pheromone were placed at each location with one trap 4.5 feet above the ground and one trap in the upper half of the tree crown. A total of 22 moths were caught in upper canopy traps while only one was taken from the low traps. This data may explain the limited efficacy of this technique in a trial in Maine last year. In the UK, this technique works well but their host species tend to be short whereas our hosts are predominantly large red oaks.

Birch skeletonizer (*Bucculatrix canadensisella*) - There was scattered defoliation from *Bucculatrix canadensisella* over much of the state but it was a minor part of a complex of many defoliation causal agents. The expected birch skeletonizer problem did not reappear in eastern Maine this year.

The birch skeletonizer has been up and down over the past four years. In 2003 there was heavy defoliation of birches resulting from feeding by the birch skeletonizer over most of northern and eastern Maine. A gross estimate of the scope of the damage was 750,000 acres of birch type affected in Franklin, Somerset, Piscataquis, Aroostook, Penobscot, Hancock and Washington counties. Then in 2004, populations had returned to endemic levels throughout the state. The next year, 2005, birch across a wide swath of eastern Maine were heavily impacted by this late season defoliator. Moderate to severe defoliation was spotty, ranging from individual trees intermingled in mixed hardwood types to 1000 acre patches when stands were predominantly birch.

So, although the birch skeletonizer usually stays at high levels for 2-3 years at a time, right now we are in a pattern of the population being high one year and low the next. This is a late season defoliator with damage showing up in August and September. It therefore does not generally have an impact on tree growth but does affect fall foliage for "leaf peepers".

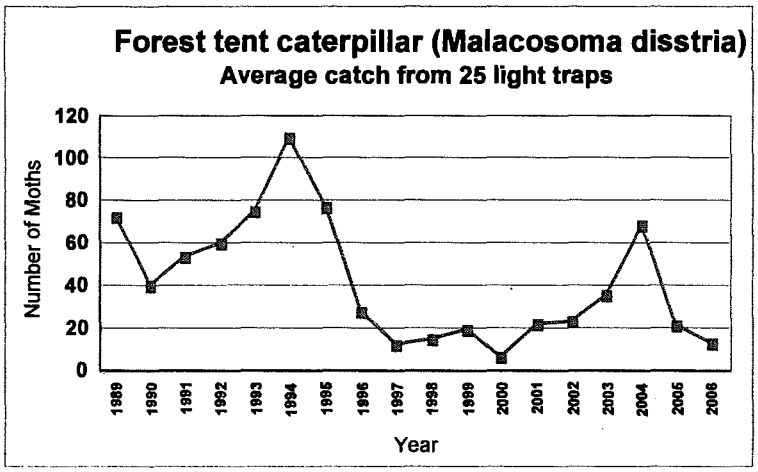
Eastern tent caterpillar (*Malacosoma americanum*) - Eastern tent caterpillar was noticeably absent from the landscape in 2006. This may be due in part to the cool wet spring in 2005 that allowed fungal pathogens to take hold in the populations of early season defoliators reducing the numbers for 2006.

Fall cankerworm (*Alsophila pometaria*) -Male moths of the fall cankerworm were common in the woods across the State this fall although the only reported defoliation was in Wells. Light, spotty defoliation was also detected in other coastal towns in York County. We may see increased defoliation from the fall cankerworm larvae early in the 2007 season, as nearby states saw increased activity in 2006. At the same time we may have winter moth moving into the State from the south. Winter moth has similar habits to the fall cankerworm. We will continue to monitor the developing situation with both these pests.

Fall webworm (*Hyphantria cunea*) - Fall webworm were at high levels in 2006 with many trees festooned with webs from top to bottom. Webs were found throughout the State and were in noticeable numbers further north than is usual. The extent of the webbing elicited many calls and news stories in late summer. This insect is an esthetic problem rather then a tree health issue, although repeated heavy defoliation may cause branch dieback.

Forest tent caterpillar (*Malacosoma disstria*) - Populations of forest tent caterpillars in the State remained at endemic levels with no defoliation from the insect seen in 2006. Light trap catches in 2004 had shown a significant

rise in forest tent moths caught and defoliation was subsequently expected to increase in 2005, as it has elsewhere in the Northeast. However, this situation did not materialize in Maine. Those late instar larvae encountered in 2005 had classic disease symptoms - most likely exacerbated by the cold, wet spring that year. The fungal pathogens that took hold in the population in 2005 continued to affect the forest tent caterpillars in 2006.



Gypsy moth (*Lymantria dispar*) - No defoliation of hardwoods resulting from gypsy moth larval feeding was recorded in 2006. It is thought that fungal disease (*Entomophaga maimaiga*), viral disease and parasites continued to keep the gypsy moth population at low levels throughout the infested area in southern and central Maine. Male moth catches in pheromone traps were up, but not strikingly, in the infested area. The 2006 fall egg mass survey indicated that the population will remain at endemic levels next season.

There were 289 pheromone traps set out in towns adjacent to the gypsy moth quarantine zone and these traps captured approximately 3,300 male moths. This is more than double the catch from the previous year. Much of the increase is attributable to a handful of towns with high moth catches.

State and Federal quarantines regulate the movement of gypsy moth and materials that come from areas infested by gypsy moth. The area regulated by these quarantines was expanded in February 2007 to include the following towns:

- In Aroostook County--Glenwood Plantation, Houlton, New Limerick, and Orient;
- In Piscataquis County--Shirley, Elliotsville, Katahdin Iron Works, T1 R11 WELS, T1 R10 WELS, T2 R10 WELS, T7 R9 NWP, TA R10 WELS, TA R11 WELS, TB R10 WELS, TB R11 WELS, and Veazie Gore; and
- In Somerset County--East Moxie Township.

Egg mass surveys revealed several additional towns with established infestations. These towns, and the unregulated towns south of Houlton and New Limerick, will be added to the regulated area later this year.

Saddled prominent/green striped mapleworm/variable oakleaf caterpillar complex (*Heterocampa guttivitta, Dryocampa rubicunda, Lochmaeus manteo* and others) - In 2005 heavy defoliation of red oak on 1600 acres was detected in western Maine and in Westbrook/Falmouth in Cumberland County. Other hardwoods were affected to a lesser extent in the same areas. Ground checks determined that lighter amounts of defoliation extended well beyond the mapped areas. Unfortunately reduced staffing meant that ground checks were not made until after most of the larvae were gone from the trees and a positive determination of the casual agent was not possible.

In 2006, moderate defoliation of red oak, maple, beech and birch caused primarily by saddled prominent was detected in western Maine as well as in a small pocket in Westbrook/Falmouth in Cumberland County. The green striped mapleworm, *Dryocampa rubicunda,* was found regularly in beating collections as well as showing prominently at light trap stations. Moderate to heavy defoliation was noticeable from the air on approximately 10,360 acres. The Cumberland County infestation was smaller than in 2005 but the western Maine area had expanded and was overlapped by birch leaf spot damage making delineation of the infestation difficult. This complex usually increases for 2-3 years and then subsides.

Satin moth (*Leucoma salicis*) - Satin moth has been at low levels since 2002.

Winter moth (*Operophtera brumata*) - Winter moth is a European pest that feeds on oak, maple, ash, basswood, apple, crabapple and blueberry. It has been in the Canadian Maritimes for decades and is kept under control by two parasites - a wasp and a fly. More recently, winter moth has been devastating the hardwoods in eastern Massachusetts and has spread throughout that state and Rhode Island.

In the fall of 2005 seven northeastern states participated in a survey for winter moths throughout the region. The pheromone trapping indicated a possible winter moth population in southern-most Maine. Only males are attracted to the traps so it is possible to have moths in the traps but no active population. The males can fly or get blown long distances plus the females not only are not attracted to the traps but they are flightless. Defoliation from an early season defoliator was reported in the Wells area in 2006 after the larvae were done feeding. Checks in the area in the fall when the adults are active turned up only native fall cankerworms. This species causes the same type of damage to the same range of hosts.

To further complicate matters there is a third insect, the bruce spanworm, *Operophtera bruceata*, that is very closely related to the winter moth and is native to North America. It is virtually indistinguishable from the winter moth (at least for humans). Initial moth dissections and genetic sequencing being run at the University of Massachusetts indicates most of the moths in Maine are the native bruce spanworm. Some of you may wonder what the big fuss is all about. The problem is that although we have difficulty telling these nondescript brown moths apart apparently insects easily can tell the difference. The native species rise and fall without causing too much problem to the trees. The winter moth on the other hand can and does kill trees.

We will be working on this problem in the coming season.

DISEASES and INJURIES Associated With Trees in 2006

Acid Rain (caused by certain pollutants entering the atmosphere and reacting to form sulfuric and nitric acids) – Although this subject has been eclipsed in the media in recent years by concerns of global warming, acid precipitation continues to occur and to affect, most likely in very subtle ways, the forest environments of the northeastern United States. While sulfur emissions have been reduced over the past few decades, little has been done to reduce the nitrogen emissions which lead to the buildup of nitrous oxides. Most precipitation chemists now believe that, although the trend is improving, precipitation remains approximately 4 to 8 times more acidic that it "should" be, or that it historically has been without these pollution inputs.

While the early reports of widespread forest damage as being caused by acidic precipitation are unfounded or attributable to other causes, most scientists agree that higher acidity levels of rain, snow, and fog have changed plant communities, particularly at the more sensitive high-elevation sites. For example, there are demonstrated effects of acid deposition such as increased nutrient leaching from plants and soils which could negatively impact tree growth, and which have been shown to decrease winter hardiness of some trees. 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 at other institutions to elucidate these possible effects.

Annosus Root Rot (caused by *Heterobasidion annosum* syn. *Fomes annosus*) -Primarily a disease of plantation pine in Maine, *H. annosum* root rot is occasionally but regularly reported from foresters and landowners. The most recent sample in 2006 was received from a landowner in Waterville. Infected plantations have been reported from the following counties: Androscoggin, Cumberland, Franklin, Kennebec, Lincoln, Oxford, Penobscot, Piscataquis, Sagadahoc, Somerset, Waldo, and York.

This disease becomes most obvious after early thinnings have taken place in pine plantations. The fungus infects freshly-cut stumps, and becomes established throughout the root system of the cut tree. Over time, the fungus can then spread to other, healthy trees via root grafts. A typical circular pattern with dead trees in the center and infected, dying trees at the perimeter provides a characteristic disease appearance at the stand level. The fruiting structure (conks) of the fungus that produces spores are formed on roots and stump collars at the ground-line or just below the soil duff layer.

When harvesting pines in red pine plantations, it is important to treat stumps with borax immediately following tree harvest. *H. 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.

Anthracnose of Ash, Birch, Catalpa, Maple, and Oak (caused by *Mycosphaerella fraxinicola*, *Septoria betulae*, *Glomerella cingulata*, *Kabatiella apocrypta* and *Discula quercina* respectively) - Unusually wet weather conditions that persisted throughout the spring, summer, and fall of 2006 resulted in a number of widespread foliar diseases of hardwood trees. These diseases, which cause irregular tan or brown spots or blotches on leaves often followed by defoliation, were abundant in both the 2005 and 2006 growing seasons. Oaks, ashes, maples, and birches were all affected to some degree statewide. Most notable were *Mycosphaerella fraxinicola* on ashes in central and mid-coastal regions of Maine, and *Septoria betulae* on paper birch. This *Septoria* appeared statewide and resulted in considerable early leaf shedding, especially in the western regions of Maine. Heavy infections were also noted in the mid-coast region.

In most cases, anthracnose diseases do not pose a serious threat to long-term tree health. However, it should be noted that both 2005 and 2006 were exceptionally wet years, and anthracnose was more widespread and damaging than usual. In the case of high levels of defoliation, as with the *Septoria* on birch, some growth loss may result. Careful consideration should be given to ornamental trees in the spring

of 2007. Applying protectant fungicides to trees known to have been severely affected the past two years will ensure against a third year of defoliation, which would have even more damaging effects.

Apple Scab (caused by *Venturia inaequalis*) – Apple scab is the most serious disease in commercial apple orchards, and will also defoliate and cause lesions on leaves, stems, and fruits of ornamental crabs. Apple scab is one of the most common non-forest diseases we encounter when responding to calls from the public. This is a fungal disease which is generally worse during moist seasons, and was very prevalent over the past two years. The fungus overwinters in old infected leaves and on previous-year twigs. The first infection of the season occurs by early June. Secondary infections can occur throughout the growing season during periods of wet weather.

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

Ash Leaf and Twig Rust (caused by *Puccinia sparganioides*) - The expectation of 2006 being a severe year for this disease did not develop. Little ash leaf rust was noted this year, even though it appeared that the problem was building over the last few years. This disease only rarely kills trees, but may weaken them so they succumb to other causes, especially where the disease strikes heavily in successive years.

This disease was epiphytotic in Maine from 1982-1984, and again from 1995 through 1997 in the Stockton Springs/Frankfort/Winterport areas of mid-coast Maine. In 2001 the orange spots on leaves and twigs which are characteristic of this disease were very conspicuous on ash in the Stockton Springs area, but little defoliation was apparent there.

In south coastal Maine, especially the Kittery/Wells/York/Ogunquit areas, considerable defoliation was apparent as recently as 2001 and 2002. The extent to which the unusually wet weather conditions, which have persisted during the 2005 and 2006 seasons, may affect this disease is unknown.

Ash Stem Cracking – Landowners in Baldwin and Farmington have reported an unusual occurrence of stem cracking on white ash in forest stands. The affected trees examined were from sapling sized through mature trees. Bark appears to split in a longitudinal direction, beginning from just above the soil line to several feet up the bole, with the splits running for two to three feet in length. Many trees in both stands have been found with this problem, and occur in a widely scattered pattern within the stand. The injuries do not appear to be associated with logging machinery patterns; the wood and the bark does not appear to have been mechanically contacted in any way.

No unusual insect activity or obvious pathogens have been found associated with these splits. Ring counts indicate that the splits developed about 5 years ago...sometime after the ice storm. One hypothesis is that trees may have been bent from the ice storm, and developed bark splits, resulting in cambial damage that has been slow to recover. However, many trees are large enough (12 to 14 inches dbh) that it seems unlikely that they would have bent without breaking so low on the main stem.

While affected trees continue to grow, the seams persist. There is no wound closure over the seam, even though growth rings developing after the initiation of the problem appear normal. Although the cause remains a mystery, anyone who has seen these symptoms on ash is asked to report the instance to the Maine Forest Service Insect Lab. Observation and examination of samples of this problem and of overall tree condition will continue.

Atropellis Canker (caused by *Atropellis tingens*) - Atropellis canker is a relatively uncommon fungal disease of pines in Maine. It occasionally has been 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 2006. 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 the chance for infection is low.

Balsam Fir Needlecasts (caused by *Isthmiella* and *Lirula* spp.) - The disease is widespread among stands of understory wild trees, but only occasionally a problem among cultivated trees. However, in 2006 several Christmas tree growers from the Aroostook, Piscataquis, and Cumberland counties reported damage from these needlecasts.

Symptoms are generally confined to foliage two years old or older; current season growth, even when infected, remains green until the second growing 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 control products are presently registered 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.

Balsam Fir-Fern Rust (caused by *Uredinopsis mirabilis*) - Fir/fern rust infection was present at moderate levels statewide in 2006. Symptoms were conspicuous on Christmas trees in many plantations, but infection was much less severe than in 2005. Late flushing trees experienced less infection than early flushers. Infected needles generally shrivel and drop from trees by July. We received no reports in 2006 of loss of tree mechantability from this disease.

Growers who noted this disease in their plantations this year should plan to eradicate susceptible fern, especially the sensitive fern, in and within 100 feet of their plantations. Glyphosate herbicides applied in July or August to mature fern fronds will eradicate ferns, but a followup application the following year is usually required to achieve complete control. For those growers who do not wish to use herbicides, frequent summer mowings of fern fronds will usually provide adequate control, assuming terrain will permit the entry of mowing machinery.

Beech Bark Disease [caused by beech scale (*Cryptococcus fagisuga*) and *Nectria coccinea var. faginata*] - Beech bark disease occurs statewide, and continues to cause losses in site productivity and timber values, in addition to resulting in decreased wildlife food for a wide variety of birds and small and large mammals. This chronic disease has affected Maine's forests for over eighty years. The disease results from the feeding on bark tissues of a scale insect, *Cryptococcus fagisuga*. The bark then becomes predisposed to infection by any of a number of *Nectria* spp. fungi, the most prevalent being *N. coccinea* var. *faginata*. Trees may survive in a highly defective, cankered state, or may succumb quickly, depending on local scale populations and other stress factors that can affect the health of trees. North-central Maine is currently undergoing significant mortality in beech, believed to be the result of a combination of drought stress and the beech bark disease. Although statewide population levels of the scale insect have been relatively low in recent years, observations in 2006 in eastern Washington County indicate that there are some local areas where the scale populations appear to be increasing.

Beech bark disease does not threaten to eliminate beech from the Maine forest because some trees are resistant to infestation by the scale, and even susceptible trees sprout profusely from roots when trees are

damaged, killed or harvested. Infected trees exhibit rough patches of dead bark which may contain small, reddish fruiting bodies of the causal fungus. Scattered through most stands are a few smooth barked, resistant trees. Losses attributable to beech bark disease are extensive but assessment of the damage is complicated by the effects of drought, oystershell scale, late spring frosts, and various hardwood defoliators.

Recent research has documented ten years of change following harvesting in a beech bark disease affected stand in central Maine. This research summary is provided as Appendix 6 of this report.

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 is not practical. 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 to maintain healthy, productive fruit trees.

Brown Ash Decline (caused by environmental stresses, especially drought) - Black ash, *Fraxinus nigra*, (called brown ash in Maine) has largely recovered from the statewide decline which first became apparent in 1989. The especially wet growing seasons of 2005 and 2006 would seem to ensure that the vigor of black ash (as well as that of most other trees) will be sufficient for trees to remain healthy for the 2007 growing season.

Butternut Canker (caused by *Sirococcus clavigignenti-juglandacearum*) - Butternut canker continues to cause damage to the butternut resource. Because this tree species occurs uncommonly, and is widely scattered as individuals and not as forest stands of any size, the disease often goes unnoticed or unrecognized. The disease has been found in all counties except Washington County. Trees affected by butternut canker are characterized by dying branches, discolored bark which may exude an inky-black fluid in the spring, and cankers on the main stem, buttress roots, and branches. No effective controls are available. All indications are that this disease will continue to progressively eliminate butternut as a tree species. Other states have reported butternut mortality rates of over 50% occurring over the past twenty-year period. At this point in time, there is little reason to expect a different fate for butternut in Maine.

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. 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.

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. Drought seems to predispose trees to Caliciopsis canker.

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) –Several reports of chemical injury to trees and shrubs were received in 2006. 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.

Chemical injury has also been found on hardwood leaves, specifically on oak, that had received drift from either lawn chemicals or from the application of fogs for mosquito control. Newly emerging leaves in the early spring appear most susceptible. Homeowners should be alert to the fact that while most pesticides themselves may not be phytotoxic, some phytotoxicity can result from the chemical carriers or other additives in spray mixtures.

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. None of these native trees is truly resistant to the disease.

Recently considerable interest has been expressed in support of an effort to reintroduce the American chestnut into Maine forests. The Maine Chapter of the American Chestnut Foundation is breeding resistant strains of American chestnut using native Maine chestnut sources. These trees are being crossed with resistant hybrids which are under development by the American Chestnut Foundation in Virginia. Within fifteen years or so it is hoped that blight resistant trees with native Maine genes will be ready to reintroduce the species to Maine forests.

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*) – Dutch elm disease continues to take its toll in remnant individuals in forest and landscape settings. The disease was observed to be quite aggressive in the mid-coast area. In the town of Thomaston, resistant elms that were planted ten to twelve years ago were dead and dying from Dutch elm disease. It is suspected that the recent wave of mortality is the result of *O. novo-ulmi*, the more aggressive strain of the fungus. This strain was reported from coastal Maine, including the Town of Thomaston, about twenty years ago.

Eastern Dwarf Mistletoe (*Arceuthobium pusillum*) - No unusual activity was reported for eastern dwarf mistletoe. While this disease continues to be quite prevalent, especially in stands of white spruce in coastal areas, conditions have remained largely unchanged, as in past years.

Severe damage as the result of infection by this parasitic plant has occurred in stands of white spruce in coastal areas of Maine. 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.

Trees in landscapes and ornamental planting may also become infected with this pathogen. Affected trees gradually lose vigor and decline. Removal of witches'-brooms (infected portions of branches), together with appropriate fertilization, generally helps to maintain the vigor of affected landscape trees.

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. 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.

Specific surveys for this disease have not been done for several years. A delimitation survey is planned for 2007 to determine if current quarantine boundaries are still effective and appropriate.

Horse-chestnut Leaf Blotch (caused by *Guignardia aesculi*) - This disease, which causes brown, irregular blotches on leaves often bordered by a yellow band, was very common and quite severe in both 2005 and 2006. This is another of the leaf diseases especially favored by wet spring and summer weather.

Ice Damage to Trees (caused by the "Ice Storm of 1998") - The status and health of forest stands damaged by the ice storm of 1998 continue to be monitored. Primary factors affecting stand recovery from ice damage are type and severity of damage, tree species, tree size, and stand density.

Trees that experienced main stem breakage remain alive for the most part, but tree quality is generally declining. Decay in birches with main stem breaks is advancing rapidly whereas decay in maples, oaks, and most softwood species is progressing at a much slower rate. Crown regeneration and sprouting in trees with main stem breakage is significant in some species, such as ash, but nearly nonexistent in poplar. Many tree species that experienced only crown branch breakage have recovered significantly. For example, many white ash trees that lost most of their branches during the ice storm now have smaller but nearly normal appearing crowns. But other species such as quaking aspen, beech, and white pine have shown very little recovery. Branch breakage in maples, oaks, ashes, locust, elm, and willow stimulated significant crown sprouting which resulted in very dense crowns. Many trees that experienced branch breakage in 1998 still retain these broken segments attached by splintered joints. On many tree species tufts of sprouts are prominent at these breaks.

Many small diameter (>6") stems of red maple, birch species, and beech were severely bent by the weight of ice during the 1998 storm. Most of these stems have either remained permanently bent (red maple and beech), or have died (birches).

Lichens - Lichens growing on dead and dying conifers are frequently and falsely accused of having a role in tree decline and death. 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 (caused by *Canavirgella banfieldi*) - This disease that we have called semi-mature tissue needle blight (SNB) in past years, was apparent as light to moderate infections in the mid-coast region in 2006. This disease causes needle tips to turn brown in July which then fade to a grayish tan over winter. Typically not all needles in a fascicle are affected. During the summer affected needles, though brown at some point beyond the needle base, exhibit no outward signs of fungal infection. By the following spring, however, numerous fruiting bodies of various secondary fungi may be apparent, confounding

attempts to identify a causal pathogen. Needle browning is typically more severe on sides and lower crowns of affected trees, while the top is less symptomatic. And some trees are apparently resistant, so only a portion of the trees in a stand is typically affected.

Affected needles and fascicles gradually weather from the trees during the spring, and tree appearance improves as new growth emerges.

While this problem generates many calls from homeowners, woodlot managers, and golf course superintendents, it is primarily an aesthetic problem except for Christmas tree growers, a percentage of whose trees may become unmarketable.

Oak Leaf Blister (caused by *Taphrina caerulescens*) - This disease, characterized by raised yellowish blisters on leaf upper surfaces, was another commonly occurring leaf disease on oaks during 2005 and 2006.

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

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

Phytophthora Root Rot of Russian Arborvitae (caused by *Phytophthora* spp.) - Russian arborvitae (*Microbiota decussata* Komarov), is in the plant family Cupressaceae and is used occasionally as an ornamental in landscape gardens and other plantings. An examination of dying plants in North Harpswell indicated the plants were affected by a root rot. On culturing fine root material using baits of small sections of *Microbiota* foliage, a species of *Phytophthora* was identified. Literature reports only one *Phytophthora* species associated with this plant, *P. cinnamomi*. However, confirmation of the species has not yet been obtained. It is unknown whether this pathogen was introduced to the site via infected nursery stock, or whether it was present in the soil before plants were established. *P. cinnamomi* has been previously reported from Maine on apple and rhododendron.

Pitch Pine Needle Cast (caused by *Lophodermium pinastri*) - Pine needle cast continued to be a problem on pitch pine in western Maine this year. The disease again was most severe in Fryeburg, Brownfield, and Waterboro areas, with a total of 11,064 acres affected. *Lophodermium pinastri* is generally considered a very weak pathogen on senescent needles of host pines. However, with the right environmental factors of weather, epiphytotics may occasionally occur.

Pine-Pine Gall Rust (caused by *Endocronartium 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 bearing galls) early in the rotation and before the end of April each year will help keep the disease from spreading to healthy trees. It is important when establishing plantations of hard pines to plant only healthy nursery stock.

Pinewood Nematode (*Bursaphelenchus xylophilus*) - Pinewood nematode in Maine is primarily a problem of stressed trees, especially those stressed by being planted off-site. But many plantations (including ornamental plantings) are in fact established off-site and we suspect that pinewood nematode has played a role in the mortality of pine and perhaps other species in such situations, even though the presence of pinewood nematode was never confirmed. The pinewood nematode causes the most serious disease of pines in Japan (pine wilt), and 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 an 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 seems unlikely that porcupine populations have actually increased in recent years. We feel that the more numerous reports simply reflects an increasing acreage of higher value conifer plantations, seed orchard trees, and landscape areas where porcupine damage is less easily ignored.

Rhabdocline and Swiss Needlecasts of Douglas-Fir (caused by *Rhabdocline pseudotsugae* and *Phaeocryptopus gaumannii*) - 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. No reports of this disease were received in 2006.

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.

Salt Damage (caused by movement of deicing salts from road surfaces to susceptible plant species) - Symptoms of salt damage to roadside vegetation were considerably less conspicuous than usual during the past winter season (2005-2006). Light snows that occurred late in the season resulted in less ice-clearing chemicals used on roadways.

The damage, when it does occur, is of two types: (1) foliage browning, especially of white pine growing very close to traveled road surfaces, the result of direct salt deposition on foliage and (2) foliage browning of fir, hemlock and white pine, growing at greater distances from traveled road surfaces, but sited where root systems could take up pooled salty water. Affected trees recover as the growing season progresses, with new growth masking the older, browned needles which generally fall prematurely.

Scleroderris Canker (caused by *Ascocalyx abietina*) - No new infestations of Scleroderris canker were located during 2006. This disease remains static at very low levels.

Sirococcus Blight of Red Pine (caused by *Sirococcus conigenus*) - Sirococcus blight of red pine continues to cause damage, especially in natural stands in western Maine and 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, unless soils are unusually droughty.

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 of paramount importance when establishing red pine plantations. *Sirococcus conigenus* disease is also occasionally a problem on various species of spruce in landscape situations.

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.

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. Numerous calls were received during 2006 regarding *Sphaeropsis* blight, particularly from Cumberland and Lincoln counties.

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.

Squirrel Damage to Pines (caused by *Sciurus hudsonicus*) – Severed twig tips of white spruce was reported from ornamental trees in Augusta during the winter of 2006. Mechanical damage was observed to stems at the point of attachment of small branchlets, where squirrels had cut small twigs from the trees. This damage usually occurs in fall, when squirrels attempt to harvest seed cones, or in late winter/early spring, when squirrels feed on the new buds.

Sudden Oak Death (caused by *Phytophthora ramorum*) - Interest in Sudden Oak Death (SOD) increased when the causal agent, *Phytophthora ramorum*, was found on infected lilac nursery stock in Farmingdale. To date, it has not become established in Maine, or anywhere in the Northeast. SOD has caused extensive dying of oaks and other woody plants in forest and landscape settings in Oregon and California, and strict Federal quarantines are in place to limit its spread. While the infected nursery material in Maine was destroyed, a survey is planned for 2007, to be sure that the pathogen has not become established.

Tar Spot of Maple (caused by *Rhytisma acerinum*) – This disease which has caused moderate to severe defoliation of maples in southern Maine, principally in the towns of Kittery and the Berwicks several years ago, was not reported causing damage in 2006. Although tarspot can be commonly found on red, sugar, and Norway maples throughout the state during most years, it rarely causes early defoliation or any real damage to tree health.

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. Trees known to be resistant to *Verticillium* include all the gymnosperms, plus apple and crabapple, mountain ash, beech, birch, butternut, oak, poplar and willow.

Weather

Global Warming - The effects of climate warming trends remains a serious concern with respect to forest insect and disease problems. The recent mild winter temperatures of 2005 and 2006 are believed to have favored populations of scale insects, most notably the beech scale, the hemlock woolly adelgid, and the balsam woolly adelgid. While there is good documentation that weather effects are critical in determining the rate of population increase for these pests, it is much more difficult to demonstrate direct cause and effect relationships over a short time period. In any case, warmer temperatures may enhance a number of other pests and pathogens. A more intensive monitoring effort may be required to effectively capture population changes resulting from warmer temperatures.

Unusually High Precipitation - In 2006, numerous Christmas tree growers reported mortality of recent (within the past two years) transplants of balsam fir stock, and of occasional, scattered larger trees of unhealthy appearance. The problem was most evident in south-central and coastal areas in the towns of Bath, Nobleboro, North Yarmouth, and Portland. While routine examinations have been made for various insects, needle cast fungi, root rots, and rusts, no biotic pests or pathogens have been associated with the damage. The current diagnosis is that the problem is likely the result of the extremely wet weather conditions which have prevailed during the past two years. Many, but not all, of the sites were located on fairly heavy marine clays. A few of the sites also had underlying bedrock close to the surface. These soils have been continually saturated for several seasons. Examination of recently transplanted stock revealed that little if any new root growth had taken place since the stock was planted. The trees were, therefore, living on the fine-root system it had developed in the nursery, but were not growing and establishing new roots at the planted sites. Fine roots were lacking and larger (0.25 in. in diameter) roots appeared moribund, often with an off-color to the woody tissue. Current-season branch extension (new growth) appeared stunted and chlorotic, and gave a slight drooping, or wilted appearance to the trees. Most growers indicated that these symptoms were not prevalent until two to three years ago, and that the problem appears to have grown more severe (more trees affected), with each passing year. This coincides with the precipitation patterns seen throughout much of the state.

Recommendations have been limited to cultural practices; improving drainage, planting on the driest portions of the available property, and removing affected stock as soon as the disease syndrome becomes evident. Sites will continue to be assessed in the coming seasons, to determine if a change in weather conditions leads to an abatement of the problem. Examinations of affected stock for other causes will also continue.

Winter Injury - Winter injury effects on trees and shrubs were exceptionally mild during the winter of 2005-2006. Forsythia blooms were prevalent in southern Maine during the spring, indicating little bud damage. Ornamental evergreens such as yews and rhododendrons also showed much less browning than usual.

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. This disease remains static at moderate levels, but is common throughout the state. Division personnel provide on the ground technical assistance to landowners interested in pursuing *Ribes* suppression, but the State *Ribes* eradication program is not presently operational.

Triclopyr (Garlon 4) remains our herbicide of choice, mixed at the rate of 6 oz./gallon of water. In 2001 a total of 42 ounces of Garlon 4 was mixed with water to provide a total finished volume of 7 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. Quarantine information can be found on page 59.

This disease remains static at moderate levels, but is common throughout the state.

White Pine Decline (caused by shallow rooting depth and drought) - The condition of pines affected by white pine decline seems to have stabilized, but a few calls related to this problem were received in 2006. Following the drought of 1995 and for a period of several years thereafter, white pines with symptoms of this disease declined and died on sites where rooting depth has been restricted. Expanded rooting depth studies have supported previous findings that effective rooting depth was less than twelve inches in all declining stands and deeper than in all asymptomatic stands.

While the problem has been recently abated, probably as the result of high moisture levels returning in 2004, 2005, and 2006, some landowners may still have overstocked stands of white pine growing on substandard (shallow to pan or bedrock) soils. Two locations, one in Jefferson and one in Harrison, were determined as likely having this disease syndrome in 2006.

Yellow Witches'-broom of Balsam Fir (caused by *Melampsorella 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. 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 – 2006

There are five forestry related quarantines currently in effect in Maine. They are: White Pine Blister Rust, Gypsy Moth, European Larch Canker, Hemlock Woolly Adelgid and Pine Shoot Beetle. The following is only a partial summary of the rules. Refer to the cited statutory authority and related rules for complete quarantine regulations. Maps of the regulated area for each quarantine can be found at the end of this section. Questions about forestry related quarantines and requests for compliance agreements can be directed to Allison Kanoti, Maine Forest Service Insect and Disease Lab, 48 Hospital Street, Augusta, ME 04330; e-mail: allison.m.kanoti@maine.gov; or (207)-287-2431.

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 Forest Health & Monitoring Division of the Maine Forest Service, phone: (207) 287-2431 or (207) 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 Hermon, Maine, phone: (207) 848-5199.

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 facility 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 Forest Health & Monitoring Division of the Maine Forest Service, phone (207) 287-2431 or (207)287-2791.

NOTE: In February of 2007 the **area regulated by the gypsy moth quarantine was expanded** to include the following additional towns:

- In Aroostook County--Glenwood Plantation, Houlton, New Limerick, and Orient;

- In Piscataquis County--Shirley, Elliotsville, Katahdin Iron Works, T1 R11 WELS, T1 R10 WELS, T2 R10 WELS, T7 R9 NWP, TA R10 WELS, TA R11 WELS, TB R10 WELS, TB R11 WELS, and Veazie Gore; and
- In Somerset County--East Moxie Township.

Egg mass surveys revealed several other new towns with established infestations. Those towns, and the unregulated towns south of Houlton and New Limerick, will be added to the quarantine area later this year. (See List of Regulated Towns at the end of this section).

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 Hermon, Maine, phone: (207) 848-5199; and the Forest Health & Monitoring Division of the Maine Forest Service, phone (207) 287-2431 or (207) 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 established to prevent the introduction of the hemlock woolly adelgid (*Adelges tsugae* Annand) into Maine. This serious pest causes mortality of Eastern hemlock (*Tsuga canadensis*) and other ornamental hemlocks. 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. The quarantine regulates the shipment into Maine of hemlock woolly adelgid carriers which consists of any hemlock articles with attached bark, including hemlock seedlings and nursery stock, logs, lumber with bark, chips with bark, and uncomposted shipments of bark.

b. The area under quarantine in the northeastern United States consists of the counties included in the USDA Forest Service's publication entitled "List of Counties and States with Known Hemlock Woolly Adelgid Infestations", In the western U.S., the states of Alaska, California, Oregon, and Washington are included in the quarantine.

c. Hemlock seedlings and nursery stock originating in or previously held in any area under quarantine are prohibited entry into Maine.

d. Hemlock seedlings and nursery stock shipped into Maine from non-quarantined areas must be accompanied by a State Phyto Sanitary Certificate with declarations of origin.

e. Hemlock logs, lumber with bark, chips with attached bark, or uncomposted bark, shipped into Maine from either **quarantined or non-quarantined** areas of other states or Canada can only be received under a written agreement between the shipper and the Maine Forest Service at pre-approved sites.

f. Arrangements or requests for importing hemlock seedlings and nursery stock must be handled through the Plant Industry Division, 28 State House Station, Augusta, ME 04333; Tel. (207) 287-7548.

g. Arrangements or requests for importing hemlock logs, lumber with bark, chips with attached bark, or uncomposted bark must be handled through the Insect and Disease Laboratory, 48 Hospital Street, Augusta, ME 04330; phone: (207) 287-2431.

NOTE: The existing hemlock woolly adelgid quarantine regulates the movement of hemlock coming over State lines; a parallel quarantine to regulate hemlock moving from the infested area within Maine is currently being developed by the Maine Department of Agriculture and the Maine Forest Service. This quarantine should be in effect within a year.

V. **The Pine Shoot Beetle Federal Quarantine is listed under 7 CFR Part 301.5, United States Department of Agriculture, Animal & Plant Health Inspection Service, Plant Protection and Quarantine as printed in the Federal Register and under 7 MRSA, Chapter 409, Section 2301 of the Laws of the State of Maine.**

a. Designates infested and regulated areas in the United States of America including the following areas in Maine: all counties except Aroostook and Washington Counties. Regulates movement of pine products with bark across State lines (managed by the USDA-APHIS, PPQ in Hermon, Maine, phone: (207) 848-5199) and movement between regulated and unregulated areas within Maine (managed by the Forest Health & Monitoring Division of the Maine Forest Service, phone (207) 287-2431 or (207) 287-2791).

b. Requires concerns outside the regulated area receiving pine products with bark from within the regulated area to have written compliance agreements.

c. Regulations restricting movement of regulated pine products with bark are complex and vary depending on the kind of product (logs or bark) and season of the year. Concerns and individuals engaged receiving pine with bark or pine bark products should refer to the detailed regulations (federal register, state laws and Me. Dept. of Ag. Rules) or call (207) 287-2431 or (207) 287-2791.

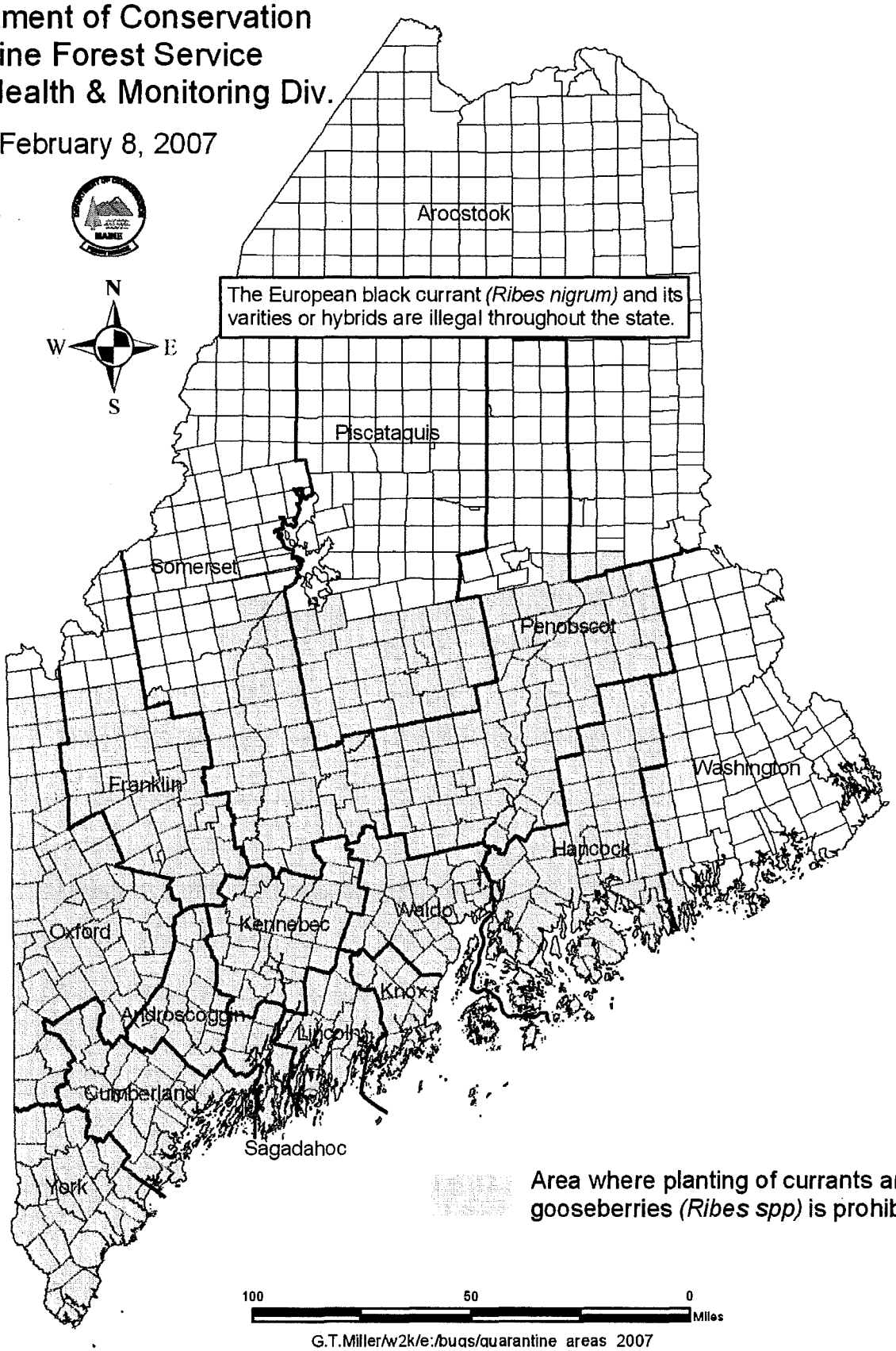
NOTE: In January of 2007 the **area regulated by the pine shoot beetle quarantine** was expanded to include all of Maine except Aroostook and Washington Counties.

NOTE: A summary of forestry related quarantines and links to maps and Federal and State laws and rules can be found on our web-site: www.maineforestservice.org (link to quarantines is in the left-hand panel).

White Pine Blister Rust Quarantine Area

Department of Conservation
Maine Forest Service
Forest Health & Monitoring Div.

February 8, 2007

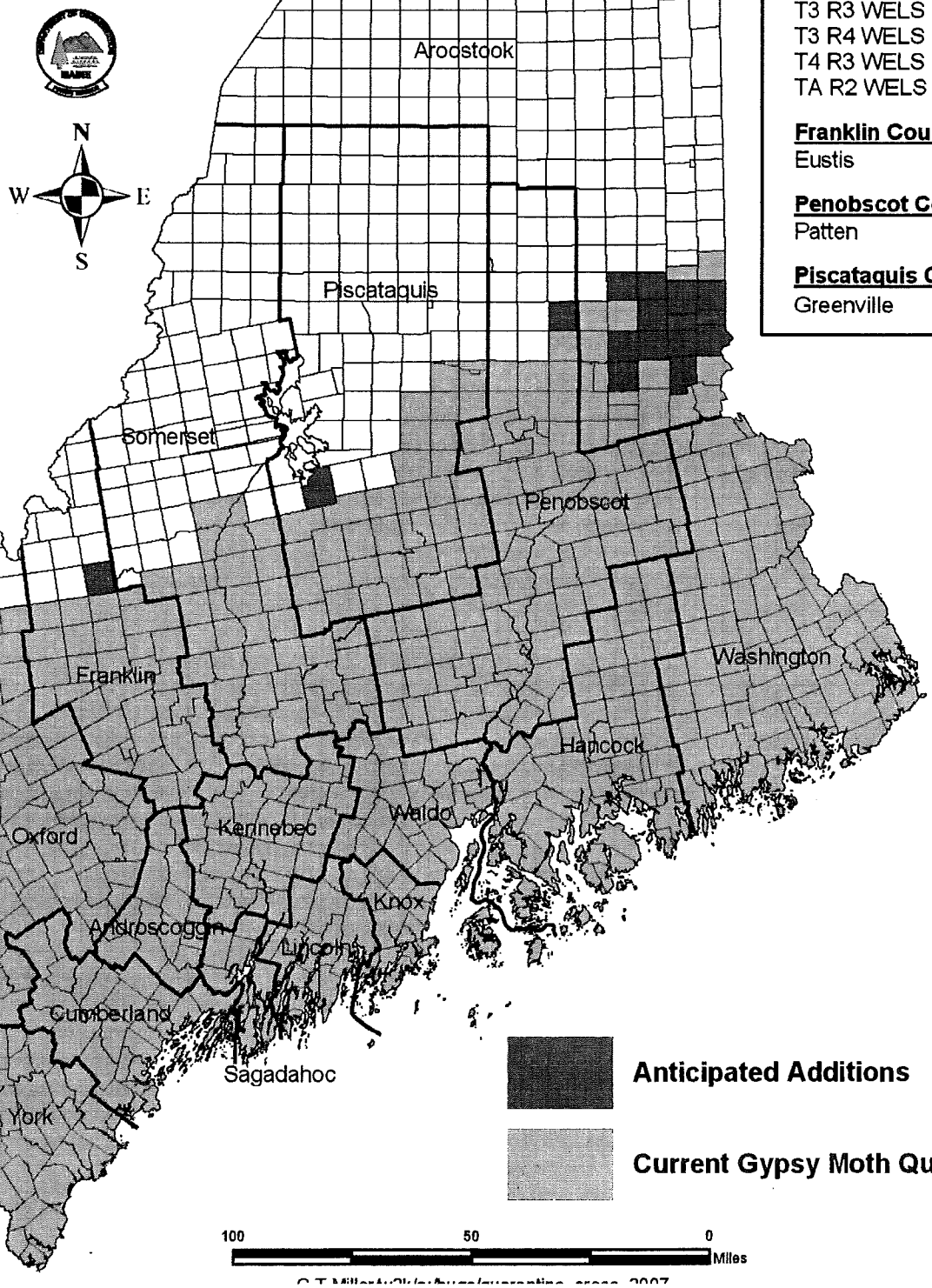


G.T.Miller/w2k/e:/bugs/quarantine areas 2007

Gypsy Moth Quarantine Area

Department of Conservation
Maine Forest Service
Forest Health & Monitoring Div.

February 8, 2007



Anticipated Additions

Aroostook County
Amity
Cary Plt
Dyer Brook
Forkstown Twp
Haynesville
Hodgdon
Linneus
Oakfield
T2 R4 WELS
T3 R3 WELS
T3 R4 WELS
T4 R3 WELS
TA R2 WELS

Franklin County
Eustis

Penobscot County
Patten

Piscataquis County
Greenville

Maine Towns in the Gypsy Moth Quarantine Zone

Androscoggin County

The entire county.

Aroostook County

Bancroft
Benedicta
Crystal
Glenwood Plantation
Houlton
Island Falls
Macwahoc Plantation
Molunkus
New Limerick
North Yarmouth Academy Grant
Orient
Reed Plantation
Sherman
Silver Ridge
T1 R5 WELS
Upper Molunkus
Weston

Cumberland County

The entire county.

Franklin County

Avon
Carthage
Chesterville
Coplin Plantation
Crockertown
Dallas Plantation
Davis
Lang
Farmington
Freeman
Industry
Jay
Jerusalem
Kingfield
Madrid
Mount Abraham
New Sharon
New Vineyard
Perkins
Phillips
Rangeley
Rangeley Plantation
Redington
Salem
Sandy River Plantation
Strong
Temple
Twp 6 North of Weld
Twp D
Twp E
Washington
Weld
Wilton
Wyman

Hancock County

The entire county.

Kennebec County

The entire county.

Knox County

The entire county.

Lincoln County

The entire county.

Oxford County

Adamston
Albany
Andover
Andover North
Andover West
Batchelders Grant
Bethel
Brownfield
Buckfield
Byron
C Surplus
Canton
Denmark
Dixfield
Fryeburg
Gilead
Grafton
Greenwood
Hanover
Hartford
Hebron
Hiram
Lincoln Plantation
Lovell
Lower Cupsuptic
Magalloway Plantation
Mason Plantation
Mexico
Milton Plantation
Newry
Norway
Oxford
Paris
Parkerstown
Peru
Porter
Richardsontown
Riley
Roxbury
Rumford
Stoneham
Stow
Sumner
Sweden
Twp C
Upton
Waterford
Woodstock

Penobscot County

Alton
Argyle
Bangor City
Bradford
Bradley
Brewer City
Burlington
Carmel
Carroll Plantation
Charleston
Chester
Clifton
Corinna
Corinth
Dexter
Dixmont
Drew Plantation
East Millinocket
Eddington
Edinburg
Enfield
Etna
Exeter
Garland
Glenburn
Grand Falls Plantation
Greenbush
Greenfield
Grindstone
Hampden
Hermon
Hersey Town
Holden
Hopkins Academy Grant
Howland
Hudson
Indian Purchase
Kenduskeag
Kingman
Lagrange
Lakeville
Lee **(cont'd)**

Penobscot County (cont'd)

Levant
Lincoln
Long A
Lowell
Mattamiscontis
Mattawamkeag
Maxfield
Medway
Milford
Millinocket
Newburgh
Newport
Old Town City
Orono
Orrington
Passadumkeag
Plymouth
Prentiss Plantation
Seboeis Plantation
Soldiertown
Springfield
Stacyville
Stetson
Summit
T1 ND
T1 R6 WELS
T1 R8 WELS
T2 R8 NWP
T2 R8 WELS
T2 R9 NWP
T3 R1 NBPP
T3 R9 NWP
T5 R1 NBPP
TA R 7
TA R 8
TA R 9
Veazie
Veazie Gore
Webster Plantation
Winn
Woodville

Piscataquis County

Abbot
Atkinson
Barnard
Blanchard Plantation
Bowerbank
Brownville
Dover-Foxcroft
Eliotsville Twp.
Guilford
Katahdin Ironworks Twp.
Kingsbury Plantation
Lakeview Plantation
Medford
Milo
Monson
Orneville
Parkman
Sangerville
Sebec
Shirley
T1 R9 WELS
T1 R10 WELS
T1 R11 WELS
T2 R9 WELS
T2 R10 WELS
T4 R9 NWP
T5 R9 NWP
T7 R9 NWP
TA R10 WELS
TA R11 WELS
TB R10 WELS
TB R11 WELS
Wellington
Williamsburg
Willimantic

Sagadahoc County

The entire county.

Somerset County

Anson
Athens
Bald Mountain
Bingham
Bowtown
Brighton Plt **(cont'd)**

Somerset County (cont'd)

Cambridge
Canaan
Caratunk
Carrying Place
Carrying Place Town
Concord Plantation
Cornville
Dead River
Detroit
East Moxie Township
Embden
Fairfield
Harmony
Hartland
Highland Plantation
Lexington Plantation
Madison
Mayfield
Mercer
Moscow
Moxie Gore
New Portland
Norridgewock
Palmyra
Pittsfield
Pleasant Ridge Plantation
Ripley
Skowhegan
Smithfield
Solon
St. Albans
Starks
The Forks Plantation
West Forks Plantation

Waldo County

The entire county.

Washington County

The entire county.

York County

The entire county.

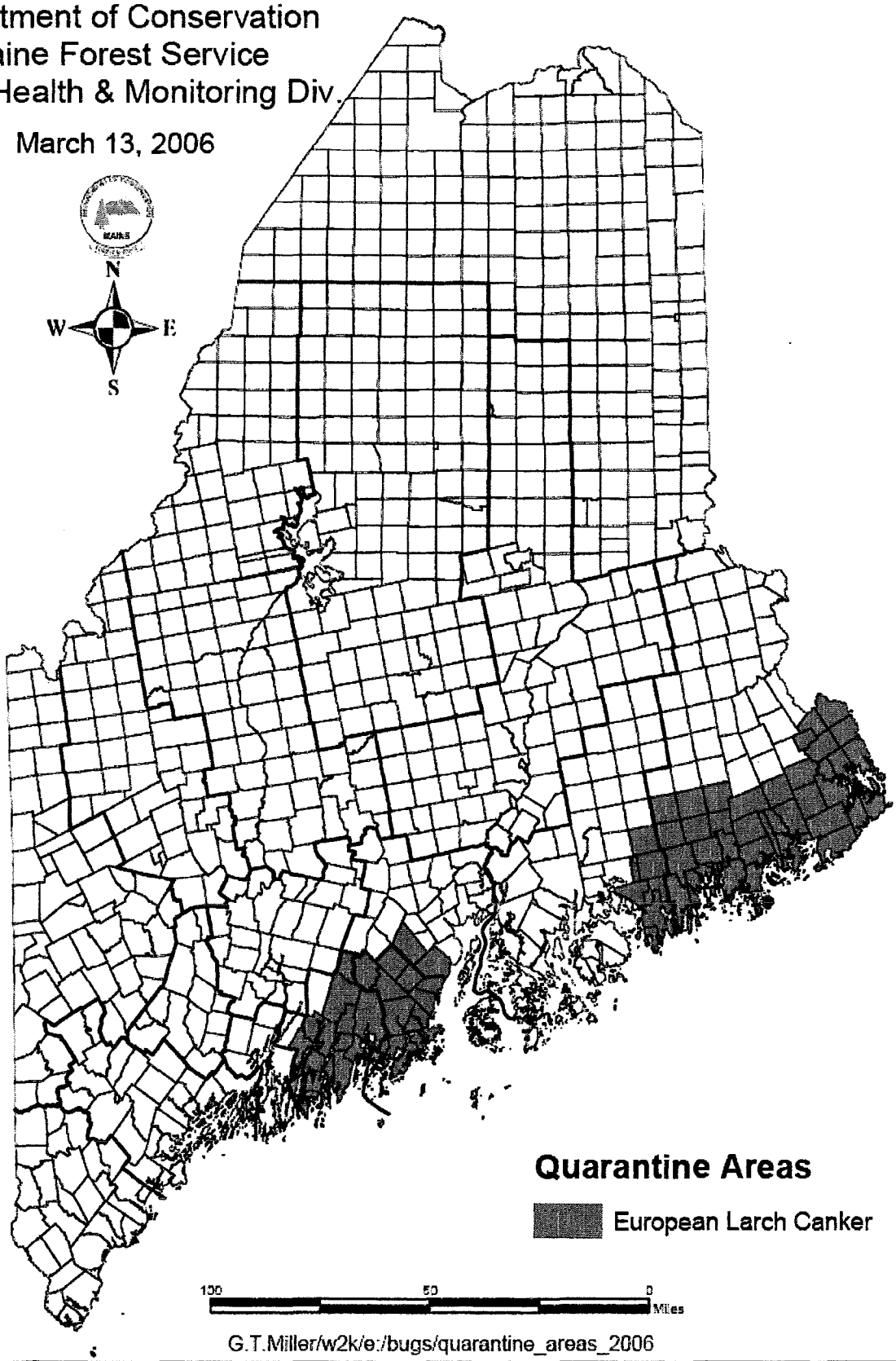
Towns Proposed for Quarantine

County	***Town***
Aroostook	*Amity*
Aroostook	*Cary Plantation*
Aroostook	*Dyer Brook*
Aroostook	*Forkstown Twp.*
Aroostook	*Haynesville*
Aroostook	*Hodgdon*
Aroostook	*Linneus*
Aroostook	*Oakfield*
Aroostook	*T2 R4 WELS*
Aroostook	*T3 R3 WELS*
Aroostook	*T3 R4 WELS*
Aroostook	*T4 R3 WELS*
Aroostook	*TA R2 WELS*
Franklin	*Eustis*
Penobscot	*Patten*
Piscataquis	*Greenville*

European Larch Canker Quarantine Area

Department of Conservation
Maine Forest Service
Forest Health & Monitoring Div.

March 13, 2006



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Maine Towns in the European Larch Canker Quarantine Zone

Hancock County

Gouldsboro	T7 SD
Sorrento	T9 SD
Sullivan	T10 SD
Winter Harbor	T16 MD

Knox County

Appleton	Rockport
Camden	South Thomaston
Cushing	St. George
Friendship	Thomaston
Hope	Union
Owls Head	Warren
Rockland	Washington

Lincoln County

Alna	Newcastle
Boothbay	Nobleboro
Boothbay Harbor	Somerville
Bremen	South Bristol
Bristol	Southport
Damariscotta	Waldoboro
Edgecomb	Westport
Jefferson	Wiscasset

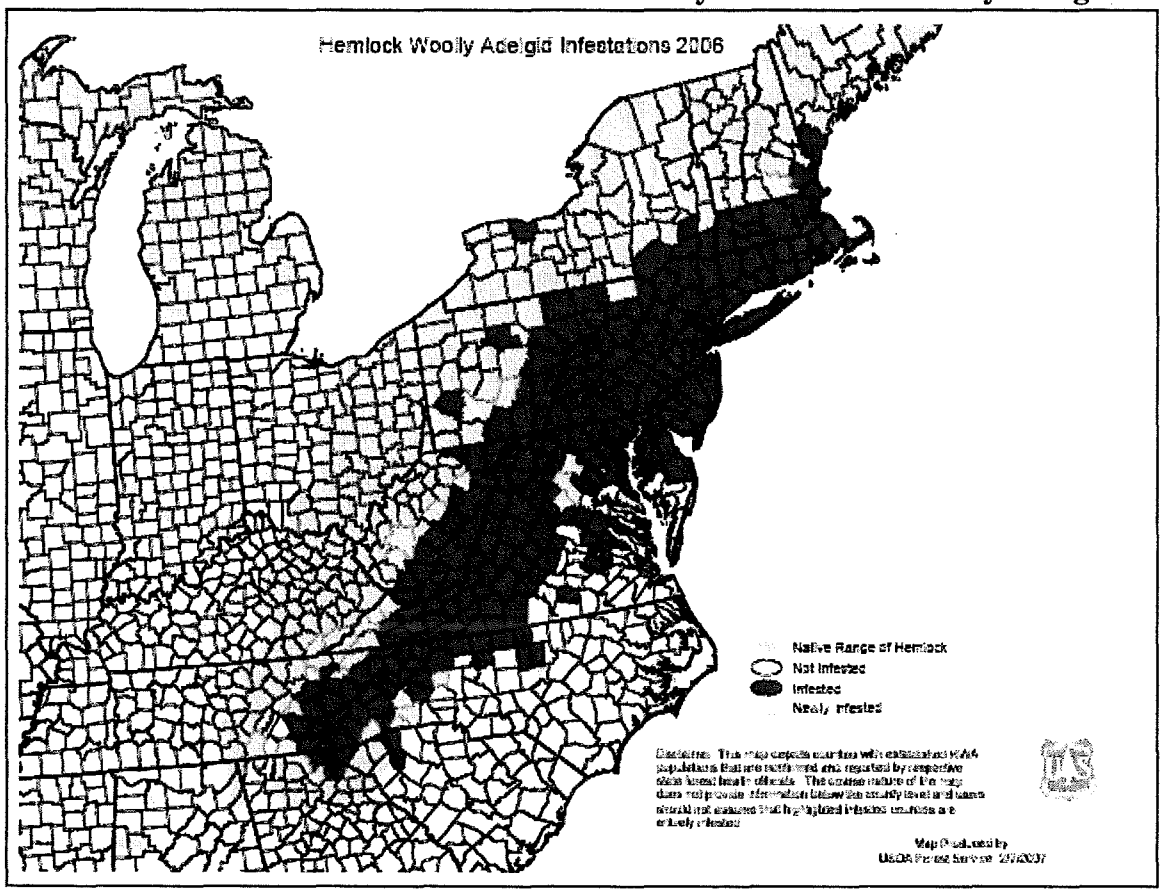
Waldo County

Lincolnville	Searsmont

Washington County

Addison	Machias
Baring	Machiasport
Beals	Marion
Beddington	Marshfield
Calais	Meddybemps
Centerville	Milbridge
Charlotte	Northfield
Cherryfield	No. 14 Twp.
Columbia	Pembroke
Columbia Falls	Perry
Cooper	Robbinston
Cutler	Roque Bluffs
Deblois	Steuben
Dennysville	Trescott
East Machias	Whiting
Eastport	Whitneyville
Edmunds	T18 ED
Harrington	T18 MD
Jonesboro	T19 MD
Jonesport	T24 MD BPP
Lubec	T25 MD BPP

Northeastern United States Counties Infested by the Hemlock Woolly Adelgid



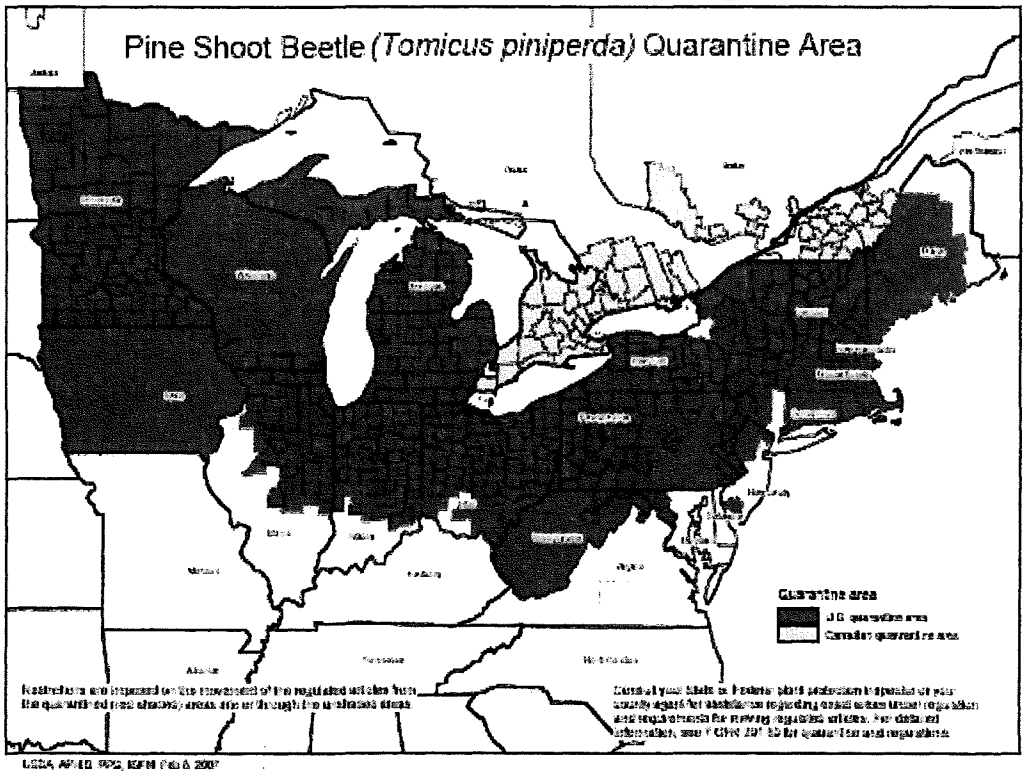
For a list of the infested counties in the northeastern United States, visit the USDA Forest Service website: http://www.na.fs.fed.us/fhp/hwa/ and follow the link in the box on the left titled "infestations."

Maine Towns with Hemlock Woolly Adelgid Infested Hemlocks (2006)

York County

Eliot
Kittery
South Berwick
Wells
York

United States and Canadian Pine Shoot Beetle Quarantine Areas

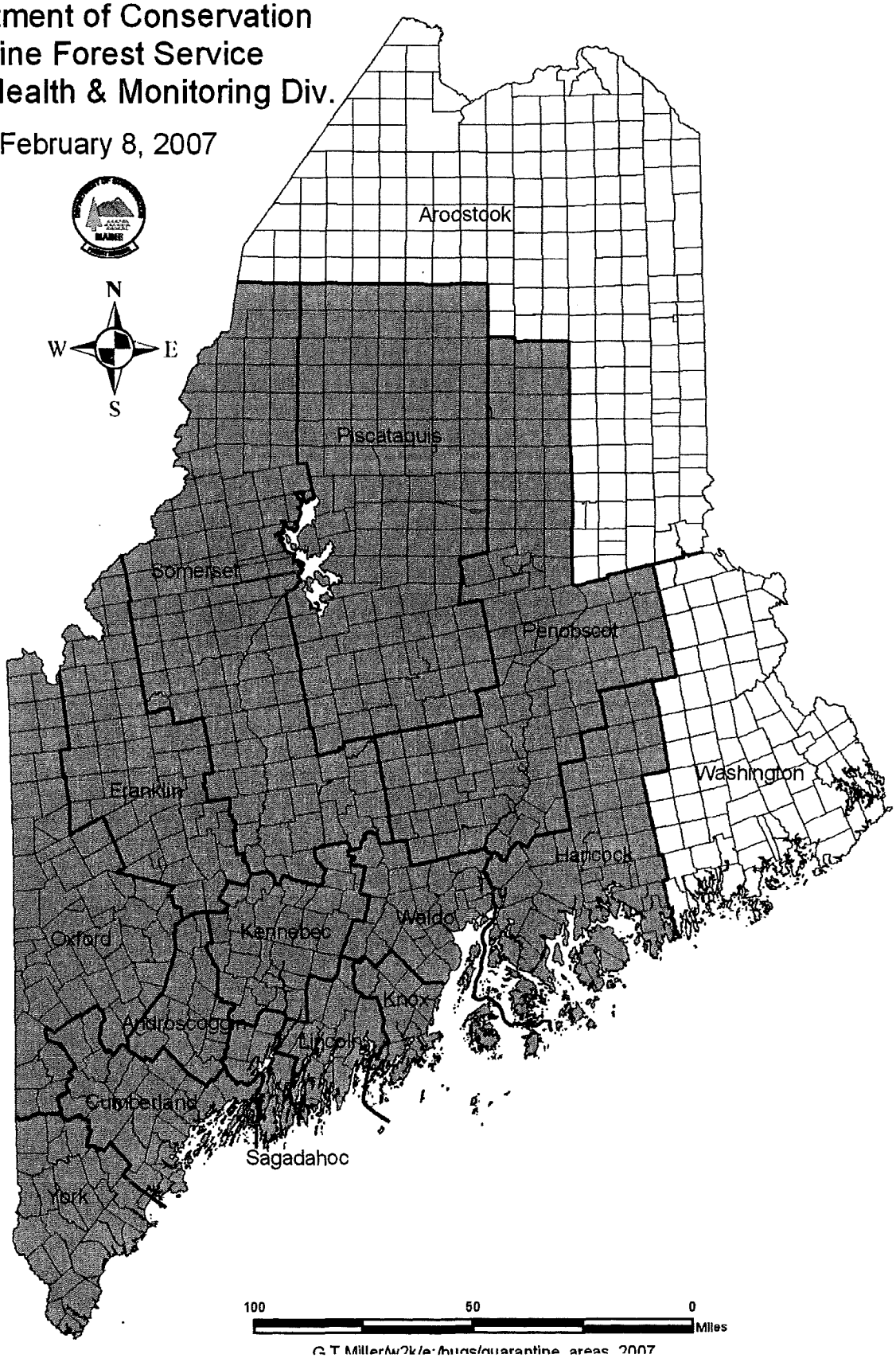


Above map is available online at: http://www.aphis.usda.gov/plant_health/plant_pest_info/psb/.

Pine Shoot Beetle Quarantine Area

Department of Conservation
Maine Forest Service
Forest Health & Monitoring Div.

February 8, 2007



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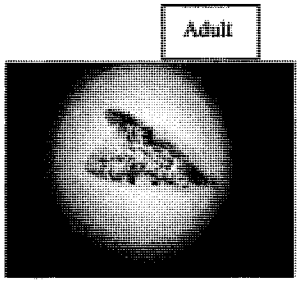
Appendix 1
Ash Defoliator, *Palpita magniferalis* (Wlk), in Mid-coast Maine

Erin West and Charlene Donahue
August 2005

Introduction

Severe ash (*Fraxinus*) defoliation was first reported in 2003 on Islesboro. Approximately 300 acres on the southern end of the island were severely defoliated by August and another 300 acres on the northern end of the island had moderate defoliation. There was severe defoliation of ash on Owls Head and light defoliation in Cape Rosier, Lincolnville, and North Haven as well. These areas were not as contiguous as the defoliation on Islesboro.



In 2004 there were reports of repeat defoliation, but ash leaf and twig rust was prevalent in the Rockland/Thomaston area and may have masked insect damage. Unfortunately this insect was not given priority due to reduced staffing and surveys were not conducted until late in the season when only a few larvae were still present. The larvae keyed out to the family Pyralidae and Dick Dearborn suggested that they were *Palpita magniferalis* (Wlk) (Lepidoptera: pyralidae). Attempts were made to rear the larvae but none survived.

Literature on pyralid defoliators is sparse. *P. magniferalis* (Wlk) is a common ash defoliator in North America, but it is not reported stripping trees as is happening in some coastal communities. Brower reports it from 30 locations in Maine with moths recorded from May to August and Covell reports adults from May to October throughout much of North America. The objective for the 2005 season was to positively determine the cause of ash defoliation, evaluate impact, and develop strategies for control if needed.

Methods

1) A light trap was set up on Owls Head and run by John Root. Originally the trap was to run from May 1-June 30, 2005 but we decided to continue operation into August because *P. magniferalis* moths were still present.

2) Field visits were made bi-weekly to Owls Head in order to survey damage to the trees. Visual surveys were done to assess the amount of defoliation. Leaf and larval samples were also taken from various trees and branch heights.

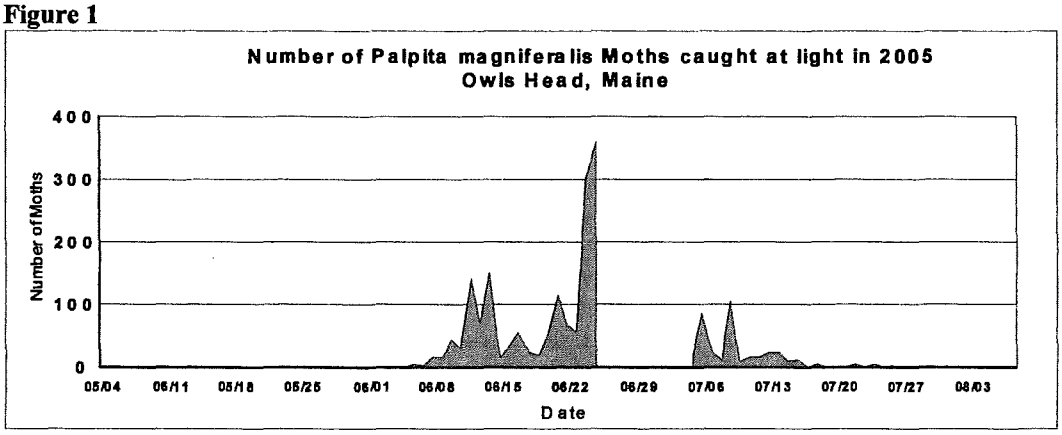
3) Reports received from citizens were confirmed and damage assessed.

4) A literature search was performed and specialists were consulted to find background information on *P. magniferalis*.

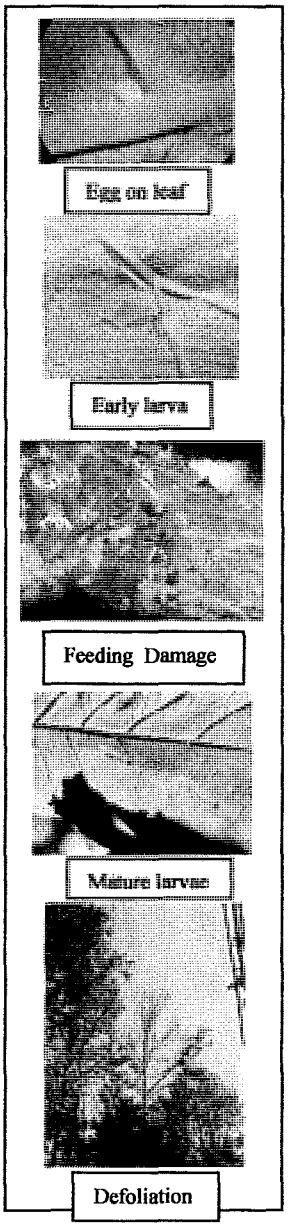
Results

The Owls Head light trap was run from May 4 until August 8 with a gap in service from June 26-July 5. *P. magniferalis* moths did not begin to appear in the light trap until June 6. The largest number of moths was caught from mid to late June. A steady catch of moths continued into July until the moths began to dwindle towards the end of the month (Figure 1). This suggests that the moths generally fly from mid June to Mid July.

Figure 1



Photos and specimens of the moths were sent to Dr. Brian Scholtens, Assistant Professor of Biology at the College of Charleston in South Carolina, for species confirmation. He positively identified the moths as *P. magniferalis.* Dr. Reginald Webster and Tony Roberts also weighed in on the side *P. magniferalis* and neither of them had heard of extensive defoliation by this common forest insect. A literature search at Fogler Library at the University of Maine uncovered no information about *P. magniferalis* as a problem defoliator and very little information on this insect at all.



Bi-weekly visits to Owls Head provided information about the extent of defoliation this year and about the timing of the appearance of larvae on the trees. The first sign of larvae and larval eggs on the leaves was in mid June, but no defoliation was yet visible at that time. By the end of June more larvae were visible and some leaf damage could be seen on the lower branches. The larvae were usually webbed by a vein, feeding on the underside of the leaf, often near the mid-vein. A visit to Owls Head on July 14 found larval skeletonizing common on leaves. Some leaves were tied together and had larvae present.

By the beginning of August the number of visible larvae on the leaves was much less (0-1 larva per leaf compound), but the damage to the trees had increased. Ten to forty percent defoliation was visible on the trees on Dynamite Powder road. The percent defoliation from tree to tree varied from only 10 percent defoliation on some to almost 90 percent on others. Overall average defoliation was around 30 percent. The larvae looked very mature and it was suspected that the larval stage would only last one or two more weeks.

A visit was also made to Islesboro on July 25. Moderate defoliation was visible along the West Side Road. Heavy defoliation was reported in this area in August of 2003. This year, larvae and defoliation were visible and the situation in the area seemed to parallel the situation in Owls Head. This was also true for the Dark Harbor area of the island where severe defoliation was reported in August of 2003.

A report from a citizen in early August suggested that a similar situation was occurring in Walpole. After a visit to the site on August 8, it was determined that the ash was in fact being significantly defoliated. Mature larvae were collected as well as samples of skeletonized leaves. Defoliation was also visible along Route 129 around the Damariscotta/South Bristol town line.

Aerial surveys of mid-coast Maine indicated approximately 1909 acres were heavily to moderately defoliated by *P. magniferalis.* Most of this acreage was on Islesboro with an

additional area in Owlshead.

The 2005 study of ash defoliation confirmed that *P. magniferalis* is causing defoliation of ash trees in mid-coast Maine. It was also found that defoliation becomes visible around the beginning of July and continues to worsen until the beginning of August. Why *P. magniferalis* becomes a problem in these isolated pockets is still unknown and should be further investigated.

Appendix 2.

Title 22: Subtitle 2: Part 3: Chapter 257-A: CONTROL OF BROWNTAIL MOTHS
§1445. Restrictions on application of pesticides to control browntail moths in coastal areas
(WHOLE SECTION EFFECTIVE UNTIL 3/31/07)

1. **Prohibition on application of pesticides.** A person may not apply a pesticide to control browntail moths on shade or ornamental trees within 50 feet of the mean high water mark in coastal areas.

2. **Restrictions on applications between 50 and 250 feet of mean high water mark.** A person may not apply a pesticide to control browntail moths on shade or ornamental trees in coastal areas located between 50 and 250 feet from the mean high water mark except in accordance with this subsection.

    A. Only products with the active ingredients diflubenzuron, permethrin, tau-fluvalinate or cyfluthrin may be applied.

    B. Applications may be performed only with a hydraulic hand-held spray gun.

    C. Applications may be performed only in a manner in which the applicator directs the spray away from marine waters.

    D. Applications may not be made when the wind is blowing toward marine waters.

3. **Notification and submission of records.** A commercial applicator, as defined in section 1471-C, subsection 5, shall notify the Board of Pesticides Control within the Department of Agriculture, Food and Rural Resources in advance of dates planned for spraying pesticides to control browntail moths in coastal areas. Upon request of the board, a commercial applicator shall submit spray records for such applications.

4. **Exemption.** The prohibitions and restrictions in this section do not apply to biological pesticides or to the injection of pesticides directly into the soil or into shade and ornamental trees.

5. **Repeal.** This section is repealed March 31, 2007.

Appendix 3.
Siberian Silk Moth Trapping Results in Maine 2006

Charlene Donahue
Dept. of Conservation - Maine Forest Service
Forest Health & Management Division
December 22, 2006

Introduction

The Siberian Silk Moth, *Dendrolimus superans sibericus,* (Lepidoptera: Lasocampidae) is a non-native insect pest of coniferous trees. It is on the USDA-APHIS high risk list for possible introduction into North America. It currently is not known to exist in Maine or North America. The 2006 survey was designed to detect the presence or absence of Siberian Silk Moth using two approaches - pheromone traps and light traps.

Methods

The FHM Division's existing network of 25 light traps (Table 1) is located in forested locations across Maine. All catch from currently scheduled light traps (run through the end of July) were screened for Siberian Silk Moth. In addition, 10 light traps in southern and coastal Maine had their season extended to mid August (an additional 2 weeks) to assure that the moth flight period was completely bracketed. Light traps were run nightly, with catch preserved and sent to the MFS Lab periodically through the season. Screening of light trap material occurred across the field season, and was completed by mid September.

Table 1. Light Traps		
Allagash	Aroostook	light trap
Ashland	Aroostook	light trap
Biddeford	York	light trap - August
Big Six Twp - Ste. Aurelie	Somerset	light trap
Bowerbank	Piscataquis	light trap - August
Calais	Washington	light trap - August
Crystal	Aroostook	light trap
Exeter	Penobscot	light trap - August
Greenbush	Penobscot	light trap
Haynesville	Aroostook	light trap
Hope	Knox	light trap - August
Jackman	Somerset	light trap
Kingfield	Franklin	light trap
Millinocket	Penobscot	light trap
Mount Desert	Hancock	light trap - August
Mount Vernon	Kennebec	light trap
New Sweden	Aroostook	light trap
Norway	Oxford	light trap - August
Rangeley	Franklin	light trap
Sedgwick	Hancock	light trap - August
South Berwick	York	light trap - August
T15 R15 WELS - Ste.Pamphile	Aroostook	light trap
T3 R11 WELS - Frost Pond	Piscataquis	light trap
Topsfield	Washington	light trap
Topsham	Sagadahoc	light trap - August

The light trap survey was supplemented with pheromone trapping using specific Siberian Silk Moth traps and lures in 30 locations (Table 2) in southern and coastal sections of the state (the area most likely to be exposed to artificial introduction on commodity shipments and containers). The traps used were milk carton traps with access holes enlarged but no funnel inserts as these were not provided as scheduled and limited personnel did not allow for redoing the traps once they had been deployed. Traps were set out the week of June 26 baited with a rubber septum stapled to the lid and a DDVP killing strip in the bottom. Traps were collected at the end of September.

Table 2. Siberian Silk Moth	**Pheromone Traps**	
Town	**County**	**Site**
Alfred	York	hard pine plantation
Augusta	Kennebec	hard pine plantation
Avon	Franklin	hard pine plantation
Bowdoinham	Sagadahoc	hard pine plantation
Bristol	York	softwood stand
Brunswick	Cumberland	softwood stand
Byron	Oxford	hard pine plantation
Cumberland	Cumberland	softwood stand
Freeman	Franklin	hard pine plantation
Fryeburg	Oxford	hard pine stand
Gorham	Cumberland	softwood stand
Hope	Knox	hard pine plantation
Jefferson	Lincoln	softwood stand
Kennebunk	York	softwood stand
Kingfield	Franklin	hard pine plantation
New Gloucester	Cumberland	hard pine plantation
North Berwick	York	softwood stand
Philips	Franklin	hard pine plantation
Poland	Androscoggin	softwood stand
Readfield	Kennebec	hard pine plantation
Sanford	York	hard pine plantation
Scarborough	Cumberland	softwood stand
Union	Knox	hard pine plantation
Vienna	Kennebec	hard pine plantation
West Gardiner	Kennebec	hard pine stand
West Rockport	Knox	hard pine stand
Whitefield	Lincoln	hard pine stand
Wilton	Franklin	hard pine plantation
Windham	Cumberland	hard pine plantation
Wiscasset	York	softwood stand

Results

No Siberian Silk Moths were caught in any of the traps in 2006. One pheromone trap in Jefferson was lost.

Appendix 4.
Trapping Results for *Sirex noctilio* (Hymenoptera: Siricidae) in Maine, 2006

William S. Urquhart, Jr. and Charlene Donahue
Dept. of Conservation - Maine Forest Service
Forest Health and Management Division
December 2006

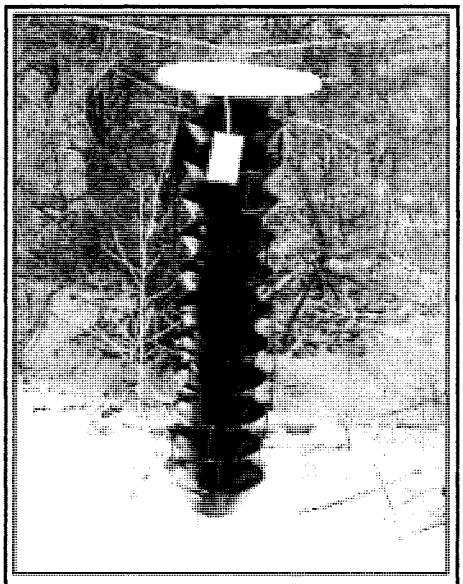
Introduction

Sirex noctilio Fabricius is an exotic wood boring wasp native to Europe, Asia, and northern Africa with the potential to cause significant tree mortality in coniferous trees within the state of Maine. The first documented specimen of *S. noctilio* in the United States was found by a factory worker in Bloomington, Indiana in July 2002. *Sirex noctilio* was found in Fulton, NY (Oswego County) in 2005 as part of the National Exotic Wood Borer and Bark Beetle Survey. In 2006 the Maine Forest Service (MFS) joined with APHIS, the U.S. Forest Service (USDA-FS), and the Maine Department of Agriculture in an international cooperative trapping effort to delimit the current range of *S. noctilio*.

Methods

Twenty 12-unit Lindgren funnel traps (Figure 1) were placed in southern and west central Maine during June 6-12, 2006 (Table 1).

Figure 1:



LINDGREN FUNNELTRAP FOR *Sirex noctilio*

Photo: Pennsylvania Department of Agriculture

Traps were baited with alpha-pinene (70%)/beta-pinene (30%) lures. The USDA-FS protocol called for replacing the lures every 45 days. Due to a supply-side mix up, lures were available for only one replacement on August 21, 2006.

Table 1. Maine 2006 Sirex Trapping Locations

TOWN	County
Alfred	York
Augusta	Kennebec
Avon	Franklin
Bowdoinham	Sagadahoc
Byron	Oxford
Freeman	Franklin
Fryeburg	Oxford
Hope	Knox
Kingfield	Franklin
New Gloucester	Cumberland
Philips	Franklin
Readfield	Kennebec
Sanford	York
Union	Knox
Vienna	Kennebec
West Gardiner	Kennebec
West Rockport	Knox
Whitefield	Lincoln
Wilton	Franklin
Windham	Cumberland

Traps were placed in overstocked and/or declining pine stands consisting primarily of hard pines. One trap per site was suspended from a tree by parachute cord with the collecting cup approximately six feet above the ground. Each trap was fitted with the "wet option" for collecting insects. Propylene glycol anti-freeze was added to the cup.

Trap collections were made every two weeks. The contents of each collection cup were strained using a small household strainer lined with a small piece of 0.36 mm mesh Dacron chiffon screening. The Dacron screen and its contents was then placed into a plastic medical specimen cup along with a preprinted label stating the collection date, trap location, and project name. The screen, collection, and label were then covered with 91% isopropyl alcohol and the leak-proof lid securely attached. The collection date, trap location, and project name were written on the lid with an indelible marker to facilitate processing the sample. The used propylene glycol was poured into a one gallon heavy plastic screw top jug and returned to the lab for disposal. The collecting cup was then refilled with new, unused, propylene glycol to a depth of approximately 4.0 cm and reattached to the trap. This procedure was repeated at each sample site.

At the lab the siricid woodwasps specimens were removed for later identification. All siricid woodwasps, with three exceptions were identified to species using the *Key To Genera of North American Siricidae* (Smith and Schiff, 2002). Leaves, twigs, pine needles, and other extraneous plant material along with the Dacron screening were removed during processing. All of the remaining insects, alcohol and the collection label were retained in their original cup and stored for future screening and identification. This material is currently being stored at the MFS Insect and Disease Laboratory in Augusta, Maine. At some point in the near future it will be sorted for buprestids, cerambycids, arachnids, and any other specimens of entomological interest.

RESULTS

No *Sirex noctilio* were caught during this survey. Twenty-one other siricid woodwasps caught during the survey period were cataloged in four genera and five species (Table 2). These specimens are retained at the MFS Insect and Disease Laboratory in Augusta, Maine for future reference.

On September 11 two siricid wasps of questionable identities were caught. One in the Avon trap and one in the Kingfield trap. Another questionable specimen was caught in the Wilton trap on September 12. These specimens were sent to E. Richard Hoebeke, PhD. at Cornell University Ithaca, New York. Dr. Hoebeke identified them as, *S. nigricornus, S. juvencus,* and *S. nigricornus*, respectively. The specimens were returned and are now part of the MFS permanent reference collection. The *S. nigricornus* is a new State record.

Table 2 Incidental siricid woodwasps caught during *Sirex noctilio* trapping survey in 2006.

Genus	Species	Location	Date	Number Of Specimens
Sirex	*juvencus*	Kingfield	September 11	1
Sirex	*juvencus*	Vienna	September 12	1
Sirex	*nigricornus*	Avon	September 11	1
Sirex	*nigricornus*	Avon	September 25	1
Sirex	*nigricornus*	Fryeburg	September 18	1
Sirex	*nigricornus*	West Gardiner	September 26	2
Sirex	*nigricornus*	West Rockport	September 25	3
Sirex	*nigricornus*	Wilton	September 12	2
Sirex	*nigricornus*	Wilton	September 25	1
Tremex	*columba*	Vienna	August 14	1
Urocerus	*cressoni*	Augusta	August 16	1
Urocerus	*cressoni*	Avon	July 31	1
Urocerus	*cressoni*	Fryeburg	August 7	1
Urocerus	*cressoni*	Kingfield	July 31	1
Urocerus	*cressoni*	Kingfield	September 25	1
Xeris	*Spectrum*	Avon	June 19	1

LITERATURE CITED

Smith, D. R. and N. M. Schiff. 24 January 2002. A Review of the Siricid Woodwasps and Their Ibaliid Parasitoids (Hymenoptera: Siricidae, Ibaliidae) in the Eastern United States with Emphasis on the Mid-Atlantic Region. Proceedings of the Entomological Society of Washington. 104(1): 174 – 194

Appendix 5

Exotic Bark Beetle and Woodborer Survey

Charlene Donahue
Department of Conservation
Maine Forest Service
Insect & Disease Management Division
February 2007

Introduction

Bark beetles and woodborers that are inadvertently brought to this country through trade have become an area of great concern. The global economy has fostered an explosion in the number of new pest introductions particularly wood infesting insects. Woodborers and bark beetles are moved in logs, boards, dunnage, packing crates, pallets, packing material, nursery stock, wood products, craft items, the list goes on and on.

Some of these insects do not survive, others seem to fit into the new habitat without much effect the we can see but there are some that can, and do, cause widespread damage. Two of the most prominent introduced pests in North America are the Emerald Ash Borer (*Agrilus planipennis* Fair.) and Asian Longhorned Beetle (*Anoplophora glabripennis* (Mot.)). There are ways to mitigate the effect of exotic pests in our forests and the first most important method is to keep exotic insects from getting here in the first place. The second is to monitor insect populations so we know as soon as possible when a pest arrives in order to take steps to reduce it's impact and spread. These are endeavors that require cooperation of people across the country, continent and world. Therefore the USDA Animal Plant Health Inspection Service - Plant Protection and Quarantine (APHIS-PPQ) has instituted an Exotic Bark Beetle and Woodborer Survey (EBB) across the nation to monitor for unwanted beetles. Maine has been participating for the past three years. This program has allowed us to develop our own expertise in identifying beetles and become familiar with native beetles as well exotic ones. By having a clear picture of what lives here, it is easier to pick out invaders when they do appear. This project has been a joint effort between the Maine Forest Service and Maine Department of Agriculture.

Methods

Twenty sites are selected for monitoring in Maine each year. These sites are located in areas deemed to have a relatively high risk of pest introduction. APHIS-PPQ has set guidelines for site selection some of which are pertinent to Maine. Not surprisingly, the majority of these sites are in southern Maine (Table 1.)

The trapping period is the approximate adult activity period from early April through the end of September in Maine. Traps are placed in the field as soon as adult activity periods begins. All work was preformed in cooperation with the Maine Department of Agriculture. We also collaborated with the USDA- APHIS-PPQ in Maine, the USDA Forest Service (USFS) and other states and provinces.

Table 1. Exotic Bark Beetle and Woodborer Survey Sites

			Year surveyed		
Town	**County**	**Criteria**	**2004**	**2005**	**2006**
Auburn	Androscoggin	SWPM/plant material	x	x	x
Auburn	Androscoggin	SWPM/transportation	x	x	x
Auburn	Androscoggin	SWPM/industrial		x	
Augusta	Kennebec	SWPM/industrial	x	x	x
Bath	Sagadahoc	Urban debris			x
Biddeford	York	SWPM/industrial	x	x	x
Easton	Aroostook	SWPM/industrial	x		
Gardiner	Kennebec	SWPM/industrial	x		
Lewiston	Androscoggin	SWPM/industrial	x		
Lewiston	Androscoggin	SWPM/industrial	x	x	x
Lewiston	Androscoggin	SWPM/pallets	x	x	x
Limestone	Aroostook	SWPM/industrial		x	x
Manchester	Kennebec	Wood products			x
Oxford	Oxford	Treated cargo	x	x	x
Portland	Cumberland	Port of Entry	x	x	x
Portland	Cumberland	SWPM/industrial	x		
Portland	Cumberland	SWPM/industrial		x	x
Portland	Cumberland	Urban debris		x	x
Presque Isle	Aroostook	Urban debris	x	x	x
Saco	York	SWPM/industrial	x		
Saco	York	SWPM/industrial	x	x	
Sanford	York	SWPM/industrial	x	x	x
Scarborough	Cumberland	SWPM/pallets	x		
Scarborough	Cumberland	Urban forest	x	x	x
Sidney	Kennebec	SWPM/pallets	x	x	
S.Portland	Cumberland	SWPM/industrial	x	x	x
Union	Knox	Urban debris			x
Waterville	Kennebec	SWPM/transportation	x	x	
Waterville	Kennebec	Urban debris		x	x
York	York	Nursery			x

Three 12-funnel Lindgren traps are placed at each site. Each trap is baited with one of the three lures or lure combinations.

- The ethanol lure is a general attractants for woodboring insects in deciduous hosts.
- Alpha-pinene and ethanol lures together are general attractants for woodboring insects in coniferous hosts.
- The three-component exotic bark beetle lure baited trap is more specific for conifer-feeding exotic bark beetles e.g. *Ips typographus, Ips sexdentatus, Hylurgus ligniperda* and *Orthotomicus erosus.*

The bark beetles and woodborer species targeted by this survey are:

Table 2. Target Exotic Insect List

Common Name (s)	Scientific Name	Concern
Asian longhorned beetle (ALB)	*Anoplophora glabripennis*	in NY, NJ
Bamboo longhorned beetle	*Chlorophorous annularis*	
Brown spruce longhorned beetle	*Tetropium fuscum*	in Nova Scotia
Chinese longhorned beetle	*Hesperophanes campestris*	
Emerald ash borer (EAB)	*Agrilus planipennis*	in IN, IL, OH, ON
European spruce bark beetle	*Ips typographus*	
Japanese pine sawyer	*Monochamus alternatus*	
Lesser Japanese cedar longhorned beetle	*Callidiellum rufipenne*	in CT
Lesser pine shoot beetle	*Tomicus minor*	
Pine shoot beetle (PSB)	*Tomicus piniperda*	Found in ME
Red-haired bark beetle	*Hylurgus ligniperda*	
Rough shouldered longhorned beetle	*Anoplophora chinensis*	
Six-toothed bark beetle	*Ips sexdentatus*	
Spruce engraver	*Pityogenes chalcographus*	
No common name	*Hylurgops palliatus*	
No common name	*Tetropium castaneum*	
No common name	*Trypodendron domesticus*	
No common name	*Xyloborus spp.*	
No common name	*Xylotrechus spp.*	

All bark beetle and wood borers were identified to genus and most to species. Suspect or unusual specimens were sent to taxonomic experts. A portion of the material was also sent for verification.

In addition to the EBB survey detailed above, the MFS also participated in a Exotic Detection and Rapid Response (EDRR) program run by the USFS in 2004 and again in 2006. This program is aimed at woodlands and wood processing plants to augment the points of entry targeted in the EBB survey. Maine was part of a pilot study in 2004 with just three trap sites in the Portland area and in 2006 deployed traps at nine sites in southern and central Maine. The protocol was the same for both surveys except specimens were sent to Cornell for identification rather then being identified in-house.

Table 3. Exotic Detection and Rapid Response Sites

Town	County	Criteria
Belgrade	Kennebec	Sawmill
Casco	Cumberland	Sawmill
Jefferson	Lincoln	Sawmill/Bark Processor
Kingfield	Franklin	Hard Pine Plantation
Poland	Androscoggin	Bark Processor
Sanford	York	Sawmill
Sanford/Lyman	York	Hard Pine Plantation
Westbrook	Cumberland	Sawmill
Windham	Cumberland	Hard Pine Plantation

Results

Over the past three years 24,000 beetles have been screened and identified in monitoring for invasive pest

species. We have developed expertise in taxonomic identifications in two people at the MFS Insect and Disease Lab as well as one person at the Department of Agriculture. In addition, there is now a network of taxonomists that we have met across North America that can aid us when unusual specimens come in. We have greatly improved our insect reference collection and have increased our knowledge of what beetle live in Maine and when and where they occur. This will all allow us to more easily detect unwanted woodborers and bark beetles if (when) they appear.

Table 4. Exotic woodborer and bark beetle survey results

Year	Target Species Found	Number of Beetles identified	Curculionidae Species (Bark & Ambrosia beetles)	Cerambycidae Species (Longhorned beetles)	Buprestidae Species (Flattedheaded woodborers)	New State Records
2004	0	7,400	43	26	9	7
2005	0	8,900	54	52	16	1
2006	0	8,000	51	34	11	0

2004
NEW STATE RECORDS

Curculionidae	Corthylus punctatissimus Zimmerman
*Curculionidae	Hylastes opacus Erichson
Curculionidae	Hylastinus obscurus (Marsham)
Curculionidae	Ips latidens (LeConte)
*Curculionidae	Xyleborinus alni Niisima
*Curculionidae	Xyleborus pelliculosus Eichhoff
*Curculionidae	Xylosandrus germanus Bland

* Four exotic species not thought to be major threats were recovered at sites throughout Maine.

2005
NEW STATE RECORD
Curculionidae Micracis suturalis (LeConte)

The large number of bark beetle State Records in 2004 occurred because these are small, cryptic beetles that are not regularly collected unless doing a particular study on them. Half of the eight species are exotics that have arrived here since these beetles were closely inventoried. All four of the recently identified exotic species were found from York to Aroostook county indicating that they have been in Maine for sometime.

Locally collected *Tetropium* specimens collected have been sent to the Maritimes Forest Research Centre for DNA analysis as part of a study of baseline genetic material and potential hybridization.

2006
NEW STATE RECORDS from EDRR
Curculionidae Hylesinus criddlei (Swaine)

*Curculionidae Pityogenes bidentatus (Herbst)	(1)
*Curculionidae Xyleborus atratus Eichhoff	(2)
*Curculionidae Xyleborus intrusus Blandford	(1)

H. criddlei is a native species that is not common and difficult to separate from a related species. The other three new finds are all exotic bark beetles and only one, or at most two, of these species were found. These sites and species will be closely monitored in 2007.

Appendix 6

Harvesting Hardwood Stands Affected by Beech Bark Disease in Central Maine

Amanda Farrar and William D. Ostrofsky

The following study was a cooperative effort between the Maine Forest Service, The USDA Forest Service, and the University of Maine. This report presents the results of a study that investigated the effects of forest practices on beech regeneration survival ten years post harvest, and the effects of various harvesting practices on residual American beech trees resistant to beech scale infestation. The complete report is available in the Northern Journal of Applied Forestry 23(3):192-196.

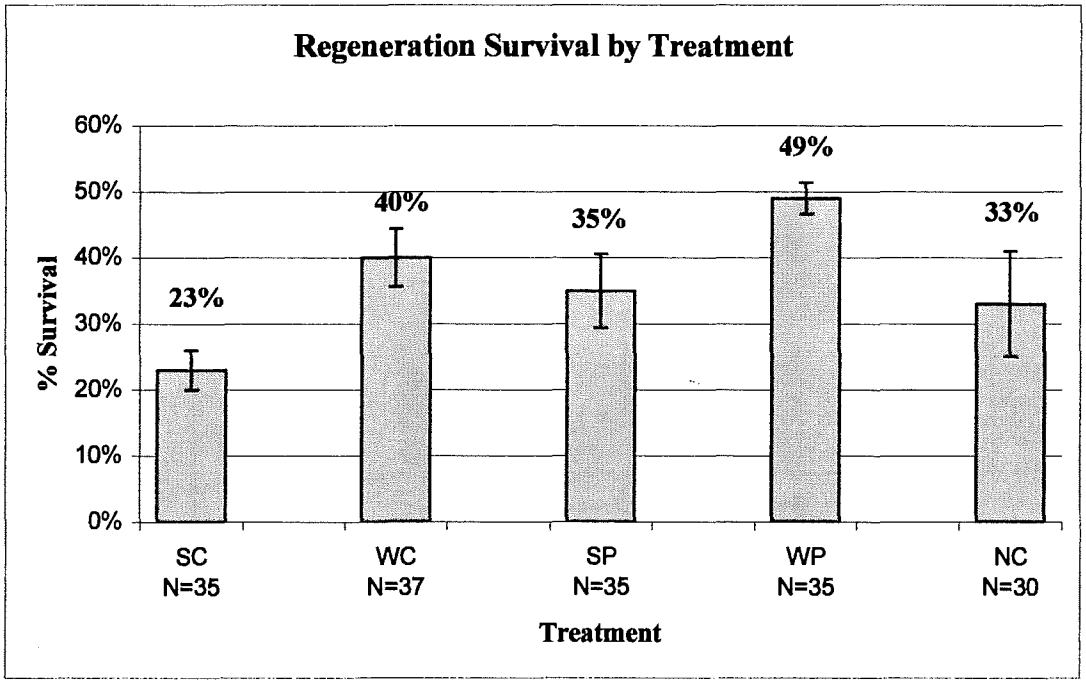
Study Summary

Understanding the consequences of the season and intensity of harvest on root disturbance and the survival of resistant beech is the key to improving the quality of beech in stands affected with beech bark disease. Determining the long-term effects of different harvesting practices will allow forest managers to evaluate the potential effects of harvesting on stands affected with beech bark disease and make management decisions that will encourage the survival and propagation of resistant trees.

The study posed three questions: is there a difference in American beech sprout mortality between summer and winter cuts ten years following harvesting; is American beech regeneration survival greater around residual beech resistant to the beech scale than around residual susceptible beech ten years following harvesting; do different harvesting levels affect the survival of residual resistant beech ten years following harvesting.

Many stands have been rendered less productive as a result of a high level of defective beech and dense thickets of beech reproduction. Unfortunately, this study leads to no clear regeneration strategy to increase the number of resistant beech stems in forests affected with beech bark disease. There was no significant difference found between the harvest-initiated sprouting around resistant and susceptible trees. Because American beech is so shade tolerant, it does not experience rapid mortality when regeneration is left to grow in the understory. It is in this way that beech is often able to work its way into the overstory by taking advantage of gaps that occur over time and by outliving other hardwood species. Apparently, as shown in this study, beech will experience mortality if regeneration is left out in the open, as with clearcuts.

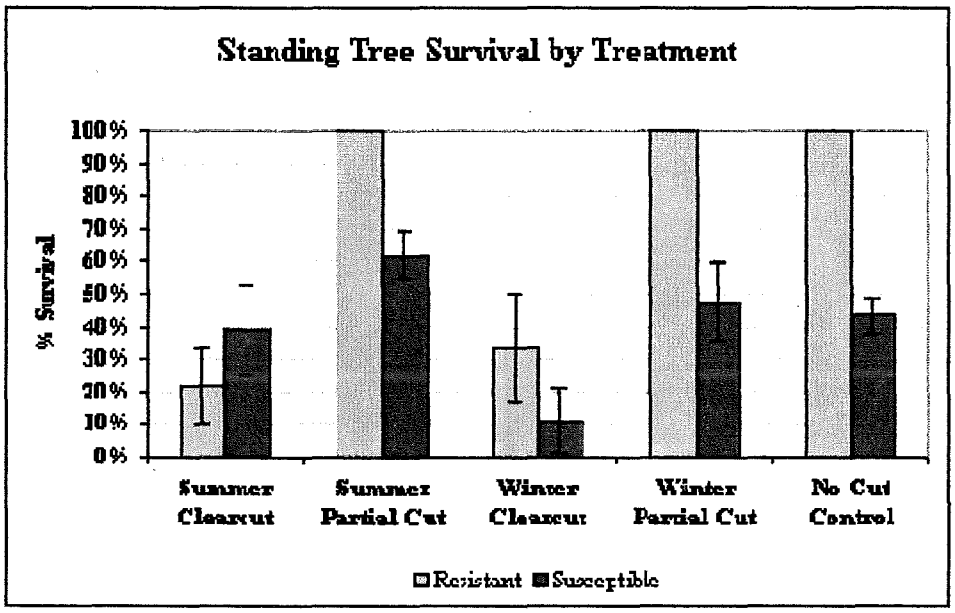
Figure 1. Beech regeneration survival by treatment ten years following harvesting. SC = summer clearcut: WC = winter clearcut; SP = summer partial cut; WP = winter partial cut, and NC = no harvest (control); N = numbers of plots assessed.



Winter partial cuts, while initially causing the least sprouting overall, resulted in the highest sprout survival. The decreased sprouting in the winter cut blocks is thought to be the result of the root system being frozen and protected by snow and thus less likely to suffer injury as a result of harvesting. Sprouts resulting from winter treatments likely survive longer because the supporting root system has more stored nutrients.

Leaving resistant trees and removing susceptible ones should enhance genetic variation through the sexual reproduction of resistant trees. In addition, large diameter, mature beech have a high wildlife value for the mast they produce. Past studies have suggested leaving resistant trees in all harvesting situations. However, this study shows that leaving resistant American beech of high vigor in clearcuts without the protection of surrounding trees leaves them susceptible to decline and death from exposure (Figure 2). When implementing management plans, resistant trees should be identified and retained, but care should be taken to ensure that they are protected from sunscald by surrounding trees.

Figure 2. Residual beech tree survival ten years following stand harvesting.



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