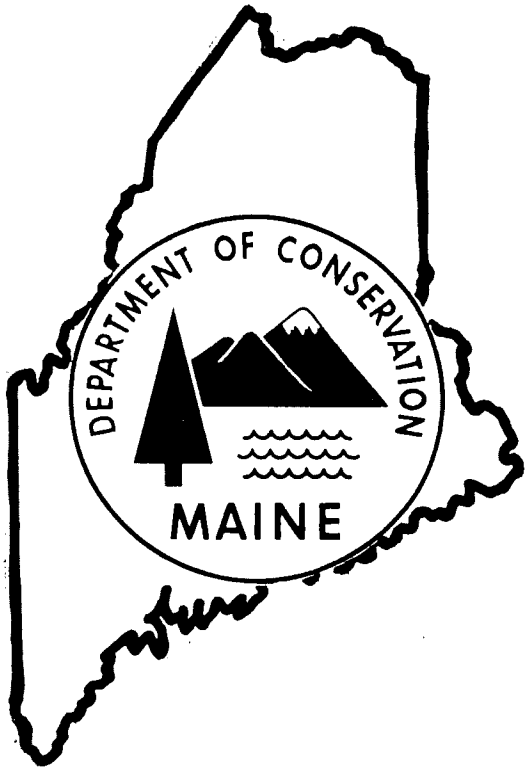
FOREST & SHADE TREE INSECT & DISEASE CONDITIONS FOR MAINE

A Summary of the 1987 Situation



Insect & Disease Management Division
Summary Report No. 2
March 1988

Maine Forest Service
MAINE DEPARTMENT OF CONSERVATION
Augusta, Maine

C O N T E N T S

Quick Finder Index

(For Major Pests and Programs)

* Mites are included in the insect sections of this report.

** Abiotic, bird and animal damage is reported in the disease sections of this report.

FOREST & SHADE TREE INSECT & DISEASE CONDITIONS FOR MAINE
A SUMMARY OF THE 1987 SITUATION

Conditions for 1987 roughly paralleled those of 1986 consisting of a diversity of relatively minor problems with few of the major pest crises of the past. The challenges of dealing with a different array of pest problems and differing emphasis provided the I & DM staff with an interesting series of mental exercises as well as increased field work. The result has been an evolving new strategy in dealing with management related problems of the "new forests."

Highlights of Division Activities for 1987

During the 1987 season, the staff of the I & DM division experienced a number of changes leading up to implementation of the reorganization plan in August. Changes associated with the reorganization were outlined in a report of the Entomology Division Review Team (see publication section following).

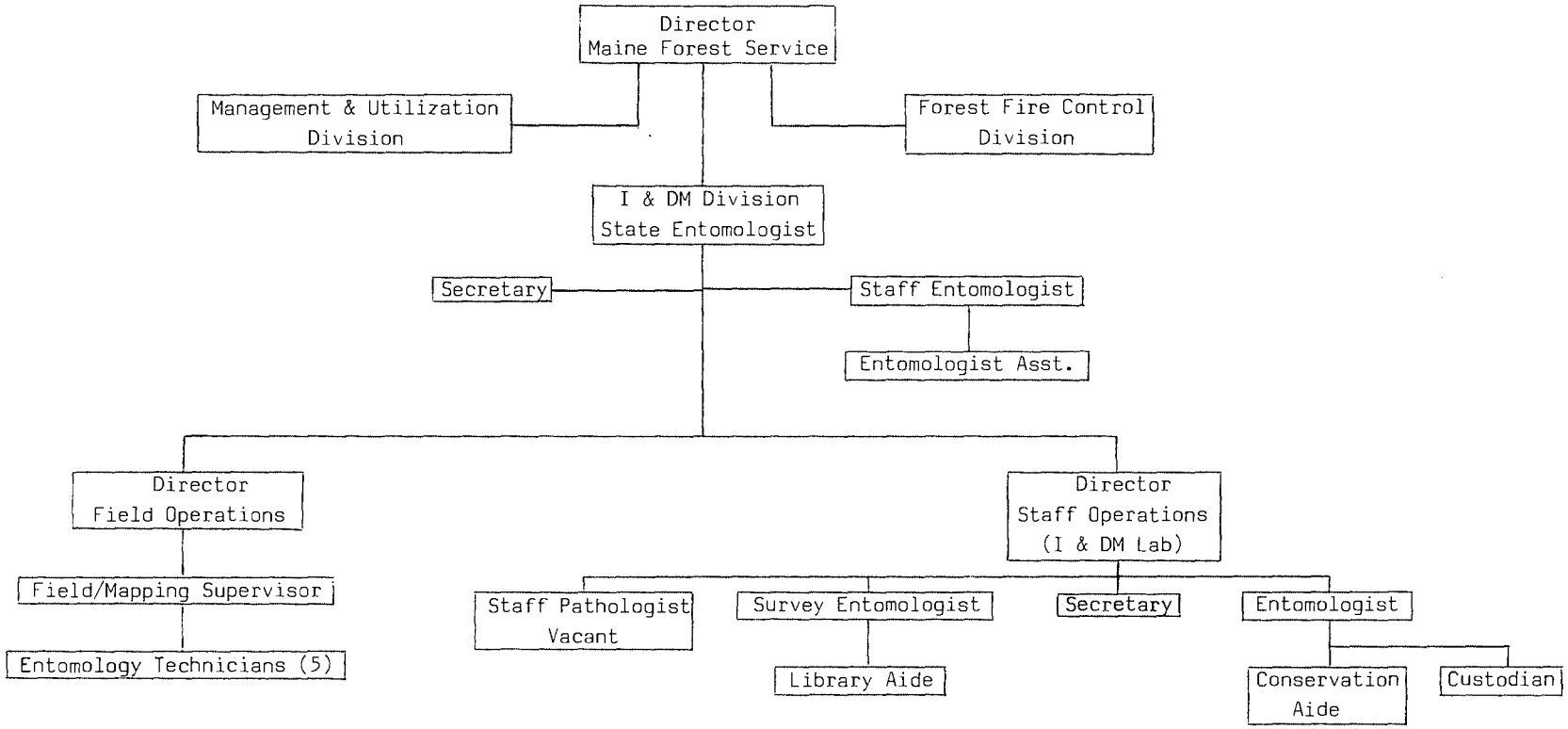
Conservation Commissioner, Robert R. LaBonta, appointed State Entomologist Thomas Rumpf to serve as Acting Director of the Maine Forest Service in March until a replacement could be found for the former Director Kenneth Stratton. Tom subsequently appointed Richard Bradbury to the position of Acting State Entomologist.

In late June John H. Cashwell was appointed to fill the position of Director of the Maine Forest Service and Tom Rumpf returned to the position of State Entomologist. John Cashwell had been employed by Georgia-Pacific for the past eight years. He is a Maine State Registered Professional Forester and a Christmas Tree Grower and holds a B.S. Degree in Forest Management from the University of Montana. He began his official duties on July 6.

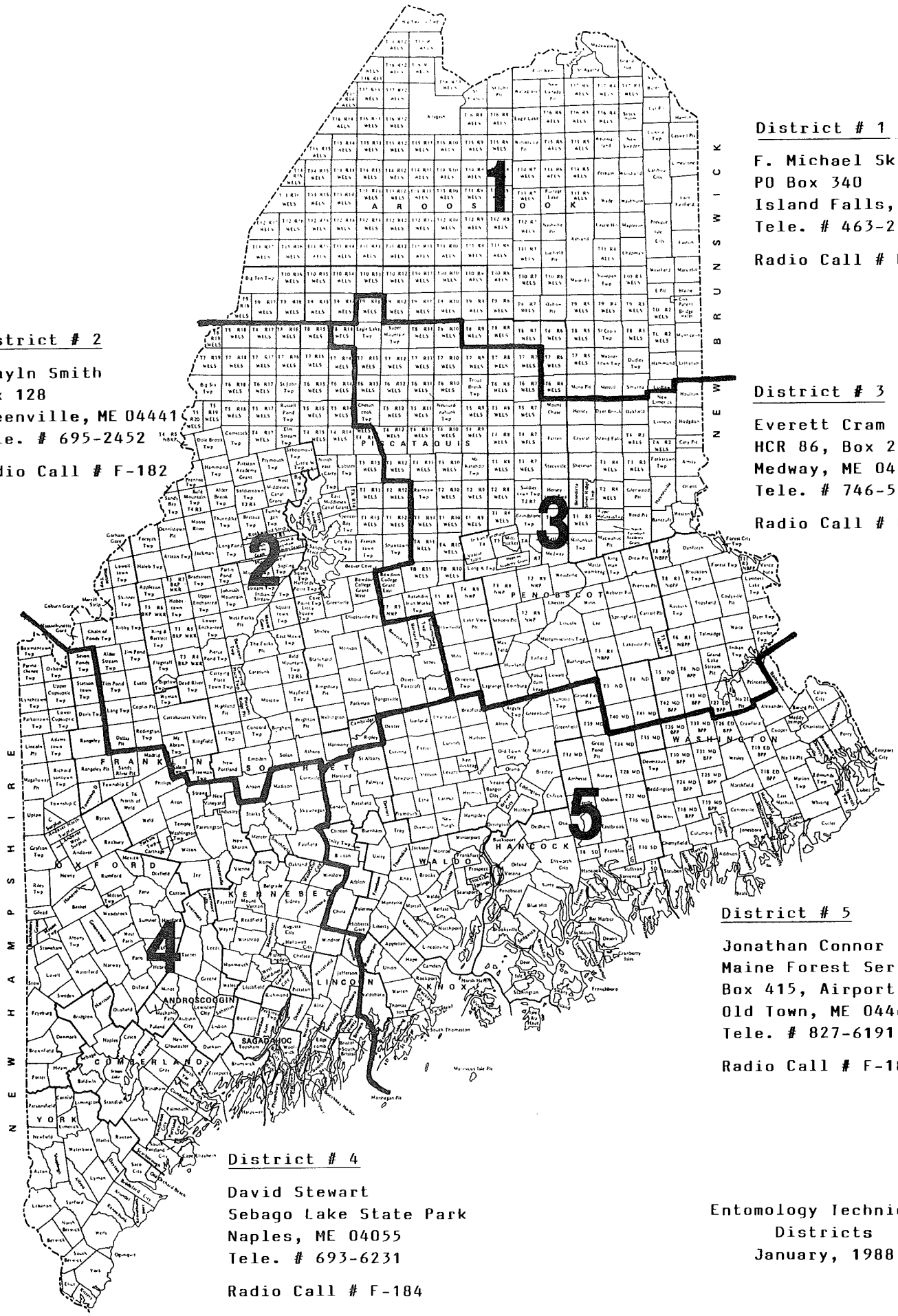
The official reorganization of the I & DM Division was implemented on August 24. Most of the changes involved are spelled out in the report of the review team. The I & DM staff organization is outlined in the following chart and the five entomology technician districts are shown on the accompanying map (as of January, 1988). Although our division does not retain all of the distinct program staff structure of past seasons (i.e., spruce budworm and white pine blister rust) much of our activity in these programs is continuing in a more integrated fashion. The Division activities do, however, blend more smoothly into changing roles to meet needs expressed in the Department of Conservation's Forests For the Future report which was presented to the legislature in January, 1988.

Tom Rumpf resigned on January 8, 1988 to return to the private sector and Henry Trial, Jr. was appointed to fill in as Acting State Entomologist.

Additional personnel and program information can be found within the pest summary sections of this report.



Maine Forest Service
MAINE DEPARTMENT OF CONSERVATION
Insect & Disease Management Division
Organizational Chart
January, 1988



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Entomology Technician
Districts
January, 1988

Publications

The I & DM Division continues to maintain and upgrade a series of published reports, bulletins, brochures and information leaflets and sheets on programs and pests of importance to Maine's tree resources, both forest and urban. Through our seasonal condition reports our readers are apprised of those items of importance in light of current pest developments. A number of publications are currently in the development process.

In addition to the standing file of materials, the following new items have been published over the past year:

Bradbury, R.L. and E.A. Osgood. 1987 (Nov.). Chemical Control of Balsam Gall Midge Paradiplosis tumifex Gagne (Diptera : Cecidomyiidae). Me. Agr. Expt. Sta. Tech. Bull. 129. 8pp.

Entomology Division. 1987 (March). Forest & Shade Tree Insect & Disease Conditions for Maine - A summary of the 1986 situation. Me. Dept. of Conserv., Me. For. Serv., I & DM Division. Summary Rpt. No. 1. 22pp.

Entomology Division. 1987. Forest & Shade Tree-Insect & Disease Conditions for Maine. 13 issues from May 6 through August 18. Edited by R.G. Dearborn and Douglas A. Stark.

Entomology Division Review Team*. 1986 (October). Report of the Maine Forest Service Entomology Division Review Team to the Director, Maine Forest Service, Department of Conservation, Augusta, Maine. An unpublished internal report. 8pp. plus 24 pages of appended information.

Trial, Henry, Jr. and J.B. Dimond. 1988 (March). An Aerial Field Trial Evaluating Split Applications and New Formulations of Bacillius thuringiensis Against the Spruce Budworm (Choristoneura fumiferana) in Maine - 1986. Me. Dept. of Cons., Me. For. Serv. I & DM Division. Tech. Rpt. No. 26. 18pp. (In press).

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* Dr. John Dimond and Dr. Bill Ostrofsky, University of Maine; Tim Sawyer, P.H. Chadbourne & Co.; Jerry Williams, International Paper Co.; and George LaBonte, Henry Trial, Jr. and Thomas Rumpf, Maine Forest Service.

1987
PEST SUMMARY

Forest pest conditions in 1987 were very similar to those experienced in 1986 with only slight variation. The severity of many problems seemed to be generally lower and problem diversity less consistent in 1987 than in 1986. While disease problems continued to take their toll, it was the insect pests and weather related problems which seemed to draw much of the attention.

Populations of most of our "traditional" major insect pests declined again in 1987 but a number of "surprises" kept the I & DM staff busy throughout a long season. The spruce budworm populations continued to slide closer to endemic levels in all but southeastern Maine and gypsy moth populations also fell strikingly with relatively little defoliation evident. White pine continued to come under attack at significantly damaging levels in 1987 by the white pine weevil to which was added severe damage in some areas by the pine fascicle mite and pine leaf aphid. Spruce and fir in forest stands in northern Maine generally received relief from many of the standard problems such as spruce budworm and Stillwell's syndrome and looked somewhat better than usual in 1987. Plantation spruce did, however, suffer locally from severe populations of budmoth, gall aphid, and twig midge. Balsam fir in plantations was plagued by increasing populations of twig aphid and gall midge. Poplars and beech seemed to take the brunt of insect problems in 1987. Balsam poplar was severely defoliated by a number of leaf miners and trembling aspen was attacked by a wider variety of defoliators as well as disease. Oystershell and beech scales continued to plague beech over most of its range and this was followed by high populations of an unusual series of defoliators from late August through October. A relatively new leafminer on birch (Messa nana) surprised us by causing widespread and severe defoliation of white birch while the normal leafminer component dropped. Oak problems appeared to be diverse but mainly at the level of curiosity.

White pine blister rust dominated disease activities in 1987 as a result of the special study discussed in this report but numerous other disease problems were investigated. Two program related disorders, the European Larch Canker and the pinewood nematode remained at 1986 levels. Armillaria root rot, ash leaf rust and scleroderris canker remained fairly stable in 1987 while conifer needle rusts (except on jack pine) declined. Sirococcus shoot blight, atropellis canker, jack pine needle rust, annosus root rot, dwarf mistletoe and poplar shoot blight seemed to be more destructive in 1987 than in 1986.

Abiotic factors stimulated a significant level of concern in 1987 along with porcupine damage. Weather related white pine needle blight (SNB) was less pronounced in 1987 than in 1986 while winter (1986-87) weather related damage was much more noticeable especially on shade trees and ornamentals than it has been for many years. Porcupine damage to jack pine and balsam fir was also up in 1987 especially damage to plantation jack pine in eastern Maine.

A more detailed summary of the 1987 pest conditions follows:

(A) Forest Pests - Softwoods
(See also Sections C & D)

Insects

Arborvitae (Northern White-Cedar) Leafminers (4 species) - Populations of these pests continued to fluctuate at relatively low levels statewide and damage was spotty except in the extreme southeast. In coastal areas from East Machias to Dennysville, including Cutler, Trescott and Lubec, damage was again in the moderate to severe range. Winter surveys late in 1987 indicate generally stabilizing populations with decreases from 1986 levels at Trescott and Edmunds but with a notable increase at Whiting. Argyresthia aureoargentella again made up over 80% of these eastern populations.

Balsam Woolly Aphid (Adelges piceae) - This insect continues to be a serious problem on balsam fir especially over the southern half of the State, although damage is often difficult to isolate from that of other causes. The gout phase continues to predominate in all areas with the woolly trunk phase conspicuously absent.

Hemlock Woolly Adelgid (Adelges tsugae) - This fascinating and potentially threatening pest of eastern hemlock (Tsuga canadensis) has come to our attention over the past year but so far has not been reported from Maine. Formerly considered a pest of ornamentals along the Atlantic Coast to the south and in the Pacific Northwest, it crossed Long Island Sound into Connecticut around 1985 where it seriously affected hemlock in forest situations. It has not moved north of Connecticut so far as we know but has received a great deal of press concerning its potential threat. The I & DM Division is presently communicating with other State and Federal agencies in order to try and determine the significance of the problem and desired course of action. More information will be provided in the near future.

Introduced Pine Sawfly (Diprion similis) - Light populations of this sawfly were reported from white pine in Baring and T28 MD in late July. This species has not been a problem for several years.

Larch Casebearer (Coleophora laricella) - Populations of the larch casebearer declined again in 1987 and the "scorched" foliage resulting from larval feeding was not as evident. This was the second year of decline from the heavy populations of 1985.

Larch Decline/Bark Beetle (Dendroctonus simplex) - Larch mortality and associated bark beetle activity continues to occur across southern Maine. (See Disease section following). Most new mortality is occurring in stands already exhibiting mortality, and is generally associated with beetle infested trees. However, new areas of active beetle populations and mortality were noted in Aroostook Co., remote from previously known problem areas.

Surveyed larch stands in southwestern Maine showed that mortality of Dominant/Co-dominant larch increased from 12 to 17% of the basal area

between 1986 and 1987. Although most stands had only minimal amounts of mortality, the overall pattern indicates continued buildup.

Larch Needleworms and Tubemakers (Several species) - These are some of the earliest feeders on larch and begin their activities as the larch needle clusters emerge in early May. We had several reports of these interesting insects from central Maine in 1987. Curiosity was expressed over their interesting habits of tubemaking. At least three species were involved but damage was very light.

Larch Sawfly (Pristiphora erichsonii) - Although small colonies of larvae were observed on larch at scattered localities across central and eastern Maine in 1987, populations continued to remain very low with no reportable defoliation. We have been expecting a resurgence of this pest since the 1975 outbreak collapsed around 1976.

Pine Fascicle Mite (Trisetacus alborum) - Flagging on white pine was extremely heavy over a wide band across central and eastern Maine in 1987. Damage became evident by early June as the dead shoots began to turn red and droop. The impact of this pest on eastern white pine may be compounded in 1988 where infestations coincide with those of the pine leaf aphid. Damage from this pest may become confused with that of pine leaf aphid except that: 1) Mite flagged tips show one or more dwarfed needle fascicles at the junction between healthy and dead tissue; 2) The bark of the twigs near the base of the dwarfed needle fascicle shows a yellow coloration; and 3) Mite flags appear early in any year whereas the pine leaf aphid flags in Maine appear early in the season only on even years (i.e. 1988).

Pine Leaf Aphid-Adelgid (Pineus pinifoliae) - Galls of this species appeared to be only moderately abundant on red and black spruce early this season but as the season progressed the great numbers of winged forms settling on white pine needles gave a different story. Populations on pine were heaviest across central and eastern Maine and by August, severe damage was evident in many areas. Damage should be increasingly evident as we proceed into the spring of 1988. Populations and damage were the heaviest seen since the last outbreak of this pest took its toll around 1956. The problem may be compounded due to heavy populations of the pine fascicle mite (see the preceding).

Spruce (Bark) Beetle (Dendroctonus rufipennis) - While scattered trees and small pocket infestations of this species have occurred throughout the range of spruce in Maine, the area presently most heavily infested appears to be in northern Maine (See Fig. 1). During 1987 there were over 1,500 acres exhibiting high beetle populations and damage in primarily two separate stands. Reports were received of two or three additional stands which had already been harvested within roughly the same area. To date, most of the extensive areas checked have been in stands containing a high percentage of large white spruce and have been near or along a water course. Of the 1,500 acres checked in 1987, infestation levels and mortality of the total large white spruce component generally exceeded 75%. Black-red spruce within these stands was either uninfested or only very lightly infested. Where possible,

harvesting was being accelerated to salvage as much valued timber as possible.

General (presence or absence) surveys for this species are conducted annually by the I & DM division due to association of the beetles with high value spruce. Most major landowners are also aware of this problem for similar reasons. Our concern at this time is how serious the problem can become on smaller diameter trees, on red and red-black spruce, and on all spruce on more upland sites.

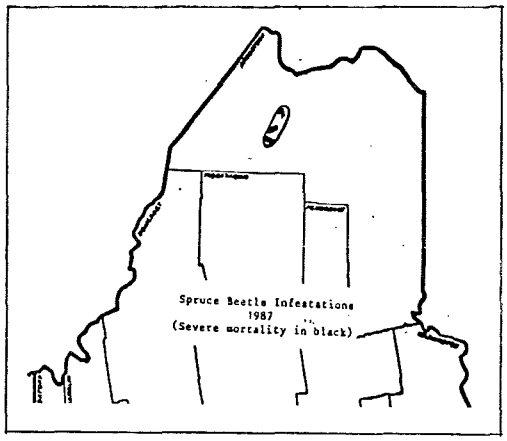

Fig. 1

Spruce Budworm (Choristoneura fumiferana) - The spruce budworm infestation in Maine is at its lowest level since the late 1960's. Nearly the entire 1970's-80's outbreak area is now free of noticeable defoliation. Operational spraying has not been conducted since 1985 and none is planned for the foreseeable future. All spray equipment formerly owned by the Maine Forest Service has been sold. Some private control operations were conducted in 1987 in eastern Maine in Christmas tree plantations (See Section C). Host trees damaged by the outbreak are showing recovery in nearly all areas but scattered losses due to Stillwell's Syndrome and spruce beetle continue in some previously heavily damaged stands. The outbreak does not show any sign of resurgence at this time.

The Maine budworm program has been scaled down to a point where large scale assessments of spring larval populations are no longer feasible. Attempts were made in 1987 to collect larvae for parasite and microsporidian disease assessment, but these surveys were discontinued after early larval reconnaissance showed a total lack of insects in all but southeastern Maine. Microsporidian assessment samples were collected in southeastern Maine where scattered moderate to heavy populations were found. The only noteworthy aspect of the 1987 larval assessment other than the lack of larvae in the north was a sharp decline in larval numbers in the southeast between the 4th and 6th instars. This observation is only supported by a small amount of data, but does correspond with similar observations made in parts of northern Maine in 1986 where the infestation has now collapsed.

The 1987 aerial and ground defoliation survey was greatly reduced due to the low larval populations found. A defoliation map showing moderate to severe defoliation was produced (Fig. 2). The area of moderate to severe defoliation in 1987 was estimated to be 210,000 acres with an additional 40,000 acres of light defoliation detected during ground evaluations. The entire defoliated area is in the southeastern portion of the state. Defoliation was so variable that the boundaries of the defoliation area were determined, but no attempt was made to delineate each patch of damage within the area.

Most of the 1987 predictive survey was done with pheromone traps placed throughout the northern two thirds of Maine. Pheromones were used because populations were expected to be too low for assessment with the L-II method. Moth catch was evaluated on approximately 150 locations and in most locations no moths were trapped. Northern and central Maine budworm populations are very low or non-existent. Traps placed in the southeastern portion of the state did catch moths, but only 1 location caught more than a 100 moths per trap. A small number of L-II collections were made in the southeast. These collections showed a highly variable low to moderate L-II population.

No host mortality surveys were conducted in 1987. Losses did increase in the southeast in small scattered areas, but losses due to past stress in the north seem to be much reduced.

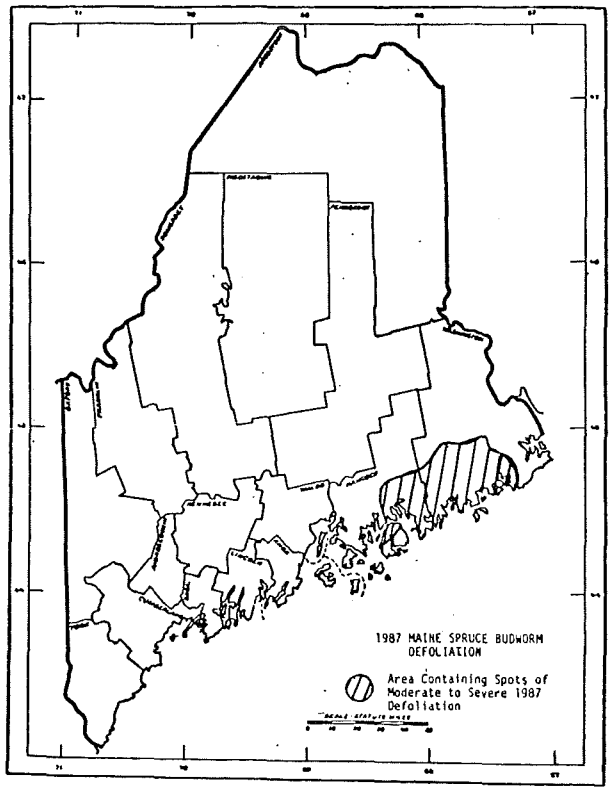

Fig. 2

Summary of 1987 Infestation Conditions

	Category	Acres	1986-87 Trend
Defoliation	Moderate-Severe	0.21 Million	Down Sharply
Hazard	High-Extreme	0.13 Million	Down Sharply
1987 Population Prediction	High-Extreme	0.12 Million	Down Sharply
Host Mortality	25% or More Dead	0.3 Million	Unchanged

All Maine Forest Service personnel previously assigned to the Spruce Budworm Management Program had either been reassigned or changed job responsibilities by September of 1987. Several former budworm employees are now assigned to the Insect and Disease Management Division and much of Maine's budworm expertise remains in the Maine Forest Service. Surveillance surveys and impact studies will continue and will gradually become integrated into the general Forest Insect Survey when populations become endemic. A number of studies concerned with various aspects of the program have been completed and should be published within the year (1988). The Maine Forest Service has contracted with consultants to document the "70's outbreak" in Maine. An extensive library of spruce budworm literature has been accumulated over the years and will be maintained at the I & DM Laboratory in Augusta. The I & DM staff will attempt to keep abreast of current developments in spruce budworm research and spray technology and maintain contact through the Eastern Spruce Budworm Council.

Spruce Coneworm (Dioryctria reniculelloides) - Coneworm populations continue their downward slide parallel to those of the spruce budworm. Populations were barely detectable in most areas in 1987 and are expected to remain low in the near future.

Stillwell's Syndrome (= "Red Fir") - Variable numbers of balsam fir which apparently survived the spruce budworm outbreak have exhibited the red fir symptoms (entire trees turn red) of this syndrome for the past several years. Mortality is 100% of all symptomatic fir. While the scattered nature of the problem has prevented the Maine Forest Service from fixing actual losses with reasonable confidence, observations suggest that the number of trees affected in 1987 was less than 1985 or 1986 levels. This may reflect a leveling off of factors which cause the problem, such as stress from past budworm damage or it may be a temporary decline, perhaps induced by a dry season in 1987. Stillwell's syndrome continues to be closely related to budworm mortality and budworm induced stress. Also, the fungus, Armillaria mellea continues to be a consistent component in the sudden reddening of stressed fir (See next section). The general reddening symptoms of this syndrome should not be confused with the fir flagging discussed in the disease section following.

(A) Forest Pests - Softwoods (See Sections C & D)

Diseases

Armillaria (= Shoestring) Root Rot (Armillaria mellea) - In the Frenchville area, sudden reddening and retention of dead needles, symptoms of this disease, were observed on fir suffering root damage from wood road construction or girdling roots. The chaulky-white mycelial fans were visible at the wood-bark interface of the root collar.

Stillwell's Syndrome which contains this disease as a component is discussed in the preceding (Insect) section.

Diplodia Tip Blight (Sphaeropsis sapinea = ellisii = Diplodia pinea) - Heavy flagging of 20-25' high pitch pine in Windham was caused by this pathogen. Black fruiting structures (pycnidia) under the fascicle sheath produce large, brown, oval spores, with or without septation.

Eastern Dwarf Mistletoe (Arceuthobium pusillum) - This parasitic plant continues to be a problem on white spruce especially along the coast, west of Penobscot Bay. Island stands seem to be especially hard hit and several islands were checked in 1987. White spruce on Squirrel Island was found to be infested to varying degrees, with some mortality of mature trees and understory reproduction occurring. The severe situation on Monhegan Island continues, causing a serious fire hazard situation and which may lead to eventual near-elimination of white spruce in this area. Much of the overstory white spruce is already dead, and understory reproduction is heavily infected. Reports on management options were prepared and presented to the respective island associations and were the cooperative effort of the three Divisions of the Maine Forest Service.

European Larch Canker (Lachnellula willkommii) - The canary-yellow flagging symptom associated with cankered branches was quite pronounced by mid-August in affected areas of Washington/Hancock and Lincoln/Knox/Waldo Counties. Although all cankers found in Maine to date have occurred only on Tamarack (Larix laricina), all larches (Larix spp.) and golden larch (Pseudolarix) are susceptible.

The **quarantine** boundary has remained stable (See Fig. 3) since 1985 when the town of Thomaston was added to the list of confirmed towns. Surveys in 1987 produced no new infested areas.

Compliance agreements previously entered into with Boise Cascade, Georgia-Pacific, International Paper Co., and Scott Paper Co. were continued following the annual inspections, and that with S.D. Warren was rescinded by mutual agreement because it was found to be no longer necessary due to the fact that the mill no longer accepts round wood with bark from the quarantined area.

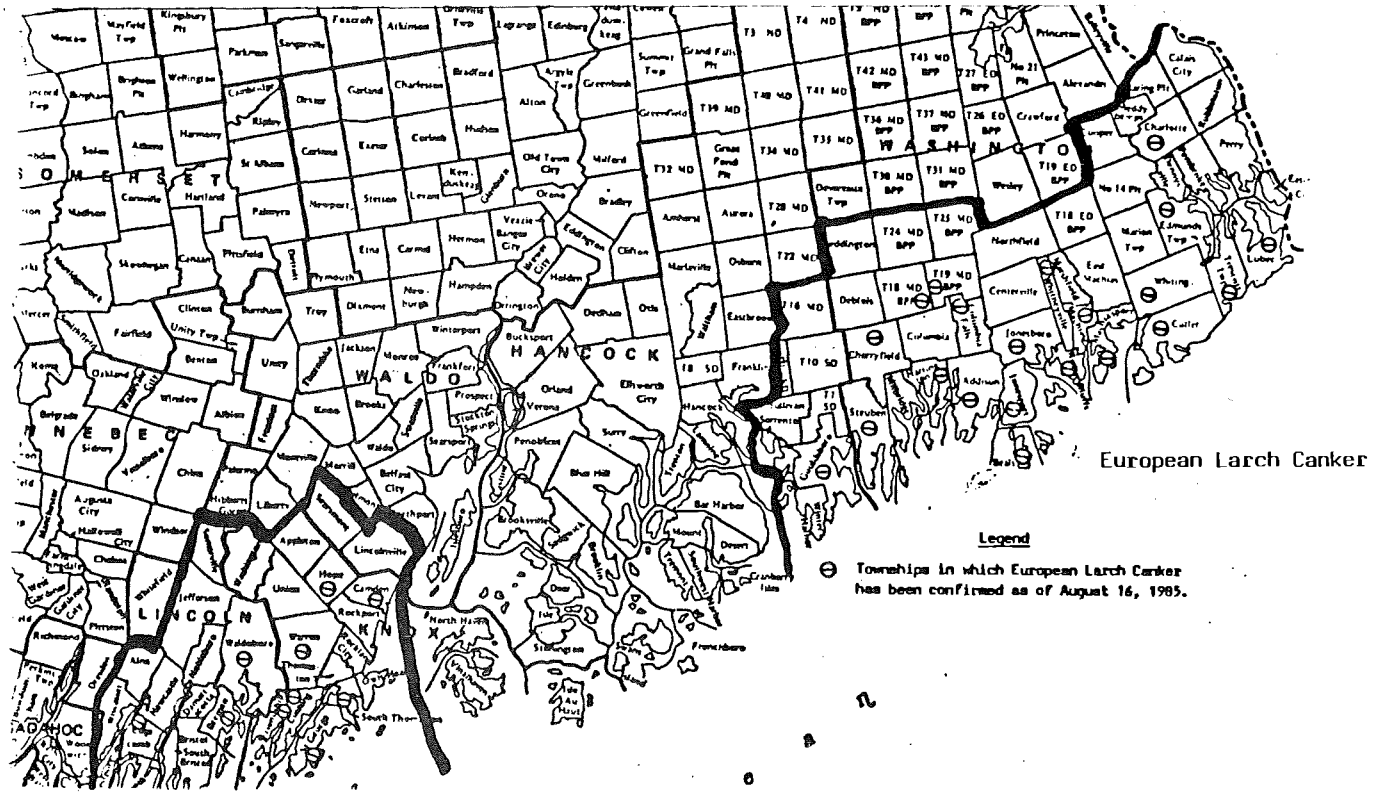

Fig. 3

Fir Flagging (Cause undetermined) - Fir in northern and eastern Maine exhibited varying amounts of scattered red flagging in June. Some **sawyer beetle** (Monochamus spp). feeding on twigs seemed to be associated with the symptom in areas of heavy cutting, but was inconsistent throughout

the entire range of the flagging symptom. Pathogens have also been suspect. A similar condition was reported from New Brunswick, Canada.

Jack Pine Needle Rust (Coleosporium viburni) - Of our native pine species, this rust only attacks jack pine. Its alternate hosts are species of Viburnum; (i.e., withe-rod, nannyberry and maple-leaved viburnum). As plantings of jack pine have increased, so has the incidence of this pathogen increased, with reports and observations received from Glenwood, Howland, and T19 MD in 1987. In Howland, the aecial stage had just gone by and the uredial stage on withe-rod was just starting on June 23. Heavy uredial infection of withe-rod occurred by the end of June and caused leaves to turn prematurely red in early July. On head-high trees, infection seems to be heavy only in the lower 1/2 of the crown.

Larch Decline - Mortality of mature trees continued in the Coopers Mills, Jefferson, Waldoboro, Warren, Union, Washington and Somerville areas, with extensive mortality occurring along the Spurwink River area from South Portland to Higgins Beach. Mortality is now starting in younger, pole-sized trees. One tree with a green top was observed to be dying from the lower crown upward. (See Insect section preceding).

Pinewood Nematode (Bursaphelenchus xylophilus) - This conifer-inhabiting nematode was first confirmed from Maine on October 19, 1986 from the towns of Whitefield and Baldwin. Since that date, confirmation has also been received from samples submitted from Albion and Casco (See Fig. 4). The host species in all cases was eastern white pine, although larch, spruce, and fir were also sampled. During 1987, samples were taken and processed from several (10) towns and to date no other positive samples have been found. All determinations were made by Ms. Shari Halik, Research Technician, University of Vermont, Burlington through agreement with Dr. Dale Bergdahl. In all, 48 towns in Maine have been sampled during 1986 and 1987, some with multiple samples, and only four have been found to be infested.

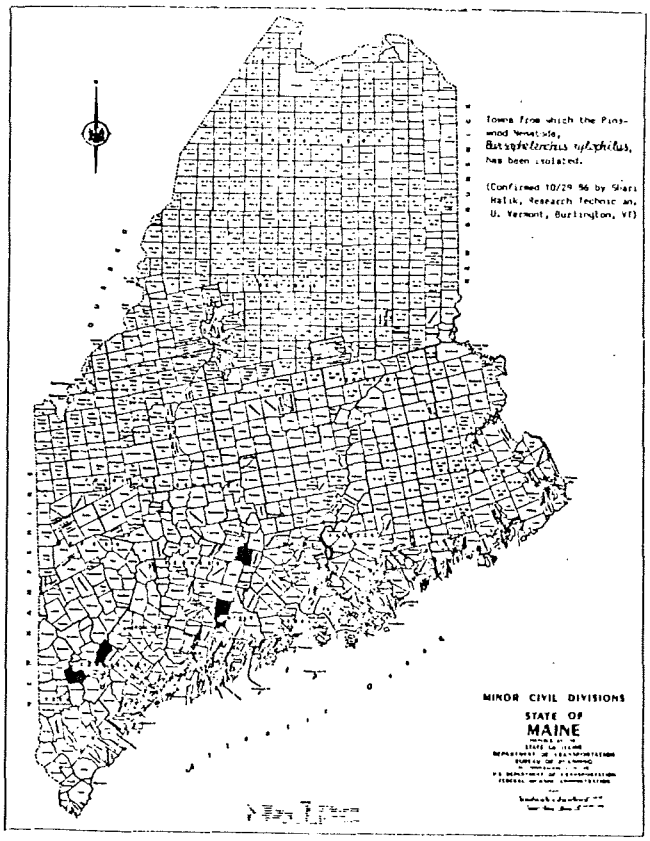

Fig. 4

Red Ring Rot (Phellinus = Fomes pini) - A 20 acre white pine stand in Buckfield containing trees 100' tall which had not been thinned in over 50 years was found to be infested with this disease. Trees with small crowns and pitching knots were recommended to be harvested, with another harvest cut recommended in about 10 years (a modified shelterwood).

Scleroderris Canker (Ascocalyx = Gremmeniella abietina) - See Section C.

Septobasidium/Matsucoccus Complex (Septobasidium pinicola/Matsucoccus macrocicatrices) - Fungus mats, 4" or more in diameter with associated heavy pitching, were observed in a 5 acre Belgrade white pine plantation. The basal area had been over 200 sq. ft./acre before a thinning last year which removed 16 cords from this pole-sized stand. Another heavy infestation was observed in a 25 year old Coopers Mills white pine plantation with a basal area of 220 to 240. For an optimum growth rate, basal area should have been 100 to 110. In association with this complex pitch pockets are formed in the wood beneath these mats as a result of feeding by the scale insects, which are imbedded in the fungus mat. The scale insects live in a symbiotic relationship with the fungus; i.e., the scale insects are protected from parasites and predators by the fungus mat, and the fungus derives nutrient from the dead scale insects. Presence of Septobasidium mats and pine bark aphid (a white woolly aphid) on tree trunks are both good indicators of over-stocked stressed or stagnated white pine stands.

Sirococcus Shoot Blight (Sirococcus conigenus) - See Section C.

Spruce Tumor (Cause undetermined) - A 10-acre spruce stand on Preble Hill in Garland contained multiple woody stem and branch tumors (burls or galls) ranging in size from marbles to basketballs. Elevation of this site was 800 feet. The Garland infestation is of particular interest, since locations inland, away from salt water, are extremely rare throughout the world. Branch and stem tumors up to grapefruit-size were observed on Squirrel Island white spruce, while beach ball-sized tumors were reported from Bucksport in a mixed stand located on a poorly-drained site near the Penobscot River. Only one tumor per tree was generally observed in the latter two sites.

White Pine Blister Rust (Cronartium ribicola) - This disease continues to be one of the major problems limiting the successful management of white pine in Maine. Although somewhat modified by the reorganization of the I & DM Division, a control program is still in effect. The control area of this disease (See Fig. 5) includes 1.86 million acres in the southern half of Maine of which 1.28 million acres have been "greenlined" meaning no control is required. The remaining acreage is scouted to delineate concentrations of the alternate host in the genus Ribes on approximately a 10 year cycle. In 1987, 40,785 acres were scouted. Seven town funded projects were conducted which resulted in control of 121 acres of Ribes concentrations.

The quarantine governing the movement and importation of Ribes (Currant and Gooseberry) within the control boundary is still in effect. A relatively new currant hybrid "Consort" shows immunity, but has self-fertile flowers, and one of the parents is the European black currant, Ribes nigrum. Progeny can therefore produce pure R. nigrum, which is banned from being planted **anywhere** in the state.

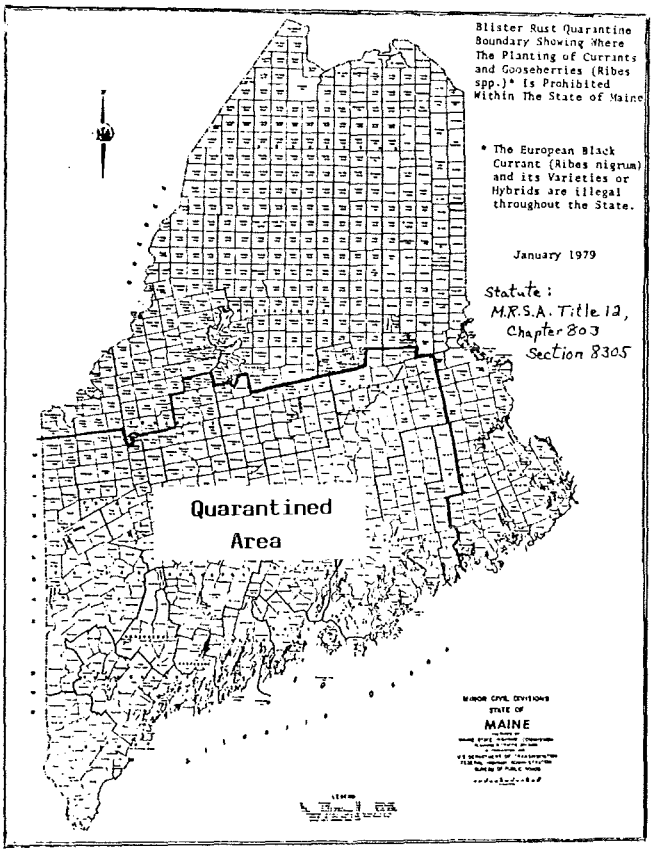

Fig. 5

Incidence of White Pine Blister Rust in Maine in Areas With and Without Ribes Control

Direct control of White Pine Blister Rust in Maine by Ribes eradication was initiated in 1917. The Maine Forest Service conducted a survey in 1987 to assess the impact of white pine blister rust and also the Ribes control program. A total of 100 white pine trees in each of 90 stands was randomly selected and examined for infection by the blister rust fungus, Cronartium ribicola. Three age classes (reproduction, sapling and pole), three hazard zones (low, moderate and high) and two levels of Ribes control (none and control for more than 50 years) were each represented by five stands. Averaged over all stands, blister rust incidence was 3.8% in the areas with Ribes control, and 9.1% in areas with no control. Incidence, averaged within size classes, was lowest in reproduction stands (2.4% with, 7.9% without control) and highest in pole stands (3.9% with, 11.1% without control). Blister rust accounted for 49% of the noted mortality in untreated stands and 14% in the treated stands. Blister rust incidence did not reflect hazard zone ratings.

The stocking and disease incidence data are presently being analyzed by Dr. William D. Ostrofsky, CFRU, College of Forest Resources, Univ. of

Maine, Orono, 04469. A report is planned by the spring of 1988. These data will also provide a basis for an economic evaluation of disease impact, and control program adjustments.

White Pine Chlorosis - Chlorotic white pines in the median and right-of-way at mile 196 of I-95 were the result of a raised water table during construction. About 25 acres were affected.

White Pine Needle Blight (SNB) - Needle tip browning was evident on some trees by the 3rd week in June, but damage involving the entire needle was not observed or reported this year as it was in 1986. Scattered, isolated trees with the terminal 1/2 of the needle blighted were reported from the Greenville area, and from Newburg southwest through Kennebec County into Androscoggin County along the Androscoggin River (Leeds, Turner) and south to Harrison in Cumberland County. Based on the amount of needle length affected, it appeared that damage only occurred in June or early July in some areas. Some areas of heavier damage were reported from central and southern Hancock County.

(B) Forest Pests - Hardwoods

Insects

Aspen Feeders (Miscellaneous) - Trembling aspen over most of the northern and eastern portions of the State suffered from a wide variety of problems again in 1987. Aside from those mentioned elsewhere, the most prevalent and noticeable insect problems included the: **serpentine leafminer** (Phyllocnistis populiella) and **aspen skeletonizer** (Phratora purpurea purpurea) in scattered stands throughout and to a lesser extent the; **leaf folding sawfly** (?Phyllocolpa sp.) and **cleft-headed spanworm** (Biston betularia cognataria). Attractive larvae of the **tiger swallowtail** (Papilio glaucus) and the **yellow-marked caterpillar**, Raphia frater, were also collected from aspen on a number of occasions.

Balsam Poplar Leaf Miner (Lyonetia sp.) - High populations of an apparently undescribed leafminer caused severe defoliation of balsam poplar over several thousand (est. 3,000-5,000) acres in northern Maine in 1987. Infested trees turned a striking rusty red early in June due to the presence of numerous small mines. Based on field reports this appeared to be the second but heaviest year of damage in T12 R11, T13 R11 and T14 R10 (Aroostook County).

In the past, balsam poplar was not generally considered economically important but there seems to be increasing interest in this resource now for flakeboard and other products. There are many very large balsam poplar in Aroostook County.

This species is being described as "new."

Beech Complex (Fall - Many species) - One of the biggest surprises of the 1987 field season was the appearance of a wide variety of defoliators on beech in late August and extending well into October. Although we did have a few collections in 1986, amplification of field surveys in 1987 made possible by the reorganization, yielded interesting results. Although

the impact of damage at this time of the year is not known with certainty, many infested trees were already under stress from other causes which may make impact assessment difficult. Due to the number of species involved, those encountered in 1987 have been categorized and listed below:

1) Significant numbers (i.e., noticeably present in most areas checked)

*Variable Oakleaf Caterpillar - Lochmaeus manteo
*Orangehumped mapleworm - Symmerista leucitys
*Spotted Tussock - Lophocampa maculata
Lacecapped Caterpiller - Oligocentria lignicolor
Unicorn Caterpillar - Schizura ipomoeae
Flat Leaftiers - Psilocorsis spp.

2) Scattered and infrequent (But with multiple records)

*Pale Tussock - Halysidota tessellaris
*Hickory Tussock - Lophocampa caryae
*American Dagger Moth - Acronicta americana
A Prominent - Heterocampa biundata
Yellowlined Caterpillar - Nadata gibbosa
Sphinx Moths - Paonias spp. and Smerinthus sp.

* These insects are discussed elsewhere in this report.

Throughout the collections there were a number of additional insects found in very small numbers such as the **luna moth** (Actias luna), **polyphemus moth** (Antheraea polyphemus) and **slug moth caterpillars** (Limacodidae). A **webworm complex** (possibly maple webworm-discussed later), a brown geometrid (? sp.) and another interesting larva, thought to be a noctuid, occurred scattered throughout which will bear further scrutiny before identification is certain.

Beech Scale (Cryptococcus fagisuga) - This insect can be found in nearly every stand of beech throughout the State although infestation levels run from trace to heavy even within a single stand. The woolly scale on the bark seems to be more obvious in some areas than it has in the past. Although we have no accurate measure of scale populations they may be increasing slowly. Fortunately several levels of resistance have been observed and one of the most effective predators, the twice stabbed lady beetle (Chilocorus stigma), was observed in some stands to be in the greatest numbers seen in many years.

It appears that mortality from this species complex (scale + Nectria) has stabilized somewhat although there are stands where mortality is increasing. Other stress factors such as oystershell scale have obviously had an additional impact.

It appears that now may be the time to test various management practices such as thinning to enhance resistance within a stand.

Birch Casebearer (Coleophora serratella) and Decline - Birch casebearer populations remained at low endemic levels over most of the State during 1987. Scattered localized areas of light-moderate defoliation (20-30%) were noted in the previously heavily hit areas around the Rangeley Lakes and at Whiting, and also in Trenton and Argyle. Observations in previously established plots showed only scattered trees with more than light defoliation (defoliation averaged less than 5%).

Evaluation of stands in and outside of areas of previous heavy defoliation show that crown dieback has stabilized and that trees are starting to recover as new branches overgrow the dead portions of the crown. Some further accrual of mortality may be expected as those trees which were hardest hit continue to die. Current estimates of potential additional mortality in the heavily defoliated areas is 7% of the Dominant-Codominant white birch basal area around Rangeley and 9% in coastal Washington County.

Birch Leafminer (Primarily Messa nana) - Although activities of five or six different leafminers were observed in 1987, it was the startling rise in populations of M. nana which drew the most attention. Populations of Messa rose from light and "insignificant?" in 1986 to very heavy in 1987. Populations of the common Fenusa pusilla were moderate and at roughly 1986 levels especially on gray birch while populations of our more common white birch leafminer, Profenusa thomsoni, remained very low in most areas in 1987 and Heterarthrus nemoratus was again non detectable.

Populations of M. nana caused moderate (less than 50% of the leaf surface affected) defoliation of white and white birch hybrids throughout much of the State. Severe (greater than 50% of the leaf surface affected) defoliation was observed locally across the central and southern portions of the State and especially in hilly sections of Franklin and Waldo Counties. This phenomena was one of the surprises of 1987 and its significance has not been assessed.

Birch Sawfly (Arge pectoralis) - Populations of this sawfly were up noticeably in 1987 over 1986 levels, especially in Franklin and Somerset Counties. Larvae were readily visible in late July and August but colonies were scattered and defoliation generally light.

Cankerworms and Loopers - Populations of the **Bruce spanworm** (Operophtera bruceata), **spring cankerworm** (Paleacrita vernata) and **fall cankerworm** (Alsophila pometaria) were very low again in 1987 and only scattered individuals in collections of other insects were seen. There did seem to be a general increase in numbers of a variety of "minor" loopers, however, but damage was not generally visible. Species which seemed to be more abundant in 1987 were the **cleft-headed spanworm** (Biston betularia cognataria) on trembling aspen and a brown looper on beech (? sp.). The **winter moth (Operophtera brumata)** has still not been reported from Maine.

Fall Webworm (Hyphantria cunea) - See Section D.

Forest Tent Caterpillar (Malacosoma disstria) - No areas of forest tent caterpillar defoliation were noted during 1987. Field surveys and light

trap collections indicate relatively stable low level populations overall.

Stands stressed by the previous outbreak (1978 +) have stabilized and recovered. An average of ten percent of the dominant/codominant poplar basal area died in the defoliated stands.

Increment cores have been collected from representative stands to evaluate radial growth impact. These data have not yet been analyzed.

Greenstriped Mapleworm (Dryocampa rubicunda) - Although both larvae and moths of this species were again quite common in central Penobscot County in 1987, little defoliation was noted.

Gypsy Moth (Lymantria dispar) - Gypsy moth populations declined significantly in eastern Maine. A total of 849 acres were defoliated of which 648 showed more than 30% defoliation. These figures represent a 93% reduction from 1986 levels, and are the lowest reported acreages since the 1970's.

Parasitized and diseased larvae were quite common in the defoliated areas suggesting further decline in those spots.

Egg mass and pheromone trapping results from southern Maine indicate that gypsy moth populations may be starting to rebound. Populations are not expected to cause noticeable defoliation in those areas in 1988.

Maple Webworm (Tetralopha asperatella) - "Clumps" or "nests" of leaves at the branch tips on maple were quite noticeable in August in many areas of central Maine. This is the first year in some time that this pest has occurred in such noticeable numbers. What appeared to be this species was also collected from beech and oak.

Oak Leaffolder (Ancylis burgessiana) - Red oak throughout the State showed the characteristic folded and webbed leaves containing larvae of this species in August and September. Defoliation was spotty and light, however.

Oak Leaftier-shredder (Croesia semipurpurana) - See Section D.

Oak Skeletonizer (Bucculatrix ainsliella) - Reports of local hot spots of defoliation by this species were received from coastal areas of Cumberland and York Counties in 1987. Light populations were noted elsewhere.

Oak Twig Pruner (Elaphidionoides villosus) - Although some trees seem to be hit by this species year after year, population levels for the twig pruner do tend to vary with the seasons. Populations for 1987 remained very close to those of 1986.

Orangehumped Mapleworm (Symmerista leucitys) - Populations of this species rose sharply in 1987 and larvae could be found on beech and sugar maple throughout central and southern Maine. Larvae appeared late in the season and were still on the twigs in many areas in October after many leaves had dropped and heavy frosts had hit. Although found most often

in association with the variable oakleaf caterpillar, discussed elsewhere, populations of the mapleworm were more widespread and occurred on more host species including oak (to a small degree). Heaviest populations and feeding occurred on beech in beech stands. Fall surveys for pupae in 1987 did not provide adequate data for future predictions.

The significance of late defoliators such as this species and the variable oak leaf caterpillar has yet to be determined for beech.

Oystershell Scale (Lepidosaphes ulmi) - Older areas of infestation from Mayfield and Elliotsville to the Penobscot River have subsided drastically. Although the greatest reduction was noted in the stands previously most heavily infested, many of the outlying moderate infestations are also subsiding. Similar patterns have been reported from Washington and Hancock Counties although new and active areas of scale were noted in beech stands throughout that area. The total acreage of heavy infestation is not known but is definitely down from 1986 levels.

Although oystershell scale caused branch and top mortality on overstory beech, all cases of beech mortality also involve beech scale/nectria.

In heavily hit areas the beech understory was killed or so stunted and distorted as to be destroyed. Where there was alternative desirable reproduction, that component was favored and the understory has improved.

Saddled Prominent (Heterocampa guttivitta) - Although numbers of moths generally increased for the third consecutive year in 1987, no defoliation by larvae was noted.

Satin Moth (Leucoma salicis) - Populations of this species continued to remain very low in 1987.

Spiny-elm Caterpillar (Nymphalis antiopa) - Several small spot infestations (less than 1 acre) of this species occurred on willow and poplar in woodland situations in 1987.

Tussocks and Dagger Moths - See Section D.

Variable Oakleaf Caterpillar (Lochmaeus = Heterocampa manteo) - Populations of the variable oakleaf caterpillar rose sharply in 1987 and larvae could be found on beech throughout much of the central part of the State. Heaviest populations occurred in Somerset County, especially along the Kennebec River from Bingham to the Forks and along Route 16 east from Bingham to Kingsbury. Light populations were observed in southern Piscataquis and Penobscot Counties and more isolated infestations were reported in Androscoggin, Kennebec and Waldo Counties. Scattered larvae occurred on beech elsewhere. Field checks in the fall of 1987 indicated fairly high populations of prepupae in overwintering cells in the duff.

Only a couple of reports of this species were received from Somerset County in 1986.

In the Somerset County infestation, maple and red oak adjacent to beech seemed to be nearly untouched. Beech seemed to be the favored host in most areas.

Populations of this species paralleled closely those of the orangehumped mapleworm discussed elsewhere.

(B) Forest Pests - Hardwoods

Diseases

American Chestnut and Chestnut Blight (Endothia parasitica) - Two "new" large chestnut trees were located in West Bethel in 1987 by lumber company foresters. In early September, the 14" Dbh tree contained many burs, while a nearby 15" tree apparently only produced pollen. Both trees were healthy, as were 4 nearby saplings. At this same location two trees 8-10" Dbh were dead or had severe sapsucker injury which resulted in topkill of most of the crown. The cause of mortality of one tree was undetermined, but suspected as being caused by chestnut blight. Another apparently healthy 15" Dbh tree was located on the Jay Valley Road near the Buxton/Saco townline.

Thirty trees were planted at the Rockport Country Club, and several trees at the Harkness Preserve have been injected with the hypovirulent strain. Callus growth appears to be developing at the margins of treated cankers.

Burs were produced on saplings at the Hebron seed orchard, but nuts were not viable, apparently due to a lack of sufficient pollen production for fertilization.

Nuts (117) collected at the I & DM lab in Augusta and at Livermore Falls were stratified in early October in preparation for spring planting.

Keen interest and requests for information on culture and seed source were received in 1987.

Armillaria Root Rot (Armillaria mellea) - Scattered red and black oak in the New Gloucester area which had been stressed by gypsy moth feeding several years ago were killed by Armillaria root rot and were being salvaged for firewood.

By September 10, the fleshy mushrooms produced by this fungus had deteriorated in a Casco hardwood stand.

An unusual observation of this disease was made in Norridgewock in late October, and involved a 9 1/2 foot balsam fir. The crown was a healthy green color, but mycelial fans of this pathogen completely encircled 2 feet of the stem, from the root collar up.

Ash Dieback - The incidence of scattered ash dieback and mortality appeared to increase somewhat this year. In the Canaan-Athens area, affected trees had small crowns and had been growing very slowly for many years. Dead

specimens contained Armillaria mycelial fans at the root collar. Black ash mortality reported from the Fort Kent area may have been related, at least in part, to the unusual weather conditions of the past winter.

Ash Leaf Rust (Puccinia sparganioides) - Incidence was generally at a very low level in 1987; however, heavy infection of the salt marsh alternate host (telial stage) was observed in early September in the Cape Elizabeth-Scarborough area. Stag-headed trees and some mortality occurred in the Arrowsic, Alna, Cumberland, Cumberland Foreside, Yarmouth, Cousins Island, and Woolwich areas. Trees heavily damaged in the past have started to develop new crowns from sprout growth. Aecial cups were releasing aeciospores when leaves were agitated on July 22, with peak production occurring earlier in the month.

Birch Red Leaf Blister (Taphrina carnea) - A single collection from a light infection on yellow birch was received from Beaver Cove (southeastern Moosehead Lake) in 1987.

Hardwood Decline (1987 Photo Survey) - There has been a great deal of interest in reports of sugar maple (and other hardwood) decline from surrounding jurisdictions. The levels of damage reported vary, as do the various causes to which the damage is assigned. The MFS in cooperation with the USFS, is conducting a 1% CIR aerial survey of Oxford, Franklin and Somerset Counties to determine the present hardwood crown condition. The photography has been taken and interpretation is nearly complete.

The survey area was divided into cells in which tree crown condition was evaluated. Certain of the cells will be closely measured and then ground checked during the summer of 1988. On-ground conditions will be correlated with photo interpretation findings to validate the results.

While this survey by itself will not show cause or trends, it will provide a measure of present condition. This information can be used to judge the seriousness of the situation and will serve as a basis for future comparison. The final report is anticipated in 1989.

Hypoxylon Canker (Hypoxylon mammatum) - In spite of a lack of reports of this disease of poplars in 1987, field observations by staff indicate a high incidence in some young stands, and a low incidence in others. Trembling aspen is the species suffering the greatest mortality, while bigtooth aspen and balsam poplar are attacked to a lesser degree.

Strains of the fungus vary in their virulence, and different clones of the host species show varying levels of susceptibility; thus the sharp difference in incidence on occasion when moving from one stand to another.

Years of high incidence may be tied in with high population levels of insects that cause bark wounds which provide infection courts for the fungus.

Hypoxylon canker is expected to cause continued, substantial loss of trembling aspen in susceptible stands in 1988.

Maple Decline - Heavy fruit production on red maple in the spring caused leaves to be smaller and fewer in number in the upper crown over much of the state. Many roadside and landscape Norway maples examined for this problem had serious girdling root problems (See Section D). The problem of decline of hardwoods, especially maple, is being studied (See hardwood decline discussion which precedes this).

Maple Leaf Scorch - An isolated case was reported from Searsport, and may have been caused by a girdling root condition, rather than an effect of drought.

Phomopsis Gall on Red Oak - Woody galls, ranging in size from a ping-pong ball to basketball size, were observed on 12-15 red oak in the Berwick area.

Poplar Ink Spot (*Ciborinia whetzelii*) - Typical oval spots (the sclerotial stage) on the leaf surface, first brown in mid-to-late June and later turning ink black, were observed on trembling aspen in Howland. The infection rate and incidence was lower in 1987 than in 1986.

Poplar Shoot Blight (*Venturia tremulae*) - Light infection occurred on bigtooth aspen in the Howland area in mid-June. Blackened tips of current growth shaped like a shepherd's crook were the typical symptoms observed. *Pollaccia elegans* is the conidial stage.

Both trembling and bigtooth aspen throughout most of northern and eastern Maine showed varying degrees of what appeared to be symptoms of this disease in 1987. No confirmation was made in most cases.

Strumella Canker (*Conoplea globosa* = *Strumella coryneoidea*) - Scattered, affected red and black oaks were being removed in a New Gloucester firewood/salvage operation.

In a Casco hardwood stand, cankers averaged about 1 per acre. Several seemed to have died out. Those which died had extensive decay on the canker face, but contained a heavy, healthy roll of callus tissue at the margin.

Conoplea globosa is the conidial stage; *Urnula craterium* is the perfect or apothecial stage.

Sugar Maple Flagging - Three weakly-parasitic fungi (*Stegonosporium pyriforme*, *Nectria cinnabarina*, and *Cytospora* sp.) generally were responsible for yellowing branches in mid-June. Affected branches later turned a rust-red color. Roadside and shade tree sugar maples appeared to be somewhat more affected than forest specimens.

Willow Blight (*Fusicladium saliciperdum/Physalospora miyabeana*) - Scattered, local infections were reported on susceptible species from Augusta to Howland, and in the Dover-Foxcroft area.

(C) Plantation, Regeneration, Nursery and Christmas Tree Pests (See also Section A)

Insects

Aphids - Many spruce and pines, and especially red pine, showed moderate to heavy infestations of aphids this past season. These aphids seem to feed among the needles on the new growth. Populations are frequently noticed first because of ants which tend the aphids, the blackened appearance of sooty mold covered foliage, or the wasps and yellowjackets which come to feed on the "sweets" produced.

Balsam Gall Midge (*Paradiplosis tumifex*) - Population levels rose throughout central and southern Maine in 1987. Damage to Christmas tree plantations was reported by three growers which was the first indication of significant damage in three years. Bradbury and Osgood (1987) published information on control of this pest of balsam fir (See Publication section).

Balsam Twig Aphid (*Mindarus abietinus*) - Populations levels have continued to rise since 1985 and have caused substantial economic losses to many growers. Many plantations were treated with various insecticides (primarily diazinon) to control the aphids. Efficacy trials of aerial application utilizing fluvalinate was attempted by the I & DM Division, however, control levels were not acceptable. Poor spray coverage was thought to be the cause as fluvalinate has given excellent results when applied with mist blowers.

Conifer Sawflies (Many species) - Sawfly defoliation of conifers in plantation situations continues to remain low with few reports of any activity in 1987. The **larch sawfly** and **introduced pine sawfly** discussed in Section A were the only exceptions and even in these cases defoliation was spotty and light.

Mites (Several species) - Mottling of the foliage and webbing resulting from mite activity was common in balsam fir plantations in central Maine. Poor color and vigor may reduce the aesthetic quality of trees and some growers have resorted to application of miticides to maintain trees of high value.

Pales Weevil (*Hylobius pales*) - This insect has become a common pest in balsam fir plantations after adjacent lots of white or Scots pine are cut. Several acres of three year old balsam fir were damaged by this insect in Cornville in 1987. Apparently, weevils flew in from a large cut-over area of white pine immediately behind the plantation.

Pine Spittle Bug (*Aphrophora parallela*) - This insect remained common in 1987 especially on white and Scots pine; however, no areas were known to have required control.

Regeneration Pests - Many landowners have made a large economic commitment to replant cutover areas or to manage natural regeneration in planning and harvesting stands. Following the example begun in 1986, the I & DM Division continued to increase its effort to examine areas of

regeneration. Whenever general F.I.S. collections were made on softwood, a special effort was made to have more regeneration represented. In addition, many plantations of spruce (white and black), pines (white, red, Scots and Jack) and larch were surveyed and revealed a variety of pests. Most of the regeneration mortality noted was spotty and was associated with animal damage (especially **porcupines** on larch and jack pine), diseases (including **white pine blister rust** and other rusts, **annosus** and **Armillaria root rots**, and **scleroderris** and **larch cankers**) and weather related disorders (i.e., tip dieback of larch). These are discussed in the disease sections following and in (A). Little or no mortality was generally noted as a result of insect feeding although growth loss and deformity of trees was observed in some areas. Insect species which were found to be especially important were: **aphids***, **regeneration weevil***, **mound ants**, **spruce bud moth***, **spruce gall aphids***, **spruce twig midge*** and **white pine weevil***. **Larch sawfly*** and other sawflies also have the potential for damage although none was observed in 1987. (*) These problems are discussed elsewhere in this report.

Regeneration Weevil (Hylobius congener) - Although this species occurs throughout the State and damage can be severe, we had no reports of verified activity in 1987.

Saratoga Spittlebug (Aphrophora saratogensis) - As in 1986, Saratoga Spittlebug caused severe browning (branch flagging) and top mortality to red pine planted on a barren in T19 MD. Examination of sweet fern, the primary alternate host, in July revealed a high population of nymphs which later yielded a damaging level of adults. Damage to this 100+ acre plantation was so severe that salvage of existing 2-5' trees may be impractical. Population surveys are planned for the winter of 1987-1988. Nearby jack pine and taller red pine showed very low damage levels. The taller red pine achieved crown closure several years ago, greatly reducing sweet fern and thereby spittlebug alternate hosts.

Two other red pine areas, one in T30 MD and one in Aurora, were checked for spittlebug damage but little was found. These plantations had problems in the 1970's, but the stands have now closed, eliminating the alternate host. Several other planted areas should be checked in 1988 for spittlebug populations and damage. Some of these areas are far from crown closure and may require treatment.

Spruce Budmoth (Zeiraphera spp.) - A complex of Zeiraphera and several other species was found to be common in white spruce plantations throughout the State in 1987. Plantations in Dyer, Waite and Codyville all sustained damage from this complex. Pheromone testing is planned for next season to monitor population levels of Zeiraphera.

Spruce Bud Scale (Physokermes piceae) - This hemispherical, shiny brown scale could be found near the buds and bases of small shoots on spruces, especially white, statewide in 1987. Populations were generally light except on individual trees in plantations in northern and eastern Maine. Heavily infested trees often showed signs of stress.

Spruce Budworm (Choristoneura fumiferanae) - While populations were dramatically lower overall in 1987 than in the past, high populations were found in balsam fir plantations in Franklin, T9 SD and Mariaville. Private landowners with technical assistance from I & DM personnel, aerially sprayed approximately 500 acres using diazinon or carbaryl. Control was acceptable in most areas. See also Section A.

Spruce Gall Aphids (Adelges spp. and Pineus spp.) - Gall forming aphids were very abundant in most plantations with a number of species involved. These insects are thought to cause only aesthetic damage, however some growth loss must be occurring because of the high populations. Future surveys should be conducted to positively identify the range of species involved and efforts made to determine reasons for their spotty distribution and their impact on growth.

Spruce Twig Midge (Mayetiola piceae) - This midge was very common in white spruce plantations in eastern Maine. Like the gall aphids it is not considered an economic pest in most of the literature, however, high levels of damage were discovered in 1987. Growth impact data should be obtained for this insect and biological studies made.

White Pine Weevil (Pissodes strobi) - This species is the most damaging insect attacking young established white pine and causes significant amounts of damage on spruce species as well. Two aspects of this problem have been dealt with; control and population monitoring. In 1987, aerial control using single and double applications of fluvalinate were tested in Alna and Winslow. Spray coverage from the helicopter was not good and, while populations were reduced, damage remained high. Future testing should be conducted as ground tests were successful and aerial application would allow increased acreage of white pine to be protected. Population monitoring methods are currently being evaluated. Most of the regular survey plots established in 1984 were discontinued in 1987.

(C) Plantation, Regeneration, Nursery and Christmas Tree Pests (See also Section A)

Diseases & Animal Damage

Annosus Root Rot (Heterobasidion annosum = Fomes annosus) - A 25-acre mature red pine plantation in Chesterville was found to contain a "Fomes hole," and a 30-year-old Belgrade red pine plantation that had been thinned 10 years previously (4th row thinning) was found to contain 5 dead or symptomatic trees, all with sporophores around the root collar, under the duff layer. Two were pruned crop trees. Several "holes" were also located in a Searsmont red pine plantation, thinned 8 years ago, and a wind thrown white pine in an adjacent plantation contained sporophores on its roots. Borax stump treatment was not practiced at the time of thinning in any of these plantations.

Incidence and damage due to this disease are increasing in the Auburn Water District red pine plantations, following successive thinnings.

Armillaria Root Rot (Armillaria mellea) - A cooperative U.S. Forest Service/University of Maine research project is being conducted in Christmas tree plantations at Norridgewock involving treatments designed to limit rhizomorph development in clearcut, mixed stands regenerated with conifers. Results probably will not be available for several years. In Christmas tree plantations established on such cutover sites, some balsam fir mortality has occurred, and the disease has necessitated premature harvest before maximum merchantible height was attained, in order to avoid excessive loss.

Atropellis Canker (Atropellis tingens) - This disease causes flagging external to branch cankers. Cankers are spindle-shaped, with several black, disc-shaped fruiting structures (apothecia) on the canker surface. Scots pine is the species most commonly affected, but incidence is increasing on pitch pine as well. This disease was a problem in 1987 in the towns of Denmark, Brownfield, Fryeburg, Hiram, Newfield, and Shapleigh (See Fig. 6). In Christmas tree plantations, moderate and heavy infections destroy tree marketability. Early detection and sanitation pruning minimizes damage.

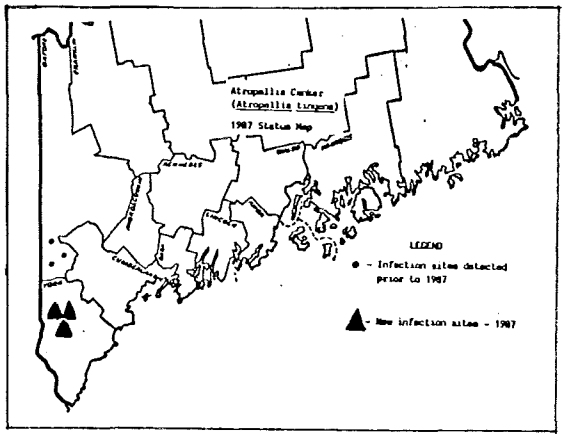

Fig. 6

Bear Damage - Climbing cubs were apparently responsible for top and limb breakage in a Fort Kent area young, 8-10' high, red pine plantation. Vertical and angled internodal bark slits, plus fine, black hairs on broken branch stubs, identified as bear hair by a game biologist, nailed the cause down. Scattered trees in a one-acre area were affected.

Concolor Fir Needle Blight (Cause undetermined) - A needle blight on concolor fir in a Bucksport plantation gave the otherwise attractive trees a scorched appearance thereby reducing merchantibility. Fruiting bodies examined in mid-June from current growth could not be identified.

Douglas Fir Needlecast (Rhabdocline pseudotsugae) - In early to mid-June several young plantings in Bucksport and Skowhegan were just showing infection for the first time on 2-year needles. No Swiss needlecast was observed. Another case of needlecast (species unspecified) was reported from North Windham. This advanced case was causing susceptible individuals to appear thin.

Fir Needle Rust (Uredinopsis mirabilis and others) - Few reports of fir needle rusts were received in 1987 and incidence appeared to be generally down. Aeciospore dispersal occurred from late June through early July. Control of the alternate host plants (willow, blueberry, fireweed, and sensitive/interrupted fern) by mowing or herbicide application should be accomplished in early June, well in advance of aeciospore dispersal.

Control of these alternate host plants 100 feet from the fir should provide protection to about 90% of the needles.

Herbicide Injury (See also Section "D") - An increasing number of reports of chlorosis and premature needlecast of fir treated with Simazine for grass control may be due to the cumulative effect of this herbicide applied over a number of years, especially at heavier-than-recommended rates of application; e.g., 5 to 10 lbs./A. Some incompletely understood aspects of herbicide application in addition to cumulative effects are: herbicide application effects in regard to soil type, soil pH, organic matter content of the soil, soil porosity, seedling size, interval between planting and first herbicide application, and root exposure from frost heaving or improper planting practices (i.e., incomplete closure of the packer wheels in mechanical planting).

Balsam fir is alleged to be sensitive to Velpar herbicide; however, one Lincolnville Center grower apparently has used it carefully and effectively in his combination blueberry-Christmas tree operation.

Jack Pine Needle Rust (*Coleosporium viburni*) - See Section A.

Naemacyclus Needlecast (*Cyclaneusma minus* = *Naemacyclus minor*) - Light infection was observed in 1987 in Bucksport, Skowhegan, Farmington and Dover-Foxcroft, and was under control with Bravo in Lincolnville Center. Moderate to heavy infection on Scots pine in Searsmont being treated with Bravo possibly was the result of an inadequate number of treatments, or too long an interval between treatments, especially if wet weather prevailed after the previous treatment.

Pine-Pine Gall Rust (*Endocronartium harknessii*) - Peak aeciospore dispersal from woody galls occurred around June 1 in the Farmington area and most had been released by mid-June. Sanitation pruning control work should be completed well in advance of this date, since these aeciospores can re-infect the pine host directly. Other infection sites reported or observed in 1987 were on Scots pine in Greenbush and Old Town. A sanitized area in a T19 MD pole-sized stand contained a few galls which undoubtedly developed from undetected latent infections at the time sanitation was accomplished.

Porcupine Damage - Heavy damage occurred to jack pine in Washington County and to balsam fir in Nobleboro. In the latter case and on the trees with the worst damage, all branches except for the uppermost and lowermost of 8' trees were chewed off and bark removed from the bole. More than 20 balsam fir trees, scheduled to be cut for the 1987 Christmas tree market, were destroyed. Light damage to red pine was observed in Aroostook County, and to white pine and other conifers in Casco.

Red Pine Needle Rust (*Coleosporium asterum* = *solidaginis*) - Aecial production on red pine was near peak on June 8 in Sidney so mowing of the alternate host plants, aster and goldenrod, should be accomplished at or before this time. By mid-June in Augusta, the aecial stage had mostly gone by and the uredial stage was moderate on all but the uppermost (newest)

goldenrod leaves. This pathogen can also infect jack pine. Heavy infections retard growth, but the pines eventually shade out the shade-intolerant alternate host plants.

Regeneration Problems (See also preceding Insect section) - Some 40 acres of fall-planted conifer seedlings in the Naples, South Paris, Hebron areas had a survival rate of 5% to 50%. Some of these seedlings were planted by experienced planting crews. The seedlings with the lowest survival rate were white pine established on an area that had been inundated by spring floods. On May 29, all but 5% of these seedlings were totally brown. When examined again on June 9, about 45% of browned seedlings had produced vigorous, new shoot growth, jumping survival to 50%. Weather, site, handling between lifting and planting, and packaging/packing may all be involved to varying degrees in the poor survival rate.

In the Presque Isle area about 10% mortality of hand- and machine-planted transplanted plugs occurred. Roots exposed to herbicide application as a result of improper seedling establishment practices may have been responsible.

Rhizosphaera Needlecast (Rhizosphaera kalkhoffii) - This pathogen was not observed or reported this past season.

Scleroderris Canker (Ascocalyx = Gremmeniella abietina) - The status of this disease remained fairly stable overall in 1987 (See Fig. 7). The North American strain is still present in the Eustis location, but has been stable in size for several years. This is used as a training site. No infection has been found at the Coplin Plantation site since it was low-pruned several years ago. No new infection sites were detected in survey activity in northern Aroostook County red pine plantations, despite its well-established presence just across the border in Quebec and New Brunswick provinces.

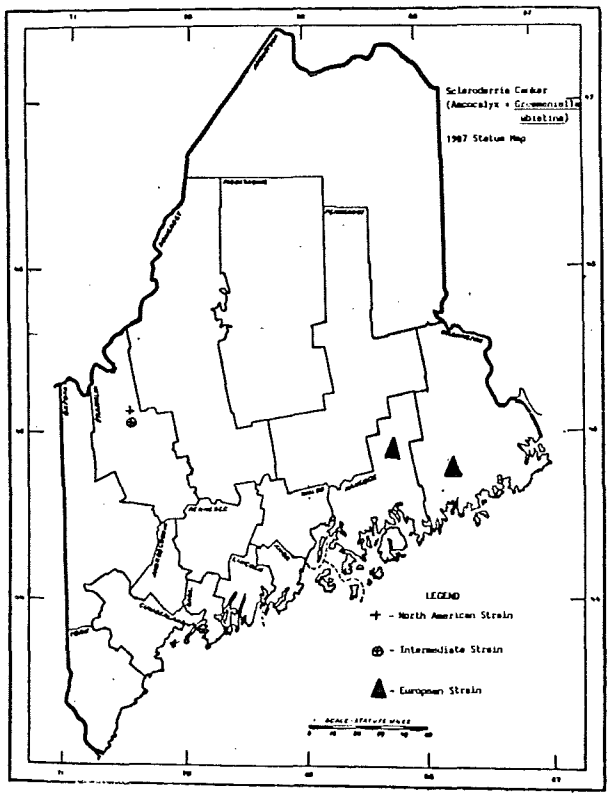

Fig. 7

A possible avenue of entry for the European strain was revealed when fiber peat shipped from Belgium to Rockland, Maine was found to be contaminated with Scots pine foliage by an APHIS Inspector. The foliage was green, but could have contained latent infections.

The township of Aurora and T19MD contained red pine plantations that had the European strain, but had been sanitized several years ago. Possibly due in part to the first deep snow accumulation in several years, a slight resurgence of the disease was detected in late October of 1987 at

both locations. Recommendations are to intensively survey both areas in late May or early June of 1988 when the basal needle discoloration symptom is most obvious, and to sanitation-prune both areas. Detection is confounded somewhat because Sirococcus shoot blight is also present in both areas, and Saratoga spittlebug damage is also prevalent in the T19MD plantations.

Sirococcus Shoot Blight (Sirococcus conigenus = strobilinus. Synonym is Ascochyta piniperda) - The incidence of this disease appears to be increasing in central and eastern Maine. In T19MD a large red pine plantation still has a light, but building infestation in sapling and pole-sized trees. A similar localized situation occurs in pole-sized trees in Aurora. Moderate to heavy Sirococcus-caused flagging occurred in a 20-acre plantation on Frye Mountain, Montville, with light mortality resulting in small-crowned trees.

Squirrel Damage - Heavy flagging to pole-sized red pine occurred in Aroostook County when squirrels bit off maturing cones and twigs became dessicated from the point of wounding outward.

Sweet-fern Blister Rust (Cronartium comptoniae) - Lodgepole and ponderosa pine plantations established several years ago in the Burnt Land Lake area, T35MD, have been completely destroyed by this pathogen. The alternate host, sweet-fern, abounds in the area.

Yellow Witches'-Broom of Fir (Melampsorella caryophyllacearum = cerastii) - Light infection of balsam fir resulting in brooming occurred in Farmington. The "worst case" situation still exists in a Dover-Foxcroft Christmas tree plantation, where the cost of sanitation pruning is increasing production costs.

Aecial pustules on needles were just starting to release spores on June 10 in Farmington. Although "brooms" are most easily detected at this time, sanitation pruning should be accomplished prior to this time to reduce infection on chickweed, the alternate host plant. Despite sanitation, some infection to chickweed will still occur from long-range infection from infected wild fir.

(D) Shade Tree, Ornamental and Miscellaneous Pests

Insects

Alder Flea Beetle (Altica ambiens alni) - Populations and damage in 1987 or slightly lower than 1986 levels. Although defoliation of alder was still striking in many areas, especially to the east and north, it tended to be more spotty elsewhere and the nuisance aspect of this species in plaguing homeowners was much less in 1987 than in 1986.

Aphids (Many species) - Aphids were very common early in the season on many hardwoods and softwoods. Populations seemed to be slightly higher than in 1986.

Bark Lice or Psocids (primarily Cerastipsocus venosus) - These harmless but interesting creatures appeared again in "herds" on the bark of various

trees throughout southern Maine in late July and August. They were mainly a curiosity.

Birch Casebearer (Coleophora serratella) - This species was only a minor problem on ornamentals except in the Rangeley Lakes area and very locally or on individual trees elsewhere (See section B).

Birch Leafminer (Various species) - See Section B.

Browntail Moth (Euproctis chrysorrhoea) - Maine's browntail moth (BTM) infestation appears to be increasing slightly on those Casco Bay Islands which presently have noticeable infestations (i.e., Long, Vaill and House). No tree mortality has been noted to date. Current noticeably infested areas equal roughly 40 acres.

I & DM personnel visted the current BTM infestation on Cape Cod during 1987 to evaluate potential problems and to compare the situation there to that which exists in Casco Bay. Based on those observations no BTM-induced tree mortality is anticipated in Maine except on the most stressed sites. The human nuisance factor in areas adjacent to our outbreak could however, be a problem. No web scouting surveys are planned for the spring of 1988 but the I & DM division will keep abreast of developments throughout the season.

Eastern Tent Caterpillar (Malacosoma americanum) - Tents of this species were very noticeable throughout the southern half of the State in late May and June of 1987. Populations seemed to be up over 1986 levels.

European Cutworm or Large Yellow Underwing (Noctua pronuba) - This introduced species, while not a forest pest, is of interest because of its rapid population buildup where introduced and its presence in the Maritime Provinces of Canada. Over the past few years moths of the species have been collected at light in Maine at Matinicus and Vinalhaven (Me. Dept. of Agr., Food & Rural Res.), Meddybemps (MFS) and Orono (Coop. Ext. Serv.).

Fall Cankerworm (Alsophila pometaria) - Populations continued to remain low in 1987 with no reports of defoliation.

Fall Webworm (Hyphantria cunea) - Tents of this species were common throughout southern Maine in 1987 but seemed to be generally smaller than usual, often containing at maturity only a single colony of larvae.

Mountain-ash Sawfly (Pristiphora geniculata) - This species appears to be on our list of perennial problems affecting ornamental mountain-ash with few ups and downs. The 1987 season was no exception with the usual complaints in spite of the fact that control of the problem is fairly easy to achieve.

Oak (Woolly) Leaf Galls (caused by tiny cynip wasps? Dryophanta = Callirhytis lanata) - In September and October we were alerted to the presence of phenomenal numbers of tiny "fuzzy pea-sized balls" which were dropping from red oak foliage in southern Maine (less in eastern sections). These turned out to be small, basically conical, foliage galls which were

covered with a soft, tan wool much like deer antler velvet. On the foliage they occurred on the underside either singly or clustered in groups of 6 or more. No injury to the trees is expected. This was the first time in more than 20 years that this gall has occurred. Numerous types of smooth galls are reported annually.

Oak Leaftier-shredder (Croesia semipurpurana) - Populations of this species continued to remain generally low in 1987 except for local defoliation (less than 1 acre) in Cumberland, Sagadahoc, Lincoln and Kennebec Counties. Moth activity and the frequency of scattered reports from this area increased in 1987 indicating possible resurgence of populations.

Oak Lecanium Scale (Lecanium sp.?) - Hemispherical, shiny-brown lecanium scales literally covered the twigs on some oaks in southern Maine in 1987. Many of the infested trees exhibited stress. No attempt was made to delineate the distribution or make species identification. The problem was generally spotty.

Sawflies (Various species) - Sawfly larvae from a wide variety of hosts continued to cause concern in urban situations. This ranged from those on various conifer species to several on **oak** (esp. Periclista sp., Pristiphora chlorea and Acordulecera sp.), **willow** (Nematus spp.), **birch** (Arge pectoralis and Dimorphopteryx sp.), **cherry** (Dimorphopteryx spp.), **fruit trees** (Caliroa cerasi), **dogwood** (Macremphytus sp.) and **alder** and **butternut** (Eriocampa spp.). Damage in most cases was light and very local.

Tussocks and Dagger Moths (Several species) - "Fuzzy" caterpillars always seem to draw more than their share of attention which they did again in 1987. The number of reports of problems with skin irritation (tussockosis) seemed to decline and the balance shifted between species somewhat but the situation remained similar to 1986. The most abundant species in 1987 was the bright yellow and black **spotted tussock** (Lophocampa = Halysidota maculata). The **hickory tussock** (L. caryea) and **pale tussock** (Halysidota tessellaris) populations declined. Fuzzy dagger moth caterpillars seem to increase in abundance, especially the **American dagger moth** (Acronicta americana) and **alder dagger moth** (A. dactylina). Also of interest was the receipt of two collections of the very attractive **tussock**, Orgyia definita from elm and white pine (these resemble a very pale version of the **white marked tussock**, O. leucostigma).

(D) Shade Tree, Ornamental and Miscellaneous Pests

Diseases and Miscellaneous Problems

Ash Anthracnose (Gloeosporium aridum) - A light to moderate infestation caused premature leaf drop of white ash at the Colby campus in Waterville, but leaf drop ceased by early July, despite plentiful acerruli on the underside of browned portions of the leaflets.

Dutch Elm Disease (Ceratocystis ulmi) - Wilting and heavy mortality continued to occur this past summer, and was widespread statewide on the diminishing number of surviving elms.

Girdling Roots - Many roadside Norway maples in Portland were suffering from severe girdling root problems which resulted in a progressive dieback and occasionally, mortality. Various roadside or landscape shade trees, especially European linden in the Lewiston/Auburn area were similarly affected. This raises questions as to the care that was exercised when the trees were first established on these sites.

Herbicide Injury - Bar Harbor and Andorra juniper ornamental plantings in Bangor browned up as the result of possible mis-application of Roundup herbicide. Wick application of Fusilade or Poast herbicides was the recommended alternative treatment.

Sapsucker Injury - Scattered damage from sapsuckers seems to occur nearly every season. Heavy attack on a single mature red pine in Belgrade contributed to mortality. The tree contained two separate areas of damage in the lower crown, each of which measured 6" x 18".

Light sapsucker damage was reported to Japanese larch in Industry, Scots pine in Vassalboro, and to various hardwoods in Casco.

Since sapsuckers commonly utilize poplars affected with Fomes igniarius (now Phellinus tremulae) as nest trees, much damage by resident birds can be avoided by eliminating these heart-rotted trees from the woodlot. Feeding damage by transient, migrating birds cannot be avoided.

Weather-Related Disorders - Winter (1986-87) injury seemed to be heavier and more widespread than usual this past year. Understory white oak reproduction in the Gray area and specimen trees at Leeds suffered heavy dieback last winter, but had started to produce new shoots and leaves by late July. Some of this late-developing growth was not expected to harden-off by the first fall frost; however, new shoot growth is expected to be produced next spring. Portions of highbush blueberry, young black walnut, black locust, honeylocust, bur and pin oaks, and rhododendron exposed above the deep winter's snow accumulation were killed back above the 3-3 1/2 foot level or higher. Some areas suffering notable damage were the Colby Campus in Waterville, Sidney, Brunswick, North Bucksport, Newburgh, Gray and South Portland. Premature activation of cambium from reflection off the snow's surface, followed by cold temperatures, may have been responsible. Strangely, forsythia showed very little winter kill for the third successive year. Rhododendrons suffered severe winter browning of foliage exposed above the snow cover.

In Waterville, some of the pin oaks affected with winterkill exhibited delayed leaf emergence, with some leaves only 1/2" long at the end of June. Affected trees were about 25-30 feet tall, with 8-10' having been killed.

On the Bates campus, Lewiston, an entire new planting of prostrate juniper established on a south-facing slope adjacent to a light colored building suffered winter-kill, while similar stock from the same source planted on a nearby site remained healthy. Reflectance and/or excessive winter transpiration may have been responsible.

Trembling aspen in Aroostook County which appeared thin-topped when viewed from a distance were believed to have been hit by a late frost in late May. Refoliation eventually took place, and new leaves appeared darker than usual. This symptom was compounded with damage caused by leaf folding sawflies (Phyllocolpa sp.) and possible shoot blight.

Trees along rivers suffered some scouring damage from floating ice during the severe flooding of early April; however, an early thaw had reduced ice thickness considerably, and damage generally was not as serious as expected.

Snow breakage and bending of young reproduction resulted from the heavy snow deposits of December 1986 - January 1987. Melting and receding snowpack literally ripped lower branches of conifers from their sockets. Pines, cedar and rhododendron suffered the most damage.

A late-season heavy wet snowstorm on April 29 also caused heavy breakage to susceptible trees and shrubs.

White pine, hemlock, balsam fir and red cedar adjacent to heavily-salted highways were browned to varying degrees from wind-borne salt deposits. White pine along the I-95 right-of-way was heavily browned, especially south of Augusta.

Open-growing fir in a localized Frenchville area exhibited brown flagging where hailstones struck. "Stones" must have been moth ball-size. Hail damage to blueberries in a localized area of North Cutler was reported to have a detrimental effect on blueberry production.

White pines in the Naples area still looked thin from last year's (1986) baseball-sized hail storm. Hardwoods in the same area looked normal and contained a normal compliment of leaves.

Unbroken balsam fir buds in low pockets in Skowhegan were believed caused by late frost injury.

Lightning strikes on very large white pines in Naples and Greene resulted in mortality of several adjacent pines as well. At the Greene location, heavy mid-crown pitching was a symptom on affected trees. Trees were shoreline in both cases, and on ledgy sites.

Further information on any entry in this report can be requested by calling or writing to the Insect & Disease Laboratory, 50 Hospital Street, Augusta, Maine 04330 Phone (207) 289-2431.

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