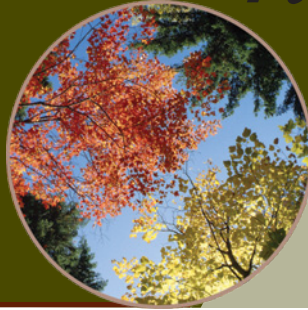


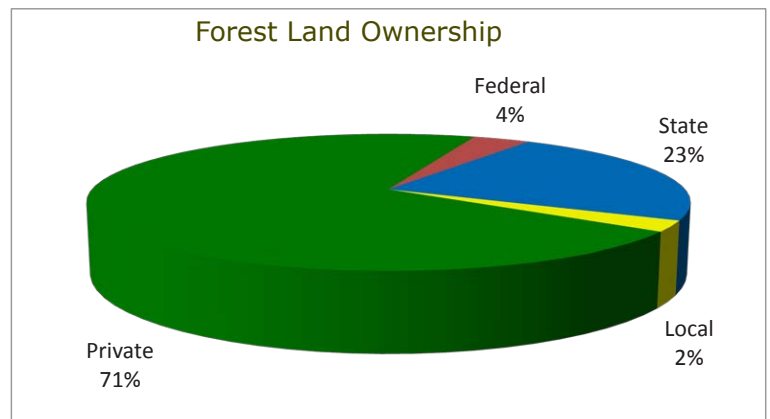
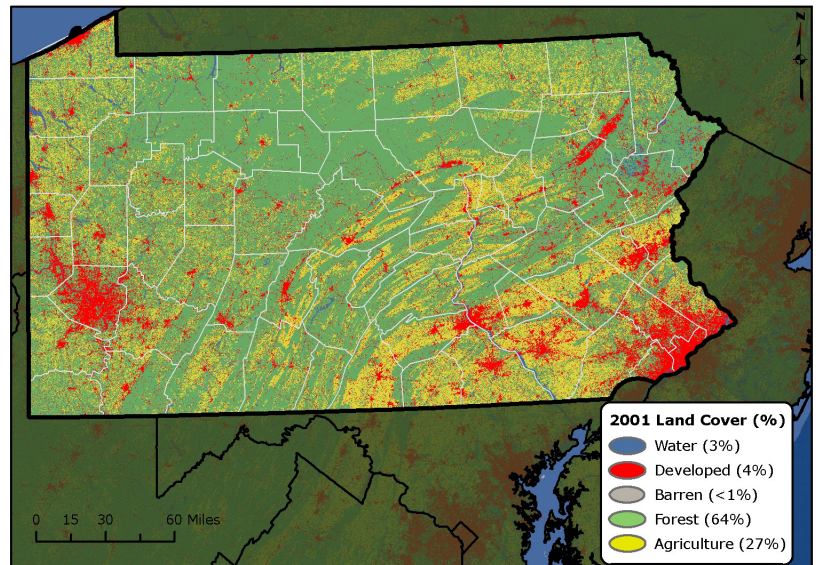
2010 Forest Health

PENNSYLVANIA *highlights*



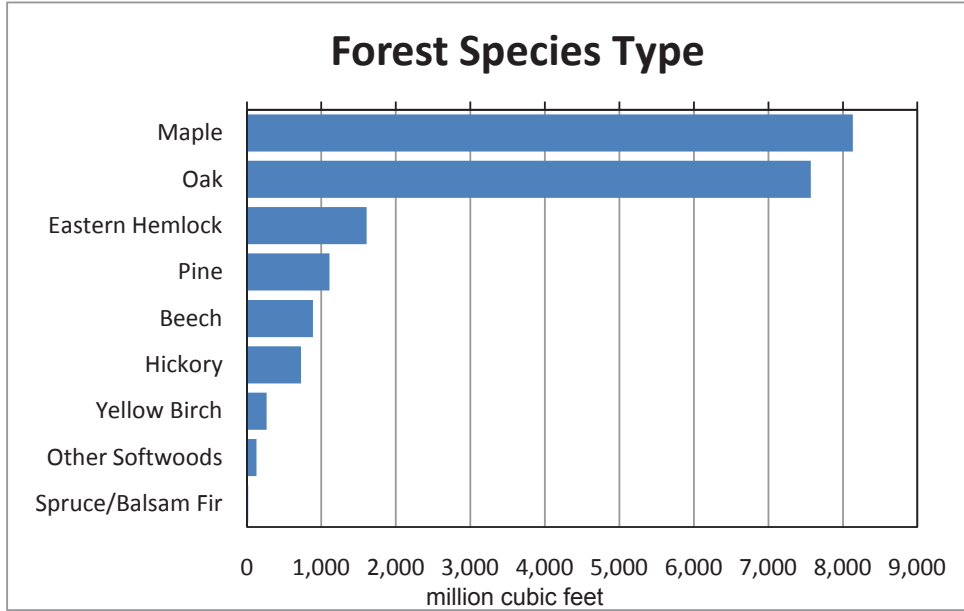
Program Summary

The Division of Forest Pest Management protects forest resources in Pennsylvania from harmful insects and diseases through active monitoring, management, cooperation, and public outreach efforts. During 2010, we continued to monitor important forest insects and diseases in the State through ground and aerial surveys. These survey efforts involved the emerald ash borer, hemlock woolly adelgid, Asian longhorned beetle, exotic bark beetles, sudden oak death, and butternut canker disease. Preventative measures to protect against emerald ash borer as well as biological suppression of hemlock woolly adelgid were conducted throughout the year. The Division participated in several cooperative pest management activities through training and assistance within the Bureau of Forestry; the Department of Conservation and Natural Resources; and other agencies and institutions at local, State, and Federal levels. In addition, we have continued to promote public outreach on forest health issues across the State through demonstration, training seminars, tradeshow, and diagnostic services. This report is intended to outline some of the major achievements of the Division throughout the year.



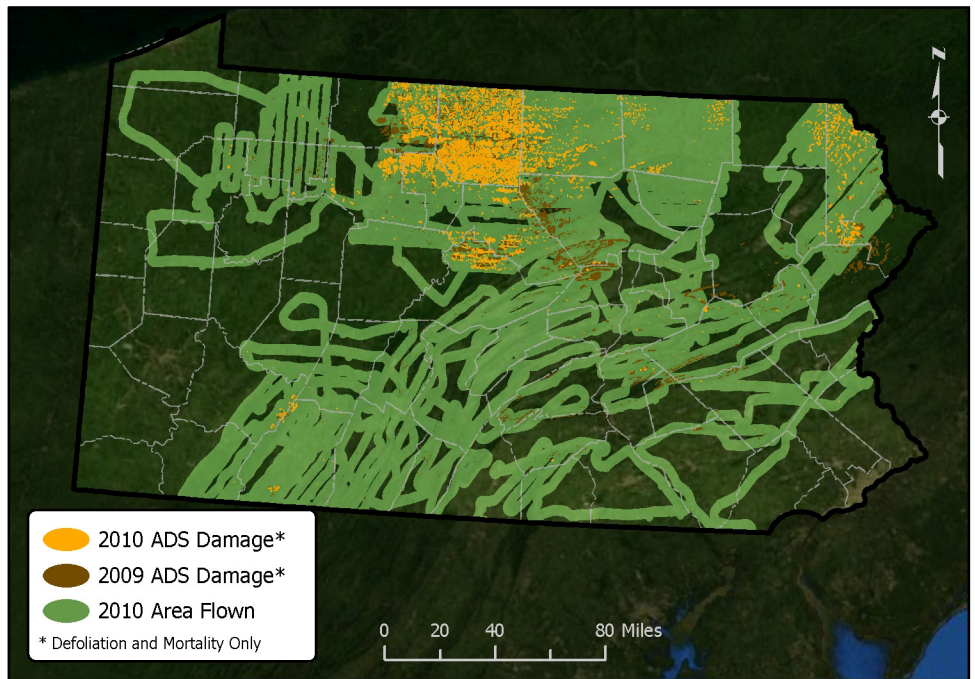
Forest Health Programs

State forestry agencies work in partnership with the U.S. Forest Service to monitor forest conditions and trends in their State and respond to pest outbreaks to protect the forest resource.



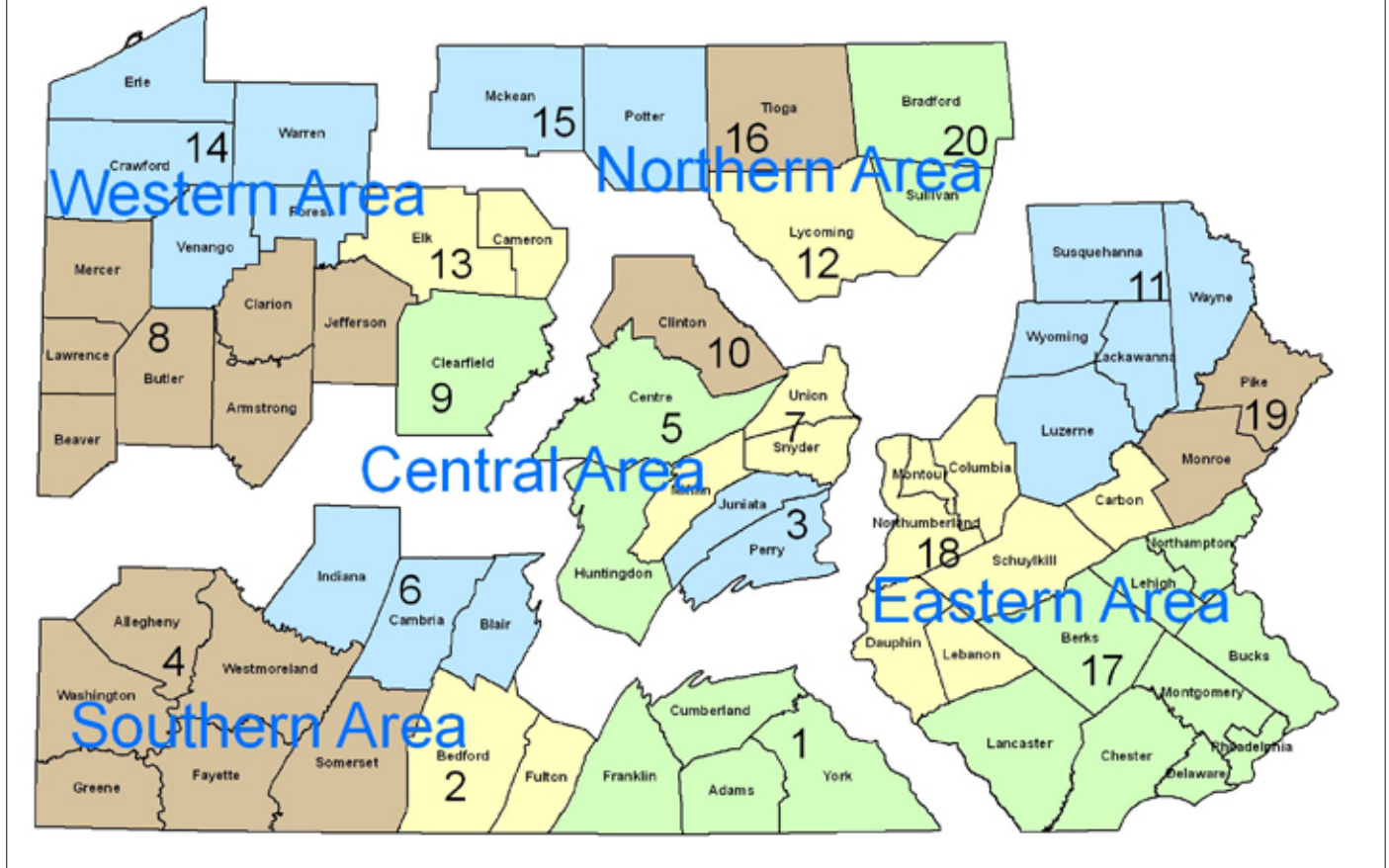
Aerial Surveys

Of the acreage flown in the aerial detection survey for Pennsylvania in 2010, 558,067 acres of damage were recorded. The vast majority (483,687 acres, or 87 percent) were damaged by the forest tent caterpillar. Unusually high temperatures in early April followed by a series of frost and freeze events caused 35,417 acres of frost damage. Gypsy moth damaged 30,686 acres, and fall cankerworm affected 6,307 acres. Additional acreage was damaged by the hemlock woolly adelgid (1,256 acres), eastern tent caterpillar (293 acres), elongate hemlock scale (209 acres), and chemicals (56 acres).



This map delineates aerial detection survey (ADS) results for Pennsylvania in 2009 and 2010.

Bureau of Forestry Forest Districts Division of Forest Pest Management Field Areas



Bureau of Forestry Forest Districts, Division of Forest Pest Management Field Areas.

Weather Conditions

Weather extremes dominated the 2010 growth period. The major weather event was an early and sudden rise in temperatures (10 to 20°F above normal) during the week of April 5-11 when record-setting temperatures exceeded 80°F across the State. As a result, the growing degree days based on 50°F were 90 percent to 100 percent above normal for that week and remained 35 percent to 45 percent higher for the remainder of the year. This led to early bud break, expansion, and leaf out of many tree species including maples, oaks, ash, and various conifers. A series of frost and freeze

events from April 16-22 brought significant damage to emerging foliage across the northern tier counties. In response to the early warmup, forest tent caterpillar eggs hatched earlier throughout the outbreak areas. Springtime rainfall was higher than normal across the Commonwealth. However, precipitation patterns were below normal for most of the remaining growth period. Temperatures were moderate through mid to late June, but hot weather returned in July and remained in place through August. Light to moderate drought conditions were experienced in most forested areas throughout the year.



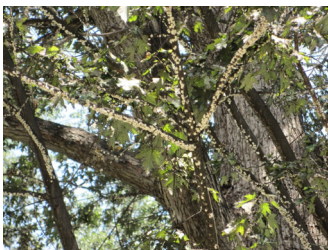
Forest tent caterpillar larvae (H. Liu, Pennsylvania DCNR)



Fall cankerworm larvae on maple (E.B. Walker, www.forestryimages.org)



Eastern tent caterpillar larvae on cherry (J. Williams, Pennsylvania DCNR)



Cottony maple scale on silver maple (S. Stitzer, Pennsylvania DCNR)



Common walkingstick on hickory (H. Liu, Pennsylvania DCNR)



Orangestriped oakworm larva (E. G. Vallery, www.forestryimages.org)

Pest Conditions

Forest pest conditions in forested land across the State were monitored through aerial surveys, forest insect and disease reports, and special projects.

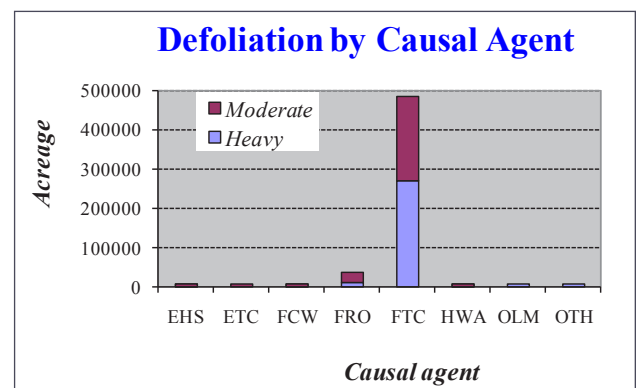
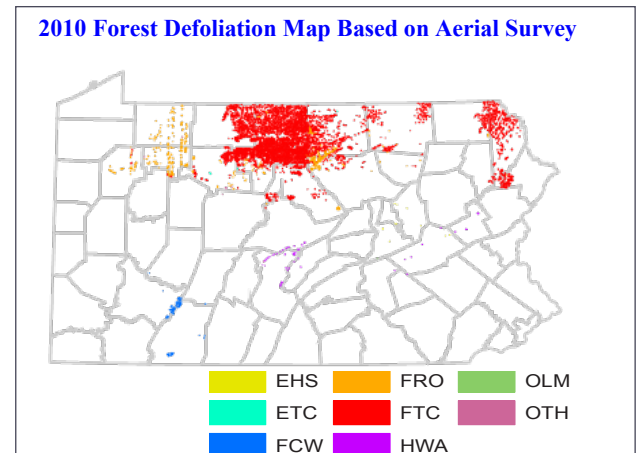
Defoliation

Over 520,000 acres of forest were defoliated by various agents. Forest tent caterpillar (FTC) was responsible for more than 470,000 acres of defoliation. Frost damage was observed in late spring across the northern tier counties. Fall cankerworm (FCW) was still active in Westmoreland and Somerset Counties. Localized populations of cottony maple scale and walkingstick were also reported. Gypsy moth (GM) populations were barely detectable following last year's fungal epizootics. Hemlock woolly adelgid (HWA) did not cause widespread defoliation on hemlock trees, although activities of elongated hemlock scale (EHS) increased in a few eastern counties. Orange striped oakworm, eastern tent caterpillar, and oak leafminer caused localized damage. Other forest pests included emerald ash borer (EAB), cherry scallop shell moth, fall webworm, and locust leafminer.



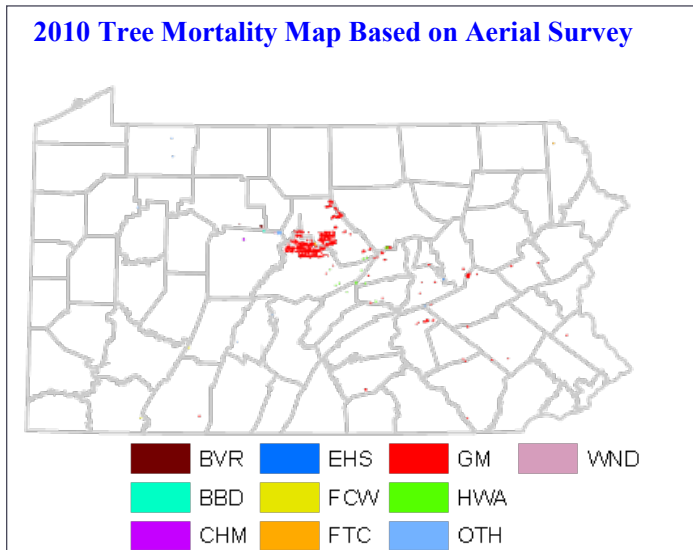
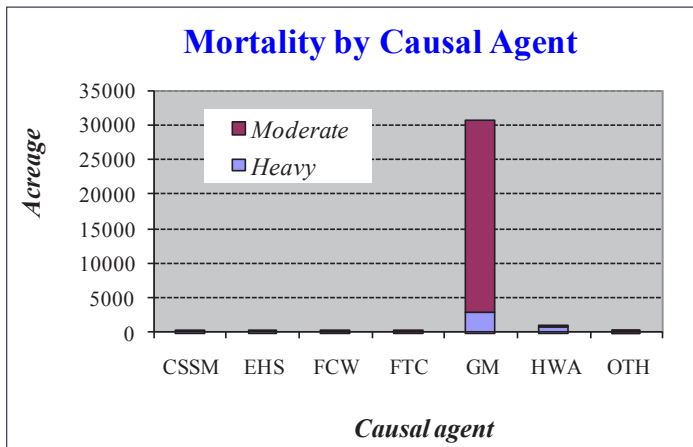
Forest tent caterpillar defoliation near lakeside homes (Steven Katovich, USDA Forest Service, www.forestryimages.org)

Localized outbreaks of leaf anthracnose were reported statewide. Bacterial leaf scorch disease was reported in Huntington County.



Mortality

Less than 32,000 acres with significant tree mortality were observed, 96 percent of which resulted from GM damage in previous years. Other mortality factors included HWA, FTC, beaver damage, beech bark disease, wind, and chemicals that resulted from a gas explosion.



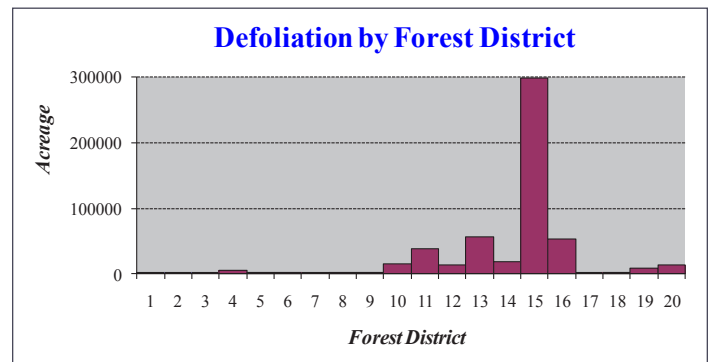
Negative Reports

Negative reports were collected from forest insect and disease and general hemlock surveys to monitor the spread and population dynamics of certain pests. A total of 2,306 negative reports covering 21 pest species were filed in 2010.

District Highlights

More than half of the defoliation in 2010 was reported from District 15, followed by Districts 13, 16, 11, 14, 10, 12, and 20. Sizable defoliation was also found in Districts 19, 4, 5, 9, 18, 8, and 6. No significant defoliation was reported from Districts 1, 2, 3, 7, and 17.

FTC and early frost were the top causal agents in most northern tier counties, with the former dominating in Districts 5, 9, 10, 11, 13, 15, 16, 19, and 20, and the latter in Districts 8, 12, and 14. District 15 suffered the most from FTC, which defoliated more than 298,000 acres of forest. FCW was the only significant forest pest in Districts 4 and 6, whereas HWA and EHS were found affecting hemlock health in District 18 (see graphic on page 3 for District locations).



District	Top Causal Agents (acres)	
	Agent 1	Agent 2
1	n/a	n/a
2	n/a	n/a
3	n/a	n/a
4	Fall Cankerworm (6187)	n/a
5	Forest Tent Caterpillar (1277)	n/a
6	Fall cankerworm (93)	n/a
7	n/a	n/a
8	Frost (354)	Forest Tent Caterpillar (75)
9	Forest Tent Caterpillar (904)	Frost (39)
10	Forest Tent Caterpillar (14253)	Frost (953)
11	Forest Tent Caterpillar (37794)	Frost (326)
12	Frost (7019)	Forest Tent Caterpillar (6119)
13	Forest Tent Caterpillar (53524)	Frost (2769)
14	Frost (18088)	Forest Tent Caterpillar (846)
15	Forest Tent Caterpillar (298125)	Frost (886)
16	Forest Tent Caterpillar (48817)	Frost (4404)
17	n/a	n/a
18	Hemlock Woolly Adelgid (578)	Elongated Hemlock Scale (171)
19	Forest Tent Caterpillar (9341)	Frost (63)
20	Forest Tent Caterpillar (12470)	Frost (521)

Entomology Projects

Entomology projects were supported by Federal grants from the U.S. Forest Service through the Cooperative Forest Health Program with matching funds from the State. Special projects were awarded through a competitive application process.

Emerald Ash Borer

Agilus planipennis Fairmaire (Coleoptera: Buprestidae)

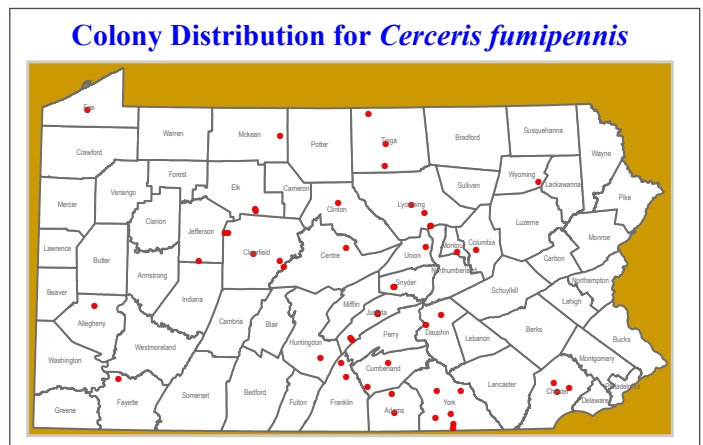
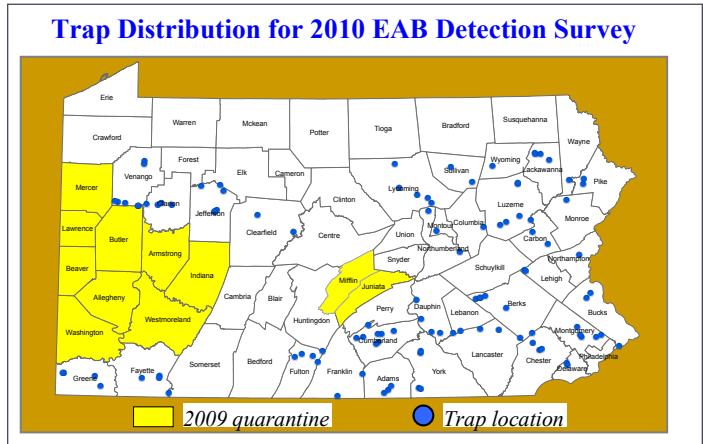
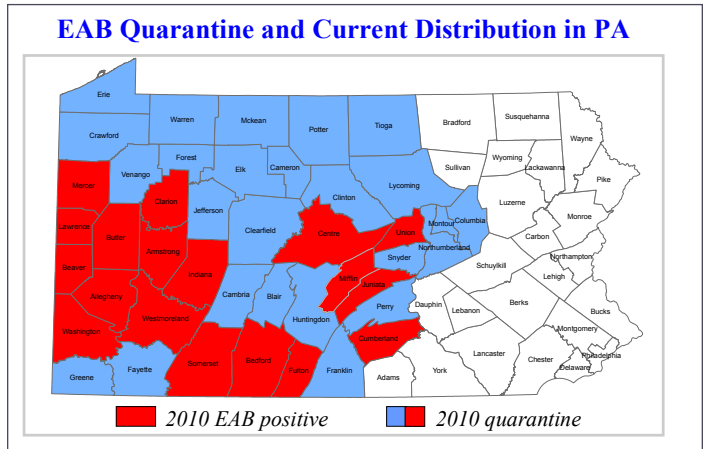
Survey. We participated in the national EAB detection survey in 2010. A total of 111 purple panel traps were placed in 33 counties throughout Pennsylvania. Traps were monitored from June to September. EAB was found in Cumberland and Clarion Counties, with adults caught on a single trap in each county. EAB was also confirmed in Bedford County from visual surveys. Our survey activities were coordinated with the Pennsylvania Department of Agriculture (PDA), U.S. Forest Service, and USDA APHIS Plant Protection and Quarantine. Four additional counties (Centre, Fulton, Somerset, and Union) were identified by the PDA as infested through their grid-based survey. As a result, 43 counties in the western two-thirds of the State were quarantined by the end of the year, with EAB found in 18 counties.

Biosurveillance. Public lands across the State were surveyed for the presence of *Cerceris fumipennis* Say (Hymenoptera: Crabronidae), a beetle-hunting wasp that is occasionally associated with EAB. Overall, a total of 51 potential colonies were identified in 24 counties across the State.

Management. For the integrated pest management and biological control of EAB, over 400 ash trees were identified at one study location in Allegheny County, and 17 infested trees were removed to reduce the EAB population. Chemical treatment with emamectin benzoate and biological control with three parasitoids will be incorporated in 2011. Successful management of EAB in this location will be used as a model for statewide public education and outreach activities in the future. Site selection and plot evaluation were also carried out throughout the infested areas across

the State in 2010 for the release of EAB parasitoids in the future.

Seed Collection, Conservation, and Public Education. We continued our effort to collect ash seeds for storage; protect the pumpkin ash resource in Erie County and at state-owned ash seed orchards with pre-emptive chemical treatments; and educate the general public about the potential impact of EAB on forest resources, urban forests, and the environment.





Cerceris fumipennis
adult dorsal
view (P.
Careless,
University of
Guelph)



Tree removal
(H. Liu,
Pennsylvania
DCNR)



Cerceris fumipennis
adult front
view (P.
Careless,
University of
Guelph)



*Chemical
treatment*
(H. Liu,
Pennsylvania
DCNR)



Cerceris fumipennis
adult nest
(H. Liu,
Pennsylvania
DCNR)



*Parasitoid
release* (H. Liu,
Pennsylvania
DCNR)



Public education (H. Liu, Pennsylvania DCNR)



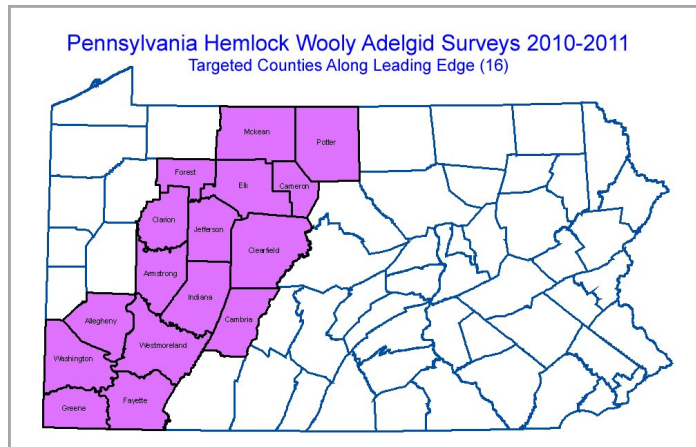
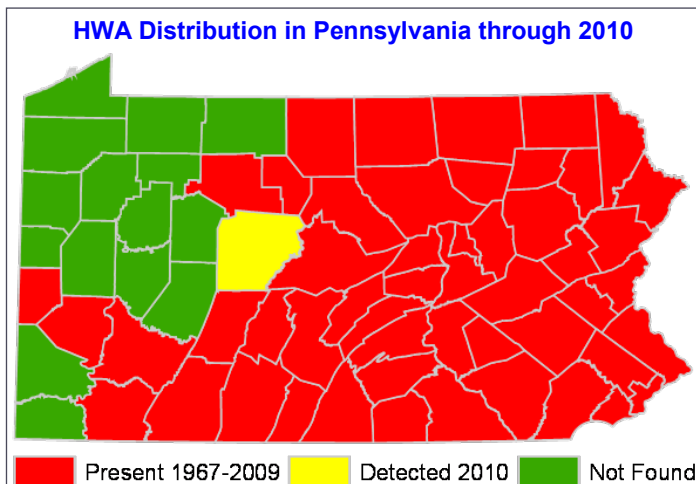
Field survey (H. Liu, Pennsylvania DCNR)

Hemlock Woolly Adelgid

Adelges tsugae Annand (Homoptera: Adelgidae)

Survey and Detection. This project was designed to detect and delineate the leading edge of the HWA infestation in Pennsylvania. A total of 16 counties in western Pennsylvania were included in this project. At least 10 geographically distinct sites in each county were selected for this survey. For each survey site, a total of 10 randomly selected branches from 3 to 10 hemlock trees were examined for HWA infestation. Clearfield County was found to be infested in 2010.

HWA Suppression. The suppression project focuses on the protection and conservation of high-priority hemlock trees and stands across Pennsylvania through the suppression of HWA populations. Several systemic insecticides will be used through soil injection, soil drench, or trunk injection. Over 2,000 acres of hemlocks across the State have been proposed for treatment. Field application of chemical treatment is scheduled in the spring of 2011.

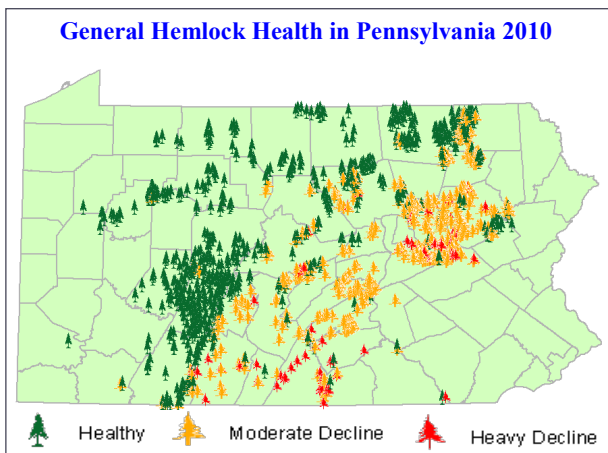
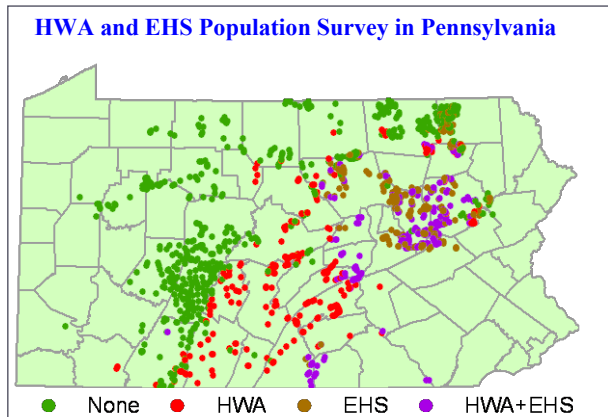
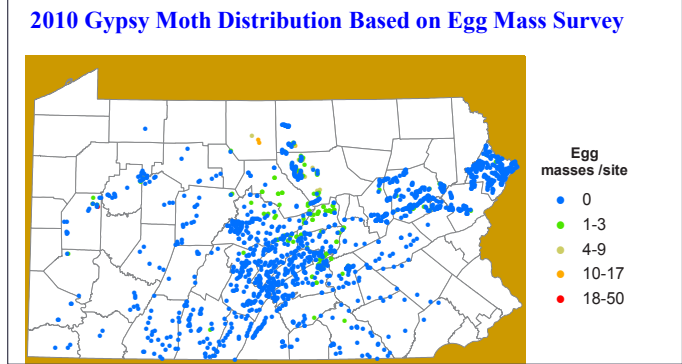


Eastern hemlock (S. Werner, Pennsylvania DCNR)



Hemlock woolly adelgid on hemlock (H. Liu, Pennsylvania DCNR)

General Hemlock Survey. A total of 1,277 hemlocks were visually surveyed in 2010. About 36 percent of the sampled trees were infested with HWA, 36 percent with EHS, and 23 percent with Fabrella needle blight. Hemlock health is clearly influenced by HWA and EHS infestations, with severe hemlock decline observed in stands with high pest populations. HWA is now found in 52 of the 67 counties in Pennsylvania.



Gypsy Moth

Lymantria dispar (L.) (Lepidoptera: Lymantriidae)

A total of 1,606 sampling sites (1/40 acre) were surveyed across Pennsylvania. Approximately 10 percent of these surveys revealed the presence of observable densities of egg masses. The 172 positive sites were located in 25 counties. Sites with more than 3 egg masses were found only in Butler, Luzerne, and Lycoming Counties. One site in Butler County had 50 egg masses; however, ground checks revealed that few larvae were present and the potential of an outbreak occurring was low.

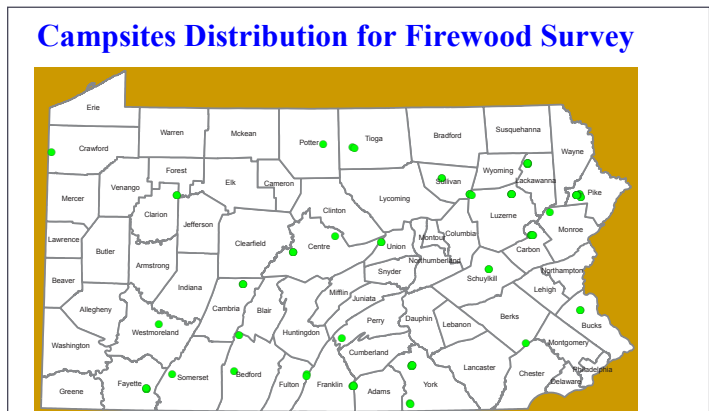
Asian Longhorned Beetle

Anoplophora glabripennis
(Motschulsky)
(Coleoptera:
Cerambycidae)



Adult Asian longhorned beetle
(H. Liu, Pennsylvania DCNR)

The objective of the 1-year project is to survey for potential Asian longhorned beetle (ALB) infestations on state-owned campgrounds visited by campers from 23 ALB-infested zip codes in Massachusetts over the last 5 years (2006-2010). A total of 84 campsites within 29 State Parks across the State have been identified for this survey based on camper reservation data. Host trees within a 10-m (33-ft) radius of each campsite were visually examined from the ground for ALB signs and symptoms using a pair of binoculars. A total of 548 host trees, including 312 red maples, 201 sugar maples, 25 American elms, 4 river birches, 2 paper birches, 2 hackberries, 1 Norway maple, and 1 white ash tree were inspected. No ALB infestation was detected. Outreach efforts on high-risk campgrounds were also carried out during the survey.



Exotic Bark Beetles

(Coleoptera: Scolytidae)

A 1-year project was initiated to detect, delimit, and monitor newly introduced exotic bark and ambrosia beetles at selected high-risk forest areas in Pennsylvania. A total of 12 sites from 10 counties were selected from wooded areas in locations with high risk due to importing, storing, or recycling potentially infested solid wood packing material, dunnage, crating, pallets, or other items in Pennsylvania. Three 12-unit funnel traps were used at each site, with each trap baited with one of three lures (ethanol, alpha-pinene plus ethanol, and Ips). Traps were monitored every 2 weeks for a period of 12 weeks, with lures replaced every 4 weeks. Non-native bark and ambrosia beetles were collected from the traps and submitted for identification. A total of 13,622 scolytid beetles representing 52 species were recovered through the survey. *Xylosandrus germanus* (Blanford) is the most abundant species, making up 36 percent of the beetles collected. Other frequently encountered species include *Gnathotrichus materiarius* (Fitch), *Xyleborus pelliculosus* (Eichhoff), *Tomicus piniperda* (L.), *Xyleborinus saxesenii* (Ratzeburg), *Anisandrus sayi* (Hopkins), *Xyloterinus politus* (Say), *Dendroctonus valens* (LeConte), *Ips grandicollis* (Eichhoff), and *Euwallacea validus*



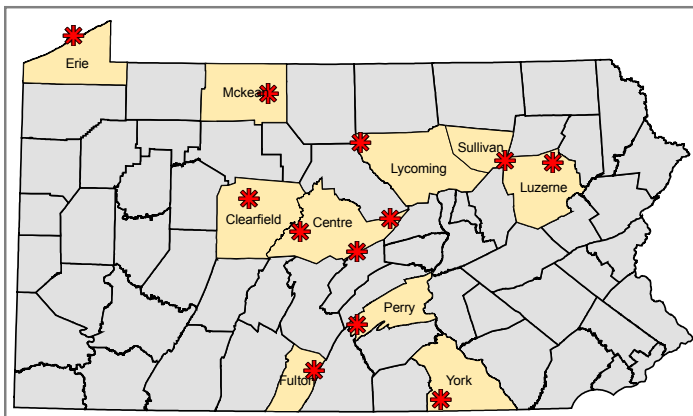
Xylosandrus germanus adult (S. Spichiger; Pennsylvania DCNR)

(Eichhoff). The top 15 species accounted for 89 percent of the specimens, while the other 37 species represented the remaining 11 percent. No *Anisandrus maiche* Stark was recovered from this survey although it has been found in nine counties in southwestern Pennsylvania.



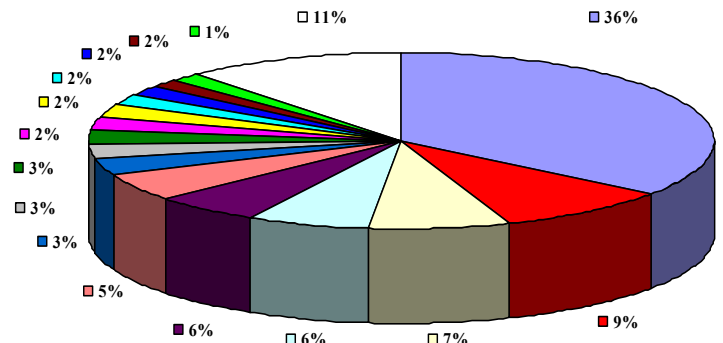
Lindgren trap (USDA Forest Service, www.forestryimages.org)

Study Sites for 2010 Scolytids Survey



Species Composition of Scolytids Recovered from Trapping

- Xylosandrus germanus*
- Gnathotrichus materiarius*
- Xyleborus pelliculosus*
- Tomicus piniperda*
- Xyleborinus saxesenii*
- Anisandrus sayi*
- Xyloterinus politus*
- Dendroctonus valens*
- Ips grandicollis*
- Euwallacea validus*
- Dryocoetes*
- Xyleborus atratus*
- Orthotomicus caelatus*
- Hylastes opacus*
- Xyleborinus alni*
- Others (37 species)



Pathology Projects

Pathology projects were supported by Federal grants from the U.S. Forest Service through the Cooperative Forest Health Program with matching funds from the State. Special projects were awarded through a competitive application process.

Beech Bark Disease

Since the 1890s, the advance of beech scale and beech bark disease from the Canadian Maritime Provinces through New England, the Mid-Atlantic, the Upper Mid-West, and the Mid-South has left a trail of beech decline and mortality. Fortunately, a small, scattered residual population of surviving beech trees resistant to beech scale has provided researchers and forest land managers with an opportunity to reintroduce resistant families to affected forested regions. Since 2005 Pennsylvania has provided researchers with seven families of scale-resistant beech in support of restoration efforts. Additional resistant families of American beech are being located to support establishment of beech seed orchards containing between 25 and 35 genetically distinct families of resistant trees in support of American beech conservation planting programs throughout the northern region.



Beech bark disease symptom on beech (J. O'Brien, www.forestryimages.org)

Sudden Oak Death, *Phytophthora ramorum*

Since 2003, the Division of Forest Pest Management has participated in various terrestrial and aquatic surveys to detect this fungal pathogen in oak forested regions of Pennsylvania. Since 2007 terrestrial surveys were replaced by stream



Symptom on oak (J.O'Brien, www.forestryimages.org)

surveys in which rhododendron leaves placed in nylon mesh bags are floated in select streams to monitor watersheds for this pathogen. Since 2006 a total of 19 streams have been monitored for *P. ramorum* activity. To date, *P. ramorum* has not been recovered from any of the streams monitored.

Butternut Canker

A 3-year, multistate effort supporting the conservation and restoration of *Juglans cinerea* (butternut) was initiated in 2009. From December 2009 through March 2010 field collections were made of dormant twigs from individual butternut trees and submitted for DNA characterization to determine genetic purity. Over 163 trees were sampled; 80 trees were determined to be "pure" *J. cinerea* and 47 were hybrids (*J. cinerea* x *J. alantifolia*). Scion wood from 27 pure butternuts



Butternut grafts in greenhouse (C. Sweeney, USDA Forest Service)



Butternut seedlings in greenhouse (C. Sweeney, USDA Forest Service)

was collected and grafted onto *Juglans nigra* root stocks. At present, 75 surviving seedlings are being prepared for pathogenicity tests and inclusion in seed orchard plantings.

Twenty-three of Pennsylvania’s 67 counties are represented in this survey as of July 14, 2010 (the number in parentheses is the number of trees sampled): Adams (4), Armstrong (7), Beaver (2), Bedford (7), Butler (16), Cameron (6), Clarion (12), Clearfield (15), Crawford (12), Cumberland (1), Elk (8), Erie (7), Forest (8), Franklin (3), Fulton (7), Jefferson (3), Lackawanna (1), Lawrence (8), Mercer (11), Somerset (1), Susquehanna (2), Venango (4), and Wayne (18).

Interagency Cooperation

We have been cooperating with Federal, State, and local agencies as well as research institutions on various projects throughout the year. A few of the noticeable projects are listed below.

Within the Department

- Cooperative HWA suppression project with the DCNR Bureau of State Parks and DCNR Bureau of Forestry forest districts
- Development of an Invasive Plant Control proposal with the DCNR Bureau of State Parks
- Participation on the DCNR Invasive Species Management Team

Federal Agencies

- Coordination of EAB surveys with USDA APHIS PPQ
- Cooperate with the U.S. Forest Service and APHIS PPQ on EAB biological control
- Training and implementation of aerial survey software and safety measures with the U.S. Forest Service
- Participation in the Aerial Application Safety Council & the Council’s Training Committee, U.S. Forest Service
- Assisting USDA APHIS on a *Sirex* woodwasp biological control project
- Participation [in] U.S. Forest Service and APHIS EAB framework development

Other State Agencies

- Coordination of EAB surveys with the PA Department of Agriculture and USDA APHIS PPQ
- EAB management with Allegheny County Parks
- Representation on the PA Invasive Species Council
- Coordination of *P. ramorum* surveys with the PA Department of Agriculture and PSU
- Help PSU on HWA efficacy trials and *Ailanthus* management projects
- Assist the Western Pennsylvania Conservancy on HWA projects
- Provide expertise to the Pittsburgh Parks Conservancy for invasive species management
- Work with local school districts on various programs

Across the Country

- Northeastern Area Association of State Foresters Forest Health Committee
- Representation on the Continental Dialogue on Non-Native Invasive Forest Insects & Diseases Steering Committee
- National Gypsy Moth Management Board
- Planning with the U.S. Forest Service and the University of Vermont on testing aerial application of fungal insecticide for HWA control

Extension and Outreach

Extension and outreach are important components of our mission as a State agency. Throughout the year we have been actively involved in public education on forest health issues across the State through training, demonstration, seminars, trade shows, and services for forest health and forest pests diagnostics. A partial list of extension and outreach activities is presented in the table below.

Activity	Number	County	Audience
Forest Health	6	5	115
Pest Diagnosis	27	9	572
Invasive Species	6	5	545
Pest Control	4	4	105
Information Seminar	22	19	2,533
Total	65	42	3,870

Examples of Outreach Audience

- Woodland Owners Associations
- Other professional associations and clubs
- Local communities (county, city, township, and borough)
- Resource management agencies
- Private citizens



Informational seminar (D. Eggen, Pennsylvania DCNR)

Glossary

Asian Longhorned Beetle *Anoplophora glabripennis* (Motschulsky) (Coleoptera: Cerambycidae)

Beech Bark Disease *Nectria coccinea* var. *faginata* Lohman, Watson, and Ayers and *N. galligena* Bres (Sordariomycetes: Nectraceae)

Butternut Canker *Sirococcus clavigignenti-juglandacearum* (Ascomycota)

Common Walkingstick *Diapheromera femorata* (Say) (Phasmatodea: Heteronemiidae)

Cottony Maple Scale *Pulvinaria innumerabilis* (Rathvon) (Homoptera: Coccidae)

Cherry Scallop Shell Moth *Hydria prunivorata* (Ferguson) (Lepidoptera: Geometridae)

Eastern Tent Caterpillar *Malacosoma americanum* (Fabricius) (Lepidoptera: Lasiocampidae)

Elongate Hemlock Scale *Fiorinia externa* Ferris (Homoptera: Diaspididae)

Emerald Ash Borer *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae)

Fall Cankerworm *Alsophila pometaria* (Harris) (Lepidoptera: Geometridae)

Fall Webworm *Hyphantria cunea* (Drury) (Lepidoptera: Arctiidae)

Forest Tent Caterpillar *Malacosoma disstria* Hübner (Lepidoptera: Lasiocampidae)

Gypsy Moth *Lymantria dispar* (L.) (Lepidoptera: Lymantriidae)

Hemlock Woolly Adelgid *Adelges tsugae* Annand (Homoptera: Adelgidae)

Locust Leafminer *Odontota dorsalis* (Thunberg) (Coleoptera: Chrysomelidae)

Oak Leafminer *Cameraria* sp. (Lepidoptera: Gracillariidae)

Orangestriped Oakworm *Anisota senatoria* (J.E. Smith) (Lepidoptera: Saturniidae)

Sudden Oak Death *Phytophthora ramorum* Werres et al. (Oomycetes: Pythiaceae)



Forest Health Protection
USDA Forest Service
180 Canfield St.
Morgantown, WV 26505
304-285-1545
<http://www.na.fs.fed.us>

March 2011



Department of Conservation and
Natural Resources
Bureau of Forestry, Division of Forest
Pest Management
208 Airport Drive H.I.A.
Middletown, PA 17057
717-948-3941
<http://www.dcnr.state.pa.us/forestry/fpm.aspx>