



# 2010 Pennsylvania Forest Health Report



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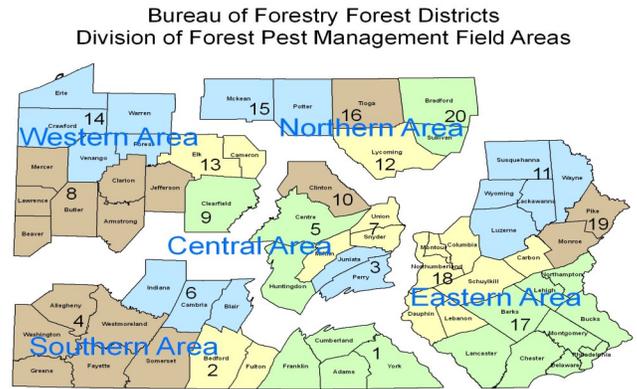
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Department of Conservation and Natural Resources  
 Bureau of Forestry  
 Division of Forest Pest Management  
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## Program Summary

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 surveys included 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, and 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, the Department, and other agencies and institutions at the local, state, and federal levels. In addition, we have continue to promote public outreach on forest health issues across the state through demonstration, training seminars, trade shows, and diagnostic services. This report is intended to outline some of the major achievements of the Division throughout the year.



## 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 (GDDs) based on 50°F were 90%-100% above normal for that week and remained 35% to 45% 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 warm-up, 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)

## Pest Conditions

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



Forest Tent Caterpillar Defoliation in Oak Stands  
(E. Wiltsie, USDA Forest Service)



Fall Cankerworm Larvae on Maple  
(E. B. Walker, www.forestryimages.org)

### 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 (FRO) 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. Orangestriped oakworm (ETC) and oak leafminer (OLM) caused localized damages. Other (OTH) forest pests include emerald ash borer (EAB), cherry scallop shell moth (CSSM), fall webworm, and locust leafminer.



Eastern Tent Caterpillar Larvae on Cherry  
(J. Williams, Pennsylvania DCNR)



Cottony Maple Scale on Silver Maple  
(S. Stitzer, Pennsylvania DCNR)

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



Common Walkingstick on Hickory  
(H. Liu, Pennsylvania DCNR)

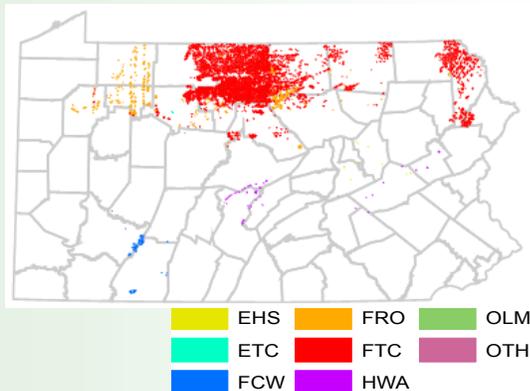
### Mortality

Less than 32,000 acres with significant tree mortality were observed, with 96% from GM damage in previous years. Other mortality factors include HWA, FTC, beaver damage (BVR), beech bark disease (BBD), wind (WND), and chemicals (CHM) resulted from a gas explosion.

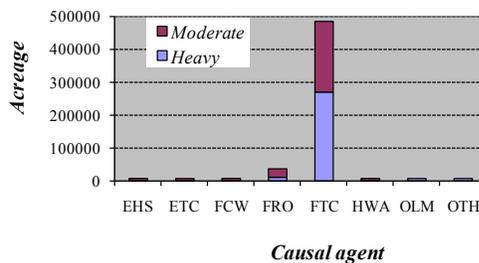


Orangestriped Oakworm Larva  
(E. G. Vallery, www.forestryimages.org)

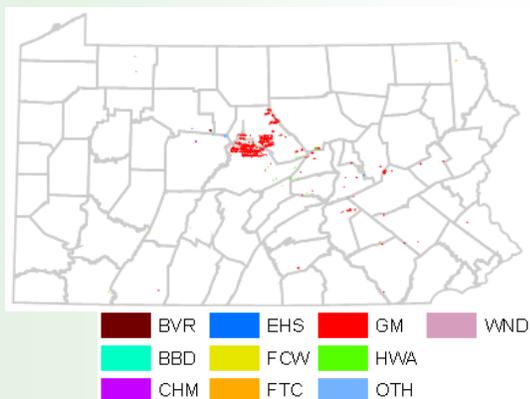
### 2010 Forest Defoliation Map Based on Aerial Survey



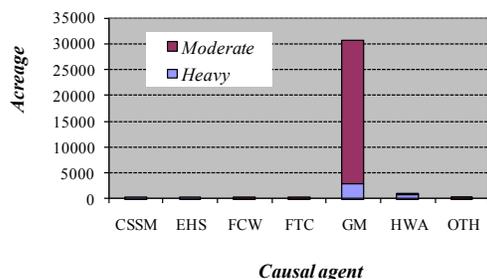
### Defoliation by Causal Agent



### 2010 Tree Mortality Map Based on Aerial Survey



### Mortality by Causal Agent



### Negative Reports

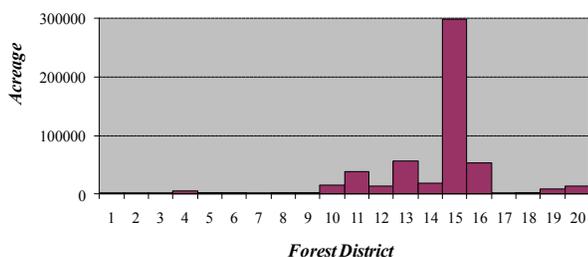
Negative reports were collected from forest insect and disease (FI&D) and general hemlock surveys to monitor the spread and population dynamics of certain pests. A total of 2,306 negative reports covering 21 pest species were filed in 2010.

### 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 forest districts 1, 2, 3, 7, and 17.

FTC and early frost were the top causal agents in most northern tier counties, with the former dominated in Districts 5, 9, 10, 11, 13, 15, 16, 19, and 20, and the later in Districts 8, 12, and 14. District 15 suffered the most from FTC, with > 298,000 acres of forest defoliated. 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 map on page 1 for District locations).

Defoliation by Forest District



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)

n/a - not applicable

## Entomology Projects

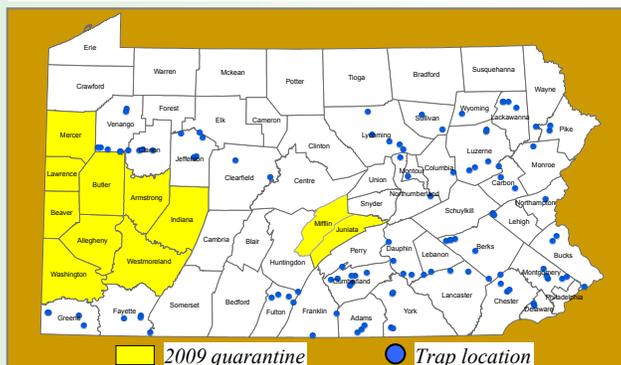
Entomology projects were supported by federal grants from USDA Forest Service through the Cooperative Forest Health Program (CFHP) with matching funds from the state. Special projects were awarded through a competitive application process.

### Emerald Ash Borer

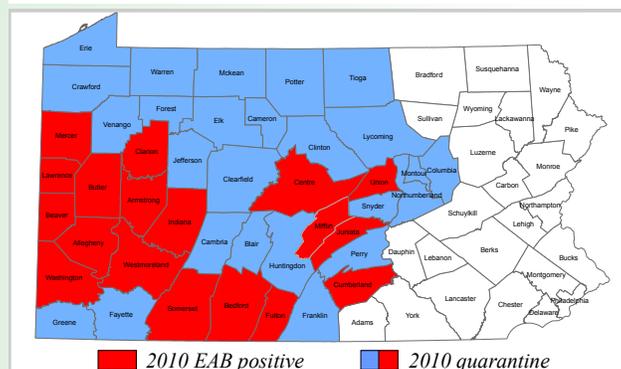
*Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae)

**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), USDA Forest Service, and USDA APHIS Plant Protection & Quarantine. Four additional counties (Centre, Fulton, Somerset, and Union) were identified by 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.

Trap Distribution for 2010 EAB Detection Survey

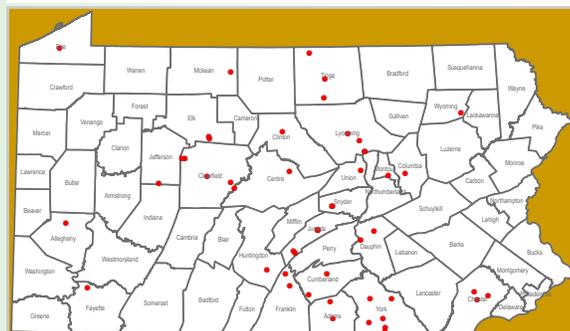


EAB Quarantine and Current Distribution in PA



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

**Colony Distribution for *Cerceris fumipennis***



Adult Dorsal View  
(P. Careless, University of Guelph)



Adult Front View  
(P. Careless, University of Guelph)



Adult Nest  
(H. Liu, Pennsylvania DCNR)

**Management.** For the integrated pest management and biological control of EAB, over 400 ash trees were identified at one study location in Allegheny County, with 17 infested trees removed to reduce 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, to protect the pumpkin ash resource in Erie County and at state-owned ash seed orchards with pre-emptive chemical treatments, and to educate the general public about potential impact of EAB on forest resources, urban forests, and the environment.



Tree Removal  
(H. Liu, Pennsylvania DCNR)



Chemical Treatment  
(H. Liu, Pennsylvania DCNR)



Parasitoid Release  
(H. Liu, Pennsylvania DCNR)



Public Education  
(H. Liu, Pennsylvania DCNR)

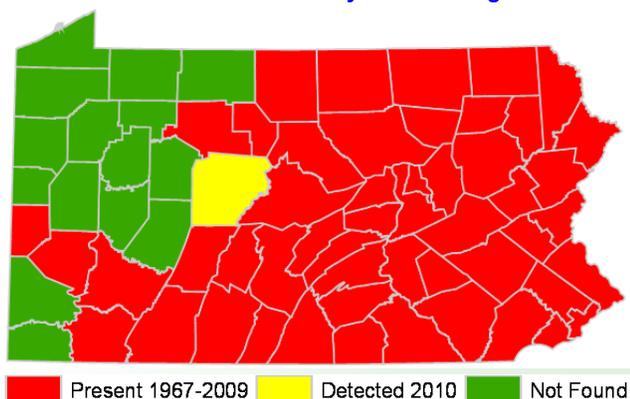
**Hemlock Woolly Adelgid, *Adelges tsugae* Annand (Homoptera: Adelgidae)**

**Survey and Detection.** This project was designed to detect and delineate the leading edge of 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 infested in 2010.

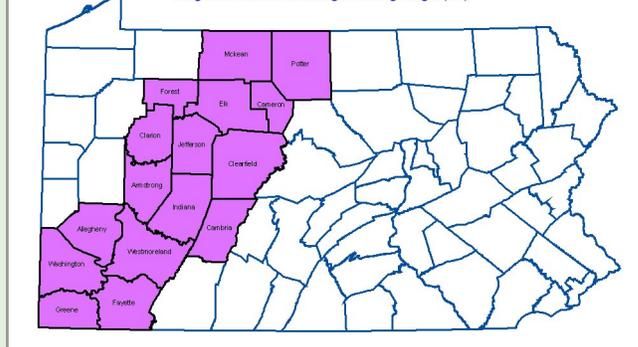


Field Survey  
(H. Liu, Pennsylvania DCNR)

**HWA Distribution in Pennsylvania through 2010**



**Pennsylvania Hemlock Woolly Adelgid Surveys 2010-2011 Targeted Counties Along Leading Edge (16)**



**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.



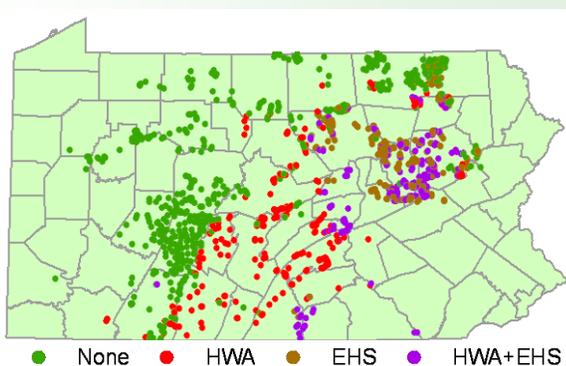
Eastern Hemlock  
(S. Werner, Pennsylvania DCNR)



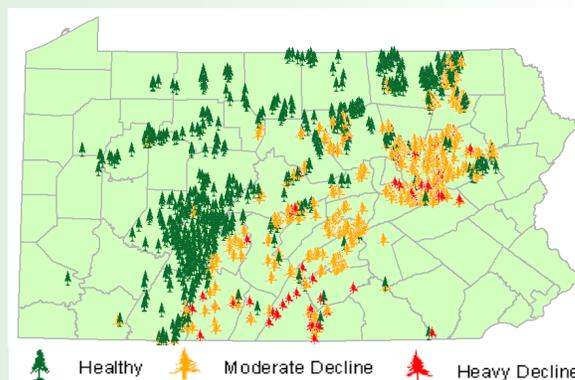
Hemlock Woolly Adelgid on Hemlock  
(H. Liu, Pennsylvania DCNR)

**General Hemlock Survey.** A total of 1,277 hemlocks were visually surveyed in 2010. About 36% of sampled trees were infested with HWA, 36% with EHS, and 23% with *Fabrella* Needle Cast. 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.

**HWA and EHS Population Survey in Pennsylvania**



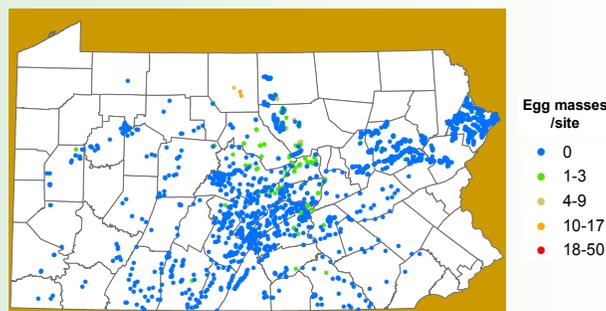
**General Hemlock Health in Pennsylvania 2010**



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

A total of 1,606 sampling sites (1/40 acre) were surveyed across Pennsylvania. Approximately 10% 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 per site 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 outbreak was low.

**2010 Gypsy Moth Distribution Based on Egg Mass Survey**



**Asian longhorned beetle  
*Anoplophora glabripennis* (Motschulsky) (Coleoptera: Cerambycidae)**

The objective of the one-year project is to survey for potential Asian longhorned beetle (ALB) infestation 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 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 maple, 201 sugar maple, 25 American elm, 4 river birch, 2 paper birch, 2 hackberry, 1 Norway maple, and 1 white ash trees were inspected. No ALB infestation was detected. Outreach efforts on high-risk campgrounds were also carried out during the survey.

**Campsites Distribution for Firewood Survey**



Asian Longhorned Beetle Adult  
(H. Liu, Pennsylvania DCNR)

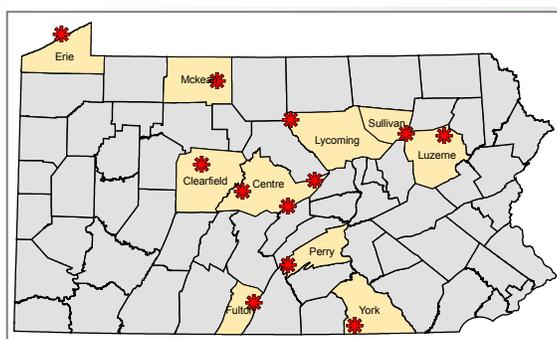
## Exotic Bark Beetles (Coleoptera: Scolytidae)

A one 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 the three lures (ethanol, alfa-pinene plus ethanol, and *Ips*). Traps were monitored every two weeks for a period of 12 wk, with lures replaced every four weeks. Non-native bark and ambrosia beetles were collected from the traps and submitted for identification. A total of 13,622 scolytid beetles from 52 species were recovered through the survey. *Xylosandrus germanus* (Blanford) is the most abundant species, making up 36% 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* (Eichhoff). The top 15 species accounted for 89% of the specimens, while the other 37 species represent the remaining 11%. No *Anisandrus maiche* Stark was recovered from this survey although it has been found in 9 counties in southwestern Pennsylvania.



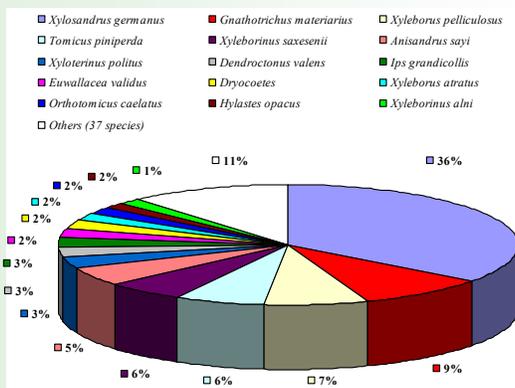
Lindgren Trap  
(USDA Forest Service, [www.forestryimages.org](http://www.forestryimages.org))

### Study Sites for 2010 Scolytids Survey



*Xylosandrus germanus* Adult  
(S. Spichiger, Pennsylvania DCNR)

### Species Composition of Scolytids Recovered from Trapping



## Pathology Projects

Pathology projects were supported by federal grants from USDA Forest Service through the Cooperative Forest Health Program (CFHP) with matching funds from the state. Special projects were awarded through a competitive application process.

### Beech Bark Disease

Since the 1890's 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 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 an opportunity to re-introduce 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 to 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](http://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 surveys whereby *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.



Symptom on Oak  
(J. O'Brien, [www.forestryimages.org](http://www.forestryimages.org))

### Butternut Canker



Butternut Seedlings in Greenhouse  
(C. Sweeney, USDA Forest Service)

A three year multi-state 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 and 80 trees were determined to be “pure” *J. cinerea* and 47 were hybrids (*J. cinerea* x *J. alantifolia*). Scion wood from 27 pure butternuts was collected and grafted on to *Juglans nigra* root stocks. At present 75 surviving seedlings are being prepared for pathogenicity tests and inclusion in seed orchard plantings.



Butternut Grafts in Greenhouse  
(C. Sweeney, USDA Forest Service)

Twenty-three of 67 Pennsylvania counties (number of trees sampled) are represented in this survey as of July 14, 2010: 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 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 USDA Forest Service and APHIS PPQ on EAB biological control.
- Training and implementation of aerial survey software and safety measures with the USDA Forest Service.
- Participation in the Aerial Application Safety Council & the Council's Training Committee, USDA Forest Service.
- Assisting USDA APHIS on *Sirex* woodwasp biological control project.
- Participation of USDA Forest Service and APHIS EAB framework development.

### Other State Agencies

- Coordination of EAB surveys with the PA Dept of Ag and USDA APHIS PPQ.
- EAB management with the Allegheny County Parks.
- Representation on the PA Invasive Species Council.
- Coordination of *P. ramorum* surveys with the PA Dept of Ag and PSU.
- Help PSU on HWA efficacy trials and *Ailanthus* management projects.
- Assist Western Pennsylvania Conservancy on HWA projects.
- Provide expertise to 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 USDA Forest Service and 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 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.



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 clavignenti-juglandacearum* (Ascomycota)

**Common Walkingstick** *Diaperomera 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: Diaspidae)

**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)

Field Training on *Cerceris fumipennis*  
(H. Liu, Pennsylvania DCNR)