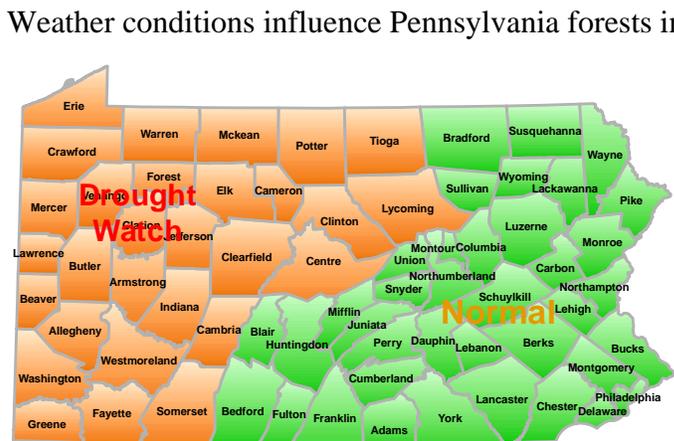


PENNSYLVANIA ANNUAL PEST CONDITIONS REPORT

Department of Conservation and Natural Resources (DCNR)
Bureau of Forestry, Division of Forest Pest Management (FPM)

WEATHER CONDITIONS FOR 2008

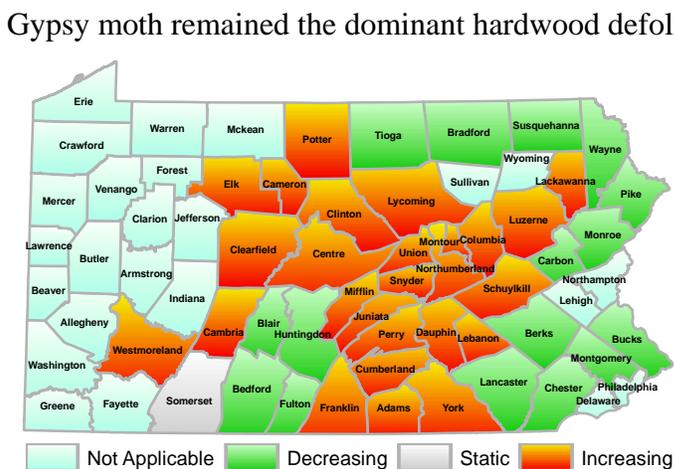


Weather conditions influence Pennsylvania forests in a variety of ways. Water stress in combination with insect pests and disease agents can significantly influence host condition and forest health. The 2008 snow pack was below normal in many areas. Cool wet weather during May and early June helped promote tree foliage diseases, especially on sycamore. Summer rainfall averaged 20% below normal in most areas of the Commonwealth. As a result, drought stress was widespread in

many areas. Dry conditions during 2008, combined with gypsy moth defoliation, resulted in scattered oak mortality throughout the State. A higher incidence of oak mortality was observed in the ridge and valley areas that were defoliated by gypsy moth in the previous year. By mid-November a drought watch was declared for 29 counties (see map above).

ENTOMOLOGY SECTION

GYPSY MOTH

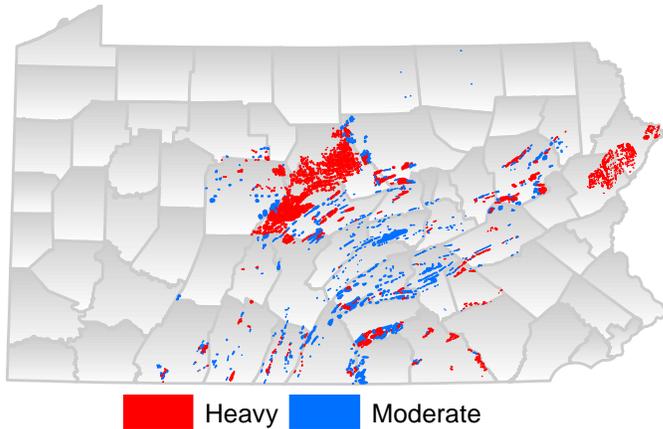


Gypsy moth remained the dominant hardwood defoliator in Pennsylvania in 2008. Gypsy moth defoliation increased in central and northeastern Pennsylvania, but decreased in the southern portion of the Commonwealth. A total of 766,507 acres of defoliation were reported through aerial and ground surveys. *Entomophaga maimaiga* infection of gypsy moth was present throughout most infested areas of

the state but the extent of larval mortality was variable, ranging from 100% (complete collapse) to less than 20%. Gypsy moth infestations actually increased in some areas, particularly the Pocono Region where decline or collapse was expected after four straight years of significant impacts.

2008 GYPSY MOTH DEFOLIATION

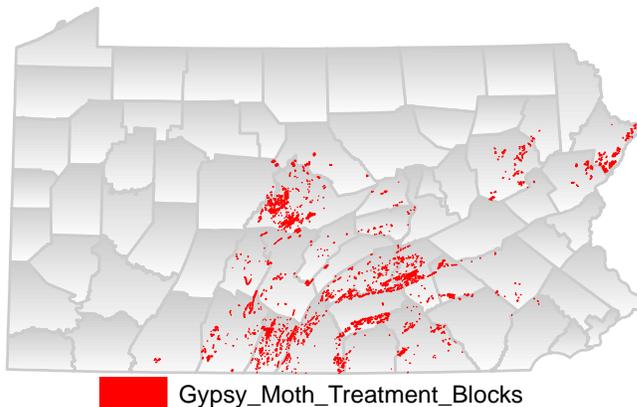
Aerial and ground surveys of gypsy moth defoliation conducted in June and July revealed a total of 766,507 acres defoliated (461,554 heavy, 304,953 moderate).



2008 GYPSY MOTH SUPPRESSION PROGRAM

The operational period for the 2008 gypsy moth suppression program was May 5 through May 28. Suppression activities were conducted in 27 counties. A total of 221,221 spray acres in 1,388 spray blocks were treated. *Bacillus thuringiensis* var. *kurstaki* (FORAY 76B) was sprayed undiluted at 38 BIU per acre in a single application of ½ gallon per acre.

A total 132 of the 1,388 spray blocks were evaluated for success using the criteria of less than 30 percent defoliation for 80% of host species trees. Of these evaluation blocks, 128 met these criteria. The overall success rate for the gypsy moth suppression project was 97%.



The total cost of the 2008 program was \$7,989,777. The average cost per acre was \$36.17. This includes the cost of aerial application

(\$33.86/acre), personnel (\$2.04/ acre), and other operational costs (\$0.27/acre) incurred by the state. The state, federal, and county governments share the expense of conducting

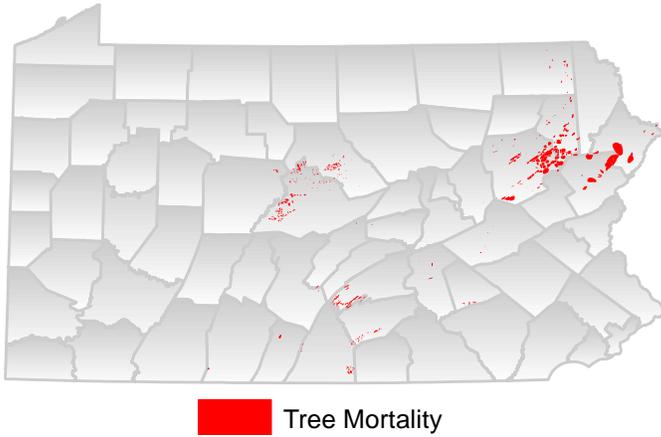
this program. Counties provided \$17.00 per acre for private residential and county-owned acreage while the federal government provides a percentage after-the-fact reimbursement for all qualified acres. The average cost per acre of treatment changes each year due to changes in application costs, differences in insecticide prices, amount of acreage treated with different formulations, and the total size of the program.

The 2009 gypsy moth suppression program is anticipated to be approximately 178,000 acres of public and private lands. Counties participating in the 2009 program will contribute \$21 per acre.

2008 GYPSY MOTH TREE MORTALITY

In 2008, aerial and ground tree mortality surveys were conducted in nine forest districts. A total of 182,587 acres containing significant tree mortality was reported in gypsy moth defoliated areas. Widespread defoliation was observed in 77% of the areas surveyed,

where up to 60% of the trees died due to gypsy moth and other defoliators. The greatest incidence of tree mortality occurred in central and northeastern Pennsylvania. Affected counties include Centre, Lackawanna, Luzerne, Monroe, and Pike where a total of 155,190 acres with significant tree mortality was observed.

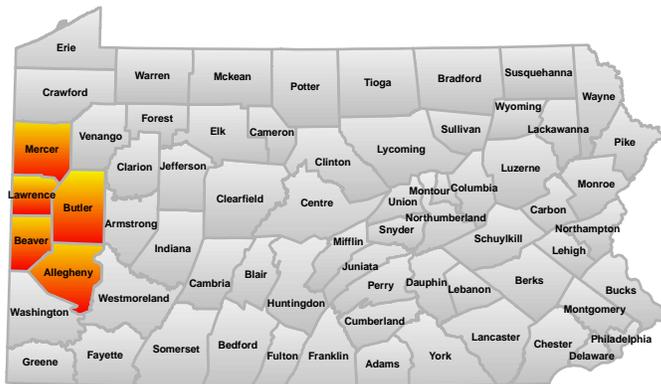


Tree Mortality

EMERALD ASH BORER

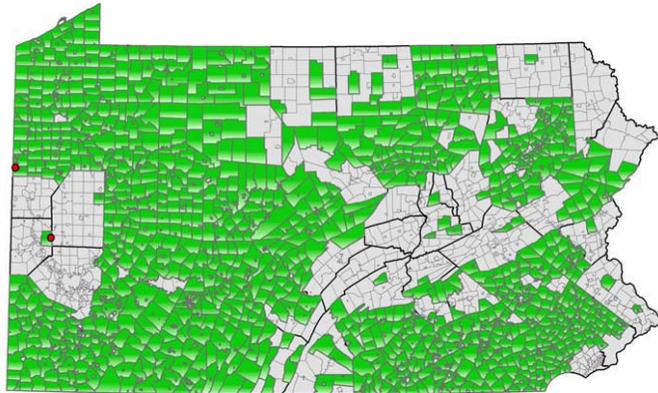
Emerald Ash Borer (EAB) was first detected in Pennsylvania in Butler County in June 2007 when two adult beetles were collected from infested ash trees in Cranberry Township. Additional infested sites were found in Jackson and Adams Townships in

Butler County; and in McCandless, Pine, and Marshall Townships in Allegheny County. Both counties were placed under federal and state quarantine. Beaver and Lawrence Counties were added to the quarantine due to their close proximity to the infestation in Cranberry Township and to known infestations in Ohio.



Non-Quarantine EAB Quarantine

A total of 57 counties across Pennsylvania were targeted for EAB survey in 2008, including 35 counties for delimiting survey, and 22 for national survey. The delimiting survey uses a system of 1.5 × 1.5 mile grid (1 trap/grid) in areas within 100 miles of a known infestation to define the leading edge of EAB infestation. The national survey targets areas outside the general infestation to determine whether any additional pockets infestations are present. In June 2008, two EAB adults were collected from the picnic area at the Welcome Center on eastbound Interstate 80 near Wheatland Borough of Mercer County.

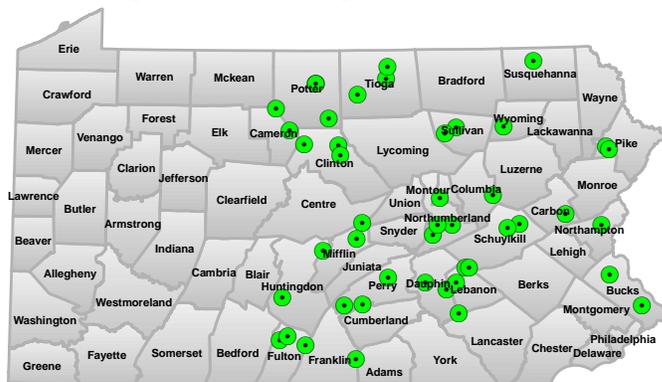


Further investigation later revealed twelve large infested white ash trees. Based on the damage and symptoms on those trees, EAB may have been present for at least five years. This infestation was outside the existing quarantine and is being considered a new introduction. Mercer County has been added to the federal and state EAB quarantine.

DCNR EAB SURVEY ACTIVITIES

DCNR participated in the National EAB Survey, establishing 48 prism purple panel traps in early June in high-risk state lands in 22 counties. Each trap was baited with a manuka oil lure, and the outside panels of the traps were covered with pestick glue to catch insects attracted to the trap. Traps were hung in the lower- to mid-canopies on the southwestern face of selected ash trees. The nominal diameter at breast height of trees with traps was 8 inches. Traps were placed in ash trees growing along the forest edge or in open sunlit areas. Traps were inspected every two weeks throughout the EAB adult flight season (early June to late September) with the lure replaced once in late July.

Beetles captured on the traps were collected twice during the season and returned to the laboratory for identification. Visual and sweep-net surveys were also conducted in some of the counties in conjunction with the EAB trap survey. No EAB adults were found. In addition, a total of 11 trap trees set-up in 2007 (6 trees) and 2008 (5 trees) were felled and the bark peeled for signs of EAB infestation. No EAB were found in any of these trap trees.

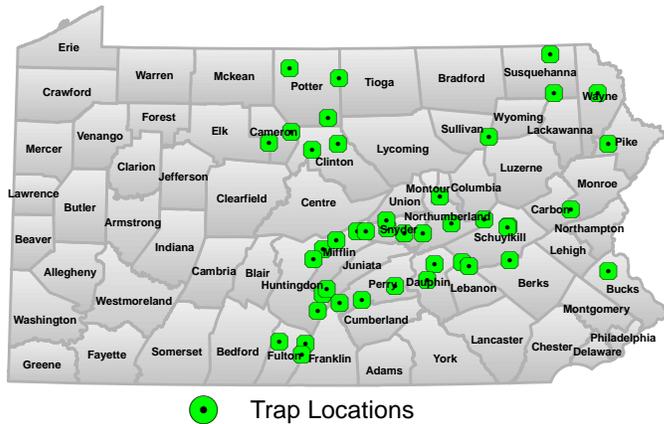


Survey information is added to a national EAB survey database and is part of the national EAB survey coordinated by USDA-APHIS. In Pennsylvania this survey is administered by the Pennsylvania Department of Agriculture (PDA). PDA is also involved in a delimitation survey within the Commonwealth. The delimiting survey uses a 1.5 × 1.5 mile grid (1 trap/grid) in areas within 100 miles of a known infestation. The objective is to define the leading edge of EAB infestations. The national survey targets areas outside the general infestation to determine whether any additional pockets of infestation are present. A total of 8,000 prism purple-panel traps were deployed and monitored during 2008 in 35 counties by PDA. No EAB adults were detected in any of these traps (see map).

Survey efforts for EAB are scheduled to continue in 2009. DCNR staff will be placing purple-panel traps in State Parks, State Forests, and State Game Land sites in 22 counties in eastern Pennsylvania.

SIREX NOCTILIO WOOD WASP

The Division of Forest Pest Management continues to participate with federal and state agencies to delimit the extent of the European wood wasp, *Sirex noctilio*, in



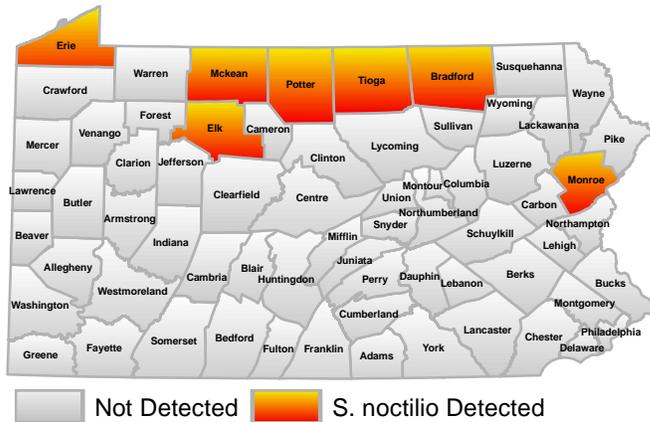
Pennsylvania. From May through November, FPM placed 42 Lindgren traps baited with alpha and beta pinene in 21 counties. The sample area was comprised of Bucks, Cameron, Carbon, Clinton, Columbia, Dauphin, Fulton, Huntingdon, Juniata, Lebanon, Mifflin, Montour, Northumberland, Perry, Pike, Potter, Schuylkill, Snyder, Susquehanna, Wayne, and Wyoming Counties (see map).

PA 2008 SIREX SURVEY RESULTS

Samples were collected from traps every two weeks and 12 sample collection cycles starting from early June and continuing to mid-November were analyzed. One trap in a red pine stand in Potter County captured a female *Sirex noctilio* in late July 2008. Numerous native *Siricid* wasps have also been captured, including *Tremex columba*, *Urocerus cressoni*, *U. albicornis*, *S. edwardsii*, *S. nigricornus*, and *U. cressoni*.

Siricid Species	Captured
<i>Sirex edwardsii</i>	54
<i>Sirex nigricornus</i>	92
<i>Sirex noctilio</i>	1
<i>Tremex columba</i>	4
<i>Urocerus albicornis</i>	1
<i>Urocerus cressoni</i>	48
Total	200

Currently, seven counties are infested with this exotic woodwasp: Bradford, Elk, Erie, McKean, Monroe, Potter, and Tioga.

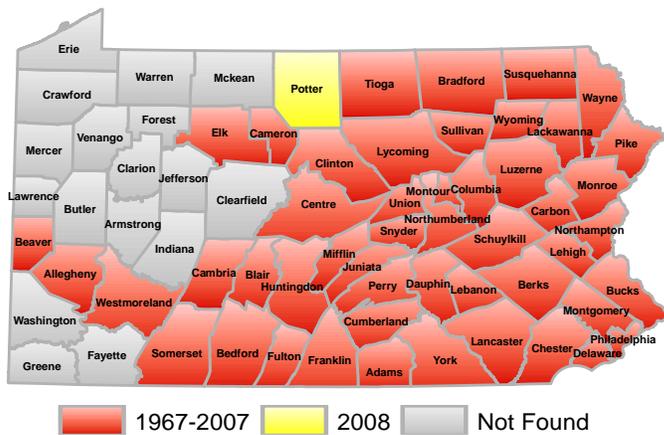


SIREX NOCTILIO CONTROL

FPM personnel assisted researchers from USDA APHIS with the controlled release of the entomophagous-mycetophagous nematode *Beddingia (Deladenus) siricidicola* (Bedding) (Nematoda: Neotylenchidae) at Hills Creek State Park. A total of twenty-six trees were inoculated with nematode juveniles. These nematodes will quickly mature and begin feeding on the developing *Sirex* larvae. All inoculated trees will be removed in the spring of 2009 and placed in a quarantine facility in Massachusetts for analysis by USDA researchers. These nematodes were observed to provide effective control in infested pine plantations in Australia.

HEMLOCK WOOLLY ADELGID

Data for hemlock woolly adelgid (HWA) was reported through forest insect and disease reports (FID) and aerial surveys. Hemlock woolly adelgid advanced into Potter County in 2008. The largest, active HWA infestations are found in Berks, Carbon, and Franklin Counties. A significant increase in defoliation acreage was reported for Huntingdon and Luzerne Counties in 2008. However, HWA damage in Mifflin and Snyder Counties decreased significantly during this same period.

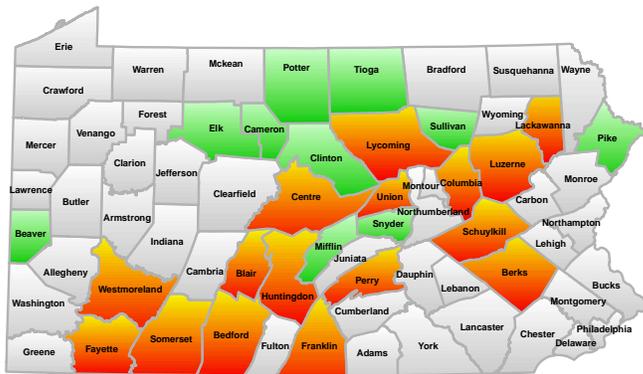


A total of 10,936 acres of hemlock were defoliated by HWA in 2008. This is a 78% increase over 2007 defoliation levels.

HEMLOCK WOOLLY ADELGID CONTROL

DCNR continues to work on the biological control of HWA with the predatory beetle *Laricobius nigrinus* (Coleoptera: Derodontidae). In 2008 a total of 1,000 laboratory-reared adult beetles obtained from Virginia Tech University researchers were released in Little Pine State Park and Loyalsock State Forest in early November. At each site, ten healthy eastern hemlock trees with medium to high HWA infestations were selected. A

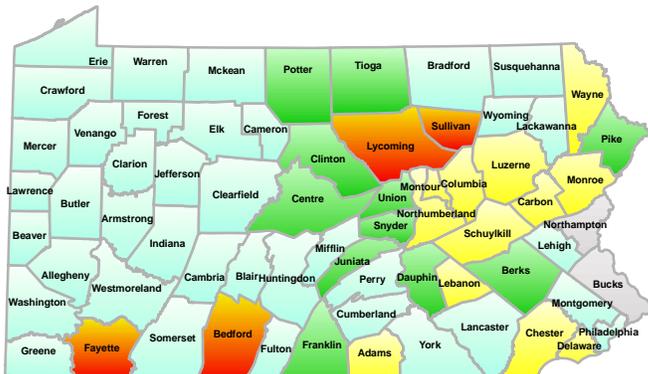
total of 50 adult beetles were released on the lower branches of each tree. In addition, a total of 300 Idaho-strain *L. nigrinus* beetles were released at two sites in Tiadaghton State Forest in cooperation with researchers from the University of Massachusetts. Post-release evaluations will be conducted at all sites.



The Bureau of State Parks treated a total of 2592 trees at seven State Parks using Merit 75 WSP. Parks that received treatment are: Trough Creek, R.B. Winter Jacobsburg, Little Pine Locust Lake, Reeds Gap and Little Buffalo. State Parks expects to treat additional locations during 2009.

ELONGATE HEMLOCK SCALE

Data for elongate hemlock scale (EHS) was only reported through FID reports. EHS is an important pest of concern on hemlock and other conifers but remains limited in its distribution to eastern and central Pennsylvania, with 24 acres of defoliation reported in 2008.



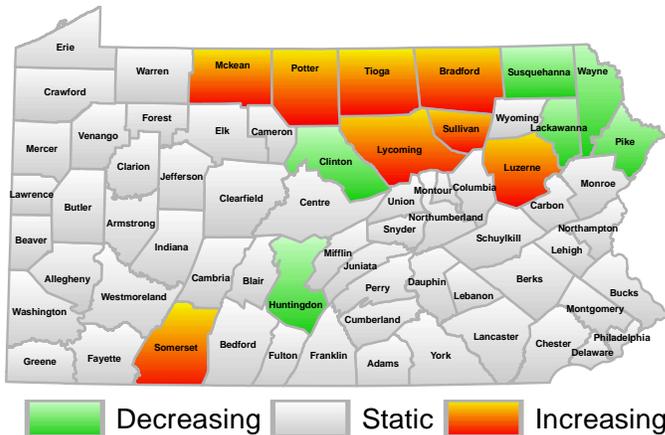
Release of *Cybocephalus nipponicus* (Coleoptera: Nitidulidae) for the biological control of EHS continued in 2008, with a total of 3,000 adult beetles released in Little Pine State Park and Wyoming State Park in Lycoming County. Post-release evaluations will be conducted at all sites.

EASTERN TENT CATERPILLAR

Data for eastern tent caterpillar was reported only through FID reports. The only significant defoliation reported for this pest was in Bradford County in 2008, though infestations could be seen many areas of the Commonwealth. Total defoliation decreased significantly in 2008 compared to 2007, especially in Huntingdon, Pike, Potter, and Sullivan Counties.

FOREST TENT CATERPILLAR

Data for forest tent caterpillar (FTC) was reported through FID reports and aerial defoliation surveys. FTC defoliation increased significantly in eight counties and decreased in six counties compared to 2007. Overall, FTC activity increased in 2008, with 81,111 acres of defoliation reported in 2008 compared to 47,794 acres in 2007. Data from aerial surveys detected more counties with significant defoliation in 2008 (ten counties) than in 2007 (three counties). The infestation in Wayne County decreased more than 70% compared to 2007.



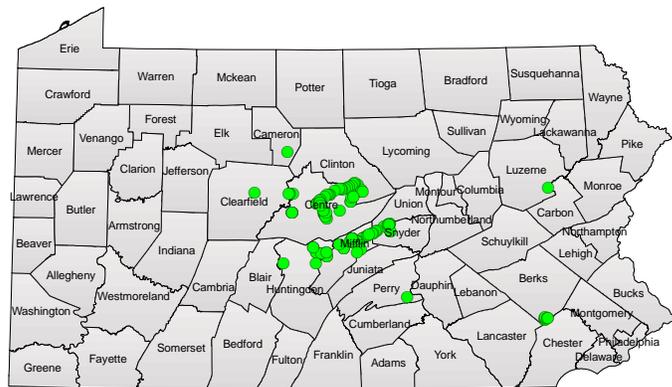
PERIODICAL CICADA BROOD XIV

According to surveys by Dr. Martin Edwards (Muhlenberg College, Pennsylvania) and the Division of Forest Pest Management (DCNR, Pennsylvania), emergence of periodical cicada Brood XIV was observed in 10 counties (see map) in 2008. Significant damages caused by the cicada were documented in Cameron, Clearfield, Mifflin, and Snyder County through aerial and ground surveys.

Based upon ground surveys by personnel of the Division of Forest Pest Management, female cicadas are most likely to insert their eggs on oak species including black oak, chestnut oak, and white oak. Cicadas may also slit on following trees and bushes in areas with heavy emergence: American Sycamore, Apple, Autumn Olive, Black Gum,

Common Sassafras, Hawthorne, Mountain Laurel, Northern Red Oak, Quaking Aspen, Red Maple, White Ash, and Witch Hazel.

As a pest, cicadas rarely destroy host plants, nor can they kill trees while they are feeding underground. However, Cicadas can directly damage twigs of host plants due to their



● 2008 Cicada Emergence

oviposition behavior and therefore influence tree aesthetics. When there are two or more rows of slits on the same segment of branch, there is a higher chance that the branch will break. Females were more likely to slit segments of twigs ranging from 3.8 to 7.7mm in diameter. Number of slits per 5 inches of segments of twigs ranged from 8.8 to 12.5.

Conventionally, mass occurrence of periodical cicadas is estimated based upon number of exit holes, skin casts, or dead/live adults. Populations of periodical cicadas may be also estimated indirectly based upon number of slits on twigs. Approximately 182,000 cicadas per acre emerged in the Reeds GAP State Forest in 2008.

GEOMETRID DEFOLIATORS

A total of 10,844 acres of defoliation by scallop shell moth, fall cankerworm and other geometrid species were reported on sugar maple, basswood, and other northern hardwoods in 2008. Damage was reported through both FID reports and aerial surveys. Counties where damage from geometrids was observed include: Bedford, Chester, Somerset, and Westmoreland. Damage was heavy in Somerset and Westmoreland Counties.

PATHOLOGY SECTION

***PHYTOPHTHORA RAMORUM* SURVEY**

The *Phytophthora ramorum* stream baiting program has been conducted for the past three years and will continue in 2009. The objective of the survey is to determine where *P. ramorum* may have been introduced in the eastern United States. FPM participated in the National Survey to examine forested areas or nursery perimeter areas in conjunction with USDA APHIS and PDA.

In 2006, the program began to evaluate forest streams for the presence of *P. ramorum* associated with interior forest communities across the United States. In Pennsylvania ten streams were designated for stream baiting using matured leaves from local populations of *Rhododendron maximum* in proximity to the selected streams. A total of 228 out of 240 leaves deployed were examined in 2006, and *P. ramorum* was not detected. In 2007 stream baiting was continued on four streams, a total of six baiting periods were made and 152 out of 160 leaf samples were deployed. *P. ramorum* was not detected.

In 2008, six baiting periods were completed by the beginning of November with a total of 192 leaf samples deployed. Although various *Phytophthoras* and *Pythium* species have been recovered in each bait period, *P. ramorum* has not been detected.

BEECH BARK DISEASE

FPM is cooperating with Dr. Jennifer Koch (USDA Forest Service Northern Research Station in Delaware, Ohio) to evaluate beech varieties exhibiting field resistance to beech scale and beech bark disease. FPM shipped dormant twig and small branch materials for hot-grafting in late-winter of 2008 (February/March). Scion material was collected representing five selected genotypes and submitted to Dr. Koch's project for grafting using a hot-graft procedure. A total of 36 successful grafts were made from 65 attempts. Six of the grafts flowered with three genotypes exhibiting flowering. Those materials were cross pollinated with other resistance materials to produce seed for germinating. Eventually, seedlings will be challenged with scale insects and resistant lines may be available for out-planting in seed orchards at a later date. Preparations for collection of additional scion material will be made for the 2008-2009 grafting season.

SUGAR MAPLE MONITORING PROJECT

Since 1994, nine stands of sugar maple have been examined annually to monitor sugar maple anthracnose, FTC, and other insect defoliator activity. In 2008, eight of the nine stands were examined and insect defoliation was found to be between 5% and 15% or at trace levels; and no anthracnose activity was observed in 2008. Other measurements of stand health recorded included dieback, live crown distribution, and tree mortality. Total

stand mortality in these nine stands from 1994-2008 was 6.1%. Dieback in 2008 for dieback classes of 0-10%, 11-20%, 21-30% and 30%+ were 70% (234/310), 6.1% (19/310), 2.8% (9/310), and 4.8% (15/310), respectively.

Over time tree mortality is increasing, but significant tree mortality and decline associated with anthracnose and insect defoliation remains relatively low. In 2006 increased defoliation by FTC in sugar maple stands reached outbreak status with significant mortality and damage in Wayne County. The outbreak appeared to be subsiding in 2008 in Wayne County, but FTC activity is increasing in other areas of Pennsylvania where sugar maple forest types prevail. Anthracnose damage in 2006 and 2008 was detected in Wayne County and associated tree mortality due to FTC defoliation and anthracnose was observed in 2006. In 2007 additional FTC defoliation was observed but anthracnose damage was much reduced. Repeated defoliation in multiple years, 2006-2007, by FTC has resulted in numerous areas of tree crown dieback or mortality. The role of anthracnose was not as severe in 2006 when compared to the 1994-1996 outbreak. This was due, in part, to drier weather conditions in the spring of 2006 and 2007 during the primary infection period in early June and secondary infection periods during the refoliation phase of the event (i.e. July/August of 2006 and 2007).

OAK WILT

Periodic reports of dying oaks have been received throughout 2008. Oak wilt appears to be static with regard to its activity and distribution throughout the Commonwealth. Diagnosis of oak wilt is usually masked in areas where extensive insect defoliation is prevalent. Widespread gypsy moth outbreaks and defoliation have been occurring throughout the eastern and central regions of the Commonwealth for several years (2005-2008). Oak mortality in gypsy moth impacted areas is also influenced by drought and by *Hypoxylon* fungi.

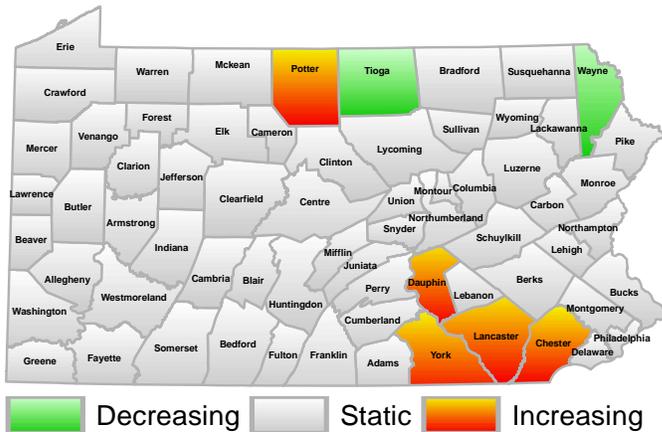
ELM YELLOWS

Elm yellows remains static and widespread throughout the Commonwealth along highway right-of-ways, in old field fence rows, forest-edge areas, and along riparian buffers. Each year symptoms of elm yellows are observed and tree mortality is evident where the disease is active. This disease is causing problems for communities where dead trees are a hazard to personal property and can cause personal injury if not removed.

ANTHRACNOSE DISEASES

Anthracnose diseases of deciduous tree species were not as prevalent as anticipated in 2008, and remained static in most areas in Pennsylvania. However, Sycamore anthracnose caused by *Apiognomonia* was very damaging (moderate to severe) to this riparian tree species throughout the Commonwealth in 2008. Cool, wet weather from

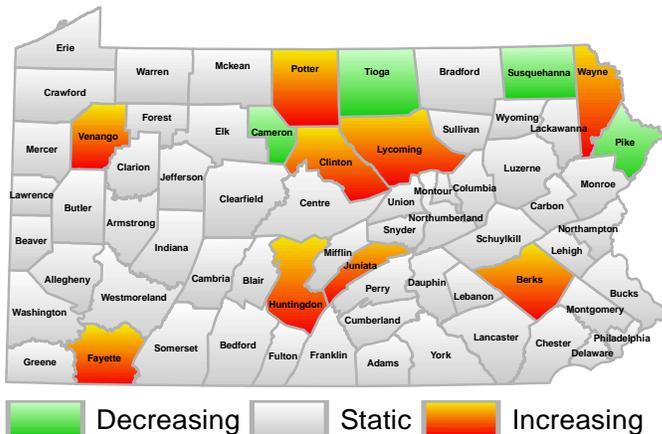
May through June resulted in a significant increase in the activity and blighting of foliage in southeastern and southcentral Pennsylvania. Damage throughout the rest of the



Commonwealth was also observed, and generally trees refoliated by the end of July although dry conditions resulted in expression of drought symptoms in many areas by early September. This disease is generally not associated with tree decline or mortality unless other stress factors are present (i.e. drought, lacebugs, etc.).

FABRELLA NEEDLE CAST

Fabrella needle cast on eastern hemlock remains static with most damage at trace or light levels. Rust diseases of hemlock (e. g., *Melampsora abietis-canadensis Pucciniastrum*,



or *Thekopsora*) have been observed occasionally in previous years. Since 2003 Fabrella needle cast has been reported in 46 of 67 counties throughout the Commonwealth. Counties where Fabrella needle cast has been reported are: Adams, Armstrong, Bedford, Bradford, Bucks, Cambria, Cameron, Carbon, Chester, Clarion, Clearfield, Clinton, Columbia, Crawford, Cumberland, Dauphin, Delaware,

Elk, Erie, Greene, Huntingdon, Jefferson, Juniata, Lackawanna, Lawrence, Lebon, Luzerne, Lycoming, McKean, Monroe, Montour, Northampton, Perry, Pike, Potter, Schuylkill, Somerset, Sullivan, Susquehanna, Tioga, Union, Warren, Wayne, and Westmoreland.

BOTRYOSPHAERIA TWIG BLIGHT

Botryosphaeria twig blight became prevalent due to the latest emergence of periodical Cicada (Brood XIV) in the spring 2008. Slitting damages associated with egg laying on pencil sized twigs created wounds that subsequently become infected with *Botryosphaeria*. The combination of insect injury and fungal infections resulted in twig

dieback and the development of *Botryosphaeria* cankers on twigs and branches that were damaged by female cicadas. These injuries are not likely to kill trees, but can be associated with significant dieback of small branches throughout the periphery of the affected crown. Affected trees tend to recover the following year.

WHITE OAK DECLINE

Reports of white oak decline and mortality have been received from the western counties of the Commonwealth for several years. Crown dieback and mortality of larger diameter trees are frequently observed. Tree decline and mortality tend to be widely scattered or patchy. Introduction of bark beetle damage and presence of *Armillaria* root/stem rot, *Hypoxylon*, and drought appear to be associated stressors with the decline. Evidence of a causal relationship with a particular pest or disease complex is speculative, although oak wilt may be evident in some situations. Field observations of mortality and decline have been made in Venango and Butler Counties for the past three years in oak-hickory stands.