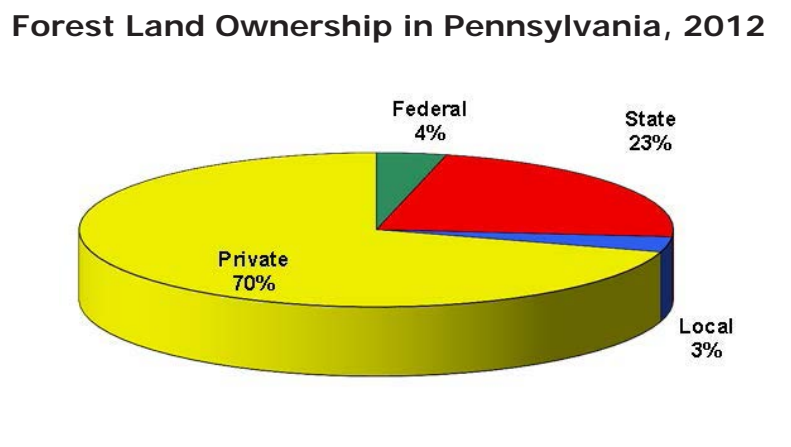
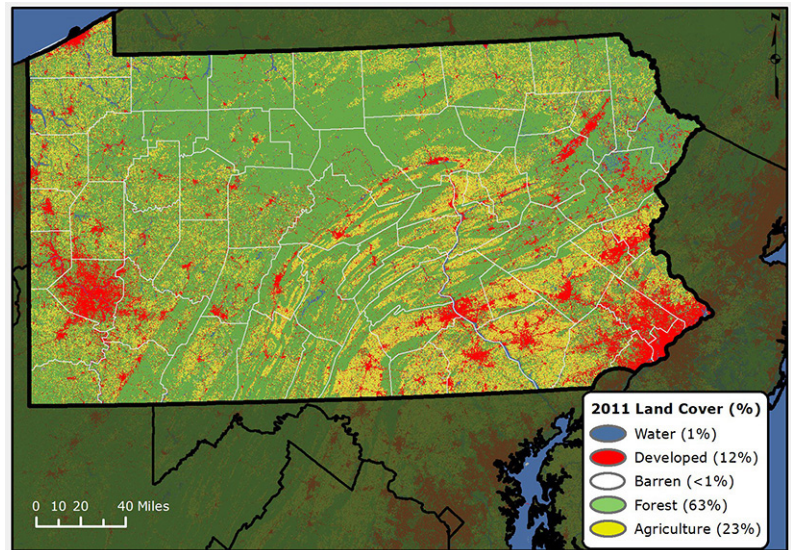




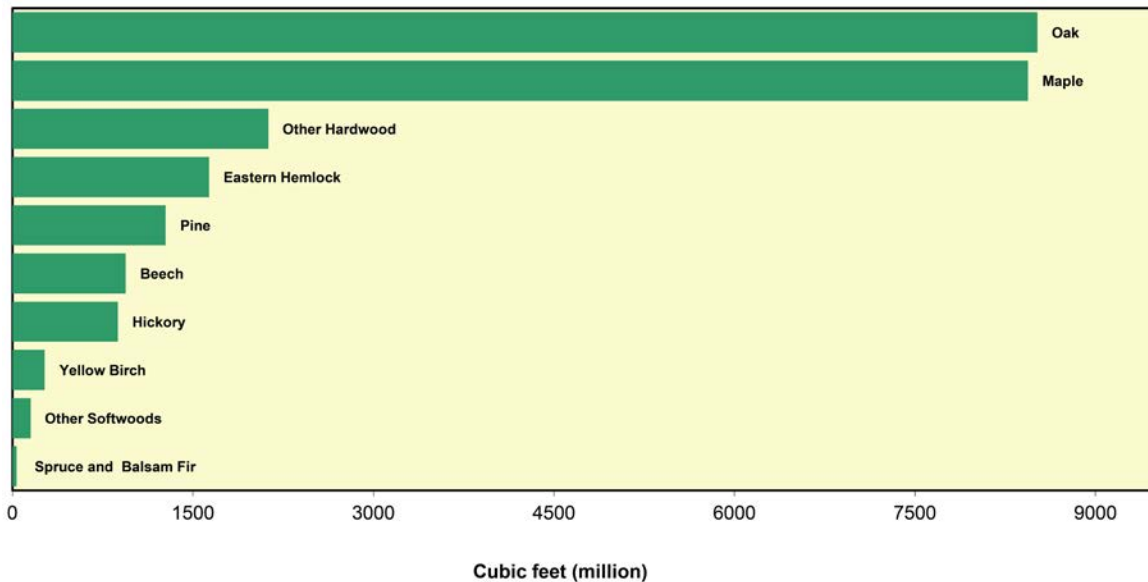
2016 Forest Health PENNSYLVANIA highlights

Forest Resource Summary

Pennsylvania covers a land area of 25,333 square miles and is 63 percent forested. Seventy percent of the forest land in the Commonwealth is privately owned by 750,000 landowners. Yet in a population of 12 million people, forest landowners account for only 6.25 percent of the total population. Forests provide timber, watershed protection, wildlife habitat, and recreational benefits for all Pennsylvanians.



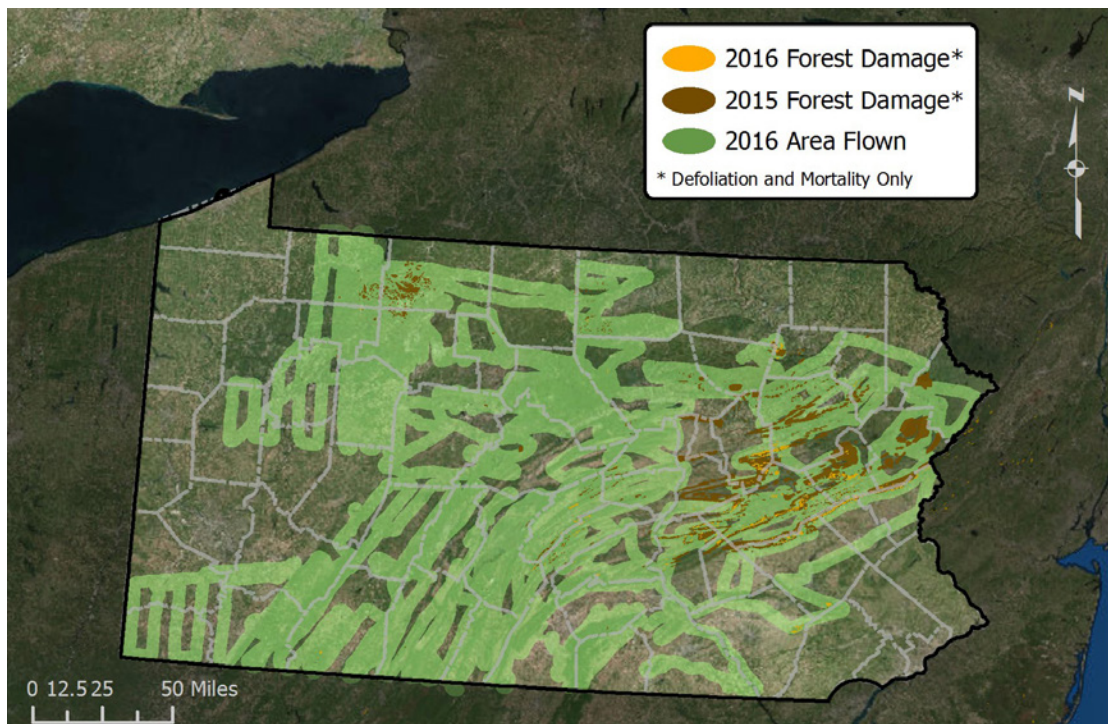
Net Volume of Growing Stock on Timberland by Species in Pennsylvania, 2012



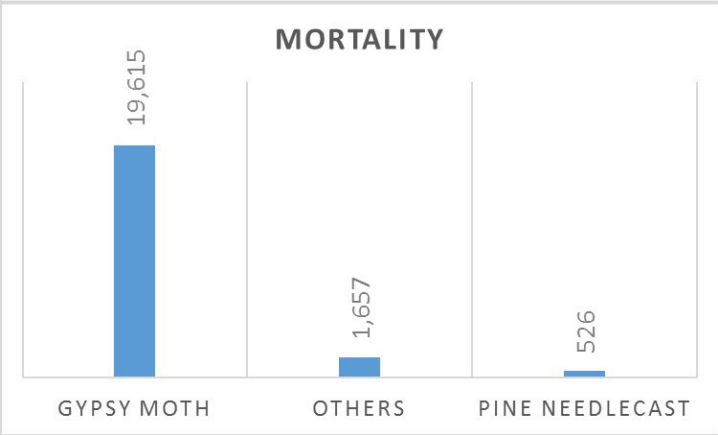
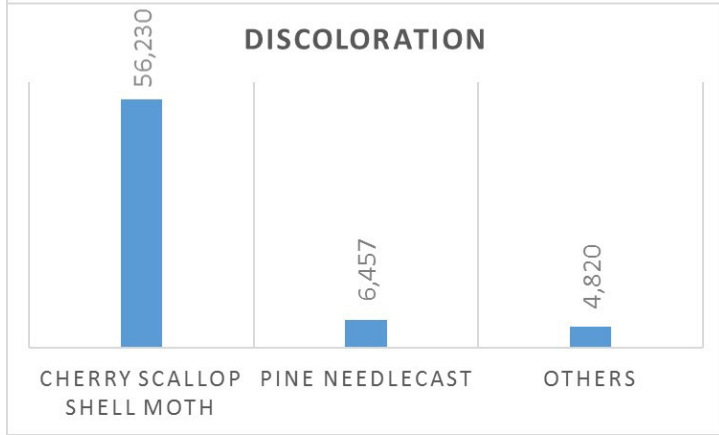
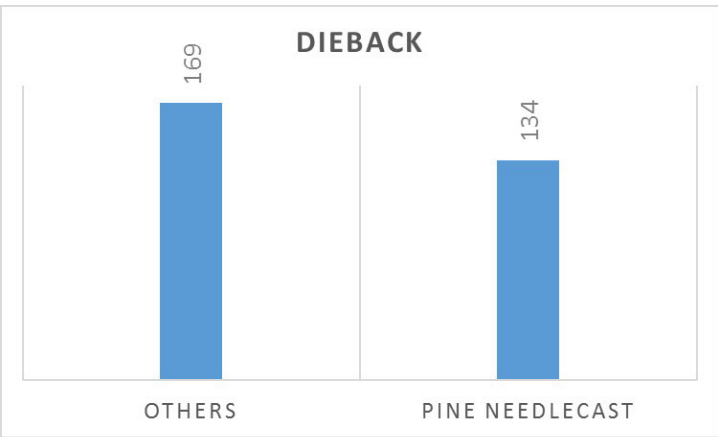
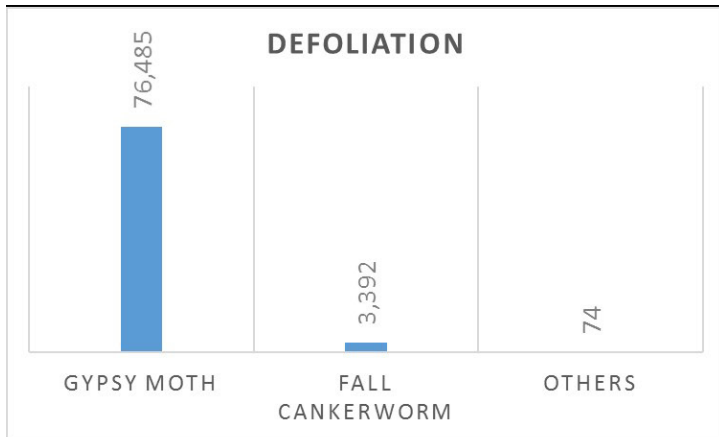
Forest Health Surveys

Pennsylvania used aerial surveys to gauge the health of its forests. Aerial surveys reported damage to 169,599 acres in 2016. Gypsy moth was the leading contributor to damage with 96,100 acres affected. Cherry scallop shell moth damaged 56,230 acres, pine needlecast damaged 7,117 acres, fall

cankerworm damaged 3,392 acres, and other damaging agents affected 6,720 acres. The "other" category included anthracnose, emerald ash borer, elongate hemlock scale, forest tent caterpillar, hemlock woolly adelgid, locust leafminer, oak decline, oak wilt, periodical cicada, yellow poplar weevil, and unknown organisms.

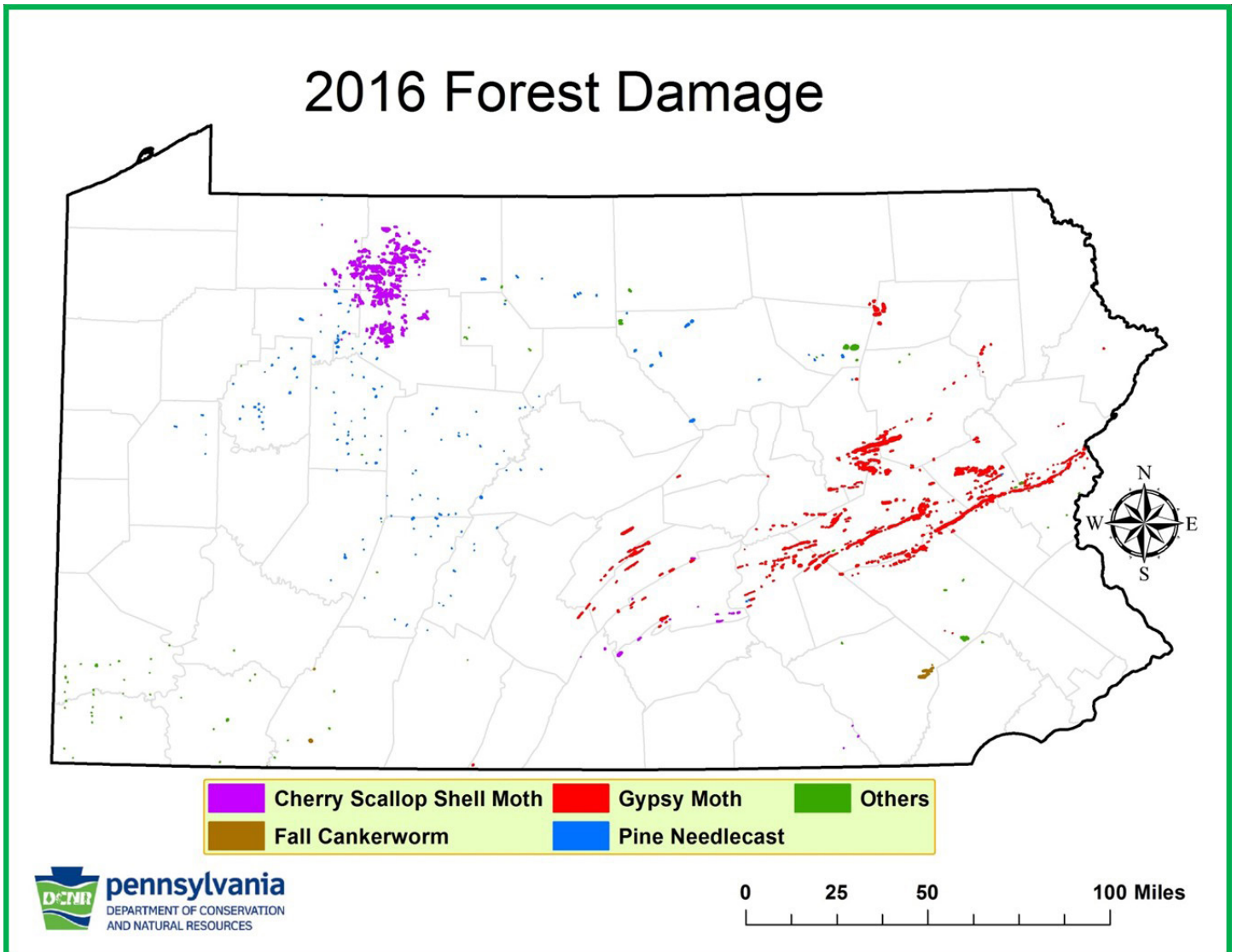


Forest health survey observations in Pennsylvania in 2015 and 2016.



Acres affected by damage type and pest in Pennsylvania in 2016.

Forest Damage Map



Pennsylvania forest damage by pest in 2016.

Emerald Ash Borer

State Land

Pennsylvania treated 210 ash trees on State land for emerald ash borer via stem injection of emamectin benzoate.

Non-State Land

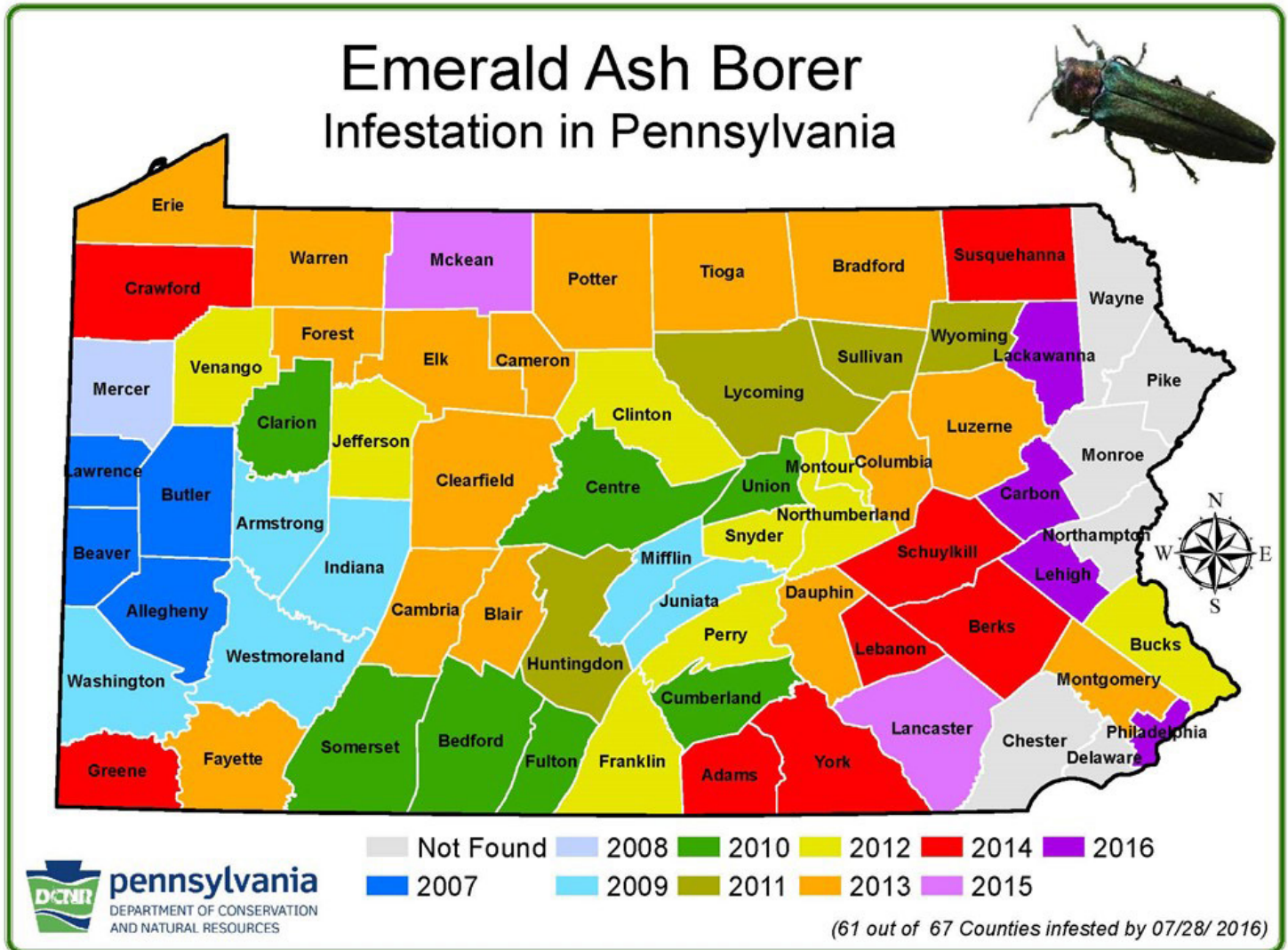
There were two new communities to come on line this year, making seven communities overall. All five of the original communities have performed treatments.

New Counties

Lehigh, Philadelphia, Carbon, and Lackawanna Counties have been confirmed positive for emerald ash borer in 2016.

Biological Control

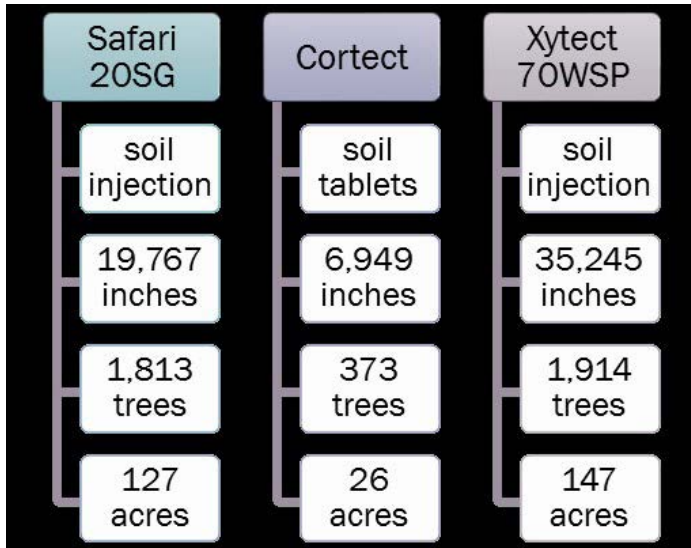
Pennsylvania released 11,924 *Tetrastichus planipennisi* and 17,700 *Oobius agrili* for emerald ash borer biological control efforts.



Emerald ash borer infestation history in Pennsylvania.

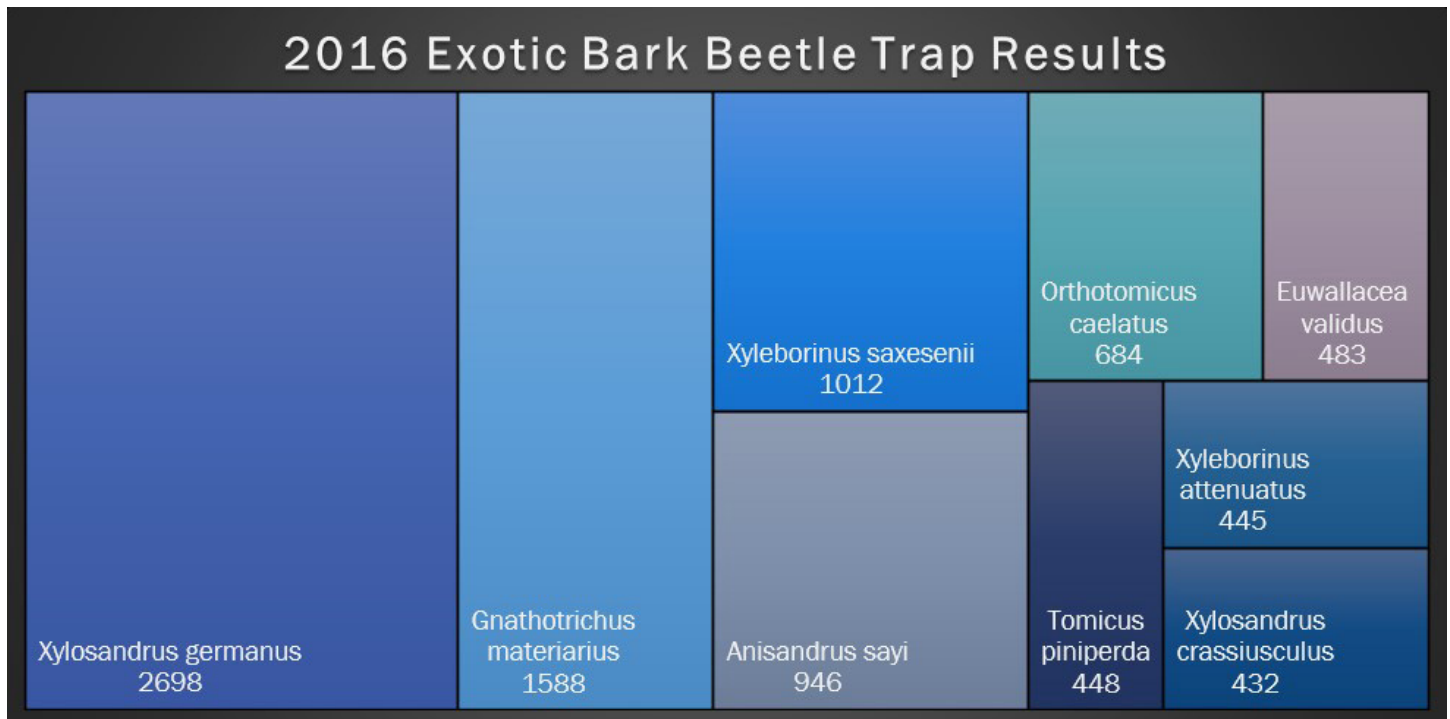
Hemlock Woolly Adelgid

Approximately 4,100 trees (representing 61,961 inches d.b.h.) and 300 acres were chemically treated for hemlock woolly adelgid. There were no biological control agents released this year.



Summary of Pennsylvania hemlock woolly adelgid treatments in 2016.

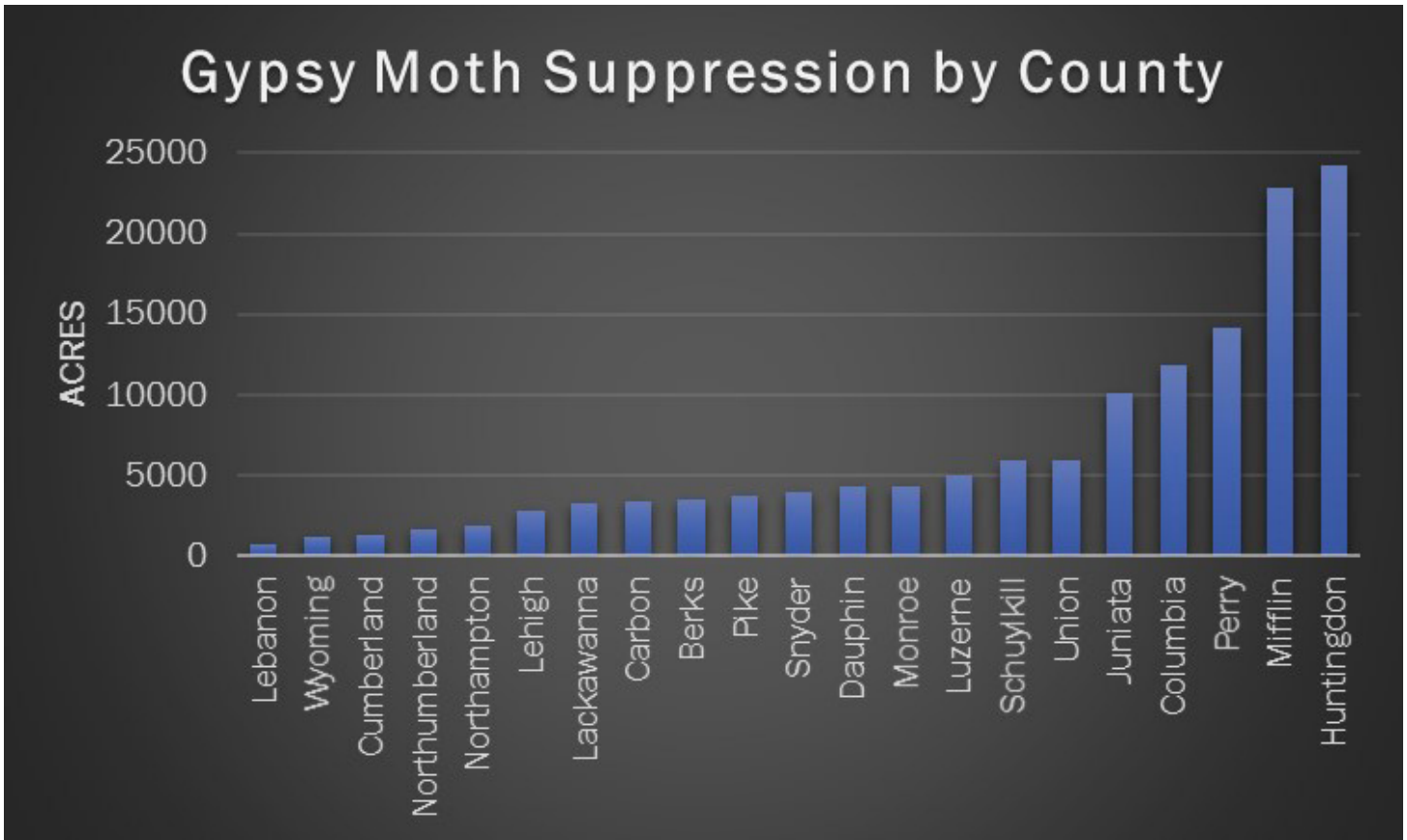
Exotic Bark Beetles



These results represent 80 percent of all exotic beetle trap catches in Pennsylvania in 2016.

Gypsy Moth Suppression Program

This year we treated 135,898 acres for gypsy moth across 21 counties. There were 86,590 acres treated via *Btk* (*Bacillus thuringiensis* var. *Kurstaki*) (41,759 acres with rotary aircraft/44,827 acres with fixed-wing aircraft) and 49,312 acres treated with Mimic® (fixed-wing aircraft).



Pennsylvania gypsy moth suppression acreage by county in 2016.

Spotted Lanternfly

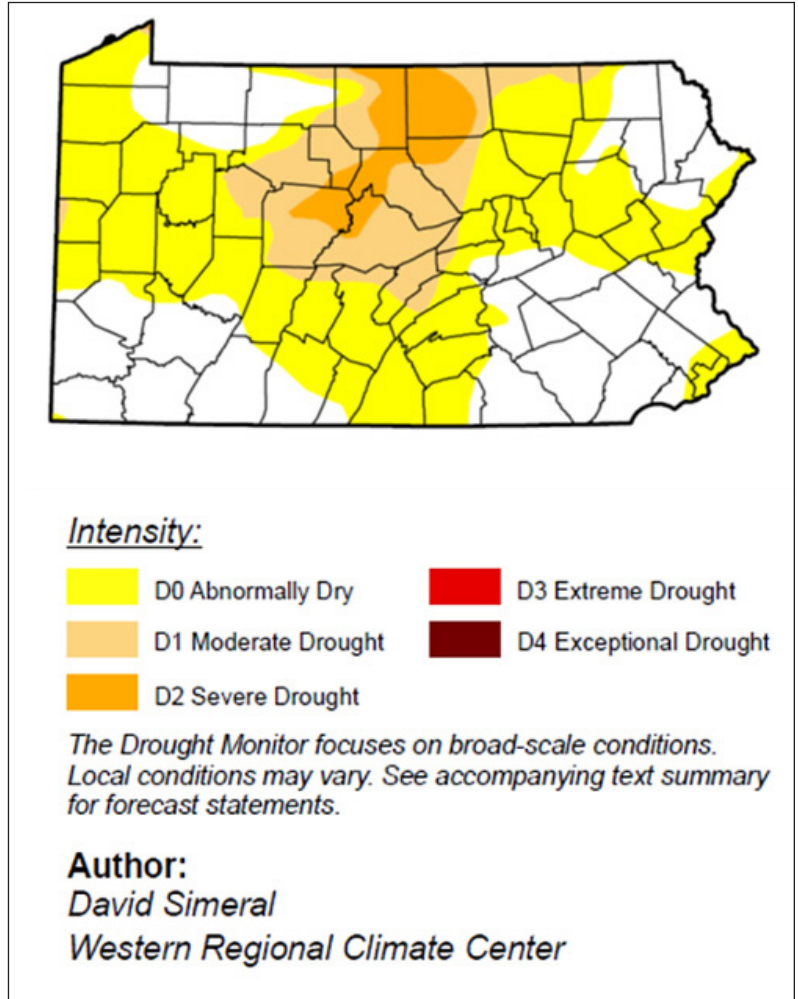
The Bureau of Forestry was awarded a grant from the USDA Animal and Plant Health Inspection Service to conduct research on the spotted lanternfly (*Lycorma delicatula*) with a focus on the life cycle of the insect and possible native parasitoids for biological control.

Weather Conditions and Effects

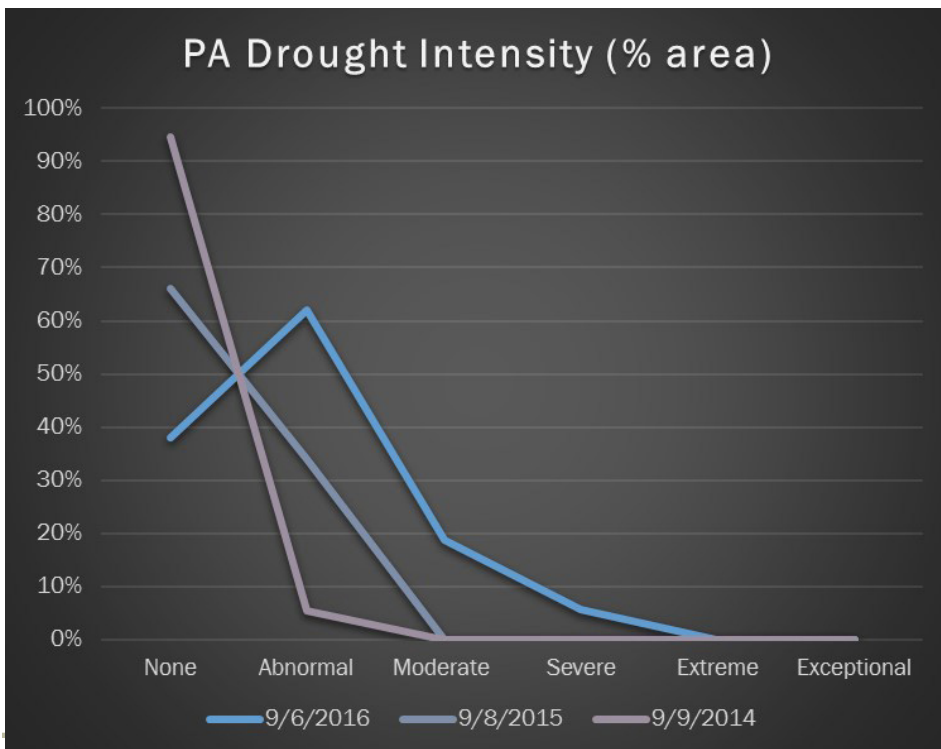
Weather was a large factor in 2016. Early bud break and leaf out in April, along with cool, moist conditions in early May, resulted in extensive anthracnose damage in sycamore. Although many trees recovered, there are numerous instances of sycamore crowns with increased foliage transparency well into the growth period. Anthracnose damage in other species was not as noticeable, but in some instances, oak anthracnose was prevalent in lower slope positions.

Drought

Severe drought and moderate stress were persistent patterns in north-central and central Pennsylvania through mid-September. Many tree species exhibited symptoms of leaf scorch, chlorosis, and abnormal leaf casting due to drought and high heat stress. Symptoms of drought stress in mid-slope and upper slope positions of mountain regions have enhanced crown dieback and tree mortality in areas impacted by gypsy moth and other insect defoliators from 2014–2016.



Drought conditions in Pennsylvania in 2016.



Pennsylvania drought conditions on similar dates from 2014 through 2016. Note the dramatic increase in the percentage of the State that experienced drought in 2016.

Precipitation and Heat Stress

The most significant weather factors have been below normal precipitation in many of the State Forest regions and extremely high heat stress. Pennsylvania has had a string of days with high temperatures in the high 80's and mid-90's across all regions. Symptoms of leaf scorch due to moisture stress and high heat stress have caused extensive foliar chlorosis in both yellow poplar and birch species, resulting in casting of foliage. Foliage transparency of many tree crowns in upper landscape positions is high with considerable portions of crowns absent of foliage.



A red oak with drought (scorch) symptoms.

Weather Effects for 2017

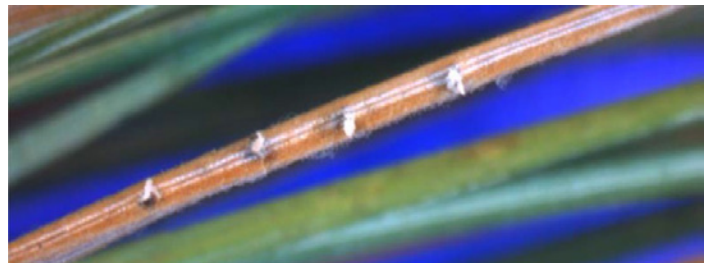
Extensive areas of tree mortality will continue to expand into 2017, particularly upper slope positions and where oak is a prevalent forest cover species. Mortality assessments will need to be made in 2017 to document the impact of hot, dry conditions and multiple disturbance events.

Pine Needle Casts

The early portion of the 2016 growth period was cool and moist in the Northern Tier. Extensive areas of white pine were exhibiting needle chlorosis, needle casting, and branch dieback associated with the following:

- *Lecanosticta acicula* (formerly *Mycosphaerella dearnessii*)
- *Lophophacidium dooksii* (formerly *Canavirgella banfieldii*)
- *Septorioides strobi* (a newly encountered fungal needle cast disease agent)

Septorioides strobi and *Lophophacidium dooksii* were most widespread; *Lecanosticta* was less prevalent.



Septorioides strobi on white pine. (Photo courtesy of UMass Extension)



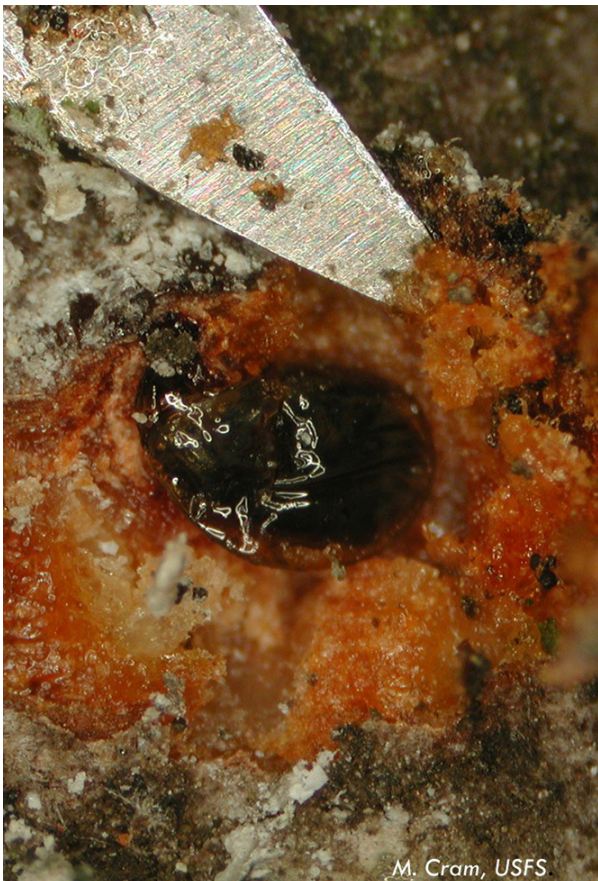
Septorioides strobi spores. (Photo courtesy of UMass Extension)

Needle and Twig Blights

Moisture trends from 2012 through 2016 have been above normal in many areas of the Commonwealth, contributing to an increase in needle and twig blights in pine and spruce species. The situation on white pine is very significant, and we expect to encounter dieback and tree mortality in the areas affected, including the north-central, northeast, and northwest portions of Pennsylvania.

Matsucoccus macrocicatrices

Pine bast scale (*Matsucoccus macrocicatrices*) was confirmed in Pike County and previously on the Allegheny National Forest. This insect is often found under lichens on branches and twigs, which provides some degree of protection. This pest and the above mentioned needle cast diseases represent important forest health conditions that will continue to impact white pine in the future.



Pine bast scale (Matsucoccus macrocicatrices).
(Photo by M. Cram, U.S. Forest Service)

Oak Wilt

There has been an indication that oak wilt may be occurring in areas of Tioga and Potter Counties. So far we have not had diagnostic confirmation based on samples sent to the Pennsylvania State University – Plant Diagnostic Laboratory in 2016. Confirmation was made on samples submitted in 2015, so we are aware that transmission and expression of oak wilt is present and possible.

Oak Decline

Due to severe and moderate drought conditions as well as a history of insect defoliation and logging operations, there is a significant increase in oak dieback, decline, and mortality being observed in Tioga and Weiser State Forests. Historic regions of oak decline seen in the late 1950s to mid-1960s are exhibiting oak mortality due to the combination of stressors related to gypsy moth, drought, and logging activity. This trend is likely to continue into the near future. Many Ridge and Valley Region counties have localized areas impacted by oak decline.

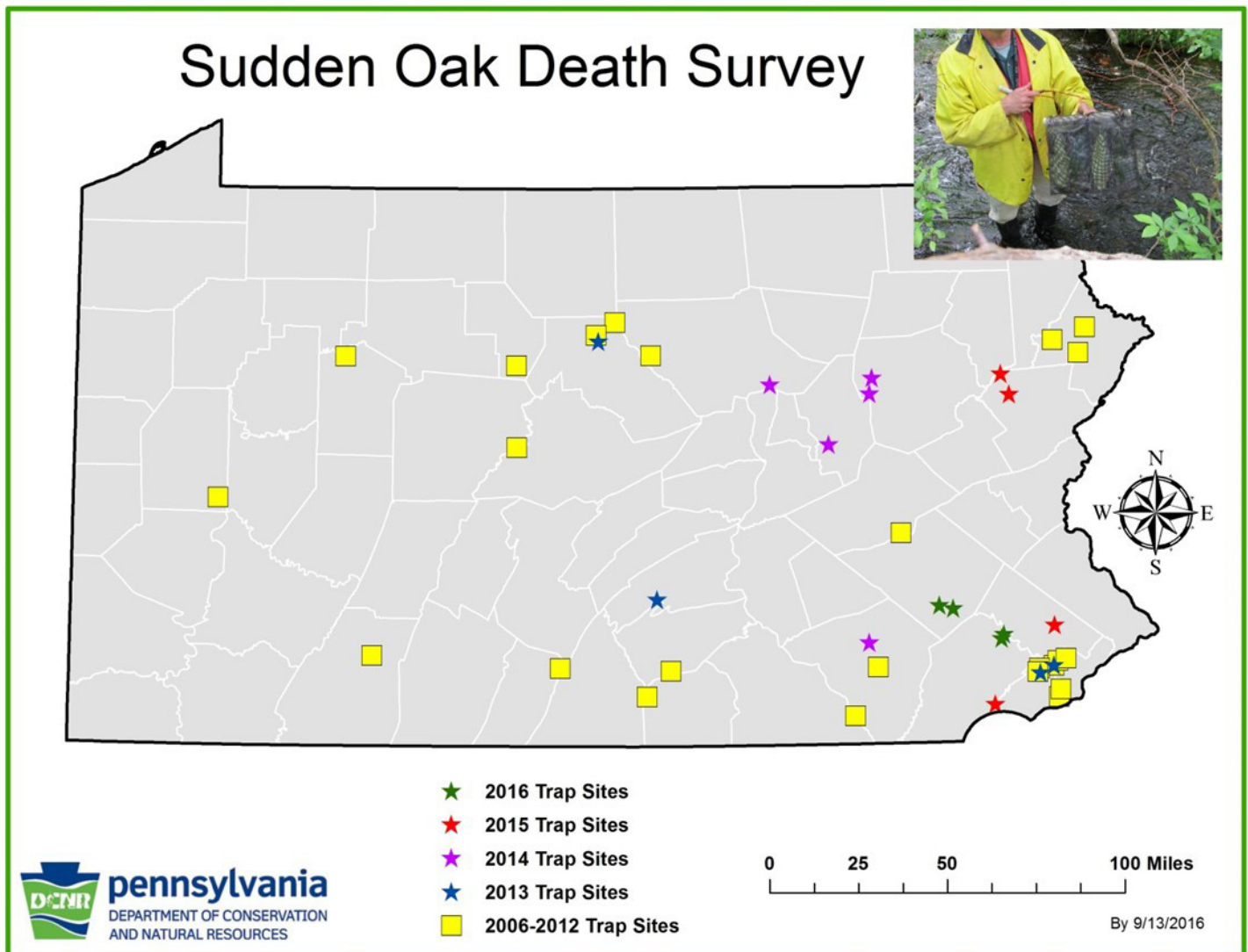
Thousand Cankers Disease

As opposed to the standard insect trapping system that had been utilized previously, the 2016 survey for thousand cankers disease (*Geosmithia morbida*) was based on examination of black walnut trees for visual symptoms of this disease. Traps set up in previous years for walnut twig beetle (*Pityophthorus juglandis*), the vector of the disease, were no longer detecting the presence of the insect within the quarantine zone. A decision was made to conduct visual surveys in lieu of trapping. The lack of positive trap captures in previous seasons also lead to the suspension of the identification and screening service being conducted by the Pennsylvania Department of Agriculture on behalf of the Bureau of Forestry. Monitoring traps will be re-established in the future if necessary. The presence of thousand cankers

disease has not proven to be a common or current problem. Trees were surveyed in Bucks, Delaware, Montgomery, Chester, and Lancaster Counties, which are the quarantined counties for thousand cankers disease. Neither walnut twig beetle nor thousand cankers disease was reported in any of the surveys.

Sudden Oak Death

Sudden oak death (*Phytophthora ramorum*) stream surveys have continued throughout Pennsylvania since 2006. Initial survey work for 2016 was conducted in the spring from late May through mid-June. Presently there is no indication of sudden oak death showing up in surveyed streams in Pennsylvania from 2006 to June 2016. Autumn stream surveys were made in the fall of 2016.



Sudden oak death survey trapping sites from 2006-2016.

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http://www.fs.fed.us/sites/default/files/media/types/publication/field_pdf/GTR-WO-91.pdf. (1 March 2016)



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.

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