IOWA'S FOREST HEALTH REPORT, 2006

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Introduction

Each year the Iowa DNR Bureau of Forestry cooperates with many agencies to protect Iowa's forests from insects, diseases and other stressors. These programs involve ground and aerial surveys, setting up sentinel trees, setting up pheromone traps, following transects for sampling, collecting samples for laboratory analysis and directing treatments for specific problems during the growing season. After each growing season, the Bureau issues a summary report regarding the health of Iowa's forests.

This year's report begins with a brief summary of weather events, followed by a summary of Forest Service Inventory data for Iowa's forests, showing that no oak tree is represented in Iowa's top 10 species, then survey summaries for insects and diseases that have the potential to impact Iowa's forests. The 2006 surveys for exotics insects and diseases were Emerald Ash Borer, Gypsy Moth survey and Sudden Oak Death. Oak tatters research describes some new intriguing information discovered in 2006. A Pine Shoot Beetle Quarantine has been implemented by USDA-APHIS-PPQ for Iowa in 2006. This report finishes up by describing forest insects and diseases already present, and concludes with invasive plant species in our forests.

Weather

Cool and wet conditions in Iowa during late April and early May set up favorable conditions for anthracnose on oak and sycamore leaves. Conversely, stress on trees in Iowa in the form of dry conditions persisted throughout the southern part of the state starting in June lasting through November. Rainfall was inconsistent across the state, but generally, Iowa received less rain as you moved from North to South across the state.

Warmer Winter conditions are allowing some insects to build-up their populations. Bagworms are becoming an increasing problem in southern Iowa by defoliating arborvitae trees.

There was an abundant red oak crop throughout Iowa. Not very much white oak was produced after the large crop that fell in 2005. Black walnut was good as well with the northern half of Iowa producing more consistently and abundantly than the black walnuts growing in the southern half of the state.

Aerial Survey

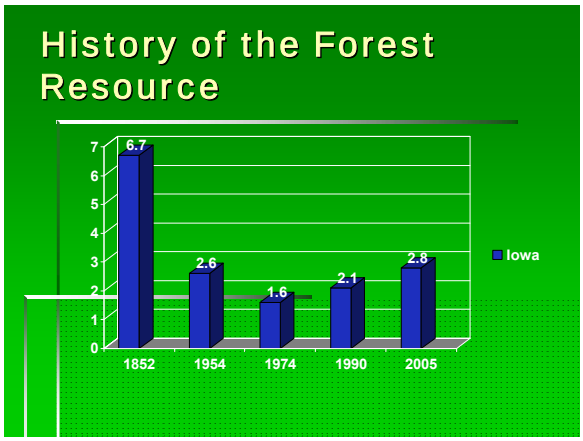
Iowa forests surveyed by plane in 2006 were found to be in generally good condition. On July 13th the surveying crew started above Waterloo and followed the Cedar River to the south until reaching the Mississippi River where they turned north following the Mississippi River back up to the northern most corner of Iowa. The crew flew back to where the Upper Iowa enters the Mississippi and followed this river to the west. This day's route showed the same level or higher amounts of oak wilt/ oak decline, pine wilt and DED compared to observations along this same route in 2005.

THE SIZE AND CHARACTER OF IOWA'S FORESTED LAND

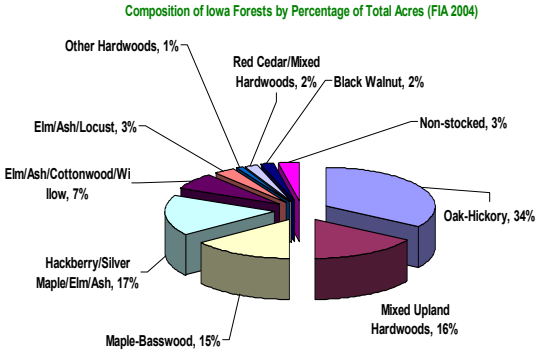
Iowa's forests are generally healthy and are increasing in the number of acres. A forest resource that is healthy contributes immensely to our state's goals of clean water, abundant wildlife habitat, lumber and veneer production, outdoor recreation and aesthetics that enhances the quality of life in Iowa for the citizen of Iowa.

Iowa has approximately 2.8 million acres of forested land representing a steady increase over the past few decades as shown in Figure 1 below. Forest conservation programs, reforestation programs and shifts in agricultural land use all contributed to an increase in forested acres. Most Iowa forests are native hardwood forests with oak, hickory, maple, basswood, walnut, ash, elm, cottonwood and many other hardwood species. Less than 3% of Iowa forests are conifer forests.

Figure 1. History of Iowa's Land Covered in Forest since Settlement.



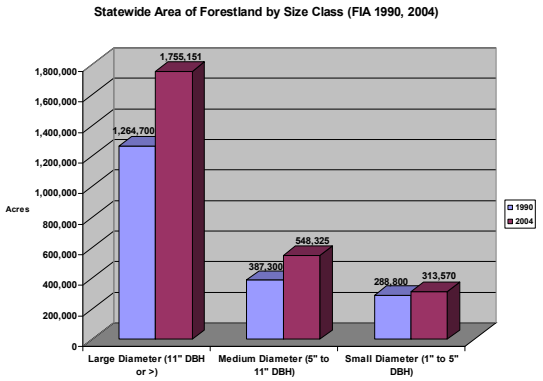
Even though Iowa forests are increasing in acreage, the oak component is decreasing in acreage in some areas of the state, as forest succession drifts toward more shade-tolerant species such as maple in the absence of forest disturbance. There are currently 927,200 acres of oak-forest in Iowa. Iowa has lost an average of 4,500 acres of oak forest annually since 1990. At the current rate of decline oak forests will disappear from the Iowa landscape in 160 years. It is important for landowners to work with DNR Foresters to use silvicultural systems to counter this trend to regenerate oak. A breakdown of the different forest communities in Iowa is shown in the pie-graph below.

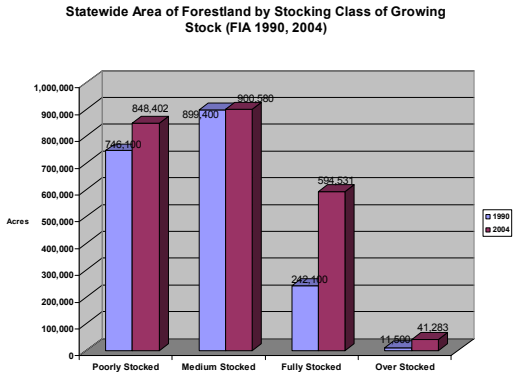


Succession to shade tolerant hardwoods eventually replaces shade intolerant hardwoods, like oak, in the absence of disturbance. Most of Iowa's oak stands are in the mature or over-mature age. Prior to settlement periodic prairie fires swept into the woodlands and eliminated mid-story layers, thus giving the thicker barked oak a competitive advantage over other species. That is largely why we have oak today. However, many of these stands are now 150+ years old. These stands may be reaching the twilight of their life span. Without fire or disturbance oak seedlings cannot get the light they need to survive. When the fire eco-system is eliminated shade tolerant species like sugar maple are in a position to fill the void.

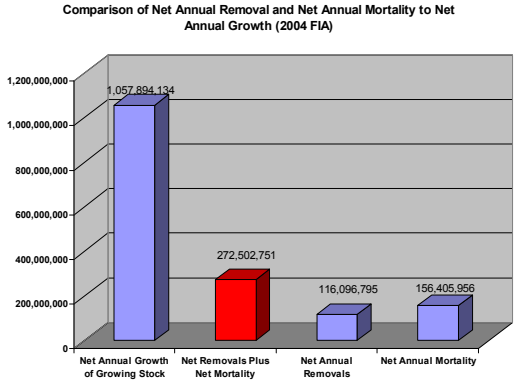
Other challenges to keep in mind about Iowa's oak forests is that oak has a sporadic seed production, exception bur oak, only producing good seed crops once every five years on average. This makes the timing of silvicultural treatments or harvesting very important to the regeneration of oak stands. Another challenge for maintaining oak forests is the deer populations may be so highly concentrated that they eat oak seedlings and keep them browsed to a point where other less palatable species out compete the oak. Fragmentation of forest land into smaller tracts with houses near or in the timber the management practice that can regenerate oak become less feasible for landowners, because they do not want to "ruin" there woods. Most people want to preserve their forests with big trees thinking that this will keep their forest in its current condition. The woodland becomes an extension off their yard not a forest. People generally believe that by doing nothing that they can preserve their forest, when in reality it take disturbance to maintain a oak-hickory forest type. Many of the oak regeneration issues can be addressed through proper application of silvicultural techniques that a district forester can consult a landowner about.
Harvesting activities do not destroy the woodland wildflower and forb seed bank, even in heavily scarified sites. Plants such as Anemone, blood root, Blue cohosh, fern come back in reaction to the disturbance and additional light. They are more likely to disappear under a very dense canopy of shade tolerant hardwoods.

Even though Iowa's forest land is currently increasing, the land is becoming more fragmented and the species growing on the land is converting to more shade tolerant species. Iowa has about 8% of its land classified as forest, according to 2004 Forest Inventory Data provided by the Forest Service. That means about 2.8 million acres of Iowa is forested. Most of Iowa's forest land is privately owned, 90% by 138,000 landowners. In 1990 there were 55,000 forest landowners in Iowa that owned on average of 31 acres of forest land. By 2004 the number of forest landowners increased to 138,000 with an average of 12 acres of forested land. Development is fragmenting the forest cover in Iowa. This will make it more difficult to manage the forest resource, as there will be so many more people with different opinions on how they want their forest to grow. Below, the left bar graph shows the size of the trees in Iowa's forests are getting larger from 1990 to 2004. The bar graph on the right compares the stocking density from 1990 to 2004.





Net annual growth exceeded the combined removal and mortality of Iowa's forestland by 785 million board feet in 2004, the latest FIA data available. This data is shown in the following bar graph.



The table below shows the results of a Forest Service survey on why Iowans own woodlands. Note timber production is not rated high in the survey. Also note that landowners own woodlands for beauty and preservation, however the management required for oak regeneration in counter intuitive to their instincts.

FIA 2004 Survey	**Ranking**
Privacy	1
Aesthetics	2
Heirs	3
Part of Farm	4
Hunt/ Fish	5
Investment	6
Timber	7

The graph and Table 1 in Appendix A shows, based on 2004 FIA data, that 24% of our current forests are composed of tree species that are not expected to be long lived. Elm (Dutch elm disease), ash (Emerald Ash Borer) scotch pine (Pine

Wilt) are all in peril because of insects and diseases that pose serious threats to their survival in the future. What will Iowa's forests look like for the next generation? Notice that no oak tree even cracks the top ten for species ranking.

Emerald Ash Borer Surveillance Effort

The Emerald Ash Borer (EAB) is native to the orient, and was introduced in the United States near Detroit in the 1990's. As of December 1, 2006 a quarantine has been placed by USDA-APHIS to quarantine the entire states of Illinois, Indiana and Ohio. The lower peninsula of Michigan is under this quarantine, also. Although not yet found in Iowa, EAB has more potential for future harm to Iowa forests than any other insect currently being dealt with in the United States. EAB kills all ash species by burrowing under the bark and eating the growth (cambium) layers of the trees. EAB has been found capable of killing every species and size of ash tree in neighborhoods or woodlands. Ash is one of the most abundant native tree species in North America, and has been a preferred and heavily planted landscape tree in yards and other urban areas.

The Iowa Department of Natural Resources (IDNR) Forestry Bureau in cooperation with Iowa State University Extension (ISUE) has been following the United States Department of Agriculture Forest Service (USFS) protocol to monitor Iowa for signs of the emerald ash borer (EAB). As per current USDA APHIS estimates, this exotic insect has caused the death or decline of over 25 million ash trees in Michigan, Indiana and Ohio since 2002. The detection of EAB in Illinois in 2006 is a great concern because of its proximity to Iowa and Interstate 80 linking the two states. According to recent sources, Iowa has an estimated 55 million rural ash trees (USFS 2004) and 10 million urban ash trees (Syracuse Urban Tree Model Estimate).

There are three ways the emerald ash borer could become established in Iowa. One is movement of nursery stock. With the voluntary moratorium on not purchasing ash trees from east of the Mississippi River by the Iowa Nursery and Landscape Association (INLA) this method of infection is preventable. A second method is movement of sawlogs to Iowa from out of state. With the new finds of EAB in Illinois this mode of being transported into Iowa has become easier. The third method to be aware of is transportation of firewood. If a person from an area with EAB was to bring infested firewood (larvae or pupae under the bark) and not burn all the firewood in an Iowa campground, it would be possible for the insect to spread into living ash hosts here in Iowa. As a preventive measure, sentinel trees were placed in high risk campgrounds, those thought to be most likely to be visited by out of state campers.

A surveillance effort has been in place the past three years in Iowa to determine if EAB was in Iowa. For 2004 and 2005, this activity consisted of visual surveys of urban ash trees (towns/cities with a population greater than 1000) in all 99 counties, visual inspection of ash saw logs at 43 sawmills, and ash nursery stock (conducted by Iowa Department of Agriculture and Land Stewardship State

Entomologist's Office staff). In 2005, 49 sentinel trees were also used to monitor for EAB. During the 2006 season, surveillance strategy for ISUE and IDNR shifted to the highest risk areas in the state, campgrounds.

Visual surveys of ash trees were conducted in 50 state and 10 county campgrounds. Sites were selected based on location near interstate highways, near tourism sites, and/or on the eastern border of Iowa. Up to 10 trees were examined in each campground for signs of EAB. The larger the campground and the greater the ash density, the more ash trees visually examined. A total of 417 ash trees were visually examined during 2006. **No evidence of EAB was noted on these trees.**

As in 2005, sentinel trees were created in one of two ways: girdling standing ash trees (4-13 inch DBH) or planting donated containerized ash trees. Sentinel trees were established by June 1, 2006. In general, containerized trees were used for private campgrounds or in areas with few ash trees, while standing ash trees were used on federal, state or county properties. A tree was girdled by using a folding hand saw, making two cuts through the bark (4-6 inches apart), and then removing the bark with a drawknife between the cuts. Every effort was made to select standing ash either in the open or with exposure on two or three sides (none of the trees were within a forest stand).

Container ash trees (1.5 – 2.5 inch caliper) were donated by Earl May (Jason Rystrom, Shenandoah), Fleming Nurseries (Mark Fleming, Cedar Rapids), Miller Nursery (Jim Poulsen, Johnston), and TNT Nursery (Brett Schram, Ankeny). The trees were not planted properly and received irrigation via rainfall; these stresses were intended to make the trees more attractive to insects from the immediate surrounding area.

There were 68 sentinel trees created in 2006, 27 were standing ash trees and 41 were containerized trees. These trees were present on 18 sites across Iowa. With the exception of 10 trees held for monitoring in 2007, sentinel trees were bark peeled by November 20, 2006. **EAB was not detected in any sentinel tree to date**.

A map in Appendix B shows the locations of visual survey efforts and sentinel tree placements in Iowa for the 2006 season.

The viability of containerized trees to serve as sentinel trees was affirmed again from the 2006 data.

- 84% of sentinel trees had one or more native borers present; this consisted of 90% of the standing and 81% of the container trees.
- Larval and/or adult redheaded ash borer, ash lilac borer, banded ash clearwing, flatheaded appletree borer and 2 scolytids were collected on sentinel trees in 2006.

- 40% of sentinel trees had more than one native borer present; 57% were standing ash and 43% were containerized ash trees.
- Native borers were found on both types of sentinel trees with the following exceptions: banded ash clearwings only found on standing ash; flatheaded appletree borers only found on containerized trees.
- The greatest number of native borer life-stage found on a given sentinel tree:
    - Redheaded ash borer = 22
    - Ash lilac borer = 10
    - Banded ash clearwing = 3
    - Flatheaded appletree borer = 16
    - Bark beetles = 13

These data give collaborators some confidence that the insects are locating the ash trees, regardless of the method used. Containerized ash trees gives IDNR and ISUE the flexibility of involving private campgrounds in the surveillance effort, placing the trees in open areas in close proximity to campgrounds, and taking the trees back to laboratory conditions to bark peel (less in field time). Standing ash trees were taller and larger in diameter, had many branch bases to examine, and thus the process of looking for borers was much longer (from 1 to 2.5 hours/tree for a 2-person team).

Educational efforts in Iowa during 2006 included the following:

- EAB posters placed at all interstate rest areas – bulletin board
- EAB information sent to all private, county and state campgrounds, IDNR foresters, and ISUE county offices
- During visual survey work, park rangers/facility managers were given additional EAB information and the identification of and importance of EAB was discussed one-on-one.
- Presentations to US Army Corps of Engineers Foresters, ISUE county meetings (Butler, Clinton, Linn), Weed Commissioners, Iowa Arborist Association, Iowa Turfgrass Industry and on ISU Campus (Horticulture faculty & Facilities Planning & Management landscape architects and grounds crews)
- Two 15' posters on EAB taken to the Iowa State Fair and Farm Progress Show, along with EAB educational information; personnel on hand to answer questions

A map showing the current known locations of EAB in the United States can be viewed in Map 2 in Appendix B below. Also in Appendix B, the following map, Map 3, shows the distribution of ash across the United States that is at risk to this exotic insect.

For more information on the most current status of the EAB log onto www.emeraldashborer.info .

The longer we can keep Iowa free of the emerald ash borer, the longer ash trees will still be a viable tree in the landscape. Hopefully researchers will soon come up with a better detection system and/ or a way to contain this destructive insect.

Gypsy Moth Survey

Gypsy Moth is a European insect species introduced into New England over 100 years ago as an experiment to help provide silk for the textile industry. This exotic insect continues to spread west from that introduction site and defoliate native forests wherever they become established. Establishment of gypsy moth in Iowa will affect the survival of our mature and oldest trees the most. The larvae of this insect will feed on the leaves of its over 300 host species during the summer removing a trees ability to create food with its leaves. It is repeated defoliation that occurs several years in a row on the same trees that will deplete the stored reservoirs of nutrients the tree has, thus leading to the decline of that tree.

Gypsy Moth has established itself in certain areas of Wisconsin now, and is just beginning to move towards northeast Iowa. Through Iowa's trapping program and follow up treatments, Gypsy Moth has been kept from becoming established in Iowa, but there are now 5 counties (Allamakee, Clayton, Dubuque, Jackson, Clinton) within 60 miles of the gypsy moth establishment boundary line. Furthermore, Wisconsin is reporting that the gypsy moth population is building in neighboring Adams, Columbia, Dane, Marathon and Sauk counties.

Some good news is that 2006 only had 1 gypsy moth catch in the counties that are closest to the "gypsy moth line". The largest single trap catch was at a nursery in Cedar Rapids. Here 10 gypsy moths were caught, but upon further inspection no sources could be identified. More traps will be set up in 2007 around this nursery to be sure there is not a reproducing population establishing itself. One trap caught two moths at another nursery in Johnson county. The remaining moths were single catches, probably from hitchhikers from infested areas that dropped off in a campground or rest area in Iowa. Gypsy moth along with many other insects and diseases, can be easily transported from an infected state to a new location by firewood.

Weather patterns along with an introduced fungus disease for gypsy moth called *entomophaga maimaiga* and a federal program called "slow the spread" (STS) have combined to slow the spread of gypsy moth into Iowa. Only 20 moths were caught, up from a 20 year low of 4 moths in 2005. Map 1 in Appendix C shows the locations of the gypsy moth catches.

A history of the number of gypsy moth catches and the number of acres treated for gypsy moth eradication in Iowa between1970-2006 can be viewed in Table 1 of Appendix C. For more background information and the latest national maps for the movement of gypsy moth visit www.aphis.usda.gov/ppq/ispm/gm/.

Background Information

The Iowa Department of Agriculture and Land Stewardship (IDALS) in cooperation with USDA-APHIS-PPQ have conducted an annual male moth detection trapping program since the 1960's. In 2001 the Iowa Department of Natural Resources (IADNR) Forestry Bureau became involved with the gypsy moth trapping program because of budget cuts to the IDALS gypsy moth detection program. Forestry believes this is an important issue for Iowa's forest resource and has since provided labor in the form of its district foresters to help with the surveying of 57 of the 99 counties in Iowa.

Eradication Efforts

Eradication prevents establishment of the gypsy moth in new areas by eliminating isolated populations. Indications of isolated populations include: 1.) male moths caught in pheromone traps; or 2.) the presence of other moth life stages.

Eradication programs, utilizing insecticide spraying of a *Bacillus thuringiensis* (Bt) var. *kurstaki* are implemented by IDALS and USDA-APHIS-PPQ to eliminate the gypsy moth populations in Iowa. Bt is a pesticide derived from a bacterial toxin that affects only certain butterfly and moth larvae. A history of acreage treated with Bt since 1972 to eradicate gypsy moth is also shown in Table 1 in Appendix C.

IDALS in cooperation with IADNR, ISU and USDA Forest Service have conducted extensive professional and general public education efforts. These efforts have ranged from the publication of gypsy moth brochures and identification cards, to formal training programs for professional nursery, arborists and foresters, and workshops for the general public and volunteers.

Current

The gypsy moth trap locations in 2006 have been focused in cities, campgrounds, and around nursery operations. Along the Mississippi a trap was placed every 1500 meters to form a line of detection along Iowa's eastern border. Nine of our largest cities were also put on a 1500 meter grid.

In 2006 the following agencies were involved with gypsy moth trapping:

- U.S. Army Corps of Engineers (67 traps)
- City Foresters (63 traps)
- County Foresters (49 traps)
- U.S. Fish and Wildlife Service (12 traps)
- USDA-APHIS (1362 traps)
- IDALS (234 traps)
- IADNR (966 traps)
- Contractors (1894 traps)

New in 2006 was the hiring of five contractors that were paid by the number of traps they set-up ($6/ trap) and took down ($4/ trap). If 95% of the traps were placed in the correct locations the contractor was rewarded an additional $3/ trap. This gave the contractors an incentive to do the work properly, yet gave them the flexibility to do the work on their own schedule.

In 2006 there were 250 volunteer trappers that set-up a gypsy moth trap on their own property, providing additional survey coverage. It is easy to become a volunteer gypsy moth trapper by contacting:
Aron Flickinger
State Forest Nursery
2404 South Duff Ave.
Ames IA, 50010

As a volunteer trapper you will be sent a pheromone trap in May that can be hung with string or stapled securely to a tree. In September send the trap back to Aron for inspection. If it is determined that a population of gypsy moth is becoming established in your area, then a plan for spraying this insect will go into place. The more traps we can have volunteers set the better our surveillance for the movement of this insect into Iowa will be.

The following page is a summary fact sheet about a national program that has been developed to slow the spread of gypsy moth into uninfested areas.

The STS Program

Slowing the Spread of Gypsy Moth
to Protect America's Hardwood Forests

The Threat

Gypsy moth is a destructive, exotic forest pest that was accidentally introduced into the United States in 1869. It is currently established throughout the northeast and parts of the upper mid west (green shaded area on maps).

- It feeds on over 300 species of trees but oaks are most preferred.
- 75 million acres have been defoliated by gypsy moth since 1970.
- Gypsy moth defoliation causes extensive tree mortality, reduces property values, adversely affects commerce and causes allergic reactions in some individuals that come in contact with the caterpillars.
- Most (almost 70%) of the susceptible hardwood forests in the United States have not yet been infested by gypsy moth and are still at risk.

The Current Proactive Strategy

Since Congress funded the Slow the Spread program (STS) in the year 2000, ten states located along the leading edge of gypsy moth populations, in cooperation with the USDA Forest Service, have implemented a region-wide strategy to minimize the rate at which gypsy moth spreads into uninfested areas. As a direct result of this program, spread has been dramatically reduced from the historical level of 21 kilometers per year to 5 kilometers per year.

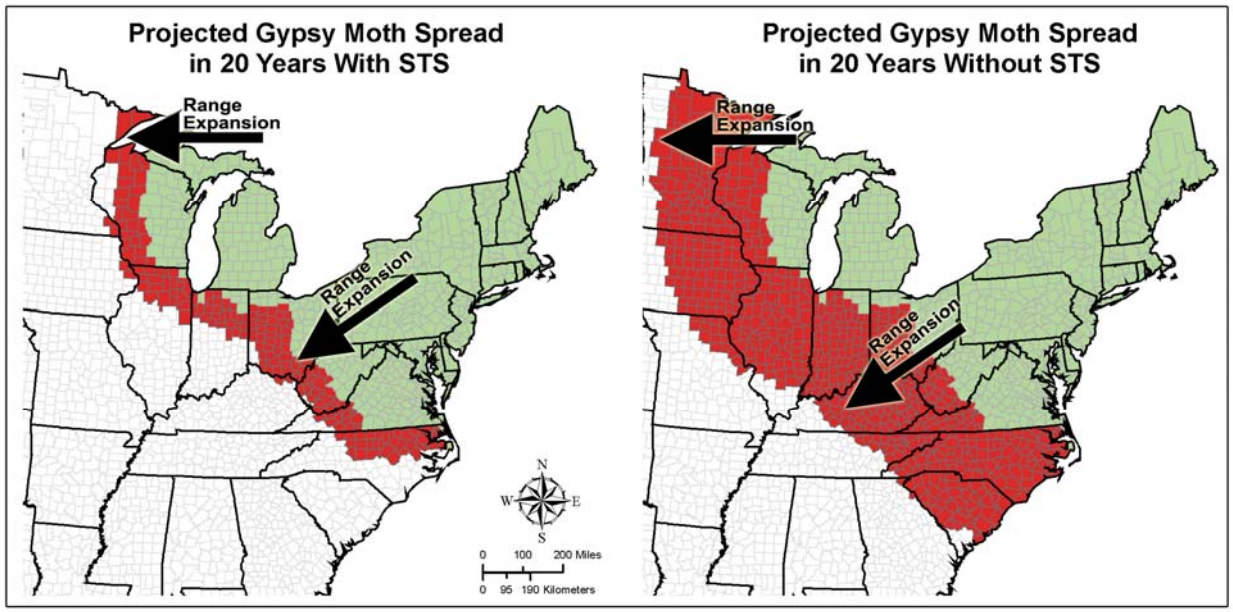
The Benefits

- STS reduces spread of this destructive pest to 5 kilometers per year and will prevent infestation of more than 150 million acres over the next 20 years (compare maps).
- STS protects the extensive urban and wildland hardwood forests in the south and upper mid-west.
- STS protects the environment through the use of gypsy moth specific treatment tactics.
- STS unifies the partners and promotes a well coordinated, region-wide action based on biological need.
- STS yields a benefit to cost ratio of 4 to 1 by delaying the onset of impacts that would occur as gypsy moth invades new areas.

The Funding

These benefits have been achieved with a partnership investment of state and federal funds averaging about $13 million each year. Since its inception, the USDA Forest Service has supported the STS program as follows:

Year	2000	2001	2002	2003	2004	2005	2006
Dollars (in millions)	$8.0	$8.3	$10.0	$10.9	$11.0	$10.0	$9.9



Green shaded counties are infested as of 2005 and red shaded counties will become infested over the next 20 years.

Sudden Oak Death

Phytophthora ramorum is the cause of the disease known as sudden oak death (SOD), ramorum leaf blight, and ramorum dieback. It is a non-native disease that was discovered in California in 2000. This pathogen has the potential to infect oaks and other trees and shrubs. For the latest information and a background of host species for this disease, visit www.suddenoakdeath.org.

The reason Iowa is monitoring for *Phytophthora ramorum* is because it is a quarantine pest and it may have been inadvertently introduced to all states outside the regulated areas of CA and OR on infested nursery stock in 2003-04 and again in separate incidents in 2004-05.

The Iowa Department of Natural Resources (IDNR) began by targeting 20 nurseries in Iowa that received potentially infected nursery stock. The survey started June 13 and was finished July 20. Of these nurseries, 12 had the appropriate surroundings with host vegetation to sample. To complete the 20 nursery site quota, national retail outlets that sell nursery stock like K-mart, Lowes, Walmart and Home Depot were chosen because of their wide distribution of nursery stock across the country. Sites surveyed are listed in Table 1 of Appendix D. Map 1 in Appendix D shows all the sites surveyed for this disease in Iowa from 2003-2005.

To see if the disease is already in a natural environment like a forest, transects were set up in 10 general forested areas across the state. Leaves and cankers were collected from host material displaying symptoms.

Host material was inspected within nurseries by IDALS personnel. This provided sampling and visual inspection of nurseries within the nursery itself as well as sampling the outside perimeter of the nursery to see if this fungus could spread on its own into Iowa's natural plant community.

Samples were collected from around the state for both nursery and general categories. Samples were sent to both The Ohio State University and Mississippi State University. All samples came back negative for *Phytophthora ramorum*. Acer, viburnum, ohio buckeye and honeysuckle were the only host species that were sampled for foliar symptoms. Several species of oaks were sampled for bleeding canker like symptoms with the results coming back negative.

Plant disease personnel are still studying whether this disease could exist on oak in Iowa and be able to withstand the winters. Iowa is not in the lowest risk category for this disease to become established, but is one level higher.

Tatters Study in Iowa

Oak tatters affects the leaves of oak trees causing them to look deformed or "tattered". It causes newly emerged leaves to have reduced interveinal leaf tissue as the leaves grow larger. Tatters was first reported in Iowa, Indiana, and

Ohio in the 1980's and more recently in Wisconsin and Minnesota. Tatters has been reported on trees of all ages in rural and urban environments.

Not all oak trees become tattered because the leaves have to be exposed to the correct conditions after the leaves have emerged from their buds. The beginning stages of tatters is a curling of the young succulent leaves as shown in the picture below.

It is answering the question of what conditions the leaves need to be exposed to that DNR Foresters have been studying for the past 3 years.

Foresters have not found insects or diseases when reviewing the damage caused by tatters. Current belief for the cause of tatters centers on environmental conditions such as cold temperatures or farm chemicals that have volatilized into the air. A study done in a lab at the University of Illinois in 2004 - 2006 has reproduced the same damage that tatters causes to oak leaves by directly applying a chemical called acetochlor during the leaf emergence phase on white and red oak trees. For a complete report on what the Illinois study has found visit their web site: http://www.nres.uiuc.edu/research/herbicide_research/index.htm

Here in Iowa, in anticipation of this annual tatters event on oak and hackberry leaves a team composed of many different backgrounds convened to plan activities for collecting compelling data to show what could be causing tatters.

The team decided to monitor on site weather temperature to watch for freezing or near freezing temperatures. This could help determine if leaves were being damaged as a result of cold temperature exposure. The team also decided to

collect air, rain water and oak leaves during a six week period of time to see how the levels of acetochlor varied in relation to the tatters event that was happening. Two rural sites were set-up with these collection stations. One site was at White Pine Hollow and the other at a private residence near Iowa City. A final addition to the study was to protect part of a branch of a tree from the environment by placing a tree pollination bag around parts of several branches on an oak tree at each site. A picture showing the bags covering part of the branches at White Pine Hollow can be seen in the picture below.

Results

Oak tatters at White Pine Hollow was observed on May 2, 2006 on many mature white oak trees. The previous site visit on April 27th noted that normal leaves on white oak trees were emerging. It was also noted that a lot of field work and planting of corn in fields in Dubuque county was occurring.

Before leaving on April 27th, 5 tree pollination bags were placed over several branches on a white oak tree that had shown leaf tatters in past years. What happened during the 5 days between site visits has been what DNR foresters have been investigating for the past 3 years.

Viewing the pictures in the figure below, shows what foresters saw upon arriving at White Pine Hollow in May. The leaves that were protected from the environment showed no signs of tatters and looked normal. Conversely, notice

the curling leaves that show obvious damage on the same branch, but not protected from the environment. This is tatters at an early stage- as time goes by the leaves develop without their interveinal tissue. Tatters can occur on the edge of a forest or in the interior. It occurs over the entire tree and it is not segmented to one side like what could be seen with drift damaging a tree on a windy day.

What may be happening is the acetochlor is applied on a corn field and then it volatilizes under the right weather conditions back into the air. This can explain how all sides of a tree can be showing tatters damage and how trees on the interior of a forest can have tatters, not just the trees on the edges of a forest stand. If a trees leaves have advanced in growth enough before being exposed to elevated levels of acetochlor, then the leaves remain normal. The trees that escape getting tattered one year may not the next year. Along the same lines a tree that gets tattered in one year may not get tattered the next year. But if a tree gets tattered many years in a row, this stress can lead to the decline of that tree.

From April 10 through May 18 air, rainwater and leaf tissue samples were collected by DNR Foresters and analyzed at the University of Iowa Hygienic Laboratory yielded some interesting results.

The concentrations of acetochlor at White Pine Hollow quadrupled during this time from 15 ng/m^3 to 55 ng/m^3. During this span of time an over 15 ng/m^3 increase occurred when tatters was fist visually observed on site. For rainwater the concentrations went from almost non-existent to over 9.5 ng/ml by the time tatters was first observed, followed by a dramatic decrease by May 18th. Comparing leaf tissue levels of acetochlor between the bags shows the concentrations to be 5 ng/g or below for the leaves protected from the environment and concentrations 3 to 10 times higher on leaves that were not protected.

What does all of this data mean? It seems that looking at all of the data that elevated levels of acetochlor in the air and rain is occurring at White Pine Hollow.

The peak levels of acetochlor occurring at the same time, or even a few days before the occurrence of tatters, looks very intriguing. No frost was reported on site during the occurrence of tatters. No freezing temperatures occurred during the 5 days the tree leaves were covered by the pollination bags. Cold temperatures were experienced previous to the bags being placed over the leaves- but all of the leaves/ buds were treated the same until April 27th.

Future
DNR Foresters will continue looking at isolating methods for tatters to occur. One experiment will be to move oak and hackberry seedlings in and out of a freezer to see if tatters can be replicated by exposing these seedlings to cold temperature during the leaf unfolding phase. Another experiment to see if volatilization can cause tatters will be worked on with seedlings as well. The Iowa DNR is searching for further grants to better investigate this phenomena known as tatters to eventually be able to publish a scientific paper describing this complex problem.

Pine Shoot Beetle

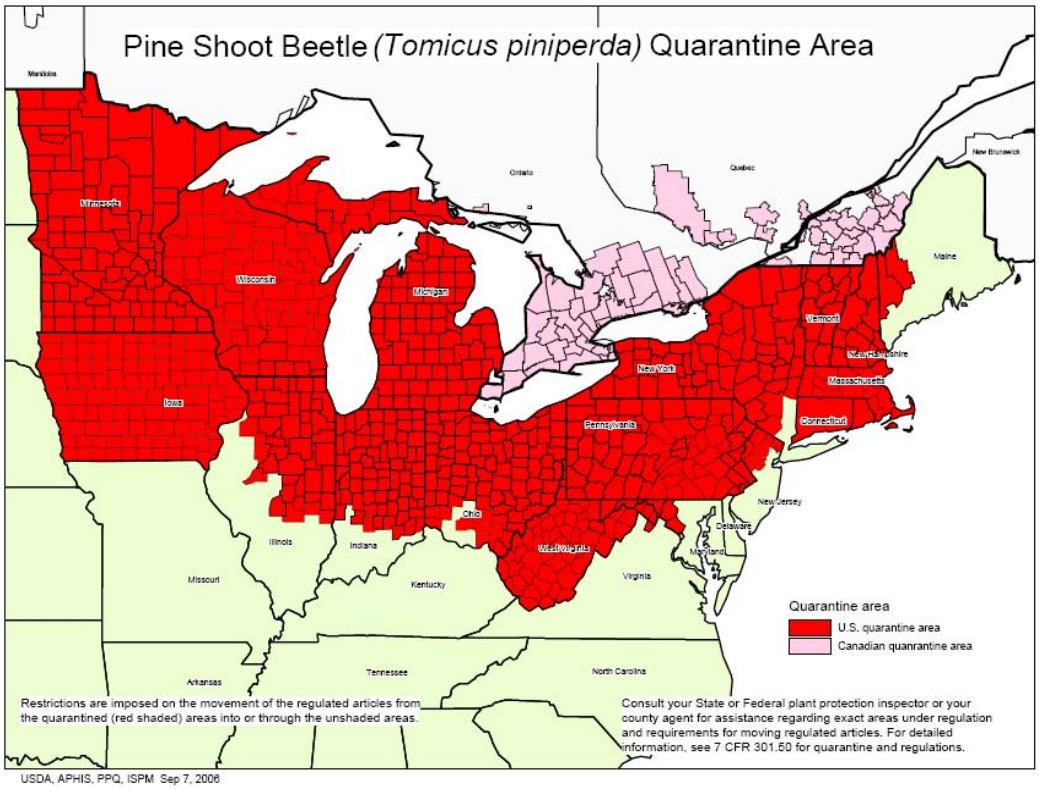
Background
The pine shoot beetle (*Tomicus piniperda* L.) is an introduced pest of pines. It was first discovered in the US at a Christmas tree farm near Cleveland, Ohio, in July 1992. A native of Europe, the beetle attacks new shoots of pine trees, stunting the growth of the trees. The pine shoot beetle may also attack stressed pine trees by breeding under the bark at the base of the trees. The beetles can cause severe decline in the health of the trees, and in some cases, kill the trees when high populations exist.

In May, 2006, USDA-APHIS-PPQ confirmed the presence of pine shoot beetle (PSB) in Dubuque and Scott counties. A Federal Order was issued effective June 22, 2006 placing Dubuque and Scott counties under a Federal quarantine for interstate movement of PSB regulated articles. Iowa Department of Agriculture and Land Stewardship (IDALS) was provided a copy of the Federal Order as well as additional information concerning the pine shoot beetle, and was requested to consider placing a state PSB quarantine for intrastate movement of PSB regulated articles from Dubuque and Scott Counties. However, after considerable review, IDALS declined to implement an intra-state quarantine for PSB. Therefore, a Federal Order was issued effective September 18, 2006 for quarantine of the entire state of Iowa for PSB, *Tomicus* piniperda.

The quarantine affects the following pine products, called “regulated articles”:
- Pine nursery stock
- Pine Christmas trees
- Wreaths and garlands
- Pine logs/lumber (with bark attached)

All pine nursery stock shipped from Iowa to a non-regulated state must be inspected and certified free from PSB. This inspection and certification must occur just before shipping. Small pine seedlings (less than 36 inches tall, and 1 inch in diameter) and greenhouse grown pines require a general inspection of the whole shipment. All other (larger) pine nursery stock shipments must have 100% tip-by-tip inspection.

The map in Figure ? shows the areas that are quarantined for the pine shoot beetle. The states affected are Connecticut, Illinois (northeast ½ of state), Indiana (north 2/3 of state), Iowa, Maine (western 1/4), Maryland (west ¼), Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey (north 1/3), New York, Ohio (north ¾ of state), Pennsylvania, Rhode Island, Wisconsin, West Virginia



As a result of this quarantine there are restrictions on nursery stock producers and Christmas tree growers.

Nursery Growers

- Pine nursery stock and other pine regulated articles produced in Iowa, and other PSB-quarantined areas can move freely among the quarantine areas, barring other state-required phytosanitary and plant pest regulations.
- Pine nursery stock (and other regulated articles) growers AND distributors wishing to ship regulated articles outside of Iowa must contact USDA, APHIS, PPQ, Des Moines, 515-285-7044, as soon as possible to make arrangements

for inspections, and possibly enactment of compliance agreements, to ensure that seamless shipping activities can occur this shipping season.

- Pine nursery stock and other regulated articles produced outside the quarantine area, moved into Iowa and then out to a non-quarantined final destination, are also subject to quarantined requirements, as if they had originated from a quarantined area.

Christmas Tree Growers

- Christmas trees, wreaths, garlands and other pine regulated articles produced in Iowa, and other PSB-quarantined areas can move freely among the quarantine areas, barring other state-required phytosanitary and plant pest regulations.
- Growers of Christmas trees and other regulated articles AND distributors wishing to ship regulated articles outside of Iowa must contact USDA, APHIS, PPQ, Des Moines, 515-285-7044, as soon as possible to make arrangements for inspections, and possibly enactment of compliance agreements, to ensure that seamless shipping activities can occur this shipping season.
- Christmas trees, wreaths, garlands and other pine regulated articles produced outside the quarantine area, moved into Iowa and then out to a non-quarantined final destination, are also subject to quarantined requirements, as if they had originated from a quarantined area.

For more information on the biology of PSB, a description of the insect, and symptoms on trees, review this website at: http://www.aphis.usda.gov/ppq/ispm/psb/

If you suspect that you have PSB, you may collect a sample and send it to USDA, APHIS, PPQ, 6000 Fleur Dr., Des Moines, IA 50321, or contact USDA-APHIS-PPQ at 515-285-7044. If you think that you will be shipping out of the quarantine area, contact USDA-APHIS-PPQ at 515-285-7044 to set up an appointment to have your facility inspected for PSB.

PSB has only been detected in Scott and Dubuque Counties, however the whole state is under federal quarantine, in response to the decision made by the State of Iowa Department of Agriculture that an intrastate quarantine will not be implemented. Without an intrastate quarantine, USDA must assume that PSB is spreading to other Iowa counties and thus place a quarantine on the entire state, which restricts the movement of all regulated articles such as Pine nursery stock, Pine Christmas trees, Wreaths and garlands, Pine logs/lumber (with bark attached) into non regulated areas.

Additional information on the pine shoot beetle, such as background information, biology, regulations, fact sheets, federal orders, quarantine maps, etc.

USDA's main website for Pine shoot beetle is:
http://www.aphis.usda.gov/ppq/ispm/psb/

Fact Sheet
http://www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/fs_phpsb.html
Federal Order for Iowa
http://www.aphis.usda.gov/ppq/ispm/psb/regs.html
Federal Regulations for PSB
http://www.aphis.usda.gov/ppq/ispm/psb/psbcfr06.txt
PSB Quarantine Map
http://www.aphis.usda.gov/ppq/maps/psbquarantine.pdf

Hickory Mortality

Dead and dying bitternut hickory in Carley State Park, Minnesota, August 2006.

Ecology & Distribution

Hickory decline, particularly of bitternut hickory and shagbark to a lesser extent, has recently been noted in Iowa, Missouri, Wisconsin, Minnesota, Ohio, Maryland, New York, Pennsylvania, West Virginia and Ontario (from various sources, including FHM data, state reports, and personal communication). Widespread mortality of hickory has historically been attributed to outbreaks of the hickory bark beetle (*Scolytus quadrispinosus*) during extended periods of drought. Hickory bark beetle is considered the most important pest of hickories. Past land use and soil fertility have been shown to indirectly determine outbreaks of the bark beetle. In 1994, a newly discovered fungus was reported in discolored wood and sunken bark cankers associated with beetle attacks. This fungus, *Ceratocystis smalleyii,* and a new sister species *(C. caryae*) were recently described by researchers at Iowa State University. Both species of *Ceratocystis* were pathogenic on 2-y-old hickories in greenhouse studies. The researchers suggested that *C. smalleyii* might play a significant role in hickory mortality. *Phomopsis* galls, *Armillaria* root rot and a flatheaded woodborer (*A. otiosus*) have also been associated with declining trees.

Stem of declining hickory, with sunken, tarry spotted bark on lower and opened canker on upper.

Hickories are an important component of many forest

associations in the eastern United States, particularly various oak-hickory cover types. Sites impacted by hickory decline and mortality have been reported to loose a high proportion of the hickory over a very short period of time (3 to 5 years), causing a significant adverse impact to wildlife, timber value and diversity on the sites.

Management and Control

Because hickory traditionally has not been a highly demanded timber species, very little attention has been given to assessment of hickory problems or development of management recommendations. Scientific information on the biology or appearance of pathogens on hickory is very limited. There is clearly a lack of information on basic diagnosis and management of hickory diseases.

Medium and Long Term Goals

The following activities are being considered by scientist with the Forest Service to help reach a better understanding of the cause and magnitude of the problems with hickory:

- Survey to determine the distribution and severity of damage.
- Field evaluations of affected ecosystems to determine the cause(s) of mortality, and the involvement of climatic, edaphic and cultural factors. It is important to determine whether the causes are consistent among affected sites.
- Determination and documentation of the role of *Ceratocystis sp.* and other pathogens in hickory mortality.
- Participate in development of management guidelines to assist land managers in reducing losses in their hickory resource.
- Develop publications and other communication tools to regarding hickory mortality.

INVASIVE PLANT SPECIES

Invasive species are plants that are non-native to an ecosystem and cause or are likely to cause economic or environmental harm to humans, crops, livestock or natural plant and animal communities. Some examples of non-native species found to be a problem in Iowa forests are buckthorn, garlic mustard, honeysuckle and multifora rose. These invasive and exotic plants are out competing native forest species, diminishing fisheries and wildlife habitat, reducing water quality, reducing economic returns from forest management and tourism, and threaten long term forest sustainability and bio-diversity.

A website facilitating the training and participation of volunteers, public educational and outreach efforts, for the entry and management of volunteer generated data for Iowa have been created. The website is www.nrem.iastate.edu/invasive_species.

The Forestry Bureau is committed to developing better awareness about invasive species and their presence on both public and private lands. The Bureau has an invasive species coordinator that is on the board of the Midwest Invasive Plant Network (MIPN). MIPN is a regional group consisting of natural resource professionals employed by public and private organizations that are monitoring for invasive plants in the Midwest. Visit the MIPN website at www.MIPN.org for more detailed information on prevention and management strategies for invasive plants.

Additional web resources for learning about invasive species are:

- Center for Invasive Plant Management- www.weedcenter.org > Invasive Plant Management on-line textbook
- National Invasive Species Information Center- www.invasivespeciesinfo.gov
- USDA-APHIS web site- www.invasive.org
- Forest Service web site: www.na.fs.fed.us/fhp/invasive_plants/links/index.shtm
- Natural Resource Conservation Service web site: http://plants.usda.gov
- Woodland invasive species in Iowa brochure produced by Iowa State University- https://www.extension.iastate.edu/store/ItemDetail.aspx?ProductID=6497&SeriesCode=&CategoryID=&Keyword=invasive%20species

The DNR Forestry Bureau is also conducting some prescribed burns to see how the effects of fire can be used to promote native vegetation and set back invasive species. Controlled burns at Backbone State Park to set back garlic mustard began in the Spring of 2005. Monitoring and burning will continue into 2006 with the addition of burning honeysuckle at Lake Ahquabi State Park.

CONCLUSION

Iowa forests are generally healthy, and providing abundant forest products and amenities, including outdoor recreation opportunities, wildlife habitat, clean water, and the economic benefits of a vast array of wood and wood fiber products.

Iowa forests also have a variety of stressors, most of which are naturally occurring and always present. These stressors take a toll on Iowa forests however; native stressors are generally less than epidemic now.

The Bureau of Forestry, through cooperation with other agencies has programs in place to counter forest stressors which have potential to move into Iowa and damage our forests. Those programs operated vigorously during 2006, and plans are in place for similar, continued vigorous forest health program operations in 2007.

I would not be able to produce all of this information without the help of my colleagues from USDA-APHIS-PPQ, Iowa State University, Iowa Department of Agriculture and Land Stewardship, and Department of Natural Resources Foresters. **Thanks!**

Appendix A

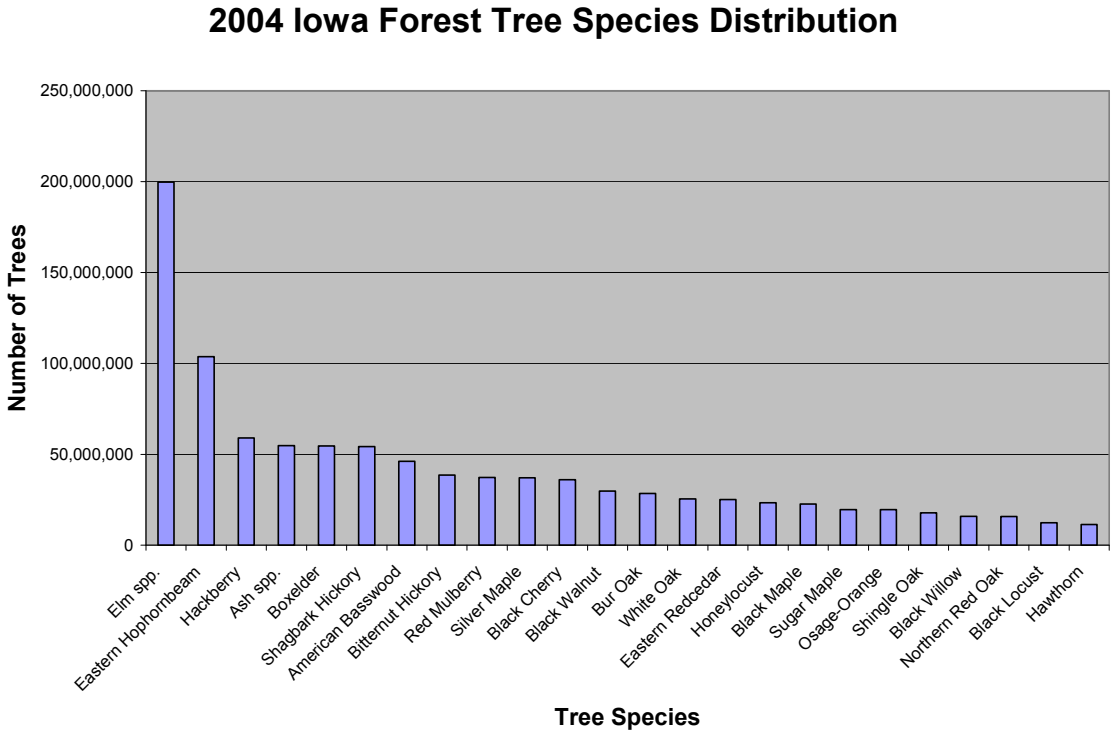


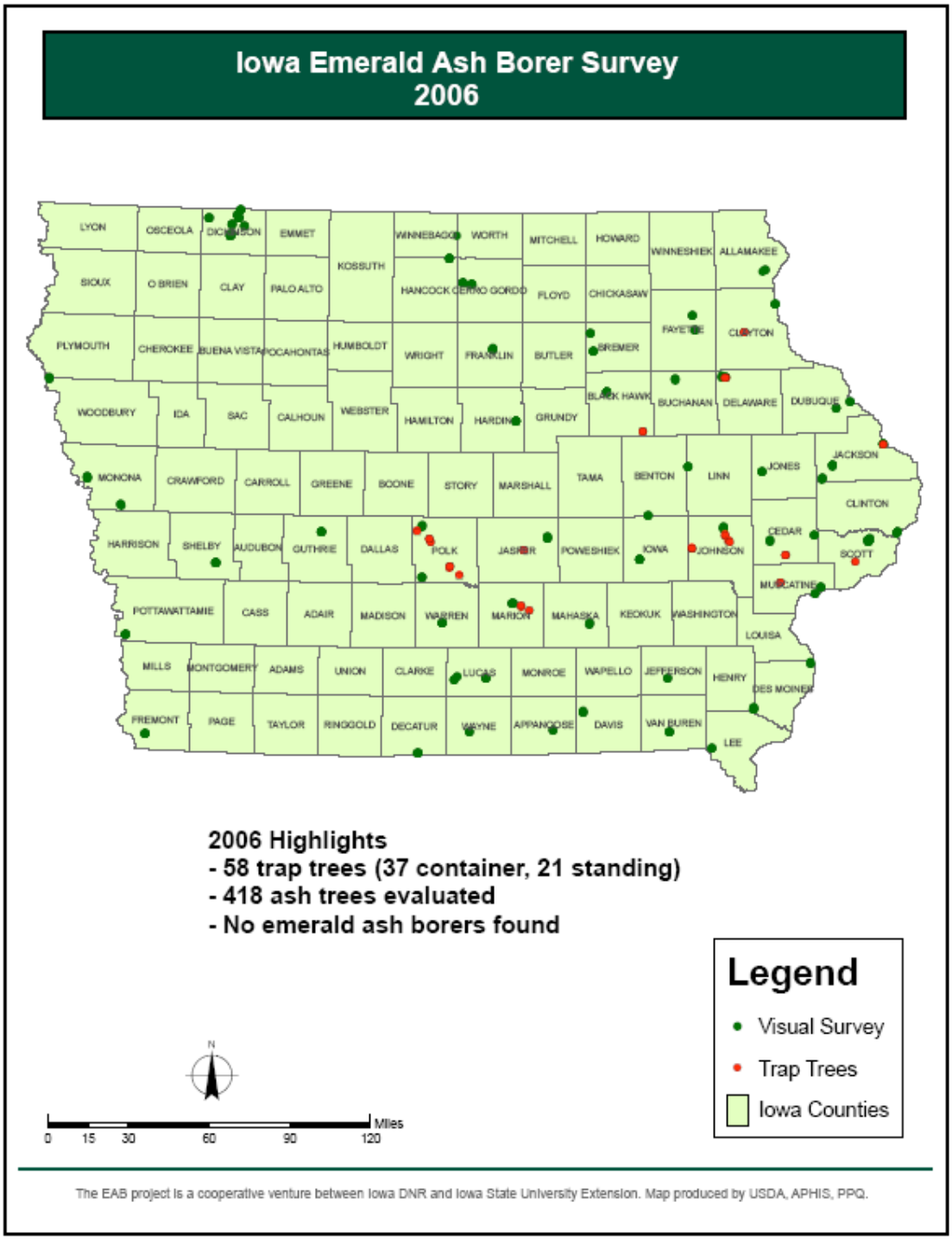
Table 1. Iowa Tree Species Rankings based on the latest Forest Inventory Data (2004)

Species	Number of Trees (2004 FIA Data)	Percentage of Iowa Forest	Ranking
Elm spp.	**199,747,471**	**18.89%**	**1**
Eastern Hophornbeam	103,743,161	9.81%	2
Hackberry	58,996,951	5.58%	3
Ash spp.	**54,706,294**	**5.17%**	**4**
Boxelder	54,655,443	5.17%	5
Shagbark Hickory	54,319,344	5.14%	6
American Basswood	46,164,722	4.37%	7
Bitternut Hickory	38,623,737	3.65%	8
Red Mulberry	37,249,868	3.52%	9
Silver Maple	37,019,842	3.50%	10
Black Cherry	35,999,712	3.40%	11
Black Walnut	**29,857,408**	**2.82%**	**12**
Bur Oak	**28,480,142**	**2.69%**	**13**
White Oak	**25,511,598**	**2.41%**	**14**
Eastern Redcedar	25,137,081	2.38%	15
Honeylocust	23,365,211	2.21%	16
Black Maple	22,661,001	2.14%	17
Sugar Maple	19,554,637	1.85%	18

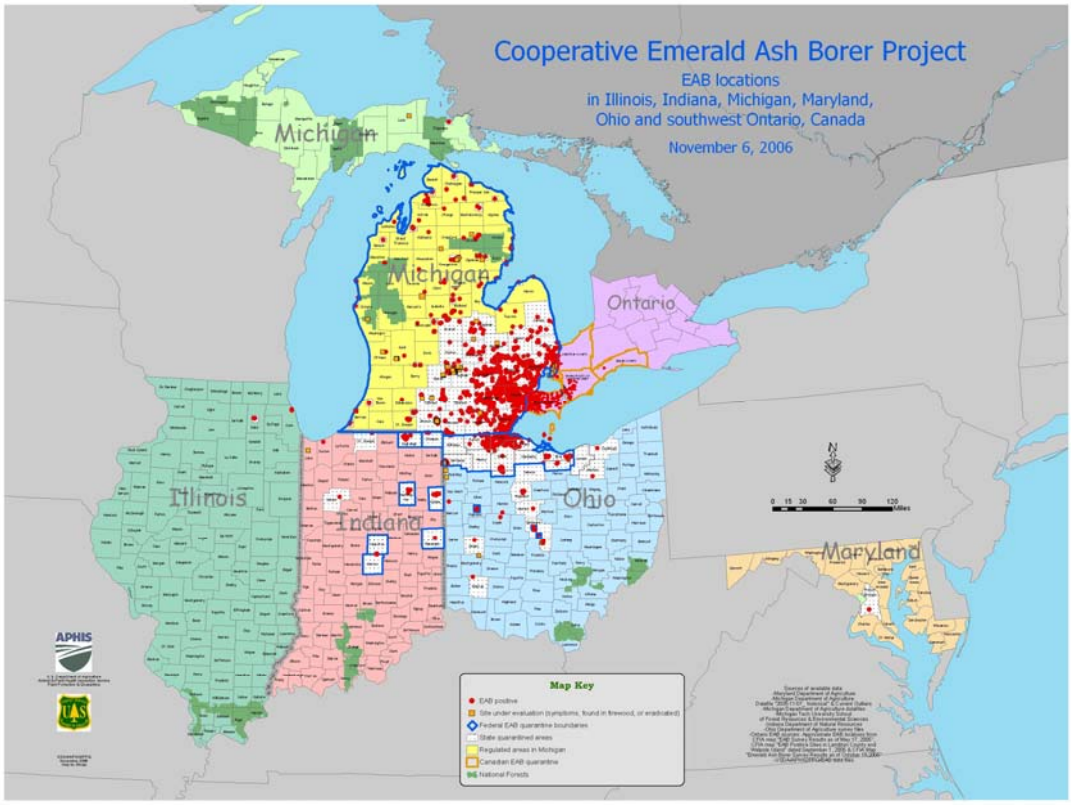
Species	Number of Trees (2004 FIA Data)	Percentage of Iowa Forest	Ranking
Osage-Orange	19,528,146	1.85%	19
Shingle Oak	17,752,870	1.68%	20
Black Willow	15,883,846	1.50%	21
Northern Red Oak	**15,783,993**	**1.49%**	**22**
Black Locust	12,297,145	1.16%	23
Hawthorn	11,309,127	1.07%	24
Ohio Buckeye	9,715,390	0.92%	25
Black Oak	8,797,517	0.83%	26
American Hornbeam	8,334,839	0.79%	27
Eastern Cottonwood	6,605,534	0.62%	28
Wild Plum	4,580,744	0.43%	29
Serviceberry	4,206,750	0.40%	30
Chokecherry	3,829,897	0.36%	31
Mockernut Hickory	3,224,924	0.30%	32
Eastern Redbud	3,010,887	0.28%	33
Northern Pin Oak	2,364,110	0.22%	34
Paper Birch	1,778,303	0.17%	35
Quaking Aspen	1,632,166	0.15%	36
River Birch	1,525,479	0.14%	37
Chinkapin Oak	1,277,804	0.12%	38
Cockspur Hawthorn	1,171,278	0.11%	39
Bigtooth Aspen	1,017,758	0.10%	40
Butternut	758,918	0.07%	41
Sycamore	740,297	0.07%	42
Pin Oak	703,473	0.07%	43
Northern Catalpa	605,246	0.06%	44
Red Maple	494,002	0.05%	45
Common Persimmon	449,359	0.04%	46
Swamp White Oak	391,358	0.04%	47
Ponderosa Pine	288,071	0.03%	48
Willow	219,304	0.02%	49
Pignut Hickory	206,959	0.02%	50
White Willow	177,328	0.02%	51
Russian Olive	156,582	0.01%	52
Apple spp.	148,122	0.01%	53
Post Oak	125,860	0.01%	54
Tamarack	102,055	0.01%	55
Red Pine	87,249	0.01%	56
White Mulberry	74,246	0.01%	57
Larch (Introduced)	74,122	0.01%	58
Ailanthus	40,767	0.00%	59
Downy Hawthorn	39,146	0.00%	60
Peach Leaf Willow	32,225	0.00%	61
Scotch Pine	32,225	0.00%	62
	1,057,369,044		

Appendix B

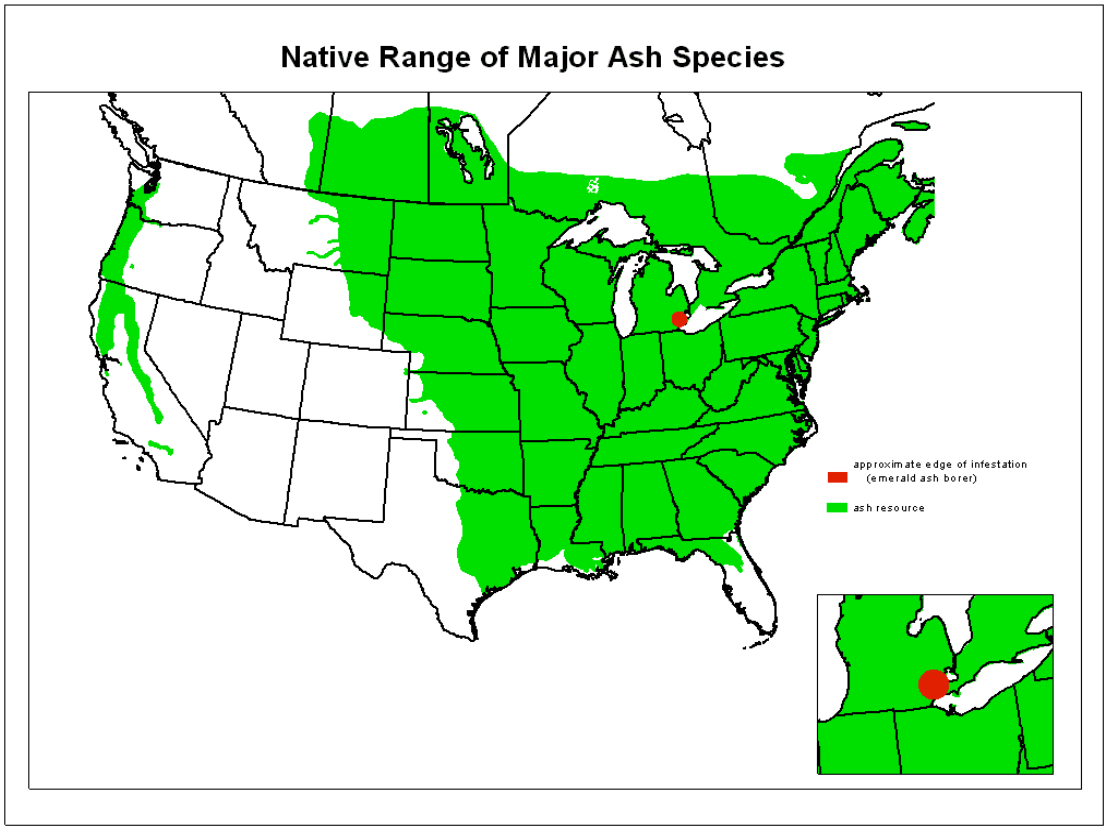
Map 1. Iowa Emerald Ash Borer Visual Survey Locations and Sentinel Tree Placement for 2006.



Map 2. Current known Emerald Ash Borer sites as of November 6, 2006 in North America.

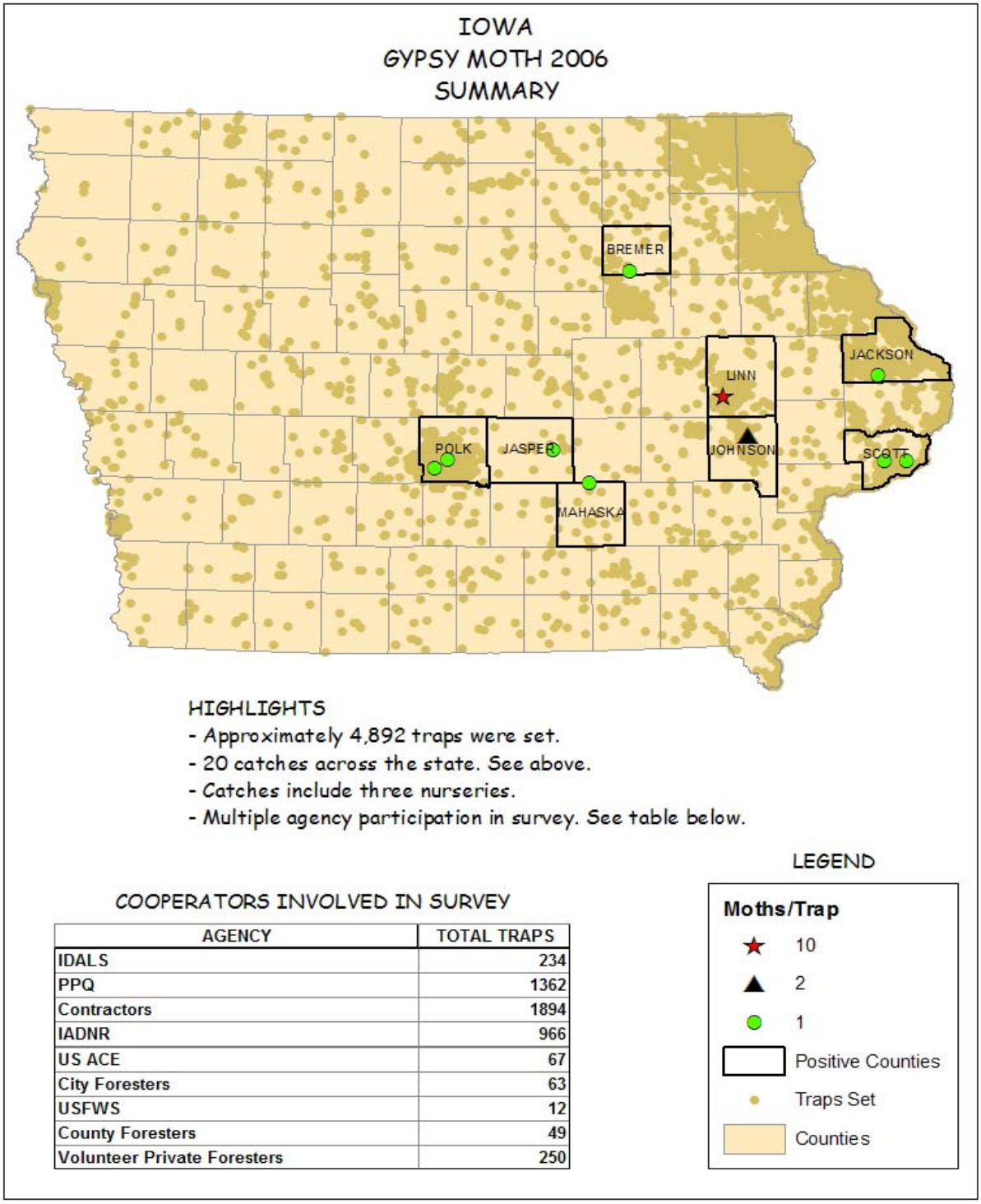


Map 3. Distribution of Ash in the United States is highlighted in Green.



Appendix C

Map 1. Gypsy Moth Summary Map Showing Trap Distribution Patterns and Where Male Moths were Caught in Iowa.



COOPERATORS INVOLVED IN SURVEY

AGENCY	TOTAL TRAPS
IDALS	234
PPQ	1362
Contractors	1894
IADNR	966
US ACE	67
City Foresters	63
USFWS	12
County Foresters	49
Volunteer Private Foresters	250

Table 1: History of the Number of Gypsy Moth Catches and the Number of Acres Treated for gypsy moth eradication in Iowa (1972-2006). Unless specified, *Bacillus thuringiensis* var. *kurstak*i was the treatment method.

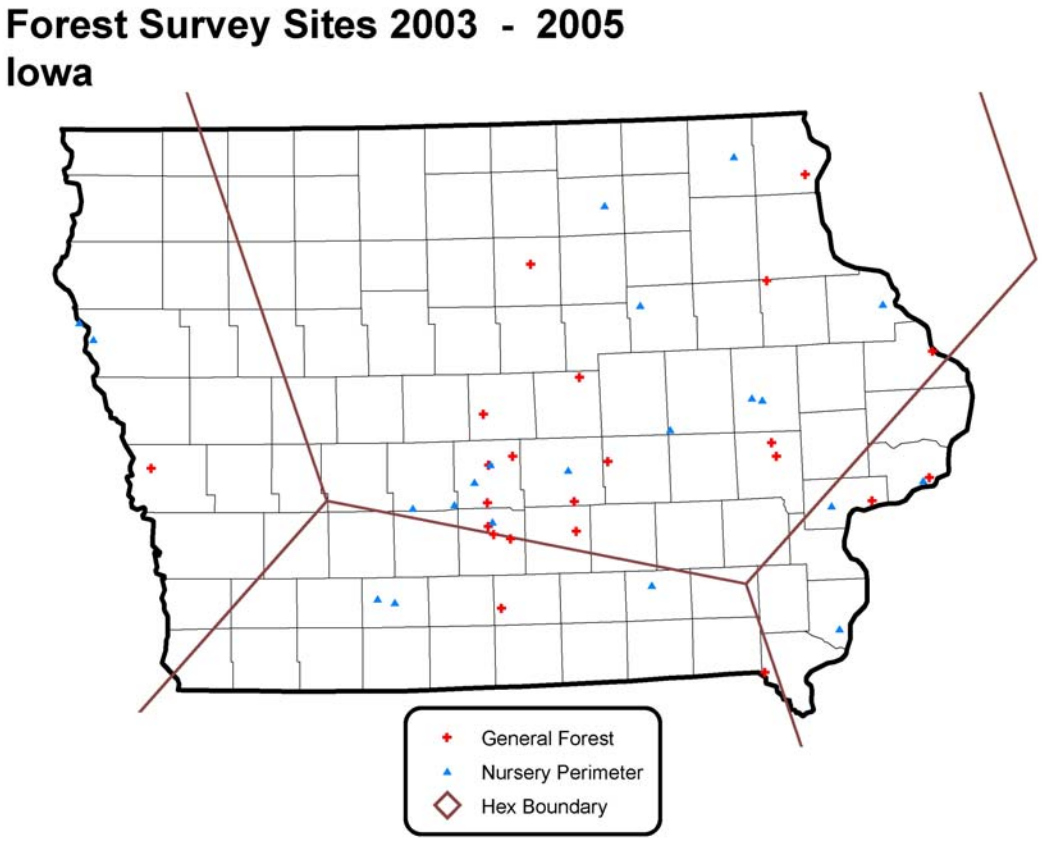
Year	Number of Traps used in Survey	Number of Multiple Catches	Total Number of Moths Caught	Number of Acres Treated
1972	253		1	
1973	1196		0	
1974	1210		1	
1975	1120		0	
1976	1650		0	
1977	1130		0	
1978	741		1	
1979	854		0	
1980	676		1	
1981	970		6	
1982	1123		11	
1983	1617		14	
1984	3585		10	
1985	2538		6	
1986	3217		15	
1987	3084		18	
1988	2259		13	
1989	2858		27	9
1990	2760		17	0
1991	2775		61	0
1992	4738		162	21
1993	4800		72	73.5
1994	5797		143	90
1995	6324		76	52
1996	5241		104	25
1997	5899		151	10
1998	7093		371	21.3
1999	7532		135	224 (pheromone flakes)
2000	6834		47	42
2001	5729		26	15
2002	5729		35	2
2003	3068		159	3 (carbaryl)
2004	4374		27	26
2005	4996		4	0
2006	4891		20	0

Appendix D

Table 1: Sites visited for 2006 National *Phytophthora ramorum* Forest Survey in Iowa with host type within ¼ mile of nursery.

Nursery	City	Nursery
Sherman Nursery	Charles City	Yes
Miller Nursery	Johnston	Yes
Struthers Nursery	Ankeny	Yes
Mosher Nursery	Sioux City	Yes
Southdale Nursery	Sargeant Bluff	Yes
Bob Lenc Nursery	Des Moines	Yes
Heard Nursery	West Des Moines	Yes
Mc Hose City Park	Boone	No
Walmart	Ottumwa	Yes
Shimek State Forest	Farmington	No
Springbrook State Park	Guthrie Center	No
TNT Nursery	Ankeny	Yes
Lowes & Walmart	Hiawatha	Yes
Belle Plaine Nursery	Belle Plaine	Yes
Fleming Nursery	Cedar Rapids	Yes
Lake Wapello State Park	Drakesville	No
Rock Creek State Park	Pella	No
Red Haw State Park	Chariton	No
Lake Keomaha State Park	Oskaloosa	No
Timber Pine Nursery	Redfield	Yes
Loess Hills State Forest	Pisgah	No
Tractor Supply	Creston	Yes
Stephens State Forest	Chariton	No
Brietenbach Nursery	Dubuque	Yes
Backbone State Forest	Strawberry Point	No
Home Depot	Dubuque	Yes
Yellow River State Forest	Harpers Ferry	No
Lake Ahquabi State Park	Indianola	No

Map 1. Summary of Sites Surveyed for SOD in 2003-2005 for Iowa.



For more information, contact:

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