

# Federal Forest Health Highlights for 2009

Minnesota Department of Natural Resources,  
Forestry – Forest Health Unit

Topics:

Aerial Detection Survey Results

Spruce budworm  
Jack pine budworm  
Larch beetle  
Larch casebearer  
Bark beetles of pine

Aspen decline  
Forest tent caterpillar  
Large aspen tortrix  
Ash decline  
Two-lined chestnut borer

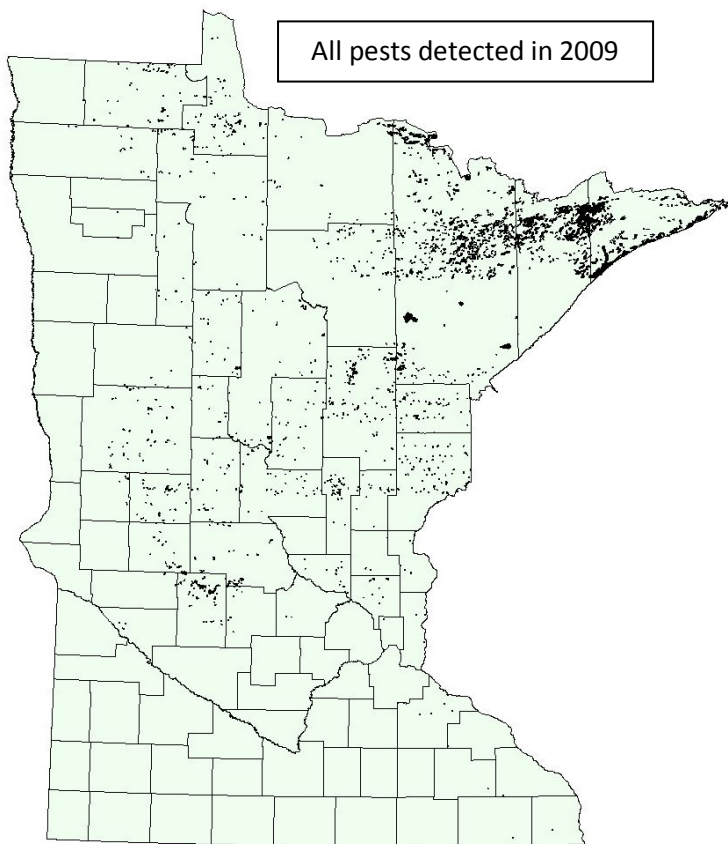
Ice storm damage

Gypsy moth (from MN Dept. of Agriculture)  
Emerald ash borer

## Aerial Survey Results

Since the early 1950's, aerial survey has been a valuable tool for monitoring the activities of forest insects and pathogens across the 16 million acres of forest land in Minnesota. For the past fourteen years, these surveys have been accomplished through the collaboration of DNR Forest Health and Resource Assessment Units and USFS, State and Private Forestry. The Forest Health staff plans the scope, timing and intensity of the surveys, trains Resource Assessment staff, provides ground-truthing, analysis and dissemination of survey data. Resource Assessment staff conducts the aerial sketch-mapping, digitizes the data and produces digital shape files. In addition to being used in Minnesota, the survey results are incorporated into the USFS's national database since our procedures and products comply with national standards.

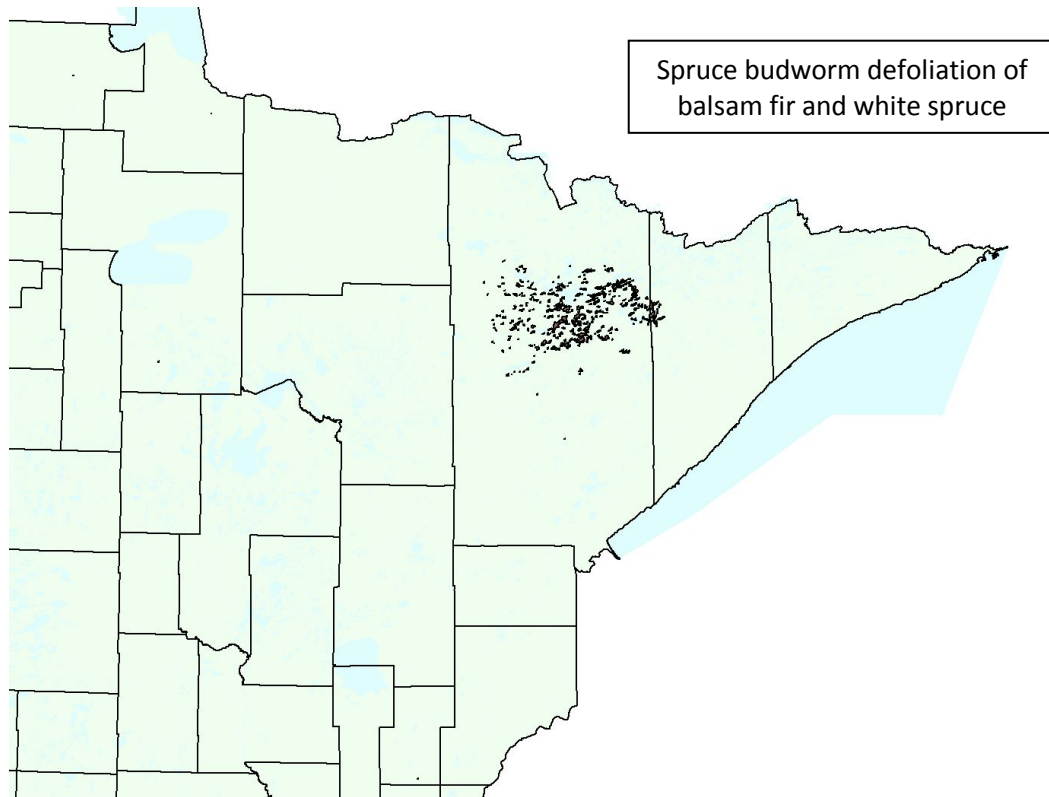
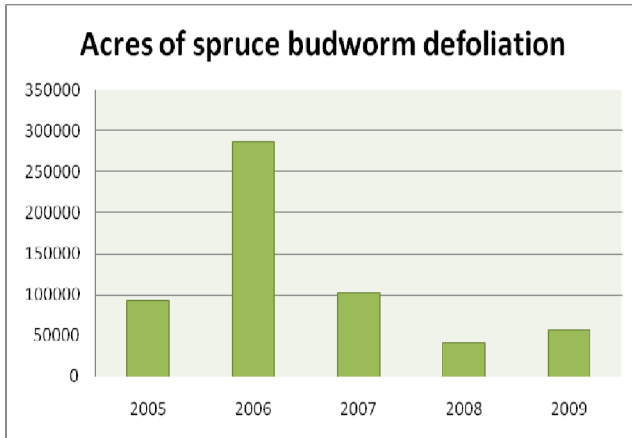
Thanks to Mike Hoppus, Pat Churak and Larry Hoyt, Resource Assessment's sketch-mappers, who accomplished this year's aerial survey. Thanks also to Marc Roberts, USFS-S&PF, for mapping the federal lands and post-flight map rectification, and for providing training in aerial detection.



Causal Agent	Number of Polygons	Acres
Ash Decline	520	21939
Aspen Decline	901	298974
Decline, Other Species	6	224
Bark Beetle	218	3658
Cattle	3	45
Dutch Elm Disease	723	568
Flooding	11	94
Forest Tent Caterpillar	369	30279
Larch Beetle	1882	19022
Larch Casebearer	139	25654
Large Aspen Tortrix	23	5790
Oak Wilt	2006	2597
Porcupine	1	1
Snow/Ice	3	363
Spruce Budworm	364	56861
Two-Lined Chestnut Borer	182	4970
Unknown	135	4896
Wildfire	4	65
Wind Damage	2	12
Winter Injury	21	24
<b>Totals</b>	<b>7494</b>	<b>475,991</b>

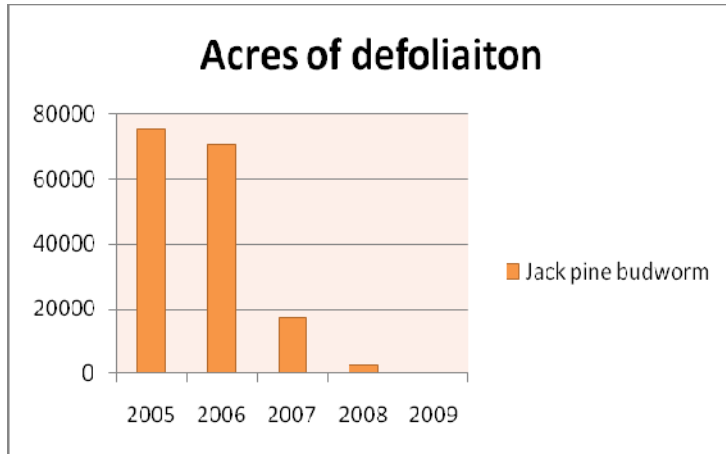
## Spruce budworm

Since 1954, when annual aerial sketch-mapping began in Minnesota, spruce budworm populations have caused defoliation of balsam firs and white spruces every single year. This year, 56,860 acres of defoliation were observed in 364 stands, primarily in the northeastern counties. In outbreak areas, budworm populations cause prolonged defoliation, sometimes for as long as ten years. Widespread fir and spruce mortality results, but, surprisingly, the host species are not locally eradicated. Instead, host trees are maintained at low densities as these mixed-wood stands mature. Surviving trees serve as seed trees.



## Jack pine budworm

One of the bright spots of the summer was the realization that the jack pine budworm population had collapsed. Egg mass surveys last fall had predicted the collapse of the outbreak and no defoliation was observed this year.



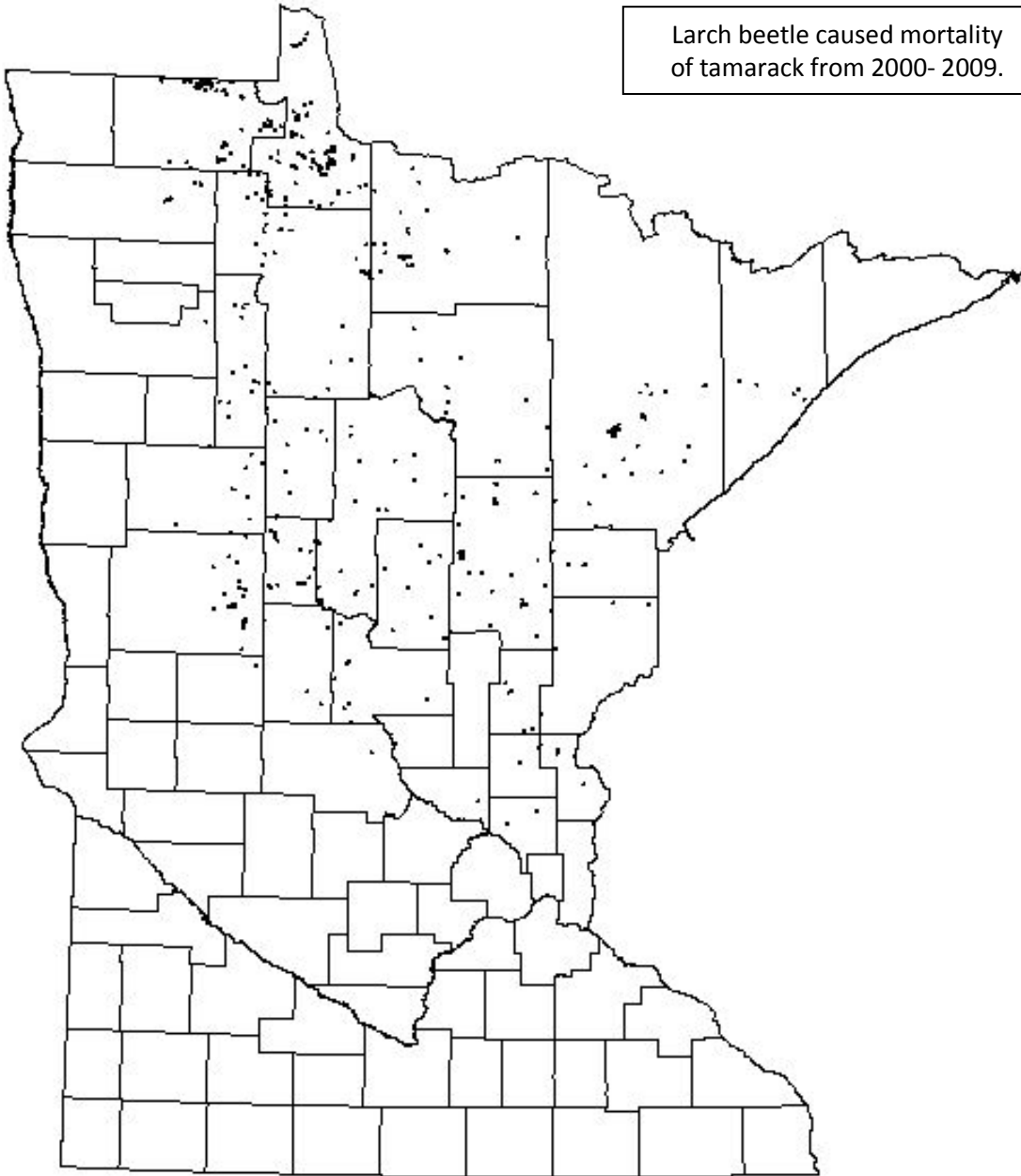
## Larch beetle

An outbreak of larch beetle has been brewing for the past nine years. Significant levels of mortality have occurred on 92,600 acres of tamarack in Minnesota. This year, 19,000 acres of mortality were mapped. No consistent stress factor contributing to the current mortality has been found, however, the droughts and fluctuating water tables in 2002 - 2003 and 2006 - 2009 have undoubtedly been involved. Damage levels vary from scattered individual trees killed by the beetles to 80% of trees in stands being killed.

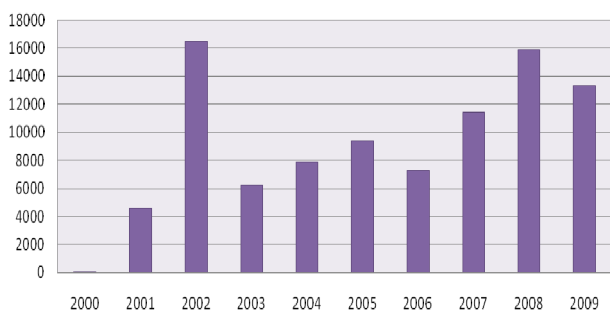
Because eastern larch beetles are currently so abundant and so widespread, attempts to control the beetles through management are unlikely to be successful in most situations. Salvage logging of stands with a lot of mortality is recommended to utilize the wood. Leaving 10 to 12 live tamarack per acre as seed trees on harvest areas is still recommended. These trees may be quickly attacked and killed by the beetle but hopefully some of them will produce seeds before they are killed. Leaving the seed trees is unlikely to cause any increased problems with larch beetle.



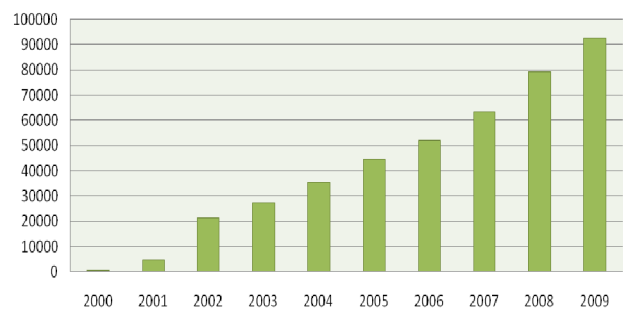
Larch beetle caused mortality of tamarack from 2000- 2009.



**New acres of tamarack mortality caused by larch beetle from 2000 to 2009.**



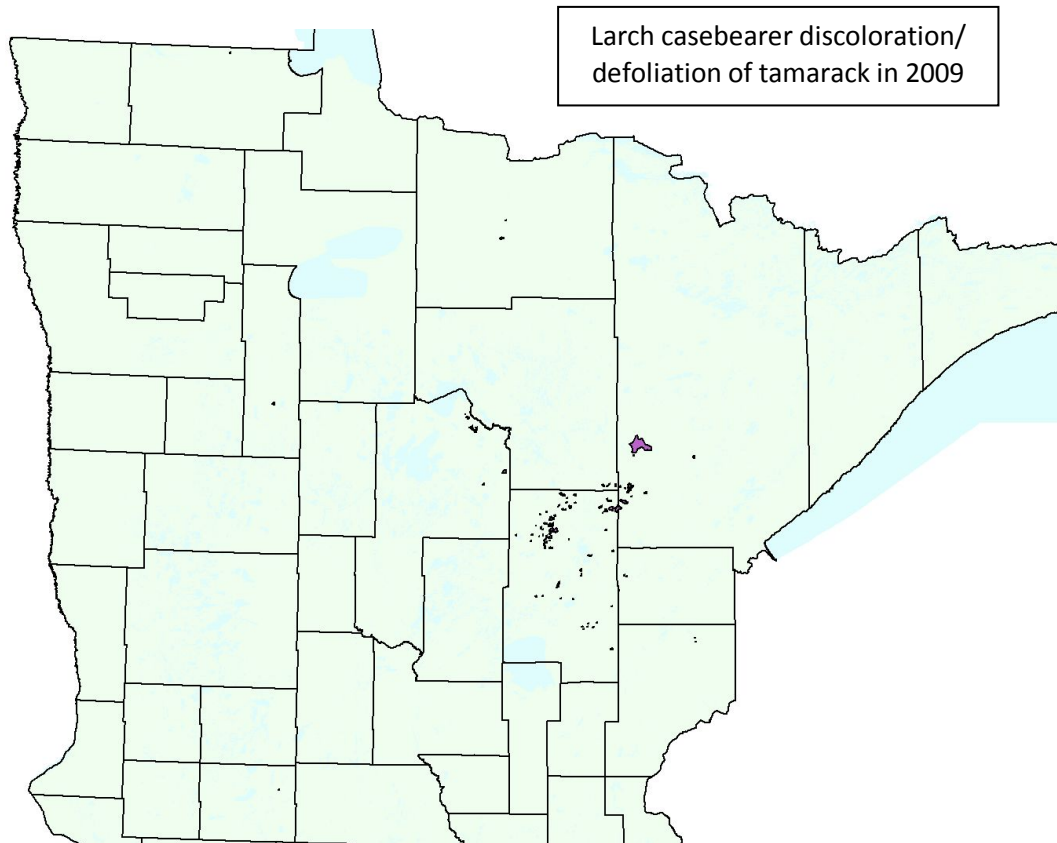
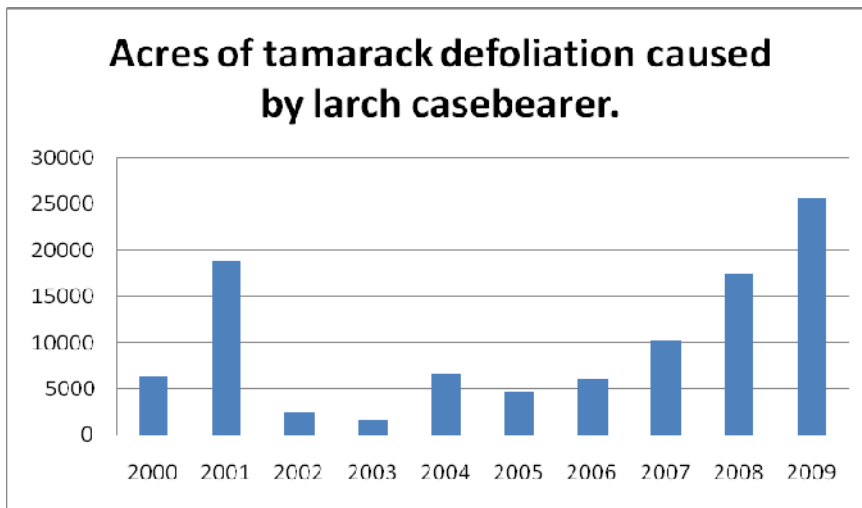
**Cumulative acres of tamarack mortality caused by larch beetle.**





## Larch casebearer

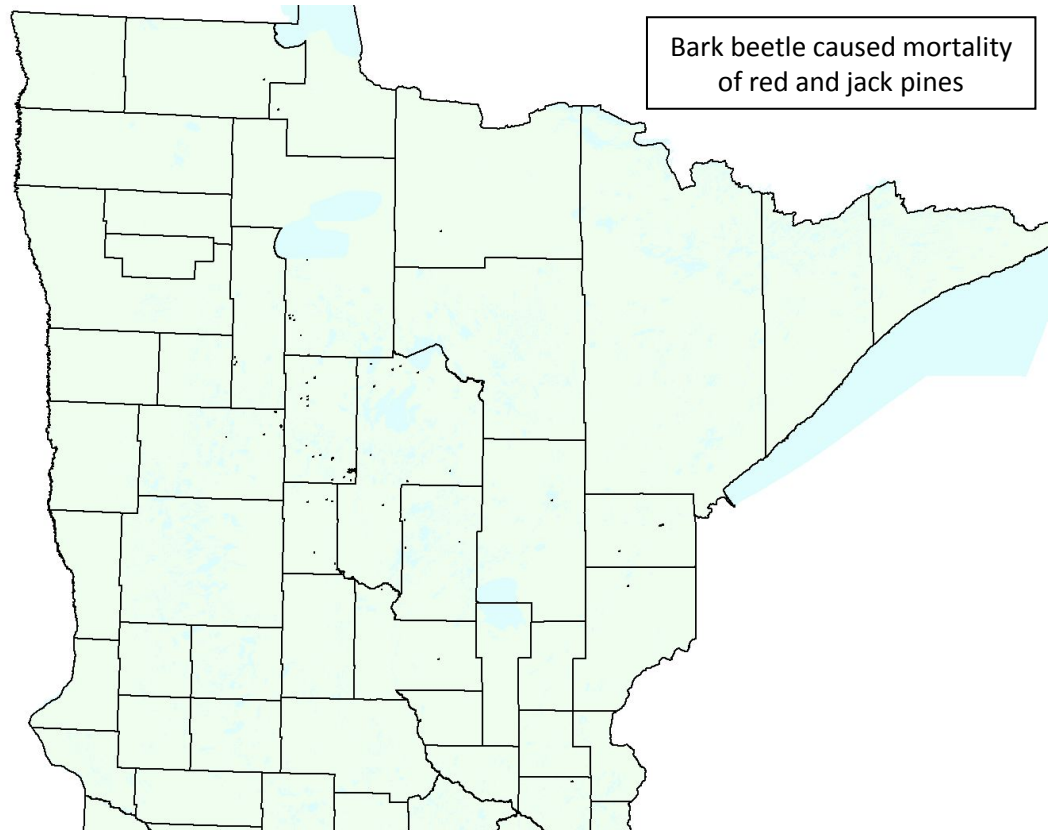
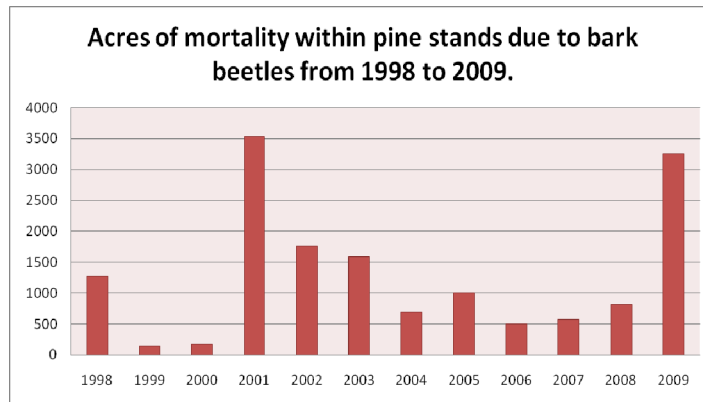
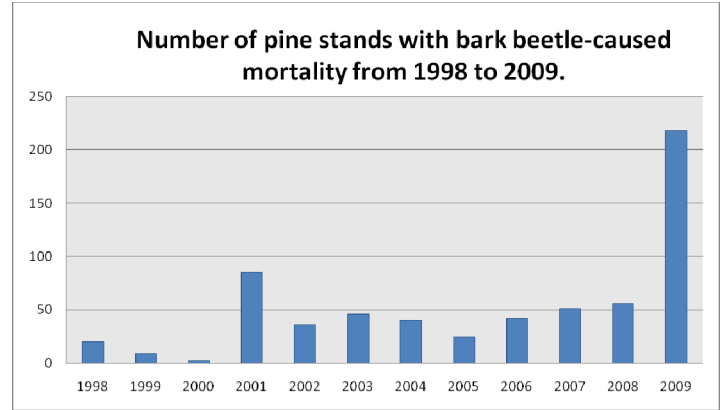
A naturalized exotic insect, the larch casebearer mines the needles of tamarack which causes them to dry out and turn a rusty- orange color by mid-summer. Unlike other states, we find that larch casebearer defoliation does not predispose trees to larch beetle attack. Larch casebearer attack has not been found to result in direct tamarack mortality in Minnesota, so far. The number of acres with discoloration/ defoliation has steadily increased since 2005 after peaking in 2001.



## Bark beetles of pine

The serious and prolonged drought from the summer of 2006 to the fall of 2009 created stress conditions favorable for bark beetle build-up and damage. For the previous eleven years, bark beetles have averaged 1,093 acres of mortality per year and this year, mortality occurred on 3,657 acres. Similarly, bark beetles have infested an average of 43 stands per year, and this year, mortality was mapped in 218 stands. See graphs.

Due to the timing of aerial survey, not all bark beetle infestations are mapped, especially small or incipient infestations. These are detected and informally reported by field foresters and are not tallied here.





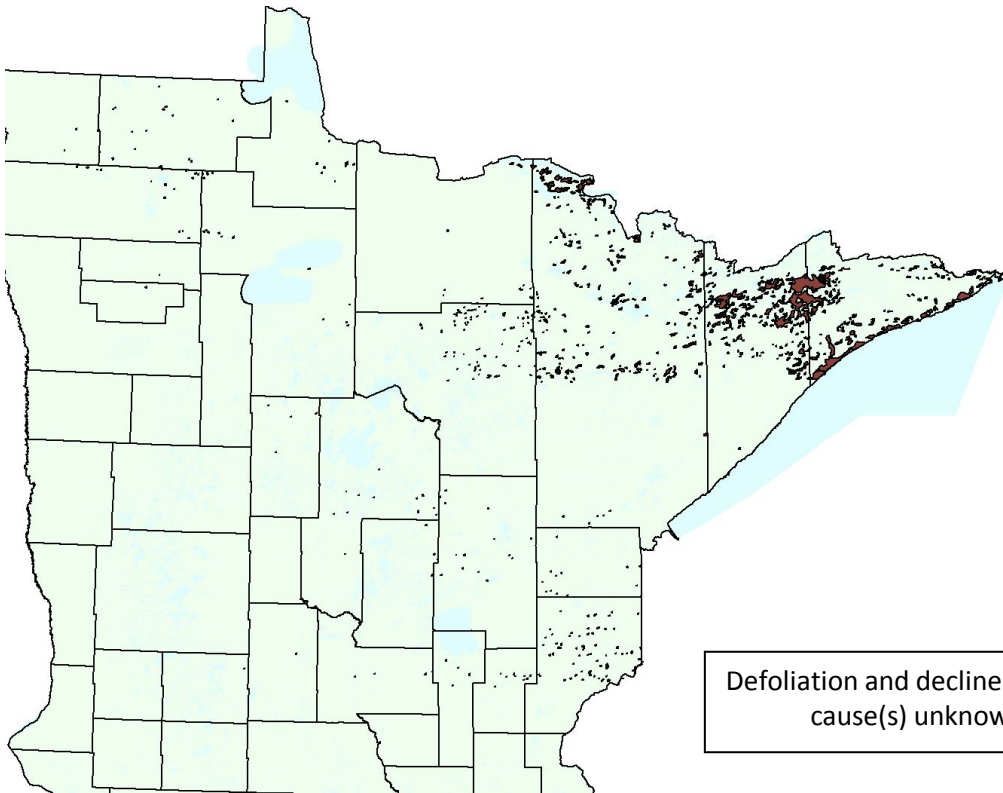
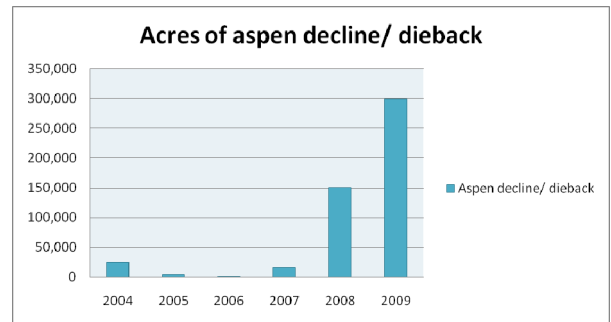
## Aspen decline

For the past several years, aerial survey crews have detected thousands of acres of defoliation, discoloration, dieback and mortality of aspen. Again this year, defoliation and dieback were mapped. See table, chart and map below.

Dieback is the most common symptom but tree mortality has also occurred. Mortality can vary from scattered trees throughout a stand to patches of 30 to 40 dead trees scattered through stands. Trees with dieback also exhibited small off color (yellowish) foliage in the live parts of the crown. In 2008, serpentine galleries were abundant under the bark on dead trees as well as on trees with extensive crown dieback. *Agrilus*-like larvae were common in serpentine galleries in recently dead trees and in trees with extensive dieback. Poplar borer, *Saperda calcarata*, populations appear to have increased in some locations but are much less common than the *Agrilus*. So far *Armillaria* has not been found in the root collar area of examined trees.

Most of the dieback was mapped in the northern tier of counties, especially in St Louis, Lake and Cook Counties. Severe droughts occurred in these counties in 2002 and 2003, and from 2006 through 2009. Much of the aspen in these areas also experienced two to three years of heavy forest tent caterpillar defoliation in 2001-2003. It is likely the dead and dying aspen were stressed trees being attacked by secondary pests. There is also a concentration of aspen dieback in Pine County which, of course, didn't experience severe FTC defoliation.

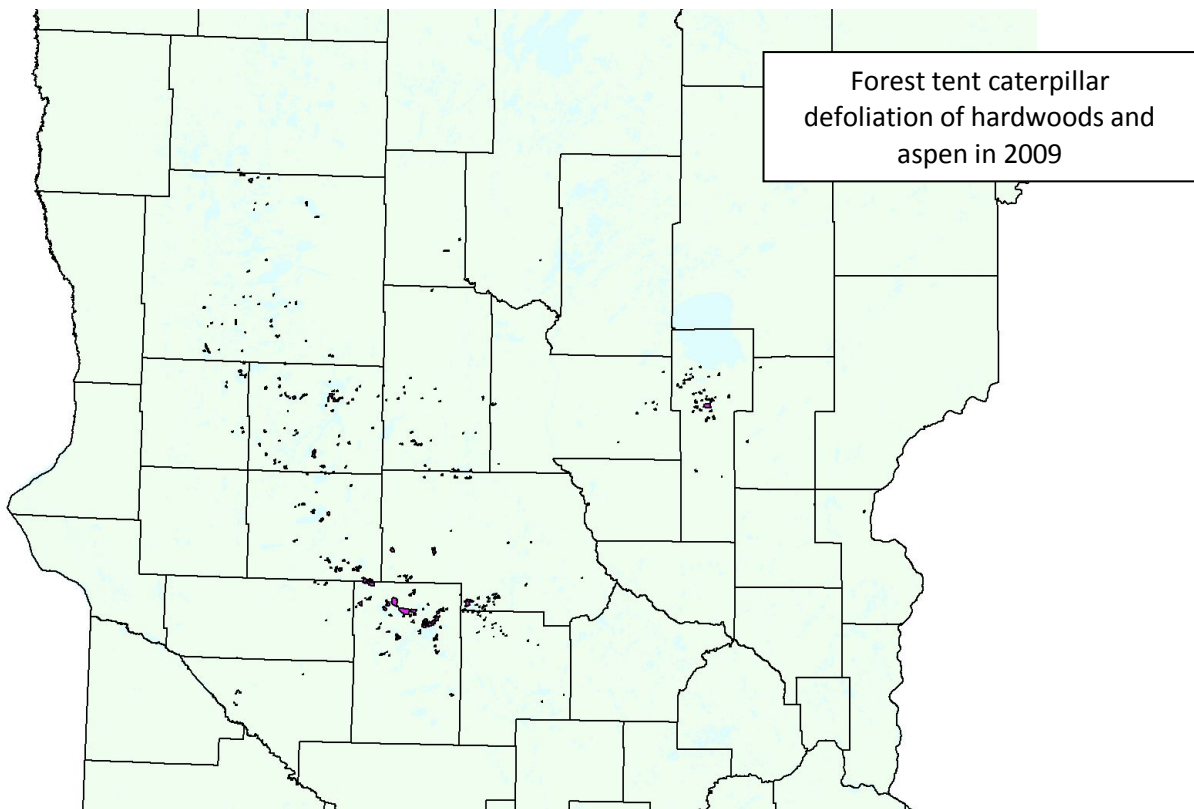
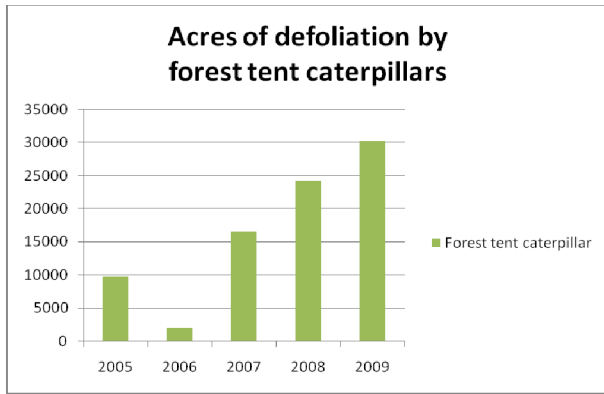
Acres of aspen damage by symptom, causal agent(s) unknown. 2004 to 2009				
	Defoliation	Mortality	Discoloration	Dieback
2004	14,570	27730	0	24,356
2005	407,606	658	423	4,381
2006	2,217	635	0	1,309
2007	73,284	613	0	16,666
2008	5,598	85	570	151,022
2009	5789	0	0	299,089



Defoliation and decline of aspen, cause(s) unknown.

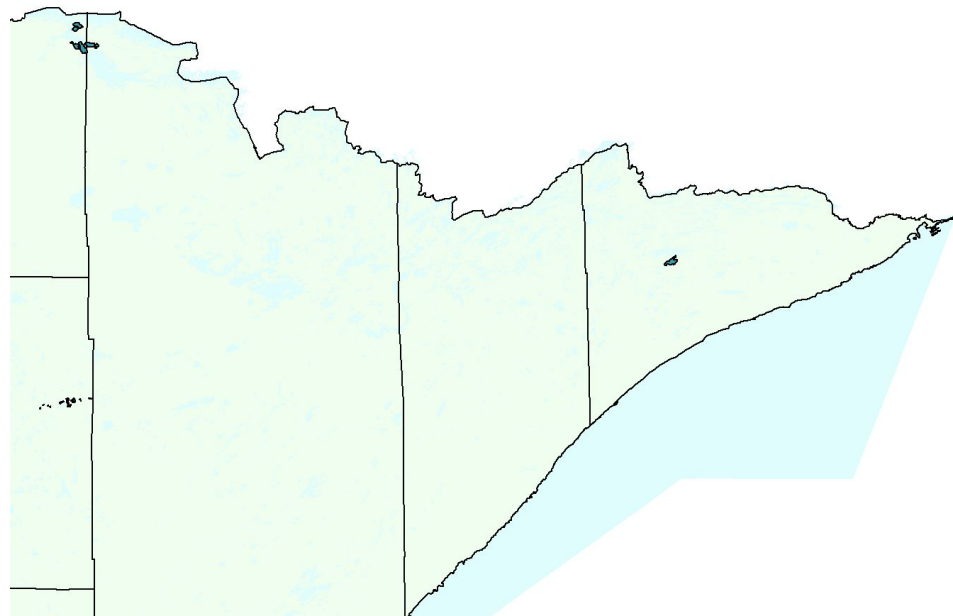
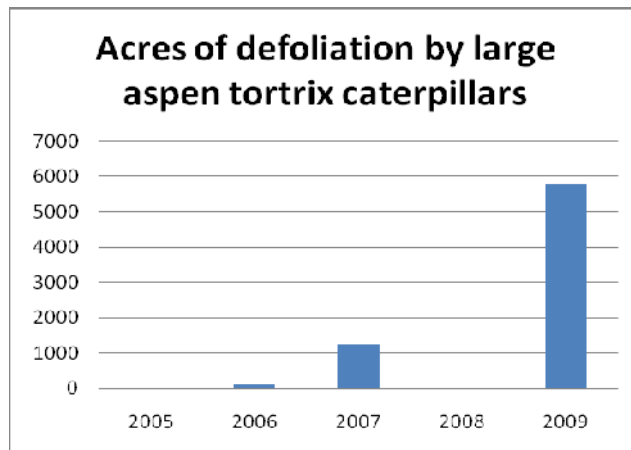
## Forest tent caterpillar

FTC populations are building in central Minnesota. The number of acres defoliated is climbing steadily with increases being found in the central counties. The number of additional sightings of individual caterpillars and small pockets of trace defoliation from the northern counties is also increasing. Taken together, these observations usually portend a north-wide outbreak in the near future.



## Large aspen tortrix

With all the aspen dieback and decline occurring in the northeastern counties, it's a testimony to excellent sketch-mapping skills when pockets of large aspen tortrix defoliation are found. The acreage numbers indicate an increasing trend, but were only found in three main locations this year.

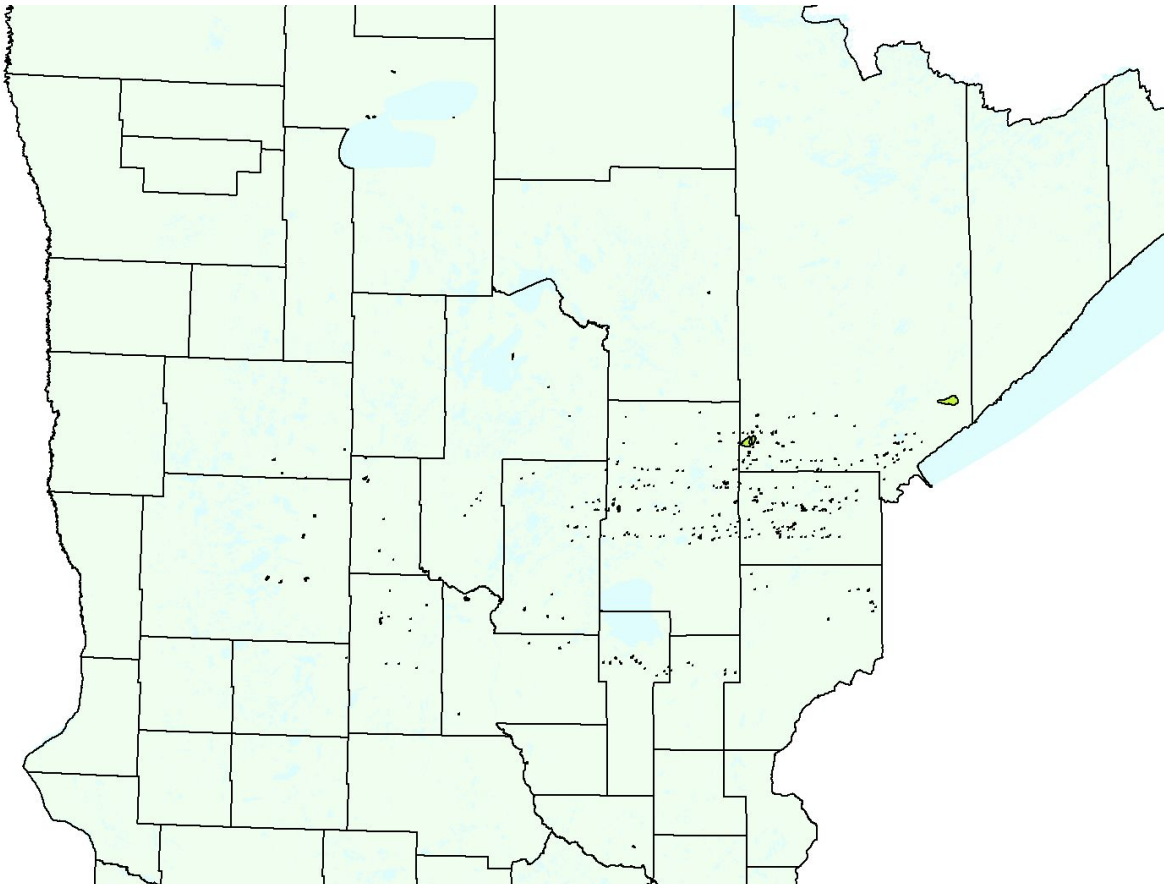
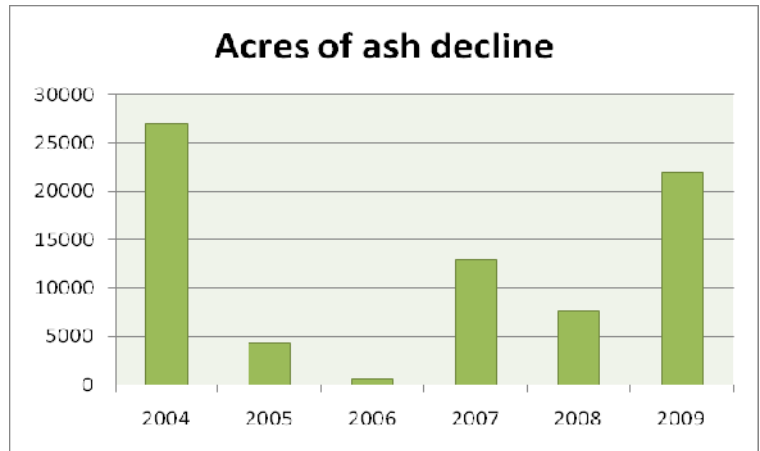


Large aspen tortrix defoliation

## Ash decline

Fluctuating water tables during the last few years is thought to be playing the major role in ash decline in Wet Forest Native Plant Communities. There are a number of other factors involved with some variation from site to site. Ash decline was observed on 21,940 acres, a three-fold increase compared to last year's acreage. The incidence of ash decline has been elevated since 2004.

The Aitkin and Duluth quads appear to have an abundance of decline polygons. This is because these quads were flown on 3-mile flight lines instead of the usual 6-mile lines and with two observers instead of the usual one observer. Additionally, all ash decline was mapped, not just new occurrences of ash decline. Without this special survey in the two quads, the statewide acreage (on the normal 6 mile flight lines) for ash decline would have been 15,473 acres.



Dieback and decline of ash in 2009

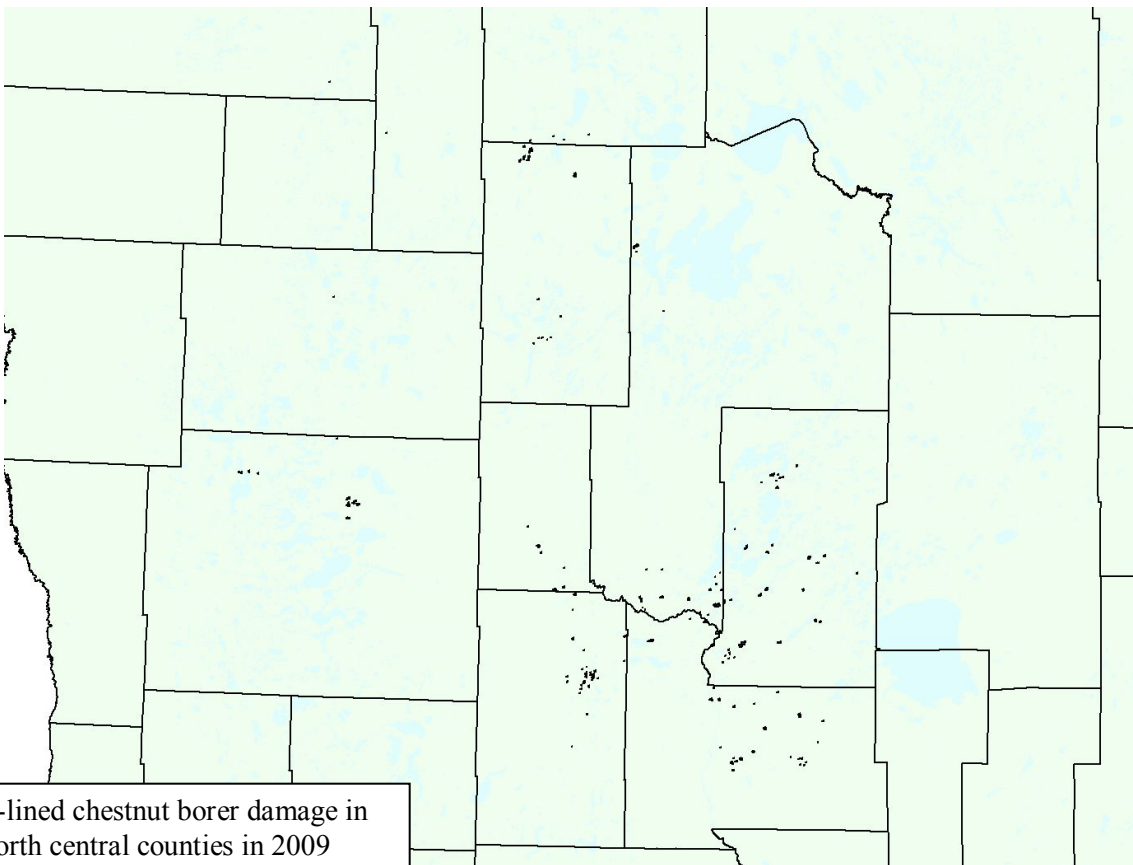
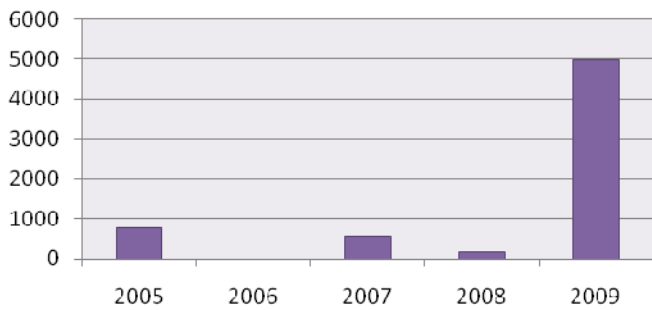


## Two-lined chestnut borer

Since aerial survey is flown in early to mid-summer, topkill and mortality due to two-lined chestnut borers (TLCB) is not detected by sketch-mapping until the following year. Widespread damage was noted during ground surveys last year and this year's aerial sketch mapping bore out those observations. In 2009, 4970 acres of oak forest had tree mortality. This outbreak is associated with four consecutive summers of severe drought and, in the vicinity of Brainerd, with three years of defoliation by linden loopers and fall cankerworms.



**Acres of oak mortality caused by two-lined chestnut borers**

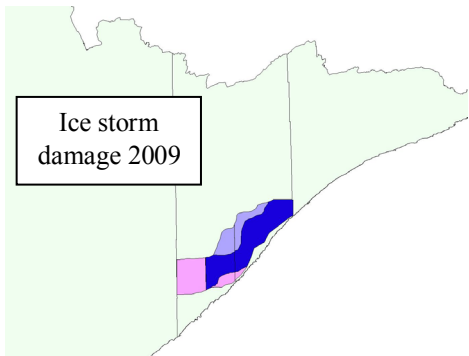




## Ice storm damage

On March 16, 2009, Lake and Cook Counties suffered an ice storm that became a federally-listed disaster. The worst damage was in Lake County but did extend up to the Hovland area in Cook County. Damage in Cook County was spotty. All stands in the ice storm area received some damage but much of it was to trees scattered throughout the stands. State-administered lands did not receive enough damage to warrant salvage timber sales and most of the damage and cleanup was limited to roads, structures and other facilities.

The worst ice damage was on Lake County Forestry lands, primarily in the 15-to-35 year old aspen cover types. Aspen trees under 25 years of age tended to bend while aspen trees over 25 years tended to suffer crown breakage while maintaining a vertical stem. Approximately 5000 acres were determined to be severely damaged. To date 2500 acres of those have been salvage logged primarily for biomass using conventional logging equipment. Many aspen stands not intended for salvage will have lower stocking than normal and will likely have concerns about future decay.





# Gypsy Moth 2009

Excerpted from *State Summary Report: 2009*  
By the Minnesota Department of Agriculture, Plant Protection Division,  
Gypsy Moth Unit 12/2009

The MDA is the lead agency undertaking the annual gypsy moth detection survey and treatments. Program activities are cooperative and include input and assistance from several state, federal and tribal partners.

## ***Program Area***

The entire state is not surveyed every year. Gypsy moth is moving into the state from the east, so trapping in the western portion of the state is typically done on a rotating basis from year to year. Minnesota's entire eastern border including the metro was trapped this season, along with an area extending west of the metro into the north central areas of Leech Lake and northeast to Ely and Crane Lake.

## ***Trapping Grid***

The STS Action Area was trapped on at least a two-kilometer grid. Outside the STS area, standard grid densities ranged from 1.5K to 3K. Grid densities differ according to the risk of introduction: smaller grid sizes yield higher trap densities which result in higher resolution of actual moth populations. Nearly the entire North Shore was trapped at a higher density, between 0.5 and 1.0 kilometers, to increase accuracy and pinpoint recurring populations.

## ***Asian Gypsy Moth***

Trapping for the Asian strain of gypsy moth (AGM) continued in 2009. Traps from pathway sites (ports of entry, warehouses or sites that receive/store containers), and around sites where heterozygous strains were identified previously were sent to OTIS Laboratories for DNA analysis. This year, 45 AGM traps with 70 moths were sent in for analysis. No AGM have been identified in Minnesota at this time.

## ***Research***

Sharp increases in moth numbers along the North Shore since 2005 along with noticeable variations in moth size and an unusually long adult flight season led MDA to request further research into the biology and behavior of northerly populations.

- Meteorological data is being analyzed to determine if wind patterns are capable of carrying gypsy moth larvae or adults over Lake Superior from eastern infestations into Minnesota.
- Autotrap were hung along the shoreline to capture and record daily flight patterns as well as seasonal activity.
- A random sampling of moths will be processed for wing measurements for help in determining whether the populations are resident or immigrant populations. MDA submitted 2,736 traps with 13,794 moths this year for wing measurement studies. The determinations started in Minnesota in 2007 and have since expanded to include other states for comparison. Preliminary results of this research indicate that approximately 20% of the males are immigrants from high density populations.
- A sentinel trap grid was established in Minnesota in 2008 on areas of the existing grid along the North Shore to monitor male moth flight patterns. Sentinel traps were set and checked frequently again in 2009.
- To address the question of how temperatures over time affect lure release rates from traps, MDA is participating in a regional lure release study to measure these differences.

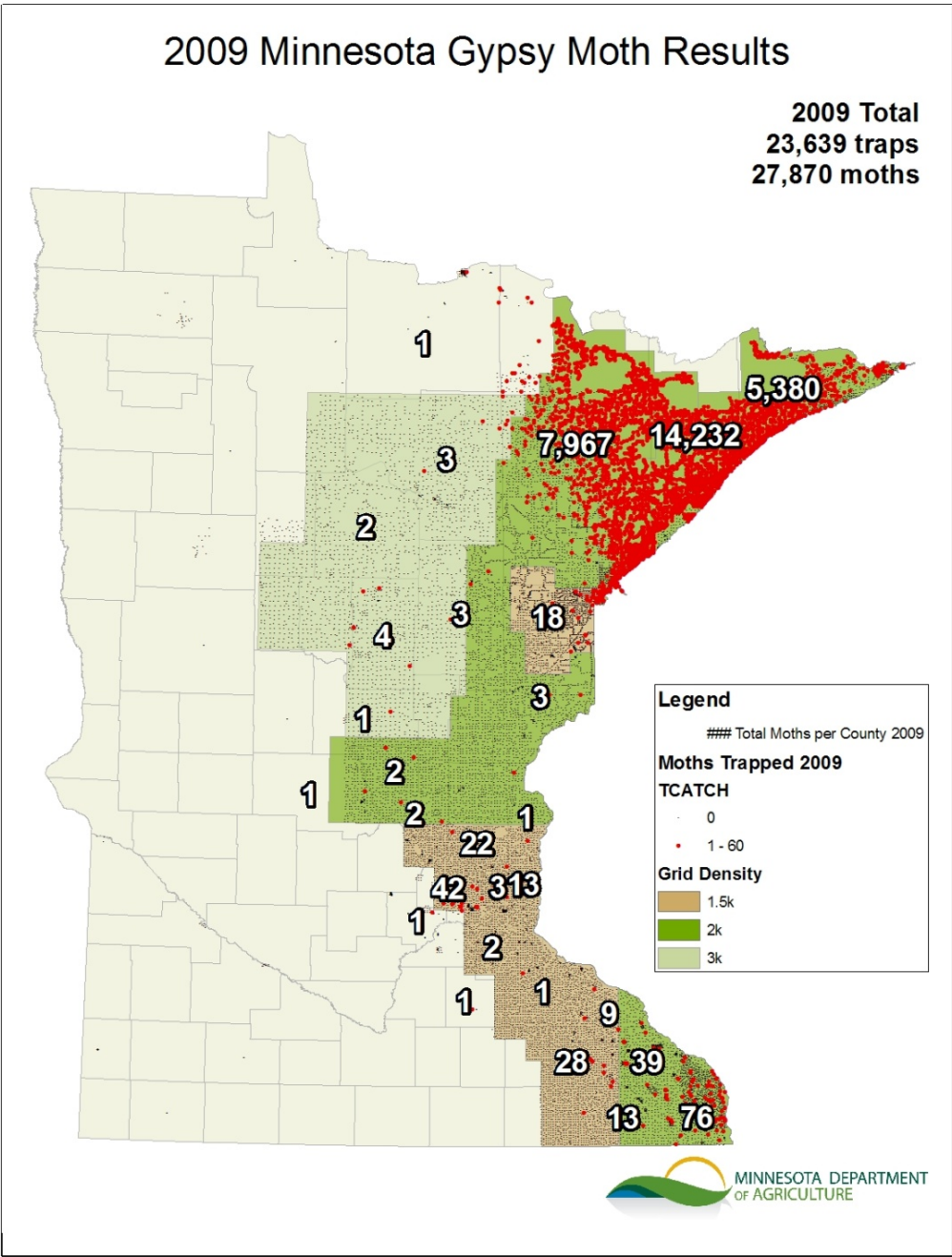
These research projects are being coordinated through the USFS Field Station in Morgantown, WV.

## ***Trapping Schedule***

MDA's trapping area was divided into northern and southern regions, as the latitudinal climate range of the state creates a delayed moth emergence in the north. Southern trappers set traps between June 1 and July 3. With the northern gypsy moth emergence being delayed about three weeks, northern trappers set traps between June 8 and July 16. Traps remained in the field for six weeks in the south and 8-9 weeks in the north. Phenology models help determine when traps should be set and removed.

## ***Survey Results***

A total of 23,639 gypsy moth traps were set in Minnesota this season, yielding 27,870 moths. See map below. The number of gypsy moths trapped in Minnesota in 2009 increased by 128% since 2008 and by 673% since 2007. In Minnesota, moth numbers were much lower in the southeastern part of the state where the pressure of adjacent Wisconsin populations has subsided this year. A total of 254 moths were trapped in the entire southern region of Minnesota, accounting for less than 1% of the statewide total. Comparing this to the 2,481 moths that were trapped in the southeast in 2008 results in a 90% decrease in moths in that area between 2008 to 2009.

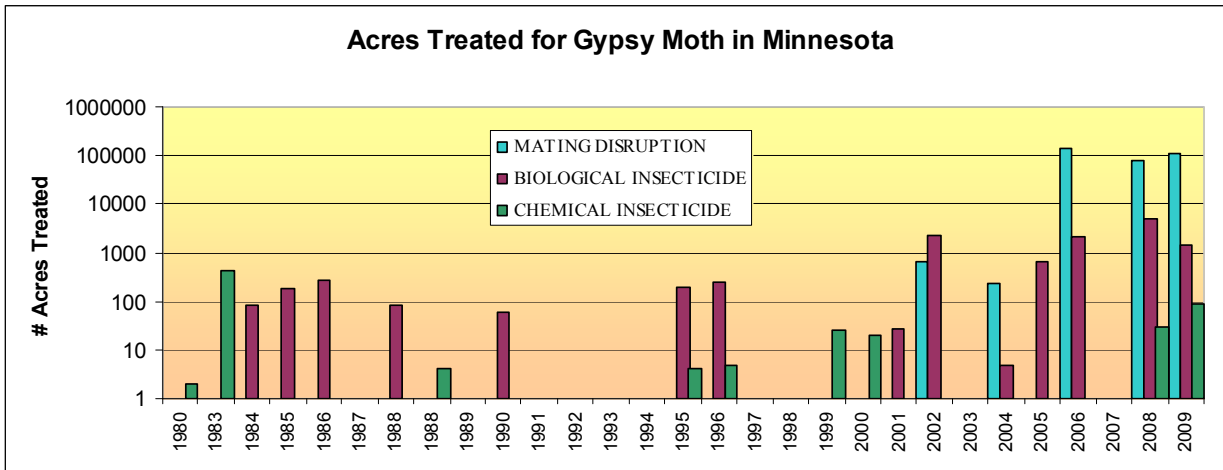


The majority of gypsy moths trapped in the northern region in 2009 were found in the northeast corner of the state, in the Arrowhead Region. This year ushered in a wave of moths to inland areas of the Arrowhead with previously low to moderate moth catches. Trapping in St. Louis, Lake and Cook counties brought in a total of 27,670 moths, accounting for over 99% of the statewide total moth count and a 250% increase from 2008. MDA will be working closely with the land stewards within these areas to align management strategies with increased moth populations. Many of the isolated positive traps will be further delimited and treatments will be proposed for these areas in 2010.

Thirteen of Minnesota's 80 State Parks were covered by the standard grid this year and had an additional 1-2 random traps placed at each. No moths were caught in the 25 traps that were placed at State Parks in 2009. Looking at other regulatory sites, there were 16 other campgrounds, one firewood dealer, and three randomly trapped sites that had positive trap catches.

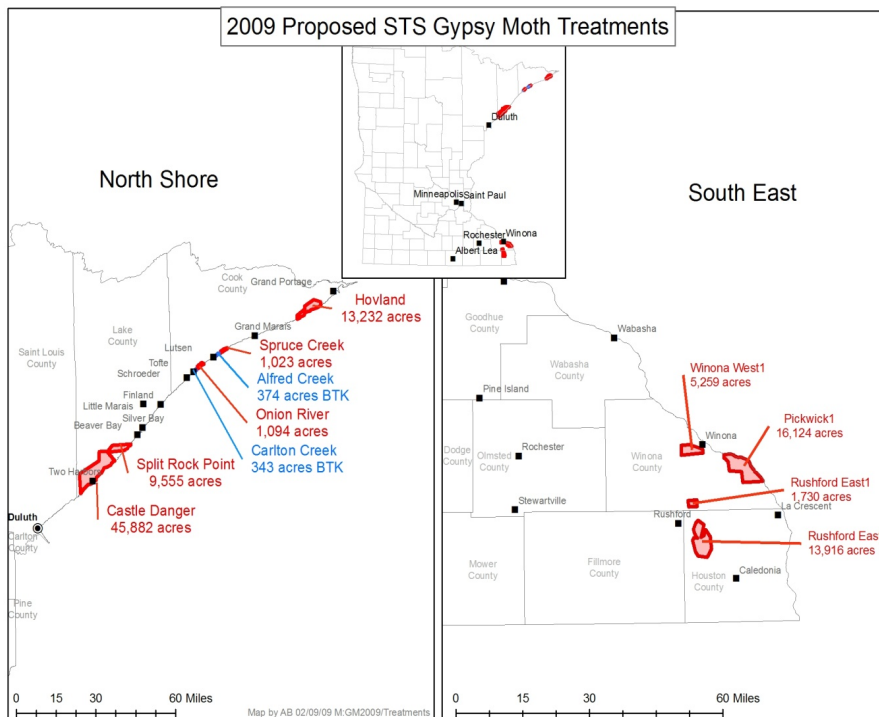
## GENERAL TREATMENT PROGRAM

Since 1980 the MDA has coordinated and overseen the treatment of more than 328,000 acres to delay, prevent or mitigate the adverse impacts associated with gypsy moth infestation on our state's natural resources, citizens and industries. As the gypsy moth front moves closer to Minnesota, treatment acreage is expected to increase to meet the statewide objective of decreasing spread rates from the historic 13 miles per year to less than 3 miles per year.



### STS and Eradication

This year 108,532 acres were treated within the STS Action Area along with 685 acres in two metro eradication sites. See map below. An organic formulation of *Btk* was used in the eradication blocks as well as in two STS blocks near Lutsen and Tofte in Cook County. Over 37,000 acres between four sites were treated with SPLAT GM in Houston and Winona counties in late June. Around 70,000 acres between five sites in Cook and Lake Counties were treated with Disrupt II in mid-July.



### Regulatory Treatments: (89 acres)

Two nurseries in Minnesota conducted eradication treatments after life stages were discovered there last summer and the stock was subsequently quarantined. Both nurseries were required to treat the stock and surrounding environs this spring using their own funds. Dimilin was aerially applied at both sites on May 25 and again on June 1, covering 88 acres. Both nurseries were released from their compliance agreements and delimit traps were placed around each site. Both sites remain gypsy moth free after the 2009 trapping season. A trace-forward from Nursery 2 is described in the Alternate Life Stage Surveys section.

### ***Treatment Monitoring***

Four sites were treated with Btk this year, which allows for same-year monitoring. Following up on treatments this year, both sites were delimited and after analysis by the STS Decision Algorithm (DA), were determined to have been successful. The two sites in Lutsen and Tofte were similarly treated and monitored. The DA declared them successfully eradicated; however, the surrounding populations of moths are still quite high. All of the five mating disruption blocks in 2008 were evaluated this year and all are considered successful.

### ***Alternate Life Stage Surveys***

An egg mass search was conducted in Hopkins, a suburb of Minneapolis, at a site where potentially infested nursery stock was planted. No alternate life stages were found but a delimitation of the area is planned for 2010. Two egg masses near Finland and Schroeder were recovered by seasonal trappers. A trapper also found alternate life stages inside a trap near Two Harbors. Searches around these sites yielded no additional finds but the areas are proposed for treatment in 2010. No life stages were found at either northeastern regulatory sites or in areas with extremely high trap captures after an inspection by MDA personnel.

## **ADDITIONAL INFORMATION ON TRAP CATCHES BY COUNTY**

<b><i>Counties Trapped, Moths Caught</i></b>				
<b>County</b>	<b># Traps Set</b>	<b># Moths</b>	<b>% of Total</b>	<b>1-year % change</b>
Aitkin	768	3	0%	300%
Anoka	508	22	0%	100%
Benton	278	2	0%	100%
Carlton	1450	18	0%	-98%
Carver	86	1	0%	-97%
Cass	581	2	0%	-33%
Chisago	314	1	0%	100%
<b>Cook</b>	<b>1318</b>	<b>5380</b>	<b>19%</b>	<b>73%</b>
Crow Wing	374	4	0%	400%
Dakota	782	2	0%	-86%
Fillmore	848	13	0%	-93%
Goodhue	906	1	0%	-98%
Hennepin	722	42	0%	-80%
Houston	978	76	0%	-94%
Itasca	751	3	0%	50%
Koochiching	118	1	0%	0%
<b>Lake</b>	<b>1471</b>	<b>14232</b>	<b>51%</b>	<b>384%</b>
Morrison	245	1	0%	100%
Olmsted	841	28	0%	-81%
Pine	1106	3	0%	-99%
Ramsey	213	3	0%	50%
Rice	139	1	0%	0%
<b>Saint Louis</b>	<b>3661</b>	<b>7967</b>	<b>29%</b>	<b>340%</b>
Sherburne	334	2	0%	100%
Stearns	214	1	0%	100%
Wabasha	589	9	0%	-94%
Washington	519	13	0%	-32%
Winona	883	39	0%	-96%
<b>TOTAL:</b>	<b>20,997</b>	<b>27,870</b>		

<i>Counties Trapped, No Moths</i>				
<b>County</b>	<b># Traps Set</b>		<b>County</b>	<b># Traps Set</b>
Becker	15		Mille Lacs	300
Beltrami	125		Mower	413
Big Stone	1		Nobles	25
Clearwater	25		Otter Tail	25
Cottonwood	25		Pipestone	8
Dodge	241		Redwood	10
Hubbard	168		Scott	105
Isanti	313		Steele	22
Kanabec	303		Todd	25
Lac Qui Parle	3		Wadena	149
Lake of the Woods	31		Wright	281
Marshall	24		Yellow Medicine	5
			<b>TOTAL:</b>	<b>2,642</b>

## 2009: The Year of Emerald Ash Borer

We knew it was coming. We just didn't know when. Many of us in state and federal agencies were hoping that a few more years would elapse before we had to engage our emerald ash borer (EAB) Preparedness and Response Plans.

EAB was found in Minnesota when our "backs were turned". Here's what happened. On April 6<sup>th</sup>, an EAB infestation was discovered in Victory, Wisconsin which is across the Mississippi River from southeast Minnesota in bluff country. See map on right. All attention turned to Houston County where EAB surveys were being conducted, traps and trap trees were being set up, quarantine regulations were being finalized, news releases were being created and inter-agency relationships were being forged.

Then, on May 13<sup>th</sup>, an EAB population was found in St. Paul. According to an EAB risk map produced by MDA in 2003, we knew that the Twin Cities area had a very high risk of introduction. See map on right. Visual searches were being conducted in this area where a tree care worker was doing some routine tree inspections. He noticed one of the symptoms of EAB in ash trees: a thinning crown. When he peeled back the bark with his knife, he saw characteristic S-shaped galleries, and contacted the Minnesota Department of Agriculture with his find.

The day after discovery, a quarantine was enacted in the Twin Cities' counties of Hennepin and Ramsey. See map on bottom of page. In an intensive, short-duration delimiting survey of the discovery area, 68 ash trees were found to be infested and were subsequently removed and chipped by the City of St. Paul and brought to St. Paul's District Energy for incineration. Twenty suspect trees were girdled near the infestation to attract some of the adult EAB in the area. The suspect trees were removed in the fall; some of these trees were found to be infested as well.

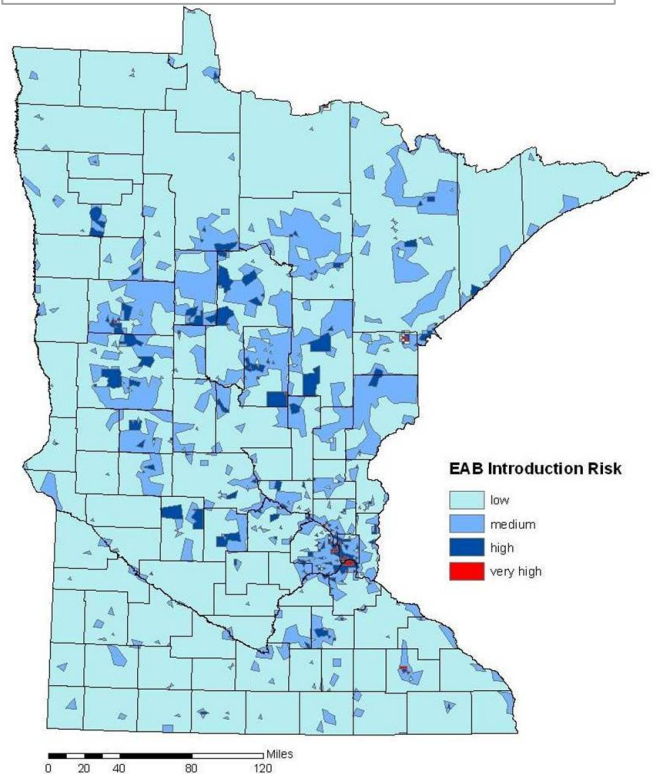
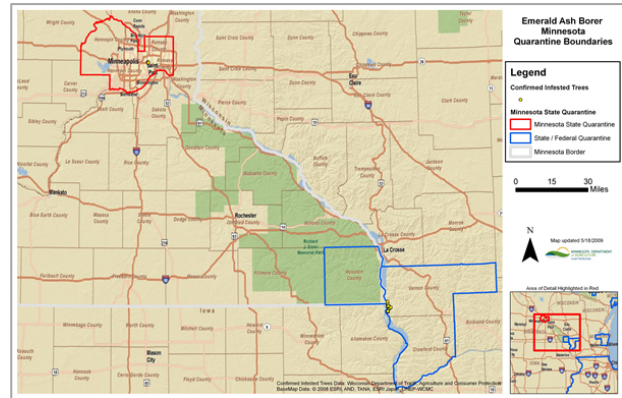
The Minnesota Department of Agriculture and agency partners deployed nearly 700 purple panel traps within a four-mile radius of the discovery, which captured only four EAB adults between the end of May and October. One of the adults was found in a trap ½-mile from the discovery site, and two were found on one trap one mile north of the site, on the St. Paul campus of the University of Minnesota.

Results from dendrochronological studies of EAB-infested trees indicate that the St. Paul infestation dates back to 2006, making this one of the quickest discoveries of an EAB infestation.

An Incident Command System was initiated to facilitate communication about EAB events, outreach, and planning, with unified command representatives from the Minnesota Department of Natural Resources (DNR), the Minnesota Department of Agriculture (MDA), and USDA APHIS Plant Protection and Quarantine.

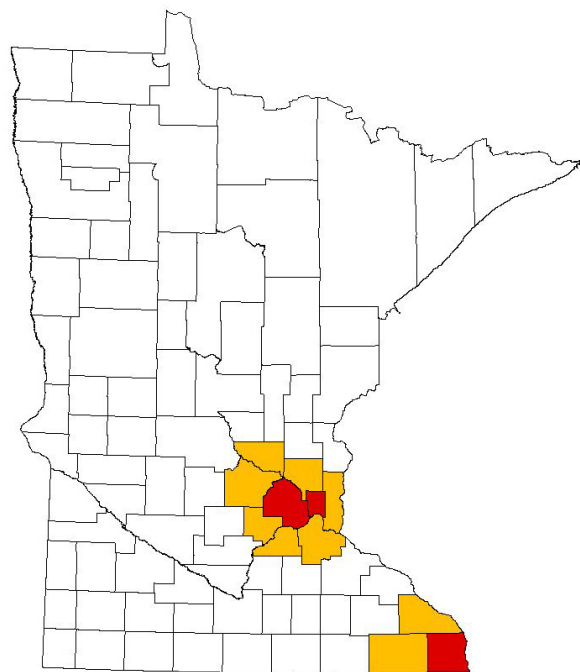
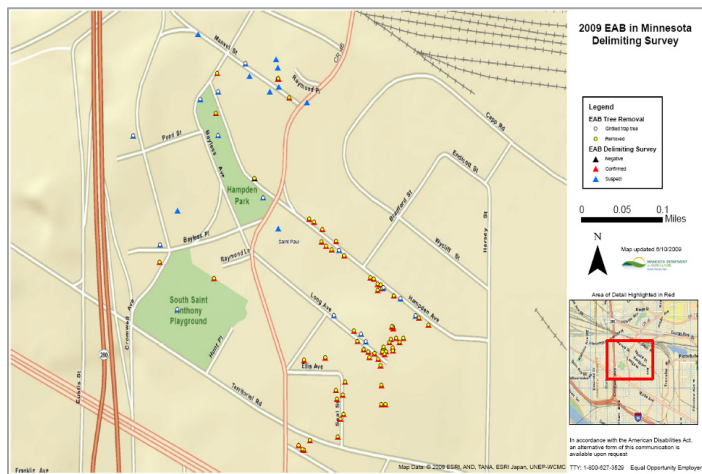
The DNR has developed an EAB Preparedness Plan and is currently developing plans for ash utilization and black ash management. Ash makes up 50 percent of the lowland hardwood forest cover type in Minnesota, and Minnesota has the third highest volume of ash in the US. Based on a survey in 2006, there are over 3 million ash trees that are publicly owned in municipalities across the state.

The DNR is continuing its efforts to limit introductions of exotic forest pests onto state-administered lands by enforcing recent firewood legislation. Firewood from over 900 vendors has been approved by DNR-Forestry for use in state parks. Since EAB was found inside Minnesota and three counties are now quarantined,





additional firewood vendor restrictions were added in 2009: hardwood firewood from quarantined counties or their bordering counties can only be used in those counties (see map of red quarantined and yellow bordering counties). Public outreach campaigns continue.



Hardwood firewood for use on state-administered lands 2009. Quarantined and bordering counties.