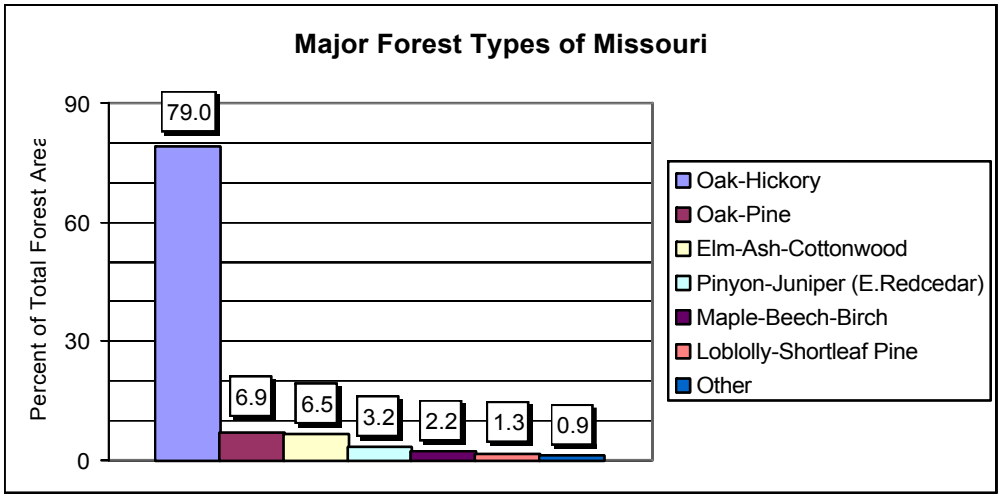
Missouri Forest Health 2007 Highlights

The Resource

Missouri is about one-third forested. There are over 14.6 million acres of forest land, an increase of 4% since 1989. Missouri is well known for its oak-hickory forests. The 2000-2004 forest inventory estimated that nearly four-fifths of the forest land in Missouri is dominated by oaks, hickories and associated species.



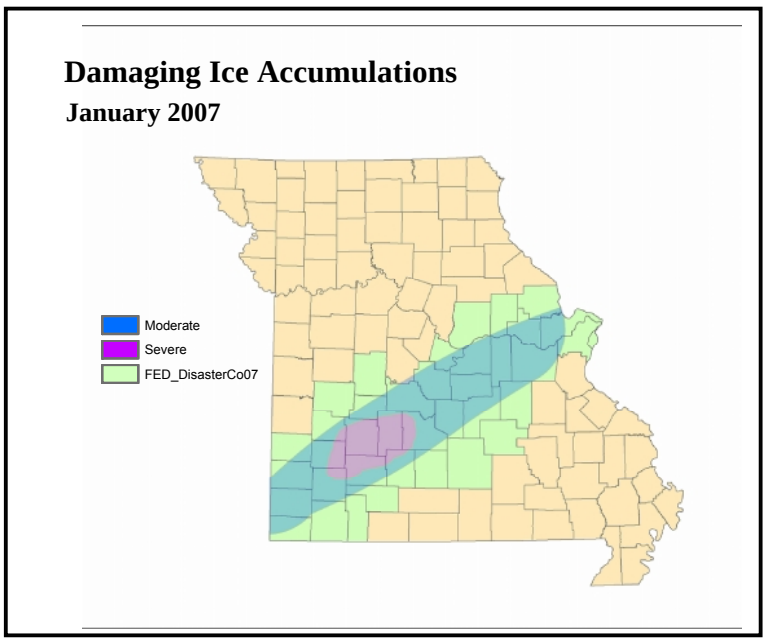
In addition to the recreation and wildlife benefits these forests provide, a recent analysis by the Missouri Department of Conservation (MDC) showed that the forest products industry contributed $4.43 billion annually to the Missouri economy in 2005 dollars. The industry supports over 32,250 jobs at a payroll of about $1.1 billion and is responsible for over $360 million in taxes, including $54 million in state sales tax.

Special Issues

A series of severe weather events set the stage for a difficult forest health year in 2007.

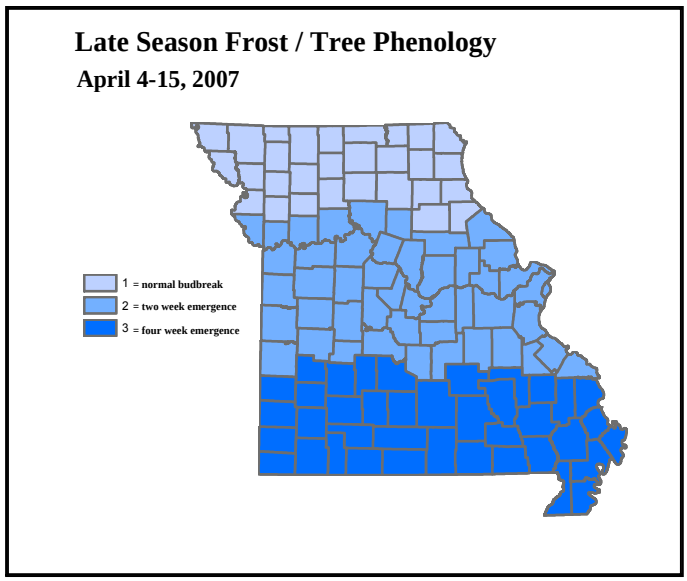
Ice Storms - Gov. Matt Blunt declared 34 of the state's 114 counties a disaster area following a significant ice storm that occurred Jan. 12-15, 2007 along the I-44 corridor between Joplin and St. Louis, Missouri. Several inches of ice accumulated over the area resulting in downed power lines and large branch and stem failures.

Ice storm-related damage created openings for opportunistic decay fungi and other pathogens and will likely impact forest health over the next several years. Field visits to the area conducted after spring leaf flush showed most trees with broken tops and prolific leafy-outgrowths up and down their main boles. Tree forms that result following ice storms are less than desirable as these 'epicormic' branches are weaker and prone to breakage in the next ice storm.



The following counties were included in the disaster declaration as of March 20, 2007: Barry, Barton, Benton, Callaway, Camden, Cedar, Christian, Cole, Crawford, Dade, Dallas, Dent, Franklin, Gasconade, Greene, Hickory, Jasper, Laclede, Lawrence, Lincoln, Maries, McDonald, Miller, Montgomery, Newton, Osage, Phelps, Polk, Pulaski, St Charles, St Clair, St Louis, Stone, Texas, Warren, Webster, Wright, and the City of St Louis. Much of this area was once again hit by another ice storm in early December 2007.

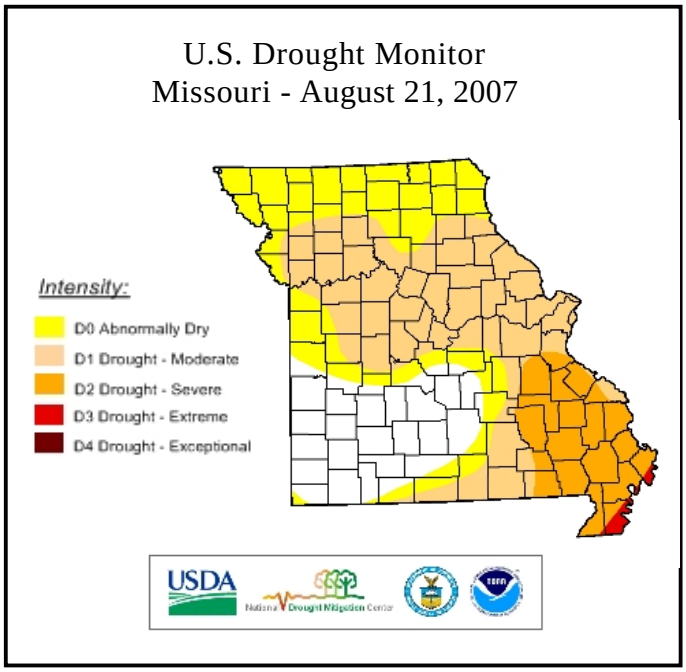
Late Spring Freeze - A period of freezing temperatures (~82 hours) occurred over most of the Midwest during April 4-9, 2007. This late freeze was particularly damaging because it followed an unusually early warm-up. Budbreak, flower, and leaf formation on most trees were four weeks advanced in southern Missouri and two weeks ahead of average in mid-Missouri. Tree phenology in the northern portion of the state was considered near normal during this freeze event.



The impact on trees, shrubs, annuals, fruit crops, and winter wheat was substantial given the consecutive number of days below freezing. Leaf damage due to the freeze was near 100% statewide on most trees and shrubs that had begun leaf development. Branch tip death was common. Trees responded with a second flush of growth within a few weeks. The severity of damage and use of stored reserves for regrowth seriously stressed plants at the start of the growing season.

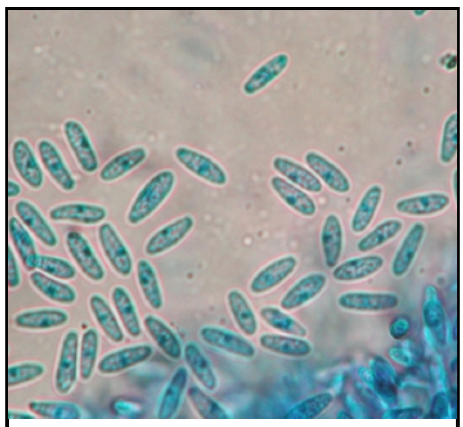
Impacts on forest mast production are difficult to predict given that frost damage is one of many possible variables in the overall production equation. Freeze damage is expected to be most severe on white oak mast, since production of acorns takes place in the same season in which flowers are fertilized. Red oak flowers that were fertilized last year will likely produce in 2008, provided the frost duration was not too severe.

Several reports of damaged leaves blackened by the freeze came to the Missouri Department of Conservation (MDC) forest health clinic on many different tree species such as, maple, sycamore, ash, oak, and especially yew. Anthracnose was also more prevalent on sycamore, oak, ash, hickory, and maple following the freeze event. Differentiating between frost damage and anthracnose was difficult as symptoms were similar in the field. Frost damage was more uniformly distributed throughout the crown, whereas anthracnose damage was localized on the tree leaves at the point of infection.



Drought - Very dry conditions existed from August to October over a large area, including southeastern Missouri and a band along the Missouri River across the central part of the state. Drought conditions were especially severe in the Bootheel area and other parts of southeastern Missouri where drought-scorched tree crowns could be seen scattered widely across forested areas.

New Leaf Blight on Yews - A possible first report of Cryptocline taxicola occurring on yew in Missouri was diagnosed in May 2007. Samples had numerous acervuli on blighted leaves and produced spores generally matching published descriptions. The extent and distribution of this disease has only recently been reported in the eastern United States. It is generally considered of low pathological importance in Europe. However, yews stressed by abiotic events such as ice storms and frost damage may make infections more severe, killing entire branches.


Cryptocline taxicola conidia

Oak Wilt - In 2007, oak wilt positives were taken from five counties in Missouri: Benton, Boone, Callaway, Clinton, and Jackson. Species testing positive included pin oak, northern red oak, and shingle oak. Oak wilt tests done on 20 other oaks returned no oak wilt positives, and were diagnosed as false

negatives since oak wilt may have been present, but just not cultured from samples sent to the MDC forest health clinic.

Pine Bark Beetles - Following the dramatic weather-related stresses of 2007, particularly the late summer drought, it was not surprising to see bark beetle outbreaks in late summer. Isolated pockets of dying shortleaf pines, ranging from a few individuals to several dozen trees, appeared in many locations in southeastern Missouri. Foliage began fading in August and entire tree crowns turned reddish brown in a few weeks. In many cases, bark beetle attacks occurred on upper trunks and limbs, and no evidence of attack was initially seen on lower trunks. Bark beetle attacks also occurred on various ornamental pines around Missouri. Three Ips species (I. avulsus, I. grandicollis, I. calligraphus) are common in shortleaf pine and other pines growing in Missouri. Ips pini often attacks eastern white pine.

Shortleaf pine in Texas County, Missouri killed by Ips spp.

Other damage agents often associated with Ips-infested trees are the black turpentine beetle (Dendroctonus terebrans) which attacks the lower 2-3 m of the trunk, and pine sawyer beetles (Monochamus sp.), whose larval chewing can be heard a few feet away from an infested tree. Pockets of pine mortality caused by Heterobasidion annosum root disease also have sometimes been associated with Ips infestations.

Aphids and Other Sapfeeders - Massive populations of aphids appeared in mid-summer on many deciduous tree species in Missouri. The greatest number of reports about aphid activity initially came from near Kansas City, but within a few weeks reports increased in central and southwestern Missouri. Several aphid species were involved in these outbreaks, with each species typically feeding on a narrow range of host trees. The walnut aphid (Chromaphis juglandicola) exploded in numbers on black walnut trees. High numbers of other aphids were present on oaks, hickories, pecan, elm, maples, sweetgum, tulip poplar, willow, and redbud. Aphid feeding, particularly in late summer, does not normally cause major damage to trees. However, the large numbers seen in some areas this year could pose a threat to the health of trees already weakened by the severe freeze in early April. Aphid predators can be expected to take advantage of this prey population

Walnut aphid (Chromaphis juglandicola)

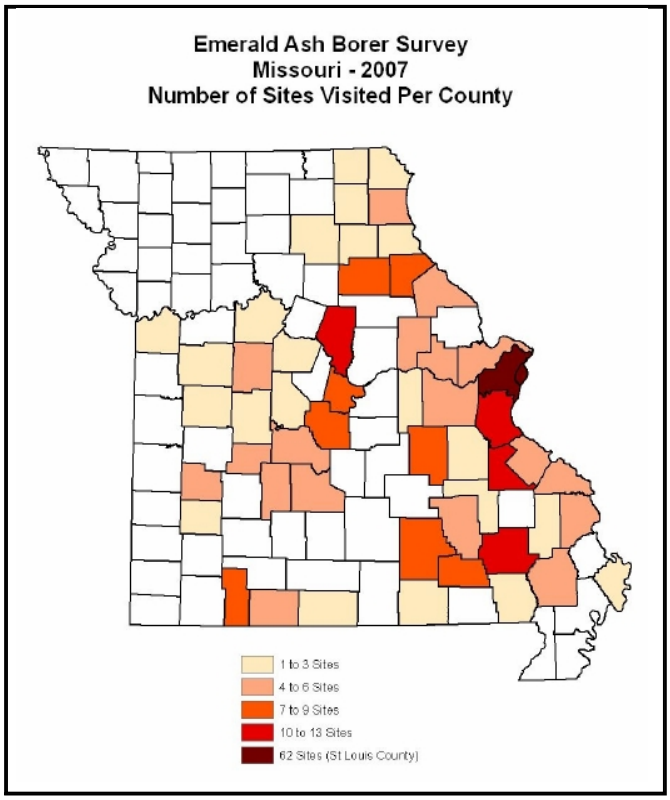
boom. Large numbers of the Asian multicolored lady beetle (Harmonia axyridis) were observed feeding on aphids on black walnut.

Lace bugs, another group of sapfeeding insects, showed up in mid-summer. Large numbers were reported on various white oaks and sycamore. Populations were particularly high on bur oaks, where entire tree crowns had obvious foliar discoloration.

Invasive Species

Sudden Oak Death - The national survey for detecting sudden oak death caused by Phytophthora ramorum was resumed in Missouri for 2007. The emphasis continued to focus on Missouri nurseries receiving ornamentals such as Rhododendron, Camellia, and Viburnum from growers in the infected areas of California, Oregon, and Washington. In addition, the National P. ramorum survey of forested environs was once again done in cooperation with the USDA Forest Service. This year's survey emphasis focused on "stream baiting" techniques in three watersheds in Missouri. No P. ramorum infections have been found in Missouri as of 2007.

Emerald Ash Borer – The emerald ash borer (EAB), Agrilus planipennis, was detected in many new locations in the Midwest during 2007. Although the EAB has not yet been found in Missouri, additional populations have been detected nearby in Illinois near Chicago and Peru (north central IL). Missouri's response to this invasive species threat emphasizes readiness, detection, and outreach efforts. A draft Missouri Emerald Ash Borer Action Plan compiled by a multi-agency group and reviewed by stakeholders is nearing completion. The plan outlines actions to reduce infestation risk, detect and respond to infestations, and mitigate potential impacts.



The annual EAB detection survey in Missouri is a cooperative effort among MDC, Missouri Department of Agriculture (MDA), and the USDA Forest Service. A new partner this year has been a central Missouri chapter of the Master Naturalists program.

The 2007 survey visited 294 sites (including 18 State Parks) in 53 counties. Over 950 declining ash trees were examined for signs and symptoms of EAB. This effort represents a substantial increase in the number of sites visited compared with past years. Survey visits concentrated on locations at high risk for introduction of EAB through the movement of firewood, whole logs, and nursery stock. Survey sites included private and public campgrounds, recent commercial

developments, urban streets, wood processors, and others. A larger proportion of survey visits occurred in the eastern third of Missouri because of its proximity to known infestations. In addition to the formal survey, MDA Plant Protection Specialists examined thousands of ash trees during the course of their routine nursery inspections and regional travels. No evidence of EAB has been detected in Missouri as of December 2007.

Missouri Conservationist article, March 2007

EAB outreach efforts in 2007 continued to focus on raising awareness about EAB, how it spreads, and how we can reduce the risk of introducing it to Missouri. MDC, MDA, Missouri Department of Natural Resources, and USDA-APHIS-PPQ cooperated on a variety of activities. Among these were:

- Presentations to arborists, nursery growers, urban foresters, Master Gardeners, Master Naturalists, State Park hosts, forest products groups, and others.
- Displays at forest products trade show and State Fair.
- An article about EAB and other invasive species hitchhiking in firewood was published in the Missouri Conservationist magazine. Article reprints are used in outreach activities.
- Training on bark peeling and examining ash trees presented at the Missouri Community Forestry Council's annual meeting.
- Distribution of Missouri's firewood awareness poster continued at campgrounds.
- Media releases about firewood and the potential transportation of EAB and gypsy moth.

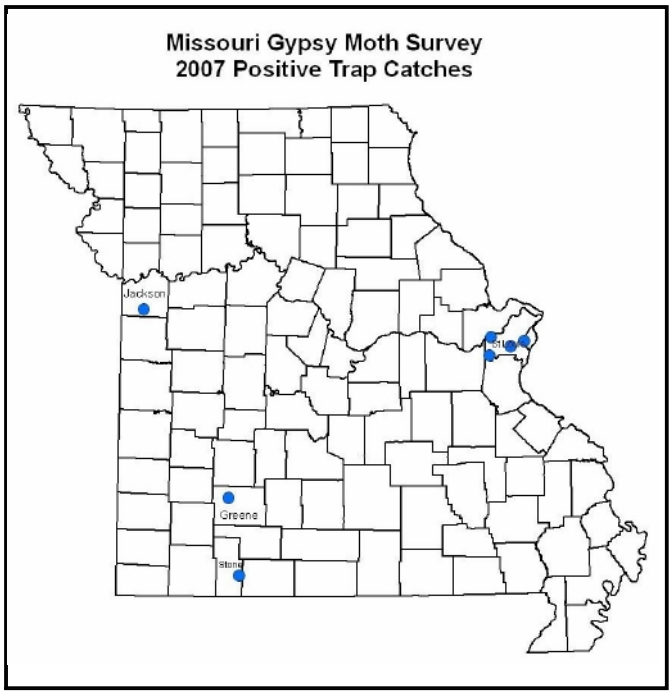

'Homestead' elm killed by the banded elm bark beetle (Scolytus schevyrewi).

MDA conducted a camper survey during summer and fall at private and public campgrounds. Preliminary results indicate that firewood is the third most common item to take camping, and the most prevalent source is the home woodpile. Over half of the respondents noted that they had seen a poster or an article about the potential of moving pests on firewood.

Banded Elm Bark Beetle - The banded elm bark beetle (BEBB), Scolytus schevyrewi, is a new threat to elms in North America. The first tree in Missouri (and possibly the Midwest) known to be attacked by the BEBB was detected in 2007 in St. Louis, although the beetle apparently has been present for several years. The BEBB is native to Asia and was first detected in the U.S. in Colorado and Utah in 2003. It has been collected in Missouri many times since 2004, but previously only in trapping surveys. It has also been collected repeatedly in traps in other Midwestern states. In July 2007, three BEBB adults were collected from the bark surface of a 3-inch dbh 'Homestead' elm in 1,400-acre Forest Park, a major attraction in St. Louis.

The tree was oozing foaming sap from multiple sites. At another location within the same park, bark beetle larvae, pupae and adults were found in early October in a dying Homestead elm (3-inch dbh). Homestead elms are Dutch elm disease-resistant hybrids. Trees at this second location were drought stressed. Subsequent dissection of the main stem of the dying elm revealed that more than 90% of bark beetle adults were S. schevyrewi (BEBB) and less than 10% were S. multistriatus, the smaller European elm bark beetle and primary vector of Dutch elm disease. This find indicates that BEBB does indeed have the potential to be an additional threat to our elm resource.

Gypsy Moth - The Missouri Cooperative Gypsy Moth Program continued its annual survey to detect the presence of gypsy moths by placing and monitoring more than 9,900 traps across the state in 2007. Seven moths were captured statewide, down from a total of 17 in 2006. Four moths were caught in 2007 in St. Louis County, one in the Kansas City area (Jackson County), and one each in Greene and Stone Counties in southwestern Missouri. No gypsy moths were caught this year in the St. Louis suburb where they had been caught repeatedly at low levels since 2000.



There are no known populations of gypsy moths in Missouri. Sites where gypsy moths have been captured are surveyed with a higher trap density in the following year. In most cases, survey results in the vicinity of past captures have been negative within one or two years following the original capture. Statewide gypsy moth monitoring efforts will continue annually in Missouri.