



Tennessee Forest Health Highlights 2021

Summary of Monitoring and Management Activities

Tennessee Department of Agriculture | Annual Report | December 2021



Executive Summary

Despite continued restrictions imposed by COVID-19, many efforts to effectively monitor and manage the health of Tennessee's forests were successfully accomplished in 2021. Major forest insect pests and diseases were addressed using both monitoring and management activities and resulted in a number of updates to the current statuses of these threats. These activities are highlighted below and then described in greater detail within this report.

Forest Health Highlights

- Emerald ash borer (EAB) has been confirmed in a total of 65 counties in Tennessee.
- A total of 68 gypsy moths were caught in 12 counties across Tennessee, with the highest number occurring in eastern Tennessee. To address last year's gypsy moth catches, two areas of Johnson County totaling 4,570 acres received an aerial mating disruption treatment in June 2021.
- The Hemlock Woolly Adelgid Strike Team successfully treated 3,779 trees across 374 acres in 10 hemlock conservation areas. Additionally, releases of *Laricobius nigrinus* and *L. osakensis* beetles, two predatory beetle species which target HWA, occurred at three sites in 2021 as a biocontrol measure on public lands.
- Laurel wilt disease, which was first discovered in Tennessee in 2019, was confirmed in two new counties in 2021, bringing the total number of counties to 16. Surveying for symptomatic sassafras was limited due to COVID-19 restrictions.
- Tennessee Division of Forestry personnel submitted a total of 658 forest health observations from across the state, including insect pests, disease, and invasive plant species affecting Tennessee's forests.
- Additional observations of storm damage, wildland fire, as well as outreach activities are included below.

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Tennessee's Forests

Land Ownership

Land ownership can often lead to complex management dynamics when considering landscape-scale strategies. In Tennessee, approximately 83% of forested land is privately owned (Figure 1). The remaining 17% represents public lands managed by local, state, and federal agencies. Given the high proportion of privately-owned lands in Tennessee, communication and collaboration with the public are fundamental for managing forest health threats. Through outreach and education activities, forest protection can be advocated across the landscape regardless of land ownership boundaries.

The Tennessee Department of Agriculture (TDA) Division of Forestry engages its stakeholders with consistent messaging regarding the current and potential threats of forest pests and diseases. Programs such as the "Don't Move Firewood" campaign and Hemlock Woolly Adelgid Strike Team directly address the need for communication and educational resources for the public and partner agencies. Through these programs, the public is provided with the knowledge necessary to assist in the protection of TN's forest resources.

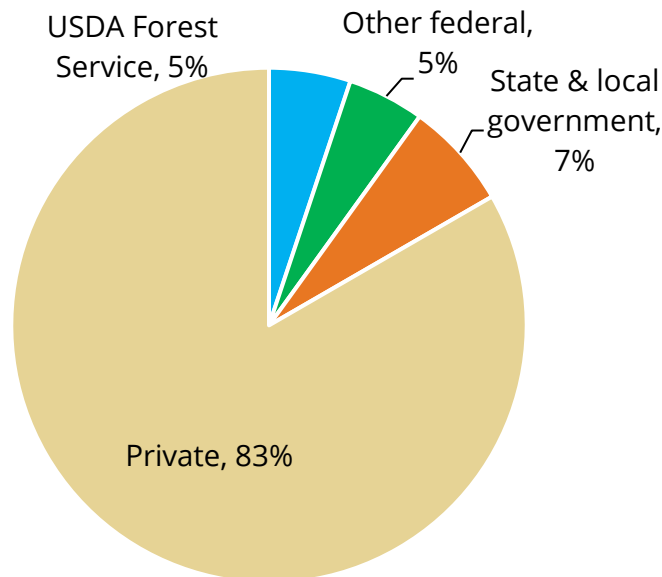


Figure 1: Forest land ownership in TN as of 2016; data compiled by Rachel Greene | Forest Data & Analysis Unit Leader

* Data Source: USDA Forest Service, Forest Inventory and Analysis Program, 2020. Forest Inventory EVALIDator web application Version 1.8.0.01. St. Paul, MN: US Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <http://apps.fs.usda.gov/Evalidator/evalidator.jsp>]

Forest Composition

Forests comprise approximately 13.9 million acres (~52%) of Tennessee's land cover. Together, these forests represent a diverse mosaic of forest cover types from the bottomland hardwoods in West Tennessee to the high-elevation forests of the Appalachian Mountains in the east. Despite the range in forest cover, Tennessee's forests are predominately comprised of oak-hickory forests (~70% of Tennessee's forests) in which valuable timber tree species such as red and white oak species, hickory species, black walnut, and tulip poplar are dominant (Figure 2). These forests with dominant hard mast producing species are ideal ecosystems for many important wildlife species native to Tennessee as well.

Many damaging forest pests and decline complexes affect tree species present in oak-hickory forests, including the European gypsy moth (*Lymantria dispar dispar*) and oak decline. New diseases such as laurel wilt pose concerns for sassafras and spicebush which are also present in this forest type. Approximately one-third of the state is within the natural range of eastern hemlock, which is a species often prevalent in the drainages of oak-hickory forest cover types. The spread of hemlock woolly adelgid throughout the range of eastern hemlock in Tennessee has thus directly impacted the integrity of these forests. Tennessee's forest health threats are not limited to the oak-hickory forests, as other dominant forest cover types, such as elm-ash-cottonwood, are threatened by various forest health threats, including emerald ash borer (*Agrilus planipennis*).

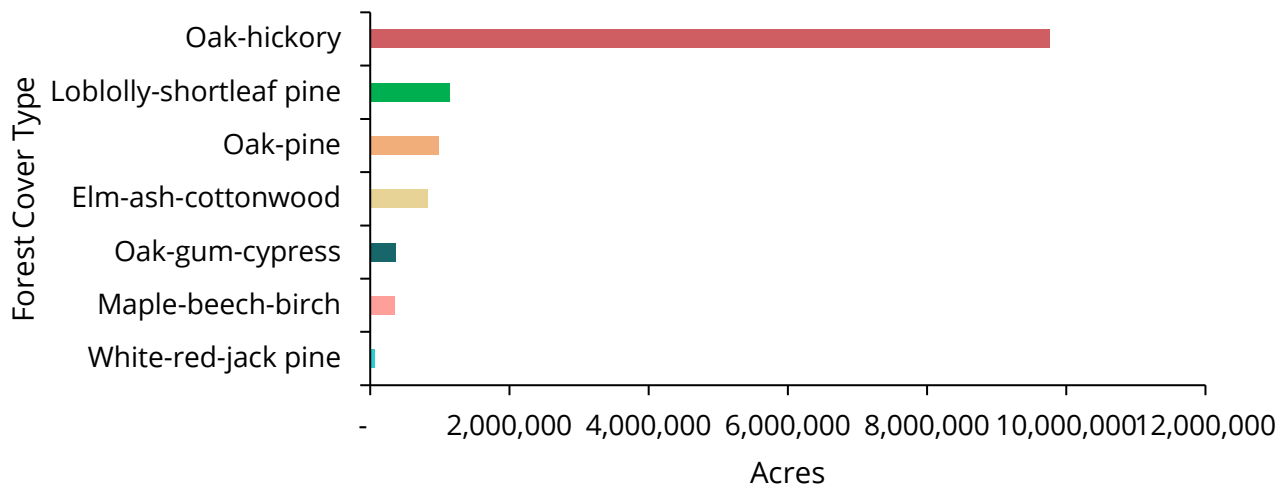


Figure 2: Tennessee forest cover types by acres; data compiled by Rachel Greene | Forest Data & Analysis Unit Leader

* Data Source: USDA Forest Service, Forest Inventory and Analysis Program, 2020. Forest Inventory EVALIDator web application Version 1.8.0.01. St. Paul, MN: US Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <http://apps.fs.usda.gov/Evalidator/evalidator.jsp>]

Emerald Ash Borer (*Agrilus planipennis*)

Monitoring Summary

In 2021, the emerald ash borer continued to advance through Tennessee. This year marked changes to management of EAB in response to the removal of the federal EAB quarantine regulations. While regulation of this pest has changed, continued outreach can help educate landowners on options to manage EAB on private land. As EAB continues to spread across Tennessee, an estimated 5 million urban ash trees and 261 million timberland ash trees are expected to be impacted representing a potential of \$2 billion and \$9 billion USD in damage, respectively (TN Forest Resource Assessment and Strategy; USDA Forest Service).



Figure 3: Map representing counties where emerald ash borer has been confirmed in Tennessee (shaded green)

European Gypsy Moth (*Lymantria dispar dispar*)

Monitoring and Management Summary

A total of 5,456 gypsy moth traps were deployed to monitor gypsy moth activity in the state by Tennessee Department of Agriculture Division of Forestry personnel and federal partners. This led to a total of 68 moths caught in twelve counties, including one new county detection in Crockett County. Of the moths caught in 2021, 38 were trapped in the Slow the Spread Action Area. Outside the action area, an additional 30 moths were caught, primarily as single-catch traps at high-risk sites across the state. Locations where moths were captured in 2021 will be intensively trapped in 2022 to ensure there are no breeding populations present.

In response to 2020 trap catches, two treatment blocks in Johnson County received an aerial application of SPLAT-GM Organic in June 2021 for a total of 4,570 treatment acres. The use of this synthetic mating pheromone serves to disrupt mating success by oversaturating the area with the female pheromone thereby inhibiting the male's ability to find a mate. This treatment will be assessed for effective population control using delimiting grid traps in 2022. In addition, two prior spray blocks (8,567 total acres) which were treated with SPLAT-GM Organic in 2020 were assessed with post-treatment delimiting grids in 2021 and resulted in only one single-catch at the treatment sites. This indicated the success of mating disruption treatments that were conducted in 2020.

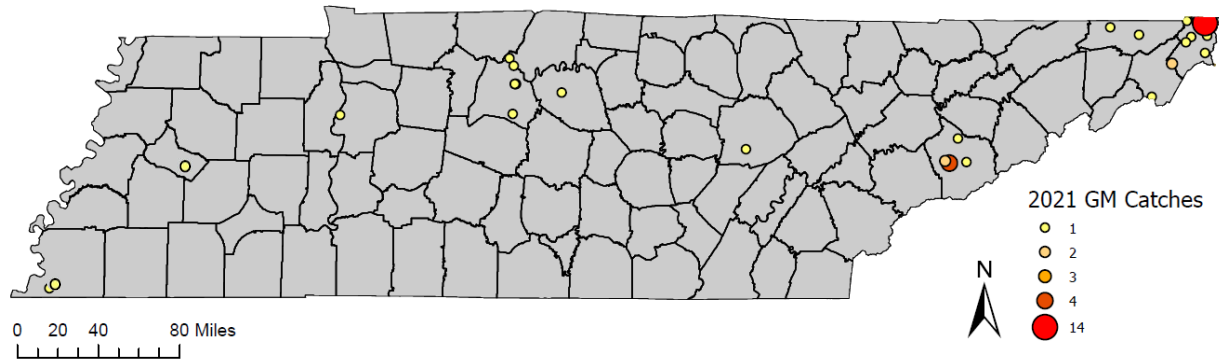


Figure 4: Results from 2021 gypsy moth traps deployed across Tennessee. Each point represents a single trap and its size corresponds to the number of moths found inside the trap.

Laurel Wilt Disease (*Raffaelea lauricola* + *Xyleborus glabratus*)

Monitoring Summary

Laurel wilt disease was first discovered in six counties in 2019. During 2020, road surveys were conducted and identified symptomatic sassafras (*Sassafras albidum*) in an additional 8 counties. These trees exhibited the characteristic foliar wilting and dark stained vascular tissues associated with *Raffaelea lauricola*, causal agent of laurel wilt disease. Additional surveys in 2021 identified another 2 counties with symptomatic sassafras (Figure 5). Bark tissue samples were collected from symptomatic trees to confirm the presence of *R. lauricola* via DNA sequence analyses. Presence of redbay ambrosia beetle (*Xyleborus glabratus*), which vectors the fungus, has been found in three counties in Tennessee but with each being only a single beetle catch. Outreach and personnel training activities are planned to aid in monitoring efforts during 2022 as the distribution of laurel wilt is likely greater than what was revealed in current survey efforts.

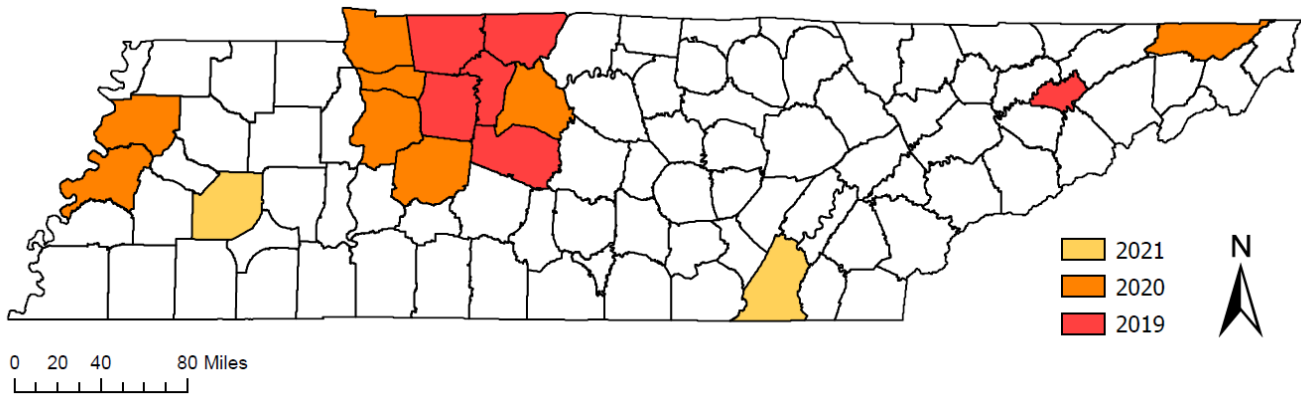


Figure 5: County-level detections of sassafras trees symptomatic for laurel wilt disease surveyed in 2019, 2020, and 2021. All counties included in this map have been molecularly confirmed.

Hemlock Woolly Adelgid (*Adelges tsugae*)

Monitoring and Management Summary

Hemlock woolly adelgid has been present in Tennessee since 2002 and has spread to a total of 43 counties which includes all counties within the natural range of eastern hemlock in TN.



Figure 6: Map representing counties where hemlock woolly adelgid has been confirmed in Tennessee (shaded brown)

Hemlock conservation efforts by TDF are conducted in partnership with many state, federal, non-profit, and private groups to treat and manage hemlock woolly adelgid (HWA) on a

regional scale. TDF's Hemlock Woolly Adelgid Strike Team represents a federally funded seasonal crew whose goals are to chemically treat HWA on hemlock conservation areas (HCAs), hold outreach programs such as presentations and workshops, provide support to the HWA predator beetle program, and facilitate events sponsored by the Tennessee Hemlock Conservation Partnership. HCAs include state parks, state natural areas, state forests and conservation easements across the native range of eastern hemlock in Tennessee.

In 2020 the TDF HWA Strike Team received the Governor's Environmental Stewardship Award for their efforts to protect hemlock forests across the state. Despite some initial hiring restrictions imposed by COVID-19, the 2020-2021 strike team treated 3,779 trees across 374 acres in 10 HCAs and facilitated two private landowner HWA workshops. The 2021-2022 strike team was hired in October 2021 and has begun hemlock treatments in HCAs for the 2021-2022 season. Additionally, Dr. Pat Parkman, Director of the Lindsay Young Beneficial Insects Laboratory at the University of Tennessee, coordinated the release of 1,372 *Laricobius nigrinus* beetles and 524 *L. osakensis* across three release sites for biological control studies on state and federal lands.

Southern Pine Beetle and other pine bark beetles

Monitoring Summary

A total of 10 SPB adults were detected in 6 monitoring traps deployed by TDF personnel in spring 2021 in Chester, Marion, and Rhea Counties. Catches occurred in only two of those counties, Marion and Rhea, with the majority caught in Marion. Traps also caught low numbers of 5 other species of Scolytids. Suspected damage by pine bark beetles was reported by landowners or TDF personnel occasionally throughout the year, but there was no evidence of significant SPB activity.



**SOUTHERN PINE BEETLE COUNTY HAZARD RATING
FOR
Tennessee**

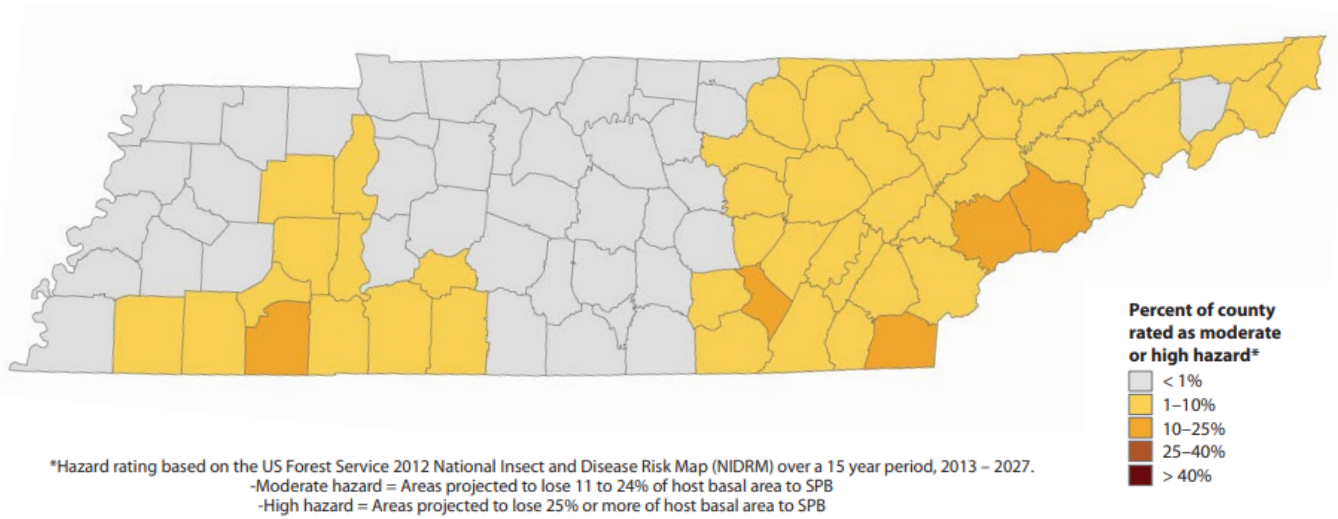


Figure 7: Map representing SPB hazard rating in Tennessee counties based on USFS 2012 National Insect and Disease Risk Map.

Wildland Fire

Annual Summary

A total of 705 wildland fires were reported on 6,980 forested acres by TDF personnel. These fires ranged from 0.1 to 1,262 acres affected with an average size of 9.90 acres.

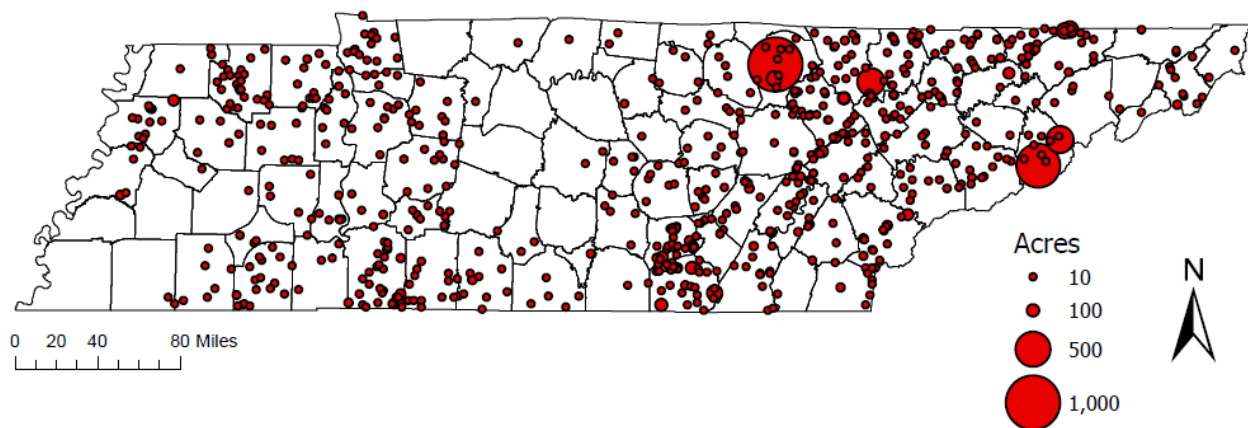


Figure 8: Reported wildland fires on forested acres in Tennessee with point size representing the number of reported acres.

Invasive Plants

Annual Summary

TDF personnel submitted a total of 462 reports of significant infestation by various invasive plant species throughout the state’s forested lands. In addition, multiple landowner assistance requests were received regarding issues controlling invasive species on forested properties. The most common reports included the following:

- Tree-of-Heaven (*Ailanthus altissima*): 54 reports across 216.8 total acres
- Chinese privet (*Ligustrum sinense*) and European privet (*L. vulgare*): 89 reports across 84 total acres
- Kudzu (*Pueraria montana* var. *lobata*): 55 reports across 295 total acres
- Japanese stiltgrass (*Microstegium vimineum*): 44 reports across 284.9 total acres
- Autumn olive (*Elaeagnus umbellata*): 24 reports across 31.3 total acres

A federal grant for invasive plant species management also allowed TDA to partner with Radnor Lake State Park, the City of Memphis, and TDEC to conduct non-native invasive plant management activities within these areas. Approximately 60 acres of invasive species

management occurred at these sites, with volunteers joining staff to contribute almost 400 volunteer hours of invasive plant removal.

Other forest health trends

Annual Summary

- 17-year periodical cicadas (*Magicicada spp.*) of Brood X emerged in several counties across the state, with the highest numbers emerging in eastern Tennessee. Observations were made by field personnel in response to some visible damage in early summer.
- Hemlock trees in at least 16 counties in the Cumberland Plateau showed symptoms of Rosellinia needle blight (*Rosellinia herpotrichoides*) following a rainy spring and early summer. This disease has periodically caused substantial visible damage to landscape and forest hemlock trees, but is typically only significant following a particularly rainy season as was the case in 2021.
- Oak decline was reported across 26 acres in Bledsoe, Hamilton, McMinn, Monroe, Sequatchie, Van Buren, and White Counties. This is comparable to 2020 observations, but oak decline remains a potential concern for Tennessee prompting continued investigation into this decline complex.

Weather Events

Annual Summary

Tennessee had a total of 29 recorded tornados covering a total reported distance of 36.5 miles from January to May 2021. TDF personnel reported some limited damage from these events, but this season had fewer reported tornadoes than in previous seasons.

An ice storm in mid-February 2021 caused some concerns for transportation and utility services across Tennessee but field observations from TDF personnel following the storm did not note significant forest damage.

Middle Tennessee experienced extensive flooding in March and August 2021, with a record-breaking 17" of rainfall occurring on August 21, 2021 at one site in Humphreys County. The August flash floods affected Dickson, Hickman, Houston, and Humphreys Counties.

Outreach and Education

Annual Summary

Tennessee Division of Forestry has utilized the ProtectTNForests campaign on social media to connect with the public and promote forest health across the state. On Facebook, ProtectTNForests has reached 20,139 users and has received 950 page likes. Additionally, ProtectTNForests has received a total of 261 followers (+41%) on Twitter and has reached 334 users (+71%) on Instagram. The current Protectnforests.org website received increased traffic from the previous 12-months with 20,438 visits (+40%) and served 12,684 users (+43%). The website and social media accounts were continuously updated to inform their respective audiences of workshops, job announcements, new forest health threats, and practices to promote forest health.

Tennessee Department of Agriculture members participated in a number of outreach and education activities, including the annual Tennessee Hemlock Conservation Partnership summer and winter meetings, Tennessee Forestry Association-sponsored conservation workshops and regional meetings, and the annual TDF-funded/TFA-administered Master Logger Training Program. A few programs were changed to a virtual format to accommodate COVID-19 restrictions, but still allowed TDF personnel to engage partners to promote forest health even through an online format. At both in-person and virtual

trainings, information and training regarding forest health monitoring and management was provided to attendees.

The National Firewood Workshop was conducted virtually in June 2021 due to COVID-19 restrictions. The Forest Health Specialist assisted the State Pathologist and Tennessee's Consumer and Industry Services Division to promote trainings for firewood kiln certification of firewood producers in TN.

In addition to meetings and training, landowner assistance was provided by TDF personnel, and resulted in 513 management plans (including plans, revisions, recognitions, and prescriptions) for a total of 68,436 acres. Of these plans, 469 had a health component.

Resources

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