ORGANISATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES

EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION

Newsletter

of the EPPO Network of experts working on surveillance, monitoring, and control of the Emerald ash borer, *Agrilus planipennis*

NO. 8

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Contents of the Newsletter

The webpage of the Network:

https://www.eppo.int/RESOURCES/special_projects/agrilus_planipennis_network

Photo of *Agrilus planipennis* above: Courtesy of Eduard Jendek.

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1. Introduction

Welcome to the 8th issue of the Newsletter of the EPPO Network of experts working on surveillance, monitoring, and control of the Emerald ash borer, *Agrilus planipennis* (Network). This Network was established by the European and Mediterranean Plant Protection Organization (EPPO) following a recommendation made in October 2022 by its Panel on Quarantine Pests for Forestry. The Network was established in association with an EPPO-EU project. Network has received funding from the European Union's Horizon Europe Research and Innovation programme under grant agreement No. 101134200 "*FORSAID: Forest surveillance with artificial intelligence and digital technologies*".

Following the release of the 7th issue of the Newsletter, the Network coordinator received notes from the members of the Network as well as information about new dissertations and publications focused on *A. planipennis* or closely related species. This information made it possible to prepare the 8th issue. Once again, the EPPO Secretariat would like to encourage participants to send all relevant information to the Network coordinator (Dmitrii Musolin, dm@eppo.int).

2. The Network's growth statistics

In March 2025, the Network continued to grow - it has now **315 members (subscribers)** from more than **45 countries**. This indicates a strong interest in the subject. The EPPO Secretariat welcomes you all. Please encourage your colleagues to join the Network via the link https://forms.office.com/e/7GxvJkS0YT (registered email addresses will not be disclosed).

3. EPPO DynaMaps: Tracking the spread of *Agrilus planipennis*

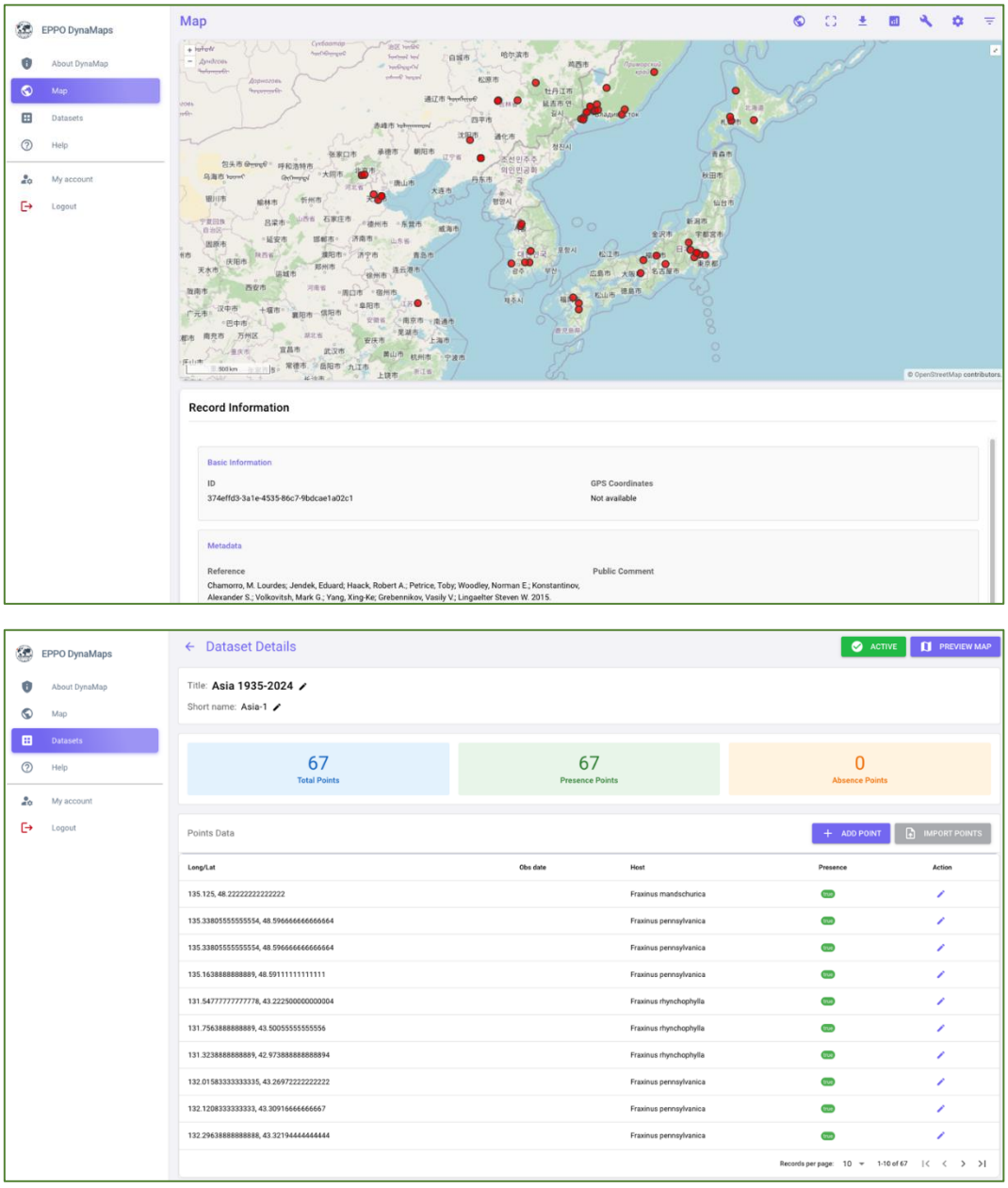
To effectively tackle the challenges posed by *Agrilus planipennis* EPPO has initiated the **EPPO DynaMaps project** – a dynamic and interactive mapping tool designed to meet critical surveillance, monitoring, and control needs across the EPPO region and beyond.

EPPO DynaMaps will offer:

- Dynamic visualization: clearly demonstrating how pest distribution changes over time,
- Comprehensive coverage: detailed local insights throughout the entire EPPO region and potentially broader areas,
- Timely updates: rapid integration of new pest records immediately following verification,
- Verified pest presence data: data sourced from scientific publications or officially confirmed by National Plant Protection Organizations (NPPOs),

- Informative content: enhanced with precise coordinates, detection dates, and host plant details,
- Pest-free area verification: ability to indicate trap locations, providing evidence of areas free from infestation,
- Eradication monitoring: capability to highlight zones where the pest has been successfully eradicated,
- Scalability: a versatile platform suitable for future adaptation to monitor additional pests.

This ambitious initiative is made possible through close collaboration between the EPPO Secretariat, providing technical infrastructure and dataset management, and dedicated experts from the EPPO Panel on Quarantine Pests for Forestry and the Network, who collect, verify and integrate data. EPPO DynaMaps is currently under active development and will soon enter a beta-testing phase. We are currently testing the DynaMap for *A. planipennis* with the first datasets and will soon make it freely available on the EPPO website.



Examples of a map and a data set of the EPPO DynaMap for *Agrilus planipennis*.

4. Documents on *Agrilus planipennis* in the Euphresco Digital Research Object Portal (DROP)

Since 2016 Euphresco has worked on the development of a platform to facilitate the accessibility of digital objects (i.e. documents, data, software, etc.) collected or produced in the framework of plant health research activities.

The Euphresco Digital Research Object Portal (DROP), was developed in the framework of the EU-funded project XF-Actors. Since 2021, DROP has been extended to cover all quarantine and emerging pests, making the platform a hub for the collection and dissemination of plant health research findings. DROP aims to provide a unique entry point to search for open research data and open access documents produced in the framework of Euphresco activities and research projects commissioned by network members. Open data and documents from other sources can also be referenced, if requested by the research funders or the research consortia.

The page for *Agrilus planipennis* in DROP

As of March 2025, the following documents are relevant to *A. planipennis* or other *Agrilus* species:

- Factsheets of high-risk pests and their most promising natural enemies - Preparedness in biological control of priority biosecurity threats,
- Risk-based strategies to prepare for and manage invasive tree borers (PREPSYS),
- Guide for determination of 12 *Agrilus* species native in Austria,
- Developing and assessing surveillance methodologies for *Agrilus* beetles.

Euphresco invites researchers to contact them to explore how the Euphresco network can support their open science activities.

(prepared by **Baldissera Giovani**, Euphresco network coordinator)

5. Contingency plans for *Agrilus planipennis* in the EPPO Member Countries

In the previous issue of the Newsletter, links to the currently publicly available contingency plans for *Agrilus planipennis* were given for several countries. **Since then, members of the Network sent information on the contingency plans for Estonia, Great Britain, Ireland, and Poland.**

Please let us know if similar plans are available for other countries of the EPPO region.

EPPO Secretariat reminds that there are Regional Standards PM 9/10(1) Generic elements for contingency plans and PM 9/14 (1) *Agrilus planipennis*: procedures for official control.

6. *Agrilus planipennis*: Risk-based strategies for pest management

A group of experts from Ukraine recently published a detailed review of risk-based strategies for management of *Agrilus planipennis*. They start with an extensive analysis of publications with a focus on the identification, biology and distribution for the pest and then offer insights into pest detection, monitoring techniques, eradication efforts, and long-term containment strategies. The authors provide critical perspectives on the local context, including the unique challenges posed by *A. planipennis* infestations in Ukrainian ash tree populations.

By integrating global research with regional studies, the authors aim to develop a robust understanding of the current state of Emerald ash borer management and to propose strategies tailored to the Ukrainian context.

Read more:

Davydenko K, Skrylnyk Y, Vorobei E, Baturkin D, Meshkova V (2024) Emerald ash borer: Risk-based strategies to pest management. *Forestry and Forest Melioration* 145: 90–102. https://doi.org/10.33220/1026-3365.145.2024.90

7. Monitoring of *Agrilus planipennis* in Ukraine by the Ukrainian State Specialized Forest Protection Enterprise DSLP 'Kharkivlisozakhist'

Agrilus planipennis was detected for the first time in Ukraine, by specialists from the State Specialized Forest Protection Enterprise DSLP 'Kharkivlisozakhist' in September 2019 in the Markivske forestry district of the state enterprise 'Belovodskoye Forestry and Hunting Enterprise' in an area of 0.9 ha (within a protected area). During further surveys of the surrounding territory, conducted jointly with scientists from the Ukrainian Research Institute of Forestry and Forest Melioration (URIFFM), the pest was also found in natural regeneration areas and forest belts up to 70 km from the initial detection site. The trees damaged by *A. planipennis* were of different ages, mostly varying from 3 to 15 years old. The ecological density was recorded at the level of 1–3 larvae per dm^2 under the bark, indicating that infestation likely began around 2017.

In 2020, the Phytosanitary Service detected the spread of *A. planipennis* in the Troitskiy, Bilokurakyne, and Novopskov districts of Luhansk Region, while specialists from the forest protection enterprise identified its presence in plantations of three state enterprises. The total affected area reached 432.0 ha.

An adult feeding on the leaves of *Fraxinus pensylvanica* (Kupyansk, Kharkiv region) and galleries of *Agrilus planipennis* (Kupyansk, Kharkiv Region, Ukraine, 2021). Photos by D. Baturkin.

In 2021, the pest was found in plantations of the state 'Kupiansk Forestry Enterprise' on *Fraxinus pennsylvanica* trees (with ecological density of 1–2 larvae per dm^2). Additionally, *A. planipennis* was recorded in the Dvorichanskyi National Nature Park, in forest belts, and alongside the road between the village of Zapadnoe and the settlement of Dvurichnaya.

Between 2022 and 2024, reports were published of *A. planipennis* detections by Phytosanitary Service specialists in parks and squares in Kyiv. Currently, the pest has been confirmed in three regions of Ukraine. Due to the geopolitical situation, surveying territories affected by ongoing or recent military activities remains challenging, preventing a comprehensive understanding of *A. planipennis* distribution. It can be assumed that the Emerald ash borer is spreading in parks, forested areas, protective and roadside forest belts, natural regeneration sites, and other suitable habitats.

Read more: State Specialized Forest Protection Enterprise DSLP 'Kharkivlisozakhist'

(prepared by **Denys Baturkin**, State Specialized Forest Protection Enterprise DSLP 'Kharkivlisozakhist' and **Kateryna Davydenko**, G. M. Vysotskiy Ukrainian Research Institute of Forestry & Forest Melioration and Swedish University of Agricultural Sciences)

8. A simulation exercise to test the contingency plan for *Agrilus planipennis* in Wroclaw (Poland)

On December 4, 2024, a simulation exercise was held in Wroclaw, Poland, to test the contingency plan for *Agrilus planipennis*. The event was organized by the Phytosanitary Surveillance Department of the Voivodeship Inspectorate of Plant Protection and Seed Inspection in Wroclaw. The primary objective was to familiarize inspectors with the procedure and practice of assigning roles and responsibilities in the event of the pest's detection in Poland.

A simulation exercise in Wroclaw (photos from the website of the Voivodeship Inspectorate for Plant Protection and Seed Inspection in Wroclaw).

During the exercise, inspectors analyzed a simulated scenario in which *A. planipennis* was caught in a pheromone trap in a tree within an ash tree alley inhabited by protected bird species. The training participants—division managers and staff responsible for phytosanitary issues—were divided into four independent teams. Each team was assigned a specific aspect of the simulated scenario to address.

As a result of the exercise, team leaders delivered presentations outlining the necessary tasks and actions required from inspectors to ensure preparedness for a potential pest incursion. This was followed by a discussion on weaknesses identified in the procedure during the exercise.

Simulation exercises for implementing contingency plans against priority pests serve as valuable tools for assessing the capacity of relevant services to respond effectively to emergency situations.

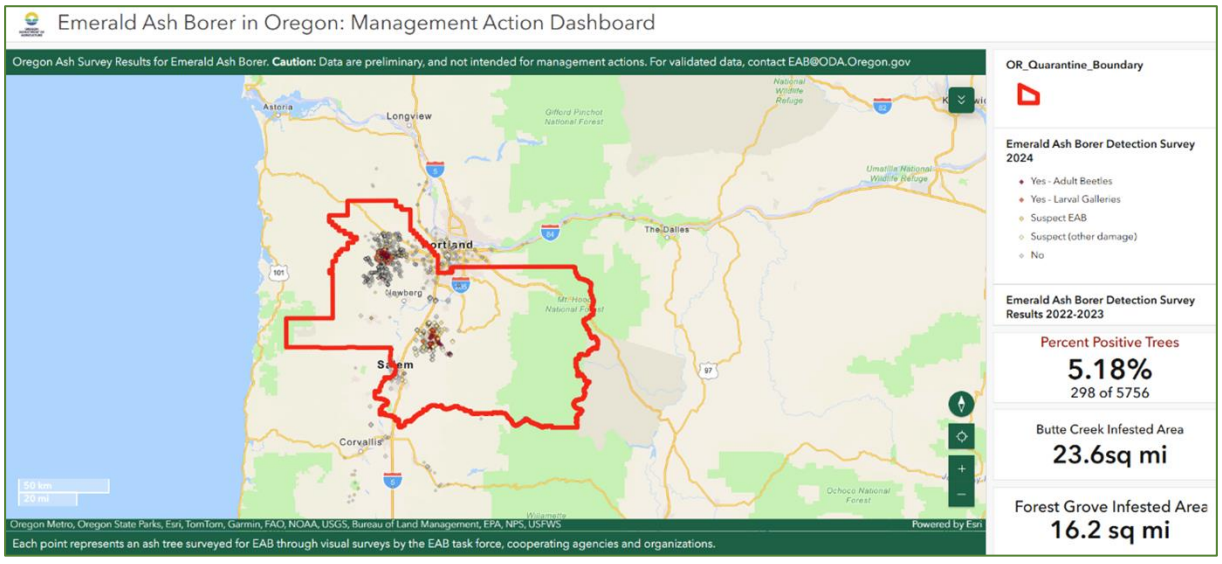
Read more:

Information on the simulation exercise on the website of the Voivodeship Inspectorate for Plant Protection and Seed Inspection in Wroclaw.

(prepared by **Magdalena Kacprzyk,** University of Agriculture in Krakow)

9. *Agrilus planipennis* in Oregon (USA)

Agrilus planipennis was first detected in Oregon in 2022, but the state has been preparing for the arrival of this invasive pest since 2018, when state and federal agencies collaborated to develop a comprehensive strategy. The first detection triggered activation of the previously prepared Emerald ash borer readiness and response plan. The Oregon Department of Agriculture (ODA) was designated as the lead agency, overseeing regulatory efforts and coordinating with other state entities. When the federal quarantine for Emerald ash borer was lifted in 2021, Oregon updated its plan accordingly, ensuring a structured response in the event of an outbreak.

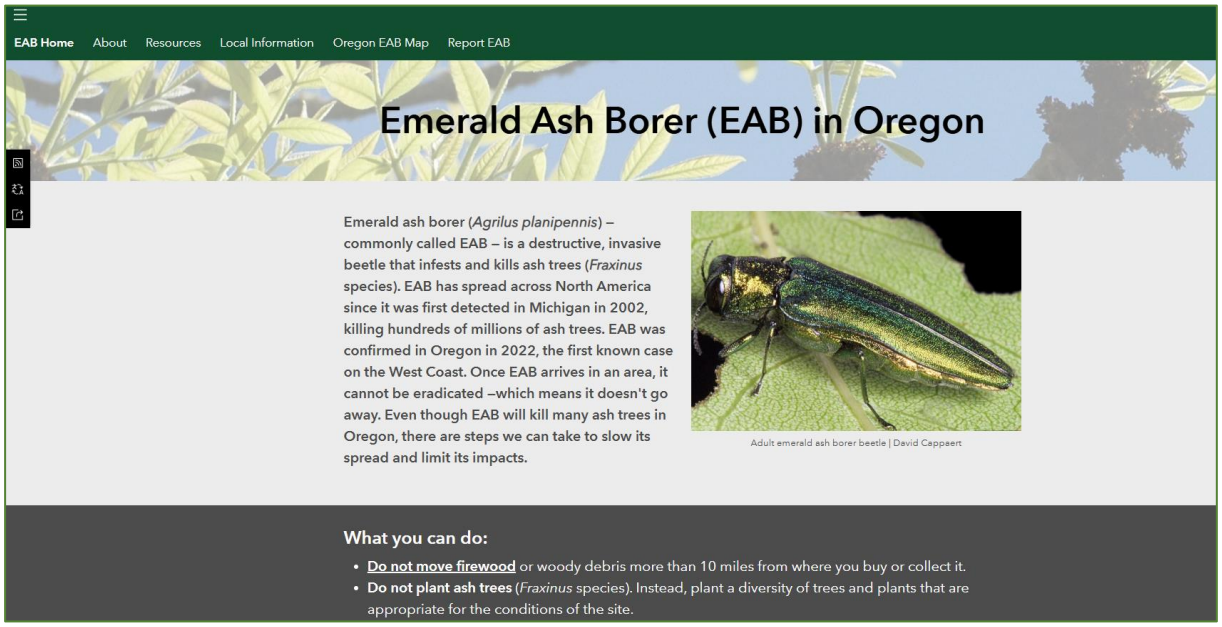


Emerald Ash Borer Management Action Dashboard tracks confirmed cases of *A. planipennis* in Oregon.

To further enhance public awareness and coordination, the Oregon Department of Forestry (ODF) and ODA collaborated in 2024 to launch a new website and interactive map. The Oregon Emerald Ash Borer Map integrates key datasets, including *A. planipennis* trap surveys, risk assessments, and management recommendations tailored to affected areas.

Upon detection of *A. planipennis*, ODA promptly formed the Emerald ash borer Task Force and has held monthly meetings since September 2022 to guide ongoing management efforts.

As part of its Insect Pest Prevention and Management (IPPM) program, ODA employs entomologists responsible for species identification and confirmation. This expertise has positioned ODA as the official state authority for EAB-related diagnostics and regulatory actions. The agency also manages the Emerald Ash Borer Management Action Dashboard, which tracks confirmed cases and provides critical information for response efforts.

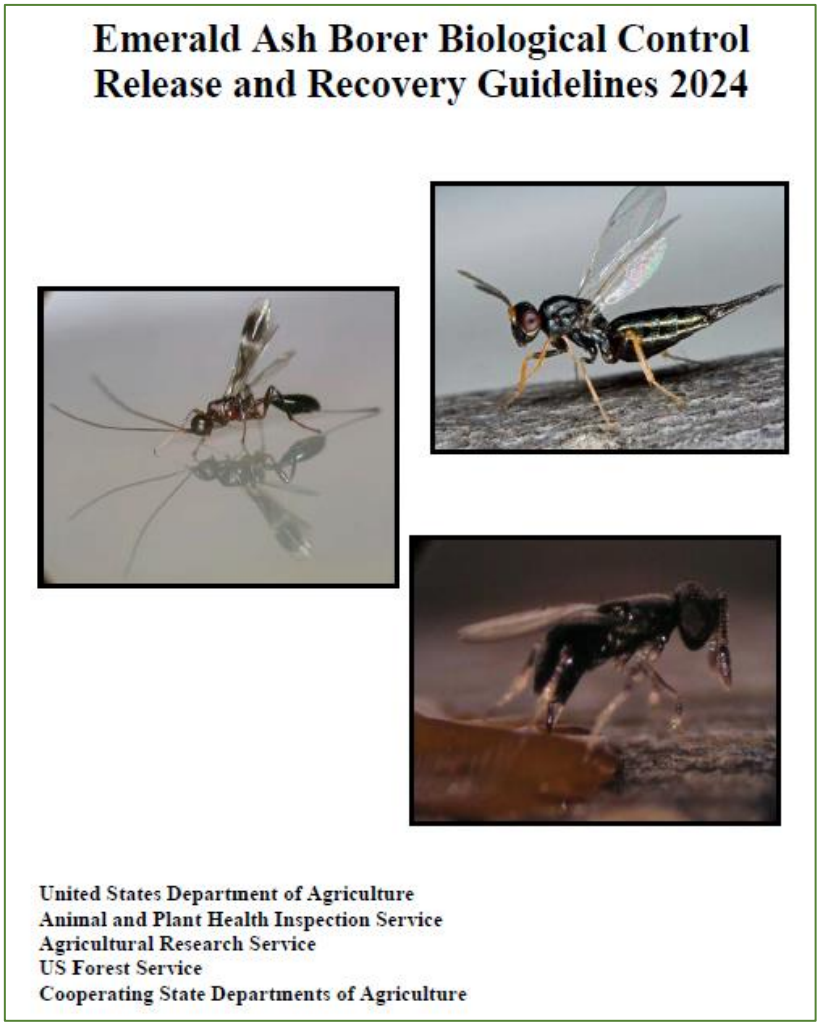


The Emerald Ash Borer (EAB) in Oregon website.

The new website, Emerald Ash Borer (EAB) in Oregon, serves as a central hub of information for landowners, policymakers, and conservation groups working to mitigate the spread of *A. planipennis* in Oregon.

(prepared by **Wyatt Williams**, Oregon Department of Forestry, USA, and **Magdalena Kacprzyk,** University of Agriculture in Krakow, Poland)

10. Biological control of *Agrilus planipennis*



At the end of 2024, United States Department of Agriculture published ***Emerald Ash Borer Biological Control Release and Recovery Guidelines 2024*** prepared by Juli S Gould, Theresa Booth (Murphy), Nicole Sawallich, and Toby Petrice. The book covers: history of introduction of *Agrilus planipennis* to North America (since the early 1990s), theoretical and practical approaches to biological control of this pest, field release of biocontrol agents, evaluation of parasitoid establishment, traps, identification, practical guidance.

Read more:

USDA-APHIS/ARS/FS (Gould JS, Booth T, Sawallich N, Petrice T) (2024) Emerald Ash Borer Biological Control Release and Recovery Guidelines. Riverdale, Maryland: U.S. Department of Agriculture, Animal Plant Health Inspection Service, Agricultural Research Service, Forest Service. 75 p. Available: https://www.fs.usda.gov/nrs/pubs/download/EAB-FieldRelease-Guidelines-2024.pdf, https://research.fs.usda.gov/treesearch/68273

11. New MSc theses using pests of *Fraxinus* spp. as models

Recently, three MSc theses, in which *A. planipennis* and ash decline were used as models, were presented in the USA and Canada:

Elesin IB (2024) The influence of abiotic stress and cultivar variation on plant defenses and resistance to emerald ash borer (*Agrilus planipennis*) in cultivated olive (*Olea* spp). MS Thesis. Department of Biological Sciences, Wright State University. Available at: https://etd.ohiolink.edu/acprod/odb_etd/ws/send_file/send?accession=wright1736896595601931&disposition=inline

Original abstract: Emerald ash borer (EAB), *Agrilus planipennis*, is an invasive pest that **significantly impacts olive trees (*Olea europaea*).** This study aimed to assess **the role of abiotic stress factors** such as drought and salinity **in influencing plant defenses and resistance** to EAB, while also examining **cultivar variation in resistance**. The study specifically aimed to address: (1) What effects do varying degrees of abiotic stress (drought, salinity) have on olive trees' antioxidant and peroxidase activity in olive tree? (2) Do distinct olive cultivars exhibit varying levels of resistance to EAB under various stressors? We used a controlled experimental design with two stress treatments (drought and salinity) and 20 olive cultivars to conduct the bioassay. **Growth metrics (height and stem diameter), peroxidase activity, and antioxidant activity were measured**, **while EAB survival and performance were assessed by monitoring larval feeding and growth**. Results indicated **no significant differences in antioxidant activity between treatments**, although **low salinity slightly enhanced antioxidant responses**. Peroxidase activity was highest under high salinity, and growth responses varied by treatment and cultivar, with Leccino showing the highest antioxidant activity. **EAB larvae performed best under drought conditions but exhibited poor survival on certain cultivars**. These findings suggest that **abiotic stress influences both plant defense mechanisms and pest resistance, with cultivar-specific responses to stress and pest pressure**.

Franks D (2024) Impacts of inundation on fine-scale forest health and composition within an air force installation. MS Thesis. Johns Hopkins University, Baltimore, Maryland. Available at: https://jscholarship.library.jhu.edu/handle/1774.2/70378

Original abstract: Scott Air Force Base (SAFB) is experiencing a transition of its bottomland hardwood forest to open canopy wetland and willow habitat in response to increasingly frequent and prolonged inundation. Flooding has resulted in large die-offs of mature hardwood trees that sensitive species (i.e., *Myotis* bats) are reliant on for habitat. Additionally, impacts from invasive emerald ash borer (*Agrilus planipennis*) have caused **broad scale mortality of green ash (*Fraxinus pennsylvanica*)**, a predominant floodplain species on SAFB. Installation managers seek to understand how and why these changes are occurring to mitigate flooding impacts and support sensitive species using future management tools. We hypothesize that the SAFB forest has differing health and composition metrics between zones that experience varying levels of floodwater inundation. We used **dendrochronological analyses** on green ash trees and vegetative analyses of all trees (>2.5 cm diameter at breast height) to analyze forest health and composition within these two zones of differing inundation. **Zone level analyses demonstrated differing tree sizes**

based on health categories, as well as distinct diversity metrics for mature trees, but not saplings. Analysis at the plot level revealed **differences in tree height between zones**, but no **difference in tree size, density, or abundance**. Tree cores revealed **similar growth patterns between zones**, but **overall larger rates of growth in the upland zones**. Results indicated **differing health and composition between the differentially flooded zones**. Trends in the more inundated areas indicated a trajectory toward less preferred bat roosting habitat.

Manoharan H (2025) Vegetation community response to black ash decline in the Lake Simcoe watershed. MSc thesis. University of Toronto, Canada. Available at: https://utoronto.scholaris.ca/items/84390961-c723-4183-b0e9-c182256e3201

Original abstract: Black ash (*Fraxinus nigra* Marsh.) is an endangered deciduous tree species in Ontario, Canada, threatened primarily by the invasive wood-boring emerald ash borer Fairmaire (*Agrilus planipennis*) (Coleoptera: Buprestidae). Black ash is a common swamp canopy species, and the loss of its presence in the forest canopy has been known to trigger ecosystem-scale changes in vegetation community structure and stand hydrology. This project aims **to quantify the extent of black ash decline** using permanent Vegetation Sampling Protocol (VSP) plots in the Lake Simcoe Region watershed, established in 2017 as part of the Lake Simcoe Protection Plan. VSP data is used to assess structural, hydrological, and vegetation responses to black ash loss over a 7 year time period (2017 to 2024). Results indicate **a significant decline of black ash basal area and coverage in canopy and subcanopy layers, and small declines in shrub and groundcover layers**. Plant species richness increased in these upper three layers, while species diversity remained relatively similar in all layers. Vegetation composition also remained relatively stable over the assessed period, with little evidence of major temporal shifts in dominant species. Despite apparent compositional similarity between 2017 and 2024, there was an increase in obligate wetland species in the groundcover layer, and an overall trend towards wetter conditions as assessed through species wetness coefficients. These results reflect the **impacts of black ash loss in non-ash-dominated forests**, where co-occurring canopy species may mitigate major compositional change that may otherwise occur in more significant canopy dieback events. Further long-term monitoring is required to evaluate any intensifying hydrological changes and the ability of functional replacements of black ash to tolerate shifts in community structure.

12. New publications on *Agrilus planipennis* and related species

After the release of the previous Newsletter, information on **29 new publications** on *A. planipennis* and on other relevant species (taxonomically related *Agrilus* species and key pests of *Fraxinus* spp.) have been received (24 journal papers, 3 conference abstracts, 1 guideline, and 1 book chapter; in addition to the data on new theses – see Section 11).

The range of topics is very wide and includes the following:

- *A. planipennis* in **Russia** (Egorov, 2025 [spreading of the invasive range]; Nikolaeva, Yemelyanova, 2024; Sidel'nikov, 2024);
- *A. planipennis* in **Ukraine** (Davydenko et al., 2025; Martynov et al, 2024; Meshkova, Skrylnyk, 2025);

- *A. planipennis* in **the USA** (Hudak, 2025; Perkins, Ragozzino, 2025);
- A gut bacterium of *A. planipennis* that degrades cellulose of velvet ash (*Fraxinus velutina*) (Wang et al., 2025);
- Larval development and parasitism of *A. planipennis* (Callahan et al., 2025);
- North American hymenopteran parasitoids of *A. planipennis*: seasonal abundance and interaction with introduced Asian parasitoids (Petrice et al., 2025);
- Biological control release and recovery guidelines (USDA–APHIS/ARS/FS, 2024);
- Augmentative biological control in plantation forests in China (Wang, Yang, 2025);
- Risk-based strategies to management of *A. planipennis* (Davydenko et al., 2025);
- A bioeconomic analysis of objective-based management options for *A. planipennis* (Martin et al., 2025);
- Invasive pests as potential drivers of urban forest distributional inequalities and inequities (Martin, Conway, 2025);
- *A. planipennis* in urban environment (Petrova et al., 2025);
- Citizen science and risk-based surveillance (van Woensel et al., 2025);
- Natural recovery of *F. excelsior* in Northern Europe (Matisone et al., 2025);
- Regeneration of ash and co-occurring species 20 years following invasion in North America (Wilson et al., 2025);
- Seed regeneration of *F. pennsylvanica* (Antipina et al., 2024);
- Traps and trapping protocols for *Agrilus* spp. (Santoiemma et al., 2024, 2025);
- Image-based recognition of *Agrilus* spp. using advanced neural networks (Caruso et al., 2023);
- Using of barcoding for identification of potential insect ecological interactions (Borsato et al., 2025);
- Detection of larvae using a dual branch time-frequency multi-dilated dense network (Zhang et al., 2025);
- gene silencing mechanism triggered by dsRNA in ash seedlings (Pampolini, Rieske, 2025);
- Molecular Identification of *Agrilus anxius* using a qPCR assay with LNA probe (Rizzo et al., 2025);
- Early detection strategies for invading tree pests (Alonso Chávez et al., 2025);
- Using artificial neural networks to explain the attraction of jewel beetles (Buprestidae) to colored traps (Santer, Akanyeti, 2025).

A reference list and an abstract of each of these publications are given in Section 14. Most of the papers are available as full text via the provided links; others may be made available on request to the authors.

13. A closing remark

That is about all for the 8th issue of the Newsletter. The EPPO Secretariat looks forward to receiving your notes, news and publications, links to recently published papers and conference abstracts by you and your colleagues, any other relevant pieces of information and announcements on Emerald ash borer so the Network can distribute them via these Newsletters.

Please inform your colleagues in your country and around the world about the Newsletter. The email for correspondence is dm@eppo.int (Dmitrii Musolin).

14. References received (April 2025; with original abstracts)

Alonso Chávez V, Brown N, van den Bosch F, Parnell S, Dyke A, Hall C, Karlsdottir B, Marzano M, Morris J, O'Brien L, Williams D, Milne AE (2025) Early detection strategies for invading tree pests: Targeted surveillance and stakeholder perspectives. *Journal of Applied Ecology* 1–15. https://doi.org/10.1111/1365-2664.70009

1. Trees are at an increasing risk from pests and diseases as global trade of trees and their products increases. One of the most destructive pests found outside its native range is the emerald ash borer (*Agrilus planipennis* Fairmaire), responsible for the death of millions of ash trees in the United States, Canada, Russia and Eastern Europe. Its early detection in countries where it is not yet present is essential for effective control.

2. One of the **most likely introduction pathways** for emerald ash borer into Great Britain (GB) is through **firewood imports from Eastern Europe**, with potential spread from ports, firewood depots and households using wood-burning fires. We developed **a novel modelling framework** accounting for the likely invasion pathways of emerald ash borer, its population dynamics, spread and detection sensitivities to determine sampling locations that maximise the probability of detection within 2, 4 and 8 years. To provide a sociological perspective, we interviewed firewood stakeholders to understand biosecurity implications of importing and moving firewood and used scenario workshops to explore landowners' willingness to adopt early detection methods for the emerald ash borer.

3. **Optimised sampling strategies** significantly improve detection compared with ranked entry points (REPS) if detection resources are plentiful and optimisation targets detection within 8 years of emerald ash borer arrival. For detection within less than 4–6 years or fewer than 70 detection devices REPS are almost as effective as optimised strategies. The methods' detection sensitivity and knowledge of likely entry pathways influence the optimal spatial sampling design.

4. **Firewood imports are actively inspected**, and samples taken to ensure biosecurity measures are followed, **but compliance at source remains uncertain**. Landowners with many ash trees were more open to tree girdling, which may lead to increased detection.

5. Synthesis and applications: **We provide the first surveillance map for emerald ash borer incursions in GB** with potential for deployment by government agencies and stakeholders concerned with biosecurity. Our framework establishes **optimal surveillance locations** depending on factors, including detection within different timeframes, knowledge certainty of entry pathways and sensitivity of detection methods. This methodological framework is applicable to other invasive threats.

Antipina GS, Platonova E, Morozova A (2024) Seed regeneration of green ash (*Fraxinus pennsylvanica* Marshall) in green spaces of Petrozavodsk city. *Hortus Botanicus*, 19: 197-221. (in Russian with English summary). https://cyberleninka.ru/article/n/semennoe-vozobnovlenie-yasenya-pensilvanskogo-fraxinus-pennsylvanica-marshall-v-zelenyh-nasazhdeniyah-goroda-petrozavodska

Green ash (*Fraxinus pennsylvanica* Marshall) is an invasive species in many European countries and regions of Russia. A number of experts recommend limiting the use of this species in landscaping due to its intensive rapid and the possible spread of a dangerous pest *Agrilus planipennis* F. The study was carried out in Petrozavodsk (Republic of Karelia), located in the middle taiga subzone, where green ash is common in street landscaping, parks, and courtyards. Seed productivity of the trees, morphometric parameters, and germination rate of seeds were

estimated in 2023. The number of flowers on the shoots is large: on female trees from 3.5 thousand to 6.5 thousand / 1 total meter of shoot (on average 4878 flowers), on male trees from 4.8 thousand to 7.4 thousand / 1 meter of shoot (average 5853 flowers). Potential seed productivity is almost 5 thousand seeds / 1 total meter of shoot. The sizes and morphology of the samaras correspond to the species characteristics. Field germination of seeds with stratification is 34%. By autumn, the seedlings have formed apical, and lateral buds, which increases the chances of young plants to survive in the winter. Seedlings of green ash in Petrozavodsk occur sporadically. Seed germination is limited possibly by deficit of light and moisture, competition from trees, shrubs and perennial grasses. At the same time, there are individual successful examples of self-seeding of green ash in Petrozavodsk, and the plants reach the age of several years and form seeds. Thus, the invasive potential of the plant in the conditions of South Karelia is not realized; mass self-seeding and widespread dispersal of this species outside the green spaces are not observed. **The dangerous pest *Agrilus planipennis* is not registered in the republic.** In the northern region there are not many beautiful broad-leaved woody species that demonstrate successful growth in urban environments. **Green ash should not be excluded from the list of species used in landscaping in Petrozavodsk in present climate conditions.** Botanical control and phytosanitary control of planting material in urban conditions is necessary.

Borsato ND, Lunn K, Garrett NR, Biganzoli-Rangel AJ, Marquina D, Steinke D, Floyd R, Clare EL (2025) Identification of potential insect ecological interactions using a metabarcoding approach. *PeerJ* 13: e18906. https://peerj.com/articles/18906/

Species interactions are challenging to quantify, particularly when they happen cryptically. Molecular methods have become a key tool to uncover these interactions when they leave behind a DNA trace from the interacting organism (e.g., pollen on a bee) or when the taxa are still present but morphologically challenging to identify (e.g., microbial or fungal interactions). The decreasing costs of sequencing makes the mass analysis of thousands of target species possible. However, the challenge has shifted to selecting molecular markers which maximize information recovery while analyzing these data at broad biological scales. In this manuscript we use model arthropod groups to compare molecular markers and their analysis across life stages. **We develop protocols for two ecologically and economically devastating pests**, the spongy moth (*Lymantria dispar dispar*) and **the emerald ash borer (*Agrilus planipennis*)**, and a group of pollinators including bees and wasps which regularly deposit eggs in "bee hotels" where the larvae develop. **Using Illumina MiSeq and Oxford Nanopore MinION platforms we evaluate seven primer pairs for five molecular markers** which target plants, fungi, microbes, insects, and parasitic phyla (e.g., nematodes). **Our data reveals hundreds of potential ecological interactions and establishes generalized methods which can be applied across arthropod host taxa** with recommendations on the appropriate markers in different systems. However, we also discuss the ch**allenge of differentiating co-occurring DNA signals and true ecological interactions**, a problem only starting to be recognized as eDNA from the environment accumulates on living organisms.

Callahan HL, Duan JJ, Ragozzino ML, Tallamy DW (2025) Larval development and parasitism of emerald ash borer (*Agrilus planipennis*) in Oregon ash (*Fraxinus latifolia*) and European olive (*Olea europaea*): implications for the West Coast invasion. *Journal of Economic Entomology* toaf008, https://doi.org/10.1093/jee/toaf008

The invasive emerald ash borer (*Agrilus planipennis* Fairmaire) (EAB) has been devastating North American ash (*Fraxinus* spp.) resources for over 2 decades. In its native range, EAB attacks and kills primarily stressed ash trees. In North America, however, EAB also attacks

healthy trees of every *Fraxinus* species encountered, most recently Oregon ash (*Fraxinus latifolia* Benth.). Successful EAB development has also been reported in European olive (*Olea europaea* L.). **The recent detection of EAB in Oregon puts the future of these 2 hosts into question**, as little is known about EAB's development in these species or how introduced biocontrol agents will respond. We conducted **laboratory and field infestations of olive and ash** in Delaware and Oregon to assess EAB development and associated parasitoid responses. **We found no difference in the net population growth rate of EAB developing in Oregon ash versus green ash**. However, **these species supported significantly more population growth than olive, in which EAB net population growth rate was zero, with most larvae dying prematurely.** Artificially infested **olives were small**, which may have negatively impacted phloem availability and larval survival. Future studies should be conducted investigating EAB development on larger olive material. **Although no parasitism was observed in infested olive**, as EAB larvae seldom reached life stages (third or fourth instars) susceptible to larval parasitism, late-instar larvae developing in Oregon ash were attacked by both *Tetrastichus planipennisi* Yang and *Spathius galinae* Belokobylskij and Strazanac, suggesting that **biocontrol is a suitable option for this newly invaded region**.

Caruso V, Shirali H, Bouget C, Cerretti P, Curletti G, de Groot M, Groznik E, Gutowski JM, Pyliatuk C, Roques A, Sallé A, Sweeney J, Wührl L, Rassati D (2025) Image-based recognition using advanced neural networks can aid surveillance of *Agrilus* (Coleoptera, Buprestidae) jewel beetles. *ARPHA Preprints*. https://doi.org/10.3897/arphapreprints.e154842

The genus *Agrilus* includes two species, ***A. planipennis*** **and** ***A. anxius*****, that are of particular phytosanitary concern and that are regulated by the European Union legislation**. This implies that phytosanitary agencies of all EU countries are obliged to establish specific surveillance programmes to verify the absence of these species from their territory. These activities commonly consist of the use of green-colored traps, which are however attractive not only for *A. planipennis* and *A. anxius* but also for a wide range of other *Agrilus* species. For this reason, much time and expertise is required to sort and identify specimens to species, impeding an efficient rapid response. In this study, we tested the efficacy of the **Entomoscope,** a low-cost, open-source photomicroscope that uses **high-resolution digital imaging and allows a pre-trained CNN model to accurately detect, image and classify insect specimens, for automatic identification of 13** ***Agrilus*** **species**, including *A. planipennis* and *A. anxius*. The correct species was among the top five most probable predictions made by the trained CNN 94.5% of times. For most species, including A. *planipennis* and *A. anxius*, either no errors or only a few errors were made, whereas for a few native species misidentifications were more common. The trained CNN also efficiently classified as "unknown" species that were not used in the training process. These results provided proof of concept for an AI-driven surveillance system that can strongly aid in surveillance activities of *Agrilus* species.

Davydenko K, Skrylnyk Y, Vorobei E, Baturkin D, Meshkova V (2024) Emerald ash borer: Risk-based strategies to pest management. *Forestry and Forest Melioration* 145: 90–102. https://doi.org/10.33220/1026-3365.145.2024.90

Emerald ash borer (EAB) originates from Southeast Asia, since the1990s it has been widely established across large areas in North America and the European part of Russia. Since 2019, EAB has been found in the Luhansk region of Ukraine and is **now present in three regions of Ukraine. The main steps to be taken in case of EAB detection are described**. The measures to eradicate the EAB infestations, slow down its spread, and mitigate its impact are revised. The long-term efforts of EAB control in North America could not stop pest spread. **Including EAB in the A1 quarantine list of Ukraine also does not allow for preventing the spread of**

this pest. Suggested measures will not allow for preserving resistant *Fraxinus* sp. genotypes that might otherwise survive. The **main methods** to control EAB spread and mitigate the consequences of its attacks are those recommended for forest protection against other stem pests. They include **in-time surveys** and fell**ing infested trees before EAB larvae complete their development**.

Egorov LV (2025) First findings of the invasive species *Agrilus planipennis* (Coleoptera: Buprestidae) in the territory of the Chuvash Republic. In: Natural Science Research in Chuvashia and Adjacent Regions: Materials of reports of the Interregional scientific and practical conference (Cheboksary, February 27, 2025). [Естественнонаучные исследования в Чувашии и сопредельных регионах: материалы докладов Межрегиональной научно-практической конференции (г. Чебоксары, 27 февраля 2025 г.)]. Chuvash National Museum. Cheboksary: Perfectum, 2025. Iss. 11. P. 104–114. (in Russian, with English summary)

Based on the results of our research in 2024, **the first information is provided on the findings of the *Agrilus planipennis* Fairmaire, 1888 (Coleoptera: Buprestidae) in Chuvashia**. The species has already **spread across anthropogenic landscapes** of the republic, affecting trees of the introduced *Fraxinus pennsylvanica* Marsh. Indigenous *Fraxinus excelsior* L. in the natural communities of the National Park «Chavash varmane» is not yet damaged by this species. [three locations close to 56.1°N, 47. 2°E; see text for details]

Hudak PF (2025) Emerald ash borer (*Agrilus planipennis* Fairmaire) damaging bottomland forest in North-Central Texas, USA. *Qual Manage* 34: e70033. https://doi.org/10.1002/tqem.70033

Emerald ash borer (*Agrilus planipennis* Fairmaire) (EAB), a phloem-feeding beetle native to Asia, continues to destroy ash trees across the United States. The objective of this study was to assess EAB damage to green ash (*Fraxinus pennsylvanica*) and seedling recovery in dwindling (remnant) bottomland near a water supply reservoir in Denton County, Texas. EAB damage was extensive; however, numerous seedlings were thriving and suggest the area will recover. Large trees suffered the most damage. Of 101 large-diameter (16–60 cm) trees, only nine were alive, and none were in good health. In a small-diameter (2.5–15 cm) class, only 49 of 174 trees were living, and 15 were in good health. Interior excavation galleries on a recently fallen tree indicate EAB may have been present in Denton County earlier than previously documented. This study highlights the **continued spread of EAB in the southern part of its range**, **recovery patterns**, and a **need for public outreach** as part of an integrated management plan to address the problem.

Martin AJF, Conway TM (2025) Invasive pests and pathogens as potential drivers of urban forest distributional inequalities and inequities. *Urban Forestry & Urban Greening* 128671. https://doi.org/10.1016/j.ufug.2025.128671

Environmental injustices are influenced by socio-political and environmental legacies. Urban forest inequalities and inequities are often attributed to drivers like systemic racism and segregation. However, in recent decades, invasive pests and pathogens have substantially changed urban forests. It is not known how these invasive pests and pathogens act as a driver of urban forest inequalities and inequities. At the western range of Dutch elm disease (*Ophiostoma* spp.) and emerald ash borer (*Agrilus planipennis*), **we examined how the loss of localized street tree monocultures of elm (*Ulmus* spp.) and ash (*Fraxinus* spp.) will result**

in changes to distributional justice. We examined street tree count and basal area distributions, applying the Gini Index to measure inequality under current conditions and hypothetical pest-induced loss scenarios. Findings reveal that DED-related elm losses could improve distributional equality, likely due to the high density of elm in already greener areas, while **EAB-related losses of ash could increase inequalities**. These street **tree losses would disproportionately affect areas of high economic dependency, ethno-cultural composition, and situational vulnerability**. Our results indicate that **pest-induced urban forest losses do not merely reduce canopy cover but may reshape distributional equality and equity in ways that align with socioeconomic disparities**. This research highlights the need to incorporate principles of environmental justice in pest management approaches and replanting efforts, particularly prioritizing systemically marginalized communities. These findings underscore the critical role of diversity and strategic planning in urban forest resilience, advocating for practices that mitigate the social and ecological impacts of invasive pests and pathogens.

Martin AJF, Olson LG, Ngan A, Conway TM (2025) A bioeconomic analysis of objective-based management options for late-stage emerald ash borer (Coleoptera: Buprestidae) infestations. Journal of Economic Entomology, toaf037, https://doi.org/10.1093/jee/toaf037

Following its North American introduction, the emerald ash borer (*Agrilus planipennis* Fairmaire) (Coleoptera: Buprestidae) (EAB) has devastated ash populations (*Fraxinus* Linnaeus) (Oleaceae), largely extirpating the genus from infested regions. Previous cost-benefit analyses of EAB management options, including insecticidal injections, preemptive removals, and replanting, have examined early-stage infestations. This study tests options for late-stage EAB management based on ecological and economic objectives. We parameterized management decisions to evaluate tree counts, basal area, and urban forest value under 7 management options, varying if and when ash trees were injected, removed, and replanted with non-ash species. The simulation is applied to the remaining ash population in Mississauga, Ontario where tree coring and annual assessments determined that injected trees have reduced growth rates and are declining in condition. The results demonstrate that injections help preserve the ash population, maximize basal area, minimize spikes in annual costs, and reduce cumulative costs earlier in the 20-yr study period. However, long-term cost reduction is achieved through ceasing injections and removing ash as they die from EAB. Maintaining tree counts and maximizing net value is achieved through proactive replanting and winding down basal injections, coupled with a slow rate of removal, ultimately bringing the SLow Ash Mortality approach to a close.

Martynov VV, Gubin AI, Nikulina TV, Orlatyi AA (2024) The first record of the Emerald ash borer *Agrilus planipennis* Fairmaire (Coleoptera, Buprestidae) in Donbass. *Entomol. Rev.* 104, 279–281 (Originally published in Russian: *Proceedings of the Russian Entomological Society*, 2024, 95 (1): 54–57. https://doi.org/10.1134/S0013873824040043

Infestation with the emerald ash borer *Agrilus planipennis* Fairmaire, 1888 (Coleoptera: Buprestidae) was detected in **September 2024** in roadside stands along the Debaltsevo–Lugansk–Rovenki highway in the Donbass region. A similar pest focus was found in the Sea of Azov region along the Rostov-on-Don–Novoazovsk highway, approximately 40 km west of Taganrog. Judging by the extent of spreading and the signs of tree decline, **the species must have appeared in the Donbass region no later than 2021 or 2022**. Adult parasitoid wasps ***Spathius polonicus*** Niezabitowski, 1910 were reared from the emerald ash borer larvae found in the infested trees. The invasion of *A. planipennis* in Donbass appears to depend on **dispersal along roadside forest belts**. It is notable that the species was not recorded in natural ravine forests of the Donetsk Ridge during forest pathology surveys in 2019–2024.

Matisone I, Klavina D, Matisons R, Krastina K, Aunina A, Krivmane B, Ramanenka M, Davydenko K (2025) A new hope: Condition of young stands suggests natural recovery of European ash in Northern Europe. *Forest Ecology and Management* 583: 122593, https://doi.org/10.1016/j.foreco.2025.122593

> The dieback has severely affected both overstory trees and natural regeneration of European ash (*Fraxinus excelsior*). The diseased mature trees have mostly been harvested, and ash has regenerated only naturally. The **density and health condition of the naturally regenerated ash were assessed** in 69 young stands in post-clear- or sanitary clear-felled mixed stands scattered across **Latvia**. On average, 4665 ashes per ha were accounted, of which 59 % were healthy, 36 % were infected to varying degrees, and 4 % had died recently. The density and health condition of young ash were similar to the prior survey in 2015, suggesting some **stability of ash in the ecosystem with relatively rich natural regeneration**. Nevertheless, the age/size-related susceptibility to disease has shifted, as the damage increased for the saplings, while the health condition, hence vigour and growth of the larger ashes improved considerably, suggesting a potentially successful regeneration pulse. Still, stand properties affected the health of ash. **The health condition was positively related to the overall tree density, and negatively related to the density of ash, suggesting that removal of the infected ashes by selective thinning could enhance the vitality of the stands**. The current stand composition suggests regeneration of mostly mixed broadleaved stands with ash admixture, and implying a gradual recovery of European ash. [*Hymenoscyphus fraxineus*]

Meshkova VL, Skrylnyk YY (2025) Emerald ash borer and mistletoe on ash trees in urban plantings of Kharkiv. In: Plants and Urbanization. XIV International scientific-practical conference. Dnipro (February 3, 2025). [Рослини та урбанізація: Матеріали XIV Міжнародної науково-практичної конференції (Дніпро, 3 лютого 2025 р.)]. P. 258–260.

> The study aimed to assess the distribution patterns of EAB and mistletoe prevalence in urban plantings, to estimate the proportion of infested trees and their health, considering tree diameter. In 2024, a survey of plantings in streets, parks, and courtyards (groups of trees around houses) was carried out. Ash trees infested by both injurious species comprised an average of 30.5±4.72 %. As of September 2024, only two dead ash trees were found, both of which were EAB-infested, and one of them was also infested with mistletoe. The brown leaves of mistletoe on the dead tree confirm that the death of the host tree was the cause of the mistletoe's death.

Nikolaeva NE, Yemelyanova AA (2024) The development of the lesion of the ash trees in Tver caused by the Emerald ash borer *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae). *Proceedings of the Tver State University. Series Biology and Ecology* 4(76): 64-81 (in Russian, with English summary). https://elibrary.ru/item.asp?id=80062793

> Here we report the data on the origin and distribution of the Emerald ash borer (*Agrilus planipennis* Fairmaire, 1888) in the city of Tver (Russia). The article examines the ways of penetration of this pest into the city, its spread and the dynamics of the increase in the lesion. We analyze the relevance of the Emeral ash borer to various types of ash tree plantings, as well as the dependence of the degree of damage to trees on their location. **The level of damage caused to common ash and Pennsylvania ash is compared.** In conclusion, **the prospects for further development of the Emerald ash borer population in Tver are assessed**.

Pampolini F, Rieske LK (2025) Root uptake, translocation and persistence of EAB-specific dsRNA in ash seedlings. *Scientific Reports* 15, 6378: https://doi.org/10.1038/s41598-025-90266-y

> RNA interference (RNAi) is a sequence-specific gene silencing mechanism triggered by doublestranded RNA (dsRNA). Exploiting the RNAi mechanism to silence essential genes in insects has emerged as a promising new pest control strategy, and RNAi-based products are being developed for plant protection. **RNAi has proven effective in silencing genes and causing mortality in the highly invasive emerald ash borer** (EAB) (*Agrilus planipennis*) (Coleoptera: Buprestidae); however, **a practical delivery method remains a barrier to its deployment**. In this study, **we evaluate the systemic distribution and retention of exogenously applied dsRNA in green ash** (*Fraxinus pennsylvanica*) tissues to investigate the feasibility of dsRNA delivery through the host plant. To evaluate the distribution and persistence of dsRNA, seedings are exposed to EAB-specific dsRNA as a root soak, sampled 3, 7, 14, 21, and 30 d after exposure, and sectioned into root, woody-stem, soft-stem, and leaf tissues. Total RNA is extracted and evaluated by RT-PCR. **Gel images and Sanger sequencing confirm the presence of exogenously applied dsRNAs, demonstrating successful uptake and translocation of dsRNAs throughout plant tissues**. Our findings demonstrate that **root application represents a viable delivery method for dsRNA in ash seedlings, supporting the potential of this technology in providing ash protection against EAB**.

Perkins E, Ragozzino M (2025) Using the slow ash mortality strategy as a response to the introduction of emerald ash borer in Oregon. In: *23rd Annual Urban Ecology & Conservation Symposium* (17.03.2025, Portland State University, Portland, OR, USA). https://pdxscholar.library.pdx.edu/uerc/2025/posters/15/

> Emerald Ash Borer (EAB), *Agrilus planipennis*, is an invasive wood-boring beetle that has caused extensive damage to ash trees across North America for the last 2 decades. Ash trees play a vital role in ecosystems, providing habitat in wetland forests and riparian zones. The first detection of EAB in Oregon occurred in 2022 in Forest Grove, marking the first confirmed sighting of this pest West of Colorado. In response, the Oregon Department of Agriculture (ODA) spearheaded efforts to contain the pest through **the Slow Ash Mortality (SLAM) program**. **The SLAM strategy combines insecticide treatments, specifically trunk injections of emamectin benzoate, with the use of trap trees to monitor and control the spread of EAB**. **Trap trees** are artificially stressed by removing a strip of bark, making them more attractive to EAB, and are subsequently felled and inspected for evidence of infestation. A "Ring of Fire" was established around Forest Grove, where clusters of treated and trap trees were selected every quarter mile to prevent further spread. This approach was implemented in 2023 and 2024, with the goal of assessing EAB's distribution and determining the effectiveness of containment efforts. **Results from this study provide critical insights into the management of EAB populations and the future of ash tree preservation in Oregon**.

Petrice TR, Poland TM, Bauer LS, Strazanac JS, Duan JJ, Schmude JM, Ravlin FW (2025) North American hymenopteran parasitoids of emerald ash borer larvae: seasonal abundance and interaction with introduced Asian parasitoids. *The Canadian Entomologist*. 157:e7. doi:10.4039/tce.2024.44. https://www.cambridge.org/core/journals/canadian-entomologist/article/abs/north-american-hymenopteran-parasitoids-of-emerald-ash-borer-

larvae-seasonal-abundance-and-interaction-with-introduced-asian-parasitoids/D4D99665F98DF015F7B89992E235B9F9

> In Michigan, United States of America, **where Asian parasitoids were released** to manage emerald ash borer, *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae), we **monitored four native parasitoids** that also attack the invasive beetle – *Atanycolus cappaerti* Marsh and Strazanac, *A. simplex* (Cresson), and *Spathius laflammei* Provancher (all Hymenoptera: Braconidae), and *Phasgonophora sulcata* Westwood (Hymenoptera: Chalcididae) – **using yellow pan traps and tree dissections.** Adult *A. cappaerti*, followed by *A. simplex*, had the broadest seasonal activity, *S. laflammei* was captured primarily in the first half of the growing season, and *P. sulcata* was restricted to mid-summer. **Adult abundances of native species** varied among years but, except for *P. sulcata*, we**re never significantly lower than the established** Asian emerald ash borer larval parasitoids, *Tetrastichus planipennisi* Yang (Hymenoptera: Eulophidae) and *Spathius galinae* Belokobylskij and Strazanac (Hymenoptera: Braconidae). Densities of emerald ash borer larvae parasitised by *A. cappaerti* or *P. sulcata* did not differ significantly from those of the two Asian species. Although adult *A. simplex* and *S. laflammei* were frequently captured, we did not confirm parasitisation of any emerald ash borer larvae by these two species, suggesting that they rarely attack emerald ash borer. **We did not find any negative correlations between adult or immature parasitoid abundance of any parasitoid species**, suggesting that **any interspecific competition that may be occurring is negligible**.

Petrova A, Michael RN, Pratt C (2025) What kills mature street and park trees in cities? Systematic quantitative review of published case studies. *Environmental Management*. https://doi.org/10.1007/s00267-025-02116-2

> **Street and park trees often endure harsher conditions, including increased temperatures and drier soil and air, than those found in urban or natural forests**. These conditions can lead to shorter lifespans and a greater vulnerability to dieback. This **literature review** aimed to identify confirmed causes of street and park tree dieback in urban areas from around the world. Peer-reviewed case studies related to urban tree decline were scanned for the words “urban”, “city”, “cities”, “tree*”, “decline”, “dieback”, “mortality”, and “survival”. From an initial pool of 1281 papers on Web of Science and 1489 on Scopus, 65 original peer-reviewed research papers were selected for detailed analysis. Out of all species reported to decline, 46 were native, while non-natives were represented by 35 species. **The most commonly affected trees were** *Platanus*, ***Fraxinus***, *Acer*, and *Ficus*. Most studies were conducted in Mediterranean, humid subtropical, and humid continental climates, with the greatest representation from the United States, followed by Australia, Brazil, Iran, Italy, and Russia. Many authors focused on either biotic or abiotic causes of dieback; some explored both, and some also discussed underlying environmental and urban stresses as potential predisposing factors. The majority (81% of the papers) concluded that a decline was caused by either an arthropod or a microorganism. Overall, **it was suggested that changing management strategies to improve water availability and soil health might help with tree resilience**. Additionally, regular monitoring and research, along with improving tree species selection and implementing biological and chemical control methods, can help prevent or slow down tree decline. Increasing awareness and adopting preventative approaches could help to extend the lifespan of street and park trees in urban environments and mitigate some of the biological threats, especially considering the challenges we may be facing due to the changing climate.

Rizzo D, Pecori F, Moriconi M, Zubieta CG, Palmigiano B, Bartolini L, Downes A, Ranaldi C, Papini V, Luchi N, Santini A (2025) Molecular Identification of *Agrilus anxius* (Coleoptera: Buprestidae) using a qPCR assay with Locked Nucleic Acid (LNA) probe. *Journal of Applied Entomology*. https://doi.org/10.1111/jen.13423

> In the present study, a **biomolecular diagnostic assay based on qPCR-LNA (Locked Nucleic Acid) probes was developed for the identification of *Agrilus anxius* (Coleoptera: Buprestidae) from adult insects.** The performance of the new protocol was also evaluated for indirect diagnosis of the insect's presence on artificially contaminated frass. The designed primer and probe were able to distinguish in silico all *A. anxius* samples from **nontarget species, with a 100% match with homologous sequences found in GenBank databases. The molecular assay was sensitive, specific and repeatable.** The analytical sensitivity (limit of detection—LoD) for *A. anxius* adults and artificially contaminated frass was 6.4 fg/μL and 0.08 pg/μL, respectively. This assay, by analysing **eDNA samples**, will allow the **insect's early detection** in an area before it has caused major impact. eDNA analysis is becoming an increasingly used tool in the spatial survey programs of phytosanitary services and **could play a decisive role in pest surveillance**.

Santer RD. Akanyeti O (2025) Using artificial neural networks to explain the attraction of jewel beetles (Coleoptera: Buprestidae) to colored traps. *Insect Science*. https://doi.org/10.1111/1744-7917.13496

> Jewel beetles pose significant threats to forestry, and effective traps are needed to monitor and manage them. **Green traps often catch more beetles**, but **purple traps catch a greater proportion of females**. Understanding the function and mechanism of this behavior can provide a rationale for trap optimization. Jewel beetles possess UV-, blue-, green-, and red-sensitive photoreceptors, and perceive color differently from humans. Jewel beetle photoreceptor signals were calculated for tree leaf and tree bark stimuli, representing feeding and oviposition sites of adult jewel beetles respectively. **Artificial neural networks (ANNs) were trained to discriminate those stimuli using beetle photoreceptor signals, providing in silico models of the neural processing that might have evolved to drive behavior**. ANNs using blue-, green-, and red-sensitive photoreceptor inputs could classify these stimuli with very high accuracy (>99%). ANNs processed photoreceptor signals in an opponent fashion: increasing green-sensitive photoreceptor signals promoted leaf classifications, while increasing blue- and red-sensitive photoreceptor signals promoted bark classifications. Trained ANNs were fed photoreceptor signals calculated for traps, wherein they always classified green traps as leaves, but often classified purple traps as bark, indicating that these traps share salient features with different classes of tree stimuli from a beetle's eye view. A metric representing the photoreceptor opponent mechanism implicated by ANNs then explained catches of emerald ash borer, *Agrilus planipennis*, at differently colored traps from a previous field study. **This analysis provides a hypothesized behavioral mechanism that can now guide the rational selection and improvement of jewel beetle traps**.

Santoiemma G, Sweeney J, Booth EG et al. (2025) Efficacy of unbaited and baited green multi-funnel traps for detection of *Agrilus* species and other wood-boring beetle taxa. *Journal of Pest Science*. https://doi.org/10.1007/s10340-024-01865-z

> Semiochemical-baited traps are a key component of post-border surveillance for detection of non-native and potentially invasive bark and wood-boring beetles (Buprestidae, Cerambycidae, Curculionidae: Scolytinae) at risk of introduction in untreated woody materials used in global trade. Because the particular species that may arrive with imported goods is unknown, plant

protection agencies need trapping protocols that effectively survey all three taxa. Baiting traps with host volatiles and aggregation/sex pheromones of longhorn beetles increases efficacy of detecting Cerambycidae and Scolytinae, but its effect on detection of Agrilus species and other jewel beetles is unknown. In this multi-country trapping study we found that the addition of ethanol and common aggregation/sex pheromones of longhorn beetles to green multi-funnel traps placed in the mid-upper forest canopy had negative effects on abundance of Agrilus species and other jewel beetles collected but no effect on their species richness, and significant positive effects on species richness and abundance of Cerambycidae and Scolytinae. Baiting green canopy traps with longhorn beetle pheromones increased the efficacy of traps for detecting total target taxa of bark and wood-boring beetles at risk of international movement in untreated woody materials. This information is beneficial for the design of multi-taxa surveys, potentially saving money and resources without decreasing trapping efficacy.

Santoiemma G, Williams D, Booth EG et al. (2024) Efficacy of trapping protocols for *Agrilus* jewel beetles: a multi-country assessment. *Journal of Pest Science* 97, 1795–1810. https://doi.org/10.1007/s10340-023-01728-z

The genus *Agrilus* is one of the most diverse insect genera worldwide. The larval feeding activity causes extensive damage in both forests and orchards. In addition, more than 30 species have been introduced outside their native range so far, including the emerald ash borer *Agrilus planipennis* Fairmaire. Thus, **the availability of efficient trapping protocols for early detection of *Agrilus* species at entry points is of utmost importance**. In this study **we tested whether trapping protocols developed for surveillance of *A. planipennis* in North America were also effective for other *Agrilus* species**. In particular, **through a multi-country assessment we compared the efficacy of detecting *Agrilus* species on**: (i) green glue-coated prism traps vs. green Fluon-coated multi-funnel traps when baited with the green leaf volatile (Z)-3-hexenol or left unbaited; and (ii) green multi-panel traps vs. green multi-panel traps baited with dead adult *Agrilus* beetles (decoys). A total of 23,481 individuals from 45 *Agrilus* species were caught. **Trap design significantly affected both species richness and abundance of *Agrilus* species in several of the countries where the trapping experiments were carried out**, and **green prism traps outperformed green multi-funnel traps in most cases**. On the contrary, **the addition of a (Z)-3-hexenol lure or dead adult beetle decoys on to traps did not improve trap catches**. Our study highlights that **reliable trap models to survey *Agrilus* species are already available**, but also that **there is the clear need to further investigate chemical ecology of *Agrilus* species** to develop semiochemical lures that can improve detection efficacy.

Sidel'nikov V (2024) Succession of forest ecosystems of the Voronezh Region: analysis and qualitative assessment of processes. In: Adaptation of Forestry to Climate Change: Nature-Based Solutions And Digitalization. Conference 'Forestry-2024' (Proceedings of the International Forestry Forum. Voronezh, 2024). P. 174-178 (in Russian) https://elibrary.ru/item.asp?id=80270531

This article is dedicated to the study of succession processes in the forest ecosystems of the Voronezh region, focusing on the dynamics of changes in tree species composition. Special attention is given to the decline of ash (*Fraxinus excelsior*) due to the impact of the emerald ash borer (*Agrilus planipennis*), the slowed growth of oak (*Quercus robur*) due to the species' biological characteristics, and the rapid spread of maple (*Acer* spp.), which is taking over the newly available territories. The current trends are analyzed, the causes of the observed changes are identified, and their potential consequences for the region's forest ecosystems are

discussed. The results obtained can be used to develop measures for managing succession and preserving forest biodiversity.

USDA-APHIS/ARS/FS (Gould JS, Booth T, Sawallich N, Petrice T) (2024) Emerald Ash Borer Biological Control Release and Recovery Guidelines. Riverdale, Maryland: U.S. Department of Agriculture, Animal Plant Health Inspection Service, Agricultural Research Service, Forest Service. 75 p. https://www.fs.usda.gov/nrs/pubs/download/EAB-FieldRelease-Guidelines-2024.pdf , https://research.fs.usda.gov/treesearch/68273

Emerald ash borer (EAB), a beetle from Asia that feeds on ash trees, was discovered as the cause of extensive ash mortality in southeast Michigan and adjacent areas of Canada in 2002. It is thought that this destructive pest was introduced in the early 1990's in infested solid wood packaging material originating in Asia. EAB feeds on ash species in the genus *Fraxinus* causing widespread ash mortality and significant economic, environmental, and social impacts.

As of March 2024, EAB infestations in the U.S. were known in Alabama, Arkansas, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, and 2 Wisconsin and the Canadian provinces of Manitoba, New Brunswick, Nova Scotia, Ontario, and Québec.

The continued spread of EAB threatens our ash resources and will permanently alter forest ecosystems in North America. Ash wood is used for a variety of applications including tool handles, baseball bats, furniture, cabinetry, solid wood packing materials, pulp, and paper. Native Americans utilize black ash for basketry, which is both economically and culturally important. In addition to its value to the timber industry and the forest ecosystem, ash was a popular landscape tree and the spread of EAB has urban, suburban, and nursey industry impacts as well. The program aims to maintain ash as a viable part of the American landscape by managing known infestations with a **robust biological control program**, while also incorporating other IPM methods and outreach to minimize EAB's impacts.

van Woensel E, van der Werf W, Parnell S, van Vliet A, Douma BJC (2025) Exploring the contribution of citizen science to statistically sound and risk-based surveillance of insect pests in the EU. *EFSA Supporting Publication* EN-9186. 94 pp. doi:10.2903/sp.efsa.2025.EN-9186. https://efsa.onlinelibrary.wiley.com/doi/abs/10.2903/sp.efsa.2025.EN-9186

This report explores the **integration of citizen science** into the surveillance of insect pests, aiming **to enhance statistically sound and risk-based surveys**. The study, conducted by researchers from Wageningen University, focuses on three primary objectives. First, **it compiles a comprehensive inventory of citizen science initiatives across Europe**, identifying **81 projects from 21 countries** that contribute significant biodiversity data. Second, it **develops a statistical methodology to estimate the probability of pest detection using opportunistic, presence-only data from citizen science**. This **methodology is tested** on three insect pests: *Popillia japonica*, ***Agrilus planipennis***, and *Anoplophora chinensis*, demonstrating that **citizen science can meaningfully complement official surveys**. Third, the rep**ort provides guidelines for incorporating these findings into existing tools and methods** used by the European Food Safety Authority (EFSA) and National Plant Protection Organizations (NPPOs). The results indicate that **citizen science can increase the overall confidence in pest freedom and reduce the required sample sizes for official surveys**. However, the study also

highlights the **spatial and temporal biases** inherent in citizen science data and the need for further research to optimize its integration into pest surveillance frameworks

Wang X, Yang Z (2025) Augmentative biological control in plantation forests in China. In: Hurley BP, Lawson SA, Slippers B (eds). Biological Control of Insect Pests in Plantation Forests. Springer, Cham. https://doi.org/10.1007/978-3-031-76495-0_16

China has the largest area of **plantation forests** in the world, but a number of forest insect pests threaten the sustainability of these plantations. **Biological control, including augmentative biological control**, is one of the approaches that can be used to manage these insect pests. In fact, China was the first country to use this approach. This chapter discusses **some of the main forest pests in plantations in China and the augmentative biological control projects implemented to control these pests**. Specifically, we summarize the augmentative biological control of the fall webworm *Hyphantria cunea* (Drury) (Lepidoptera: Arctiidae), pine moths *Dendrolimus* spp. (Lepidoptera: Lasiocampidae), Asian longhorned beetle *Anoplophora glabripennis* (Motschulsky) (Coleoptera: Cerambycidae), Japanese pine sawyer *Monochamus alternatus* Hope (Coleoptera: Cerambycidae), oak longhorned borer *Massicus raddei* (Blessig) (Coleoptera: Cerambycidae), white-striped longhorn beetle *Batocera lineolata* Chevrolat (Coleoptera: Cerambycidae), **emerald ash borer *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae)**, and apple jewel beetle *Agrilus mali* Matsumara (Coleoptera: Buprestidae). **The occurrence, screening of candidate natural enemies, mass rearing of selected natural enemies, field release of biological control agents, and evaluation of biological control program are summarized for each species of these forest pests**. The advantages and disadvantages of augmentative biological control in plantations in China are discussed as well as the further development of augmentative biological control in China.

Wang Y-H, Liu Q, Vuong TMD, Wang H-L, Fu J-Y, Su X-Y, Wang Y-J, Yang J-Y, Zeng J-Y, Li H-P (2025) Gut bacterium *Delftia tsuruhatensis* strain ALG19 isolated from *Agrilus planipennis* larvae degrades cellulose in *Fraxinus velutina*. *Front. Microbiol.* 16:1567054. https://doi.org/10.3389/fmicb.2025.1567054

Introduction: Strain ALG19, a predominant culturable bacterium isolated from the larval gut of the emerald ash borer (*Agrilus planipennis*) infesting velvet ash (*Fraxinus velutina*), was investigated to determine its taxonomic identity and evaluate its cellulose-degrading potential.

Methods: The taxonomic classification of ALG19 was determined through whole-genome sequencing, average nucleotide identity (ANI) analysis, and phylogenetic reconstruction based on single-copy orthologous genes. Functional annotation of carbohydrate-active genes was performed using the COG, KEGG, and CAZy databases. Cellulolytic activity was assessed using a multi-faceted approach. First, carboxymethyl cellulose hydrolysis assays were conducted to evaluate cellulolytic capability. Additionally, filter paper degradation and the utilization of velvet ash phloem cellulose were examined. For these experiments, the strain was cultured in an inorganic salt medium supplemented with the respective cellulose substrates for 60 days.

Results: Genomic analyses confirmed that ALG19 belongs to *Delftia tsuruhatensis*. The strain harbors 283 COG-annotated genes associated with carbohydrate transport and metabolism, 355 KEGG genes involved in carbohydrate metabolism pathways, and 105 CAZy-annotated carbohydrate-active enzymes. Phenotypic assays revealed a carboxymethyl cellulose hydrolysis zone ratio of 1.74. After a 60- day incubation period, ALG19 completely decomposed filter paper strips into flocs, resulting in a 38.06% reduction in dry weight compared to control

samples, which basically retained their original shape. Furthermore, the strain degraded velvet ash phloem cellulose, leaving a residual content of 69.91%. This was 15.60% lower than the control, which exhibited a residual content of 82.83%.

Discussion: These findings demonstrate that *D. tsuruhatensis* ALG19 is capable of degrading cellulose present in the host plant of the emerald ash borer, its associated insect. This study identifies a potential target microorganism for future pest management strategies, which could mitigate the damage caused by the emerald ash borer by impairing its digestive capacity.

Wilson CJ, Labbate L, Petrice TR, Poland TM, McCullough DG (2025) Ongoing regeneration of ash and co-occurring species 20 years following invasion by emerald ash borer. *Forest Ecology and Management* 580: 122546. https://doi.org/10.1016/j.foreco.2025.122546

Emerald ash borer (*Agrilus planipennis* Fairmaire) is a destructive invasive insect pest of ash trees (*Fraxinus* spp.) in North America. **Monitoring ash regeneration** within post-invasion forests is essential to assess ash persistence in North America. We recorded density of overstory ash [> 10 cm diameter at breast height (DBH)], ash recruits (2–10 cm DBH), ash saplings (≥ 45 cm in height; < 2 cm DBH), and ash seedlings (< 45 cm in height), along with canopy dieback of overstory ash and recruits in four post-invasion areas in south-central Michigan, USA. We also recorded density of all other overstory trees, recruits, saplings, and seedlings by species. Ash regeneration was abundant in recruit (470 ± 68.9 stems per ha), sapling (2599 ± 336.1 stems per ha), and seedling strata (4557 ± 557.9 stems per ha). Overall, 47 % of overstory ash, 17 % of ash recruits, and 7 % of ash saplings were dead. More than half of the live overstory ash (54 %), and 43 % of ash recruits had < 30 % dieback, although 33 ± 3.0 % of ash recruits had external signs of EAB infestation. Living ash basal area was inversely associated with *Quercus rubra* and *Tilia americana* density. Dead ash basal area was not related to tree species composition, indicating that stands with low ash density, and subsequent effects on community structure, were not due to canopy gaps resulting from EAB mortality. Overall, we documented **substantial ash regeneration in post-invasion forests despite high mortality of trees > 10 cm DBH**.

Zhang C, Chen Z, Zhang H, Li J (2025) A dual branch time-frequency multi-dilated dense network for wood-boring pest activity signal enhancement in the larval stage. *Forests* 16, 20. https://doi.org/10.3390/f16010020

The **early identification** of forest wood-boring pests is essential for effective pest management. However, detecting infestation in the early stages is difficult, as larvae, such as the emerald ash borer (EAB), *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae), usually feed inside the trees. **Acoustic sensors can detect the pulse signals generated by larval feeding or movement**, but these sounds are often weak and easily masked by background noise. To address this, **we propose a dual-branch time-frequency multi-dilated dense network (DBMDNet) for noise reduction**. Our model decouples two denoising training objectives: a magnitude masking decoder for coarse denoising and a complex spectral decoder for further magnitude repair and phase correction. Additionally, to enhance global time-frequency modeling, we use three different multi-dilated dense blocks to effectively separate clean signals from noisy data. Given the difficult acquisition of clean larval activity signals, we describe a self-supervised training procedure that utilizes only noisy larval activity signals directly collected from the wild, without the need for paired clean signals. Experimental results demonstrate that our proposed approach achieves the optimal performance on various evaluation metrics while requiring fewer parameters (only 98.62 k) compared to competitive models, achieving an average signal-to-noise ratio (SNR) improvement of 17.45 dB and a log-

likelihood ratio (LLR) of 0.14. Furthermore, **using the larval activity signals enhanced by DBMDNet, most of the noise is suppressed, and the accuracy of the recognition model is also significantly improved.**