

Emerald Ash Borer Compilation of Resources

General: Emerald ash borer (EAB) is a non-native invasive wood boring beetle that kills all native species of *Fraxinus* found in North America. Green ash is common in Montana in both human-modified landscapes (in cities and towns, planted as windbreaks) and natural landscapes (along rivers and lakes). The closest known breeding populations of EAB are in Colorado and Winnipeg, Canada.

[EAB information network](#) This is a primary website with multiple resources on planning, research, and detection, administered through Michigan State University.

[Where EAB is and when it was detected there](#)

[Creating EAB Readiness and Response Plans](#)

[2013 Review Article](#) Herms, D.A and McCullough, D.G. 2013. Emerald Ash Borer Invasion of North America: History, Biology, Ecology, Impacts, and Management. Annual Review of Entomology 59:13-30.

[APHIS EAB program manual](#) Animal and Plant Health Inspection Service. 2020. Emerald Ash Borer Program Manual: 2nd Ed. USDA- APHIS Publication.

Montana-Specific: A website and printable pdf fact sheet are available to provide information on emerald ash borer biology and damage symptoms, what you can do right now, management recommendations if the EAB is found in Montana, other ash pests or non-EAB ash issues, and EAB look-alike insects in Montana.

[Emerald Ash Borer - Urban IPM | Montana State University](#)

[Emerald Ash Borer \(montana.edu\)](#)

[Green Ash in Eastern Montana](#) Lesica, P., and Marlow, C. (December 2011) "Values and management of Montana's green ash draws." *Montana State University Extension*.

[More on Green Ash](#) Lesica, P., and Marlow, C. Green Ash Woodlands: A Review. Montana State University Extension. Research Bulletin No. 4601.

[Montana Interactive Tree Inventory](#) "Statewide Urban Forest Inventory". *Montana Department of Natural Resources*. The Montana Mapping tool and community factsheets, shows prevalence of ash in communities throughout Montana.

Identification and Monitoring: EAB can be difficult to detect at low densities. Destructive sampling of live ash is effective but challenging at scale; currently there is no lure specific to EAB that can be used to directly attract EAB into monitoring traps. Often EAB infestations are 3-5 years old, or more, when detected because of these difficulties.

[Signs and Symptoms](#) Wilson, M.; Rebeck, E. 2005. Signs and Symptoms of the Emerald Ash Borer. Michigan State University Extension Bulletin E-2938.

[More in-depth identification guide](#) Parsons, G.L. 2008. Emerald Ash Borer *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae) A guide to identification and comparison to similar species. Department of Entomology, Michigan State University, November, 2008.

[Life Cycle](#) US Forest Service/Michigan State University. 2009. Unwanted! Emerald Ash Borer. USDA Bulletin E-3004.

[USDA Survey Guidelines](#) USDA APHIS PPQ. "Emerald Ash Borer Survey Guidelines."

[Phenology Network EAB Forecast Tool](#) "Emerald Ash Borer Forecast." *USA National Phenology Network*. This site uses national weather trends to predict occurrence of life stages of EAB around the country as if the insect was present.

[Prism Traps](#) "Emerald Ash Borer Trapping Program." *Bioforest*.

[Multifunnel vs prism traps](#) Crook et al., 2014. Improving detection tools for emerald ash borer: comparison of multifunnel traps, prism traps, and lure types at varying population densities. *Journal of Economic Entomology* 107:1496-1501

[Comparison of trapping methods](#) Tobin et al. 2021. Evaluation of trapping schemes to detect emerald ash borer. *Journal of Economic Entomology*. 114: 1201-1210.

[Destructive branch sampling](#) Ryall, K.L; Fidge, F.J.G.; Turgeon, J.J. Detection of emerald ash borer in urban environments using branch sampling. *Frontline: Forestry Research Applications*. Canadian Forest Service, Sault Ste. Marie. Technical Note No. 111.

Treatment/Management: A wide variety of pesticide treatments are effective when applied correctly to uninfested or very early infestation trees, but these are not indicated in areas without known EAB presence. Pesticide treatments are also expensive and must be maintained over time to remain effective, so prioritization and replacement schemes should be coupled with any active treatment plan.

[Pesticide Treatments](#) Herms, D.A.; McCullough, D.G.; Smitley, D.R.; Sadof, C.S.; Miller, F.D.; Cranshaw, W. 2019. Insecticide options for protecting ash trees from emerald ash borer (3rd Ed). North Central IPM Center.

[Management Guide](#) Nagle A.M; Sadof, C. *Managing Emerald Ash Borer: Decision Guide*. Indiana DNR and Purdue University.

[EAB Cost Calculator](#) "Emerald Ash Borer Cost Calculator." *Purdue University Extension Entomology*.

[Hazard Trees](#) "Avoid Deadly risk of Dying Ash Trees with Timely Tree Removal." *Purdue University Extension- Forestry and Natural Resources*. 2019.

Biological Control: Several biological control agents have been established in the northern infested ash range around the Great Lakes and New England. Biological control agents released for EAB are not anticipated to eliminate EAB when established, but rather to reduce ash tree mortality to a level where overall ecosystem integrity is not compromised by EAB. It is not yet clear if they will reduce ash tree mortality.

[Parasitic Wasp release guidelines](#). Gould, J.S.; Murphy, T.; Bauer, L.S.; Duan, J.; Petrice, T. "Emerald ash borer biological control release and recovery guidelines 2019."

[Summary of current biological control status](#). USDA APHIS-PPQ. "Questions and Answers: Biological Control for Emerald Ash Borer."

Dispersal: EAB disperses naturally in relatively short distances (0-5 miles) and long distances on infested ash products (most often firewood and nursery stock). Regulations and rules on firewood and nursery stock are inconsistent and/or non-existent across/between states and regions.

[Flight Capacity](#) original paper can be found [here](#) Taylor, R.A.J.; Bauer, L.S.; Poland, T.M.; Windell, K.N. 2010. Flight performance of *Agrilus planipennis* (Coleoptera: Buprestidae) on a flight mill and in free flight. *Journal of Insect Behavior* 23:128-148.

[Hitchhiking](#) Buck, J.H.; Marshall, J.M. 2008. Hitchhiking as a secondary dispersal pathway for adult emerald ash borer, *Agrilus planipennis*. *The Great Lakes Entomologist* 41:197-198. Starts on page 137 of the pdf.

[Modeling landscape-level spread](#) Ward, S.F.; Fei, S.; Liebhold, A.M; 2020. Temporal dynamics and drivers of landscape-level spread by emerald ash borer. *Journal of Applied Ecology*. 57:1020-1030.

[Temperature impacts on flight](#) Fahrner, S.J.; Lelito, B.H.; Aukema, B.H. 2015. The influence of temperature on the flight capacity of emerald ash borer *Agrilus planipennis* and its parasitoid, *Tetrastichus planipennis*: implications to biological control. *Biocontrol*. 60:437-449.

[Temperature impact on mortality](#) DeSantis, R.D; Moser, W.K.; Formanson, D.D. 2013. Effects of climate on EAB mortality and the potential for ash survival in North America. *Agriculture and Forest Meteorology*. 178-179:120-128.

[Survival in Firewood](#) Haack, R.A.; Petrice, T.R. 2005. Emerald ash borer survival firewood. Proceedings of the Emerald Ash Borer research and development meeting 2004 October 5-6. Romulus, MI.

[Removal of Federal Quarantine](#) Animal and Plant Health Inspection Service, USDA. 2020. "Removal of Emerald Ash Borer Domestic Quarantine Regulations." *Federal Register: The Daily Journal of the United States Government*, December 15, 2020.

[Firewood Regulation and Recommendation](#) L. Greenwood and L. Downs, 2022. Firewood comparison report: State and territory firewood relevant regulations, certifications, and outreach statuses across the USA. The Nature Conservancy.

Impact on Urban Canopy: EAB rapidly kills ash trees in urban and suburban environments. With the high density of ash canopy in Montana cities, EAB is forecasted to have very serious impacts on Montana city forest canopies and municipal budgets.

[Economic Impact in Midwest](#) Sydnor, D.T; Bumgardner, M.; Subburayalu, Sakthi. 2011. Community ash densities and economic impact potential of emerald ash borer (*Agrilus planipennis*) in four midwestern states. *Arboriculture and Urban Forestry*. 37(2):84-89.

[Impacts on human health](#)- Donovan, G.G; Butry, D.T; Michael, Y.L, Pestemon, J.P; Liebhold, A.M; Gatzolis, D.; Mao, M.Y. 2013. The relationship between trees and human health: evidence from the spread of the emerald ash borer. *American Journal of Preventative Medicine* Feb 44(2):139-145.

[Impact in Boulder, Colorado](#) "Weighing the impact of the Emerald Ash Borer on Boulder's ash tree population." 2020. *Center for Sustainable Landscapes and Communities*.

[How EAB affects the aesthetics of urban forests](#) Arnberger, A; Schneider, I.E.; Ebenberger, M.: Eder, R.; Venette, R.C.; Snyder, S.S.; Gobster, P.H.; Choi, A.; Cottrell, S. 2017. Emerald ash borer impacts on visual preferences for urban forest recreation settings. *Urban Forestry & Urban Greening* 27:235-245.

Cold climate tolerance: The native range of EAB extends very far north along the Pacific rim into high latitude Russian forests. EAB can establish in very cold climates if ash trees are present. The farthest north known infested range areas of EAB are (broadly) in; Winnipeg, Canada, northern Maine USA, and Moscow, Russia.

[Cold hardiness](#) Venette, R.; Abrahamson, M. 2010. Cold hardiness of emerald ash borer, *Agrilus planipennis*: a new perspective. In: Black ash symposium: proceedings of the meeting. May 25-27, 2010: Bemidji, MN.

[Temperature impact on mortality](#) DeSantis, R.D; Moser, W.K.; Formanson, D.D. 2013. Effects of climate on EAB mortality and the potential for ash survival in North America. *Agriculture and Forest Meteorology*. 178-179:120-128.

[New research from Winnipeg](#). Duell, M.E.; Gray, M.T.; Roe, A.D.; MacQuarrie, C.J.K.; Sinclair, B.J. 2022. Plasticity drives extreme cold tolerance of emerald ash borer (*Agrilus planipennis*) during a polar vortex. *Current Research in Insect Science*. 2(2022): 100031.