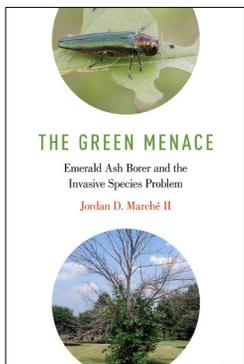


The Green Menace: Emerald Ash Borer and the Invasive Species Problem

By Jordan D. Marché II. 2017. Oxford University Press. 320 pages, 77.00 USD, Cloth.

Despite its relatively recent arrival, Emerald Ash Borer (EAB; *Agrilus planipennis*) is one of the most destructive invasive species in North America. In little over 20 years, the economic impact of this beetle is estimated in the billions, while its ecological damage is incalculable. *The Green Menace*, by Jordan Marché II, provides a thorough case-study of



this invasion, from the first signs of ash (*Fraxinus* spp.) decline detected in Michigan in 1998, the belated attribution of the problem to the EAB in 2002, and through the varied, and largely futile, efforts to eradicate it since then.

For the most part, the book is arranged chronologically. The first chapter reviews what was known about EAB prior to 1998. EAB arrived in Michigan sometime before 1998, but wasn't properly identified until 2002, a period covered in Chapter Two. Chapter Three provides a brief survey of invasion ecology and integrated pest management, and the first steps in developing a government response to EAB. This is followed by two chapters on EAB biology and its social and economic impact. The later stages of the failed effort to eradicate the beetle, or at least contain it to Michigan, are presented in Chapter Seven. More recent efforts to manage EAB with chemical pesticides, biological control, and breeding resistant ash varieties are each explored in separate chapters.

The great strength of the book is the meticulous cataloguing of the historical details of the story. This includes the conventional timeline of the detection of EAB. That is, the first symptoms were detected by Michigan arborists in 1998. They didn't notify plant pathologists (at Michigan State University) until 2001. That led to a tentative diagnosis that the problem was due to a disease called "Ash Yellows". However, the presence of an as-yet-unknown beetle was also noted. This species, one of more than 2700 in the genus *Agrilus*, was unknown to North American entomologists, and didn't appear in any regional references. Not surprisingly, it took until the following summer before it was properly identified. With that information in hand, authorities were at last in position to initiate control efforts.

However, Marché also documents reports from 1998 documenting ash trees in the area declining as a result of infestation by one or two beetles. At the time, the beetles were suspected to be native species, but identification wasn't confirmed until 2002, as mentioned

above. In effect, EAB had an extra four years to establish and spread. In retrospect, it may have been possible to control it had forceful action been taken in 1998 or 1999. By 2002, it was almost certainly too late—that we knew it yet.

The chronological presentation of the story highlights the challenges faced by the scientists charged with eradicating EAB. Putting a name on the pest was only the first challenge: nearly nothing was known about its biology or ecology. As with so many noxious invasive species, it is largely unremarkable in its home range, such that it hadn't attracted the attention of Chinese entomologists. There were reports of EAB attacking plantings of North American ash species introduced into China, but they weren't accessible to English-speaking scientists in North America.

In the meantime, it took years to clarify the life history and dispersal potential of EAB. Unfortunately, early data suggested that females could disperse only up to a half mile (0.8 km), and control buffers were established using this figure. As it turns out, this grossly underestimated how far the beetles actually travel. Furthermore, EAB remains difficult to detect for the first two years after arriving in a new location. Consequently, when control efforts started in earnest in 2002 and 2003, EAB had already moved beyond the quarantine zone.

While the central focus of the book is the EAB program managed by the Michigan Department of Agriculture (MDA), it also includes efforts to control the pest in Ontario. Led by the Canadian Food Inspection Agency, an ambitious plan to remove all ash trees from a firewall in southwest Ontario, the so-called "Ash Free Zone", 10 km across and 30 km long, was implemented in 2004 (pp. 111–112). This didn't keep EAB from spreading to the rest of the province, but Marché argues that it was still worthwhile. Despite the public outcry, the ash-free zone may have bought researchers crucial time to develop more robust strategies.

In sum, the first half of the book very effectively presents the challenges posed by invasive species. At a time when seemingly anything you might want to know can be learned by consulting your phone, it is humbling to realize how much about our natural world remains a mystery. Marché has harsh criticism for MDA staff, particularly the opportunities lost in the crucial period between 1998 and 2002. But even had they acted swiftly, and the government provided the requested funding, controlling or eradicating EAB would still have been a formidable challenge.

At this point EAB continues to spread largely unchecked across North America. However, the second half of the book outlines three approaches that may ultimately lead to effective long-term management. Chemical control methods are now available. While they will

never be practicable on a large scale, they may nevertheless provide foresters and landscapers with tools for managing small numbers of important trees. Longer term solution will require a combination of biological control or breeding ash stock resistant to EAB attack.

Overall, *The Green Menace* provides a very insightful case study of the early invasion, establishment, and spread of a serious forest pest. The text does occasion-

ally get bogged down in minutiae. That said, this will undoubtedly serve as an important document for the study of invasive species. I highly recommend it for anyone interested in invasive species, habitat conservation, or large-scale ecological management issues.

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