Emerald Ash Borer Economics, Management Approaches, and Decision Making

By Richard J. Hauer

The discovery of Emerald ash borer (*Agrilus planipennis*) in North America seems just like yesterday, even though the ten year anniversary just occurred this July. Much has been learned about Emerald ash borer (EAB) during that decade. As a recap, North American ash tree species are still susceptible to EAB and tens of billions of dollars of economic impact are at stake. Tens of millions of ash trees have died and tens of millions more are facing the beetle's invasion. Resistant ash trees are being looked at within breeding programs and the evaluation has started of the few ash survivors after EAB has killed the rest in an area. Progressive research with the biocontrol of EAB continues to move forward with the hope that natural predators will decrease the future impact of EAB. Municipal EAB management plans that are developed to address the pest will help to make an orderly transformation beyond ash. Scientific advancements into tree treatments are offering exciting ways to prevent EAB from killing ash trees. The effectiveness of these chemical treatments provides an excellent way to slow the loss of ash and to conserve the ash canopy. Finally, developed economic models provide a means to address the financial impacts of EAB management approaches.

Just what should ash tree owners do is an important question? Ultimately this is a question based on the desires of ash tree owners. People make rational and irrational decisions and sometimes decide to go with a desire not so much based on economic worth as much as I desire that option. Just look at cars. A very fast and cool looking sports car will get you from A to B in the same time as a plain economy car, assuming all traffic laws are followed. Tree care is sometimes like that with clients, they desire to retain a tree longer, but the cost of the treatment might be greater than what the future tree value can justify. There is nothing wrong with that scenario if it is the desired decision. Typically however the investment in landscape plants is a growing property asset.

Determining the benefits and costs of EAB management approaches is important to rational decision making. If ash trees have no value, the decision could be as simple as doing nothing except removing those trees in harms ways. Homeowners, residents of a community, arborists, and other decision makers, can debate the value of ash trees and if a do nothing approach is truly best. Others may place their efforts with removing ash trees before EAB arrives. Trees will cost money to remove anyways so why not just preemptively remove them and be done with the problem goes the logic. A third approach is retention of ash trees through treatments currently chemically based. In all cases some economic consideration is a vital basis as to which management approach is used.

There are many economic approaches to account for tree value. The Council of Tree and Landscape Appraisers (CTLA) and the i-Tree system are two common methods used to quantify the value of urban trees. Value is often used interchangeably with benefit. There is also a cost associated with every EAB management alternative. A benefit is the value associated with an asset and in contrast the cost is the resources used associated with management approaches. Money is often used as the common denominator in tree benefits and costs. Net benefits and benefit cost ratios are common ways to financially evaluate the outcomes of management

approaches. A net benefit is the difference between the benefits and costs and a benefit cost is a ratio between the benefits and costs. A positive net benefit and benefit cost greater than 1 suggest more value is occurring than the cost associated with maintaining the tree.

Looking Beyond EAB Will Cost Money

Years ago as a new student to the arboriculture and urban forestry profession, I remember a statement by Mark Stennes about Dutch elm disease that stuck in my mind "whether you like it or not, it will cost you money." The outcome of EAB is no different. Emerald ash borer will cost you money, whether you like it or not. As arborists and urban foresters, we are faced with making decisions that ideally minimize the expenses associated with EAB. There will certainly be costs associated with removing ash trees in locations that present a risk for injury or property damage. Tree replacements and proper establishment will also cost money. There are certainly the societal costs associated with the loss of ash tree benefits. These include the loss of shade, increased storm water runoff, air pollutants not absorbed by ash leaves, decreased property values, less desirable shopping areas, sunnier streets that decline faster, and perhaps even increased crime. If we just give up, it seems like EAB has the potential to make the It's a Wonderful Life Bedford Falls urban forest into a Pottersville.

Too often the discussion of EAB rests and stops with the cost side. What will it cost to remove the tree? How much is it going to cost to treat trees? Do we even dare spend more money to replant trees on private or public landscapes? Certainly one needs to address the costs of management outcomes. The benefit side of ash trees should likewise be considered. Two tools exist to evaluate the economics of EAB management approaches. The EAB Cost Calculator is one tool located at http://extension.entm.purdue.edu/treecomputer/. Sadof et al. (2011) provide an excellent overview of the use of this model. The Emerald Ash Borer Planning Simulator (EAB-Plans) also allows practitioners to evaluate EAB economics http://cnrfiles.uwsp.edu/hauer/EAB-PLANSVersionBeta.xlsx. VanNatta et al. (2012) detail the outcomes and assumptions of this model.

Different Management Approaches

Several alternative management approaches seem to compete for the title of best to use. Options such as doing nothing, treating ash trees, or preemptive removal compete regularly in the battle for the best. Doing nothing implies you let ash trees die and remove them afterwards. Preemptive removal involves removing trees before they die. Treatment in contrast prolongs the longevity of the treated ash tree. Any option may win given the right context.

As suggested earlier, if little or no value is given to an ash tree, it might be economically difficult to rationally justify too treat and retain ash trees. Likewise, if ash trees have a poor structural or health condition, perhaps it is time to consider tree removal (Figure 1). High value ash trees and those in good to excellent structure and health might be great candidates to retain as monetary resources allow.

EAB Economic Analysis Through EAB-Plans

Approximately 2 years ago we set out to develop a system to evaluate EAB management approaches. An initial objective was to evaluate three commonly suggested EAB management approaches: (1) Do Nothing, (2) Preemptive Removal, and (3) Chemical Treatments. The ash population at the University of Wisconsin – Stevens Point was used to develop, test, and refine a model used to evaluate these three approaches. Later a fourth scenario, no EAB, was added as a comparison in the EAB-Plans program. All values are adjusted for inflation to the present time. Trees grow in diameter annually and they also die annually based on natural and EAB enhanced mortality rates. Tree maintenance, removal, and treatment costs are part of the analysis. The number of years to preemptively removal all ash trees is entered. Finally, the cost to chemically treat ash trees and the survival rates for the selected treatment. The end-user can modify these variables to customize the analysis for their local situation.

What we found with many different tested scenarios was retention of ash trees was economically favored over doing nothing. Doing nothing was economically more favorable than removing ash preemptively (Figure 2). One of the biggest reasons why chemical treatment is better than preemptive removal is current chemical treatments are low cost and effective. The chemical emamectin benzoate costs homeowners approximately 10 to 15 dollars per diameter inch to treat their ash. The cost of a chemical treatment would need to increase by 2 to 3 times to approximately $30 per diameter inch until the outcome of preemptive removal and chemical treatment had a comparable benefit/cost ratio. Other chemical treatments labeled for EAB control (i.e., imidacloprid) also consistently supported retaining ash with the outcome of a greater the net value of ash tree population.

Certainly financial resources are needed to chemically treat. Using a 1000 ash trees with a 10 inch mean diameter as an example population, approximately $33,000 annually is needed to treat these trees at a $10 per diameter inch cost. In large tree populations, commercial bids at the $6 per diameter inch are reported which lowers the cost to approximately $20,000 per year. The City of Milwaukee, WI has been able to economize the cost using municipal staff at $3.25 per diameter inch. This scenario effectively reduces the cost in the example 1000 tree population to $10,000 per year. The trend is for EAB chemical costs to decline in price. Recent research is suggesting that not all ash trees need to be treated to get an overall significant reduction in EAB in a community. Finally, the treated ash population remaining after 20 years is comparable to a no EAB scenario (Figure 3).

Summary

Whether you like it or not, EAB will cost you money. Much is being learned about the ecology of EAB, natural predators, resistant ash species, chemical protection of ash trees, and economic models to evaluate EAB outcomes. Ideally the tree owner is looking to retain good and excellent ash trees in high value locations. As practitioners, we have several chemical based treatments that have high success rates that are economically viable options compared to doing nothing or preemptive removal of ash trees. Doing nothing and preemptive removal of ash trees are also appropriate options for ash trees in poor health or in low value settings. As part of an integrated approach to EAB management, all options should be considered.

Further Information

Sadof, C., L. Purcell, F. J. Bishop, C. Quesada, and Z. Zhang. 2011. *Evaluating restoration capacity and costs of managing the emerald ash borer with a web-based cost calculator in urban forests.* Arboriculture & Urban Forestry. 37: 74–83.

VanNatta, A. R., R. H. Hauer and N. M. Schuettpelz. 2012. *Economic Analysis of Emerald Ash Borer (Coleoptera: Buprestidae) Management Options*. Journal of Economic Entomology. 105(1):196–206

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Figure 1. Removal of an 110 year old ash tree in poor structural health is a wise safety choice than retention through chemical treatment. Limbs are failing periodically at locations with brown rot. Photograph by Richard J. Hauer

MANGEMENT ALTERNATIVE ANALYSIS

Goals & Objectives	Management Alternatives				No EAB
	Control	Treatment	Removal	Remove & Replant	
Mean Net Per Tree Value	$963	$946	$211	$233	$988
Net Per Tree Value at Year 20	$882	$896	$0	$232	$931
Net Total Tree Value at Year 20	$25,915	$525,154	$0	$164,901	$621,836
Mean Net Per Tree Value Lost	$1,329	$1,333	$324	$1,293	$1,301
Total Trees Lost After 20 Years	971	414	1,000	1,290	332
Mean Annual Tree Diameter (DBH)	12.0	13.6	2.5	6.1	13.7
Mean Number of Trees Lost Per Year	46	20	48	61	16
Trees Retained at Year 20	29	586	0	710	668
Mean Per Year Maintenance Cost	$14,175	$22,843	$6,435	$13,037	$23,437
Total Maintenance Cost	$297,685	$479,698	$135,142	$273,770	$492,179
Mean Per Year Removal Cost	$12,121	$4,849	$14,274	$15,426	$3,968
Total Removal Cost	$254,547	$101,830	$299,748	$323,943	$83,337
Mean Per Year Planting Cost	$0	$0	$0	$12,035	$0
Total Planting Cost	$0	$0	$0	$252,742	$0
Mean Per Year Treatment Cost	$0	$32,632	$0	$0	$0
Total Treatment Cost	$0	$685,282	$0	$0	$0
Total Management Cost	$552,232	$1,266,810	$434,889	$850,455	$575,516
Mean Per Year Total Management Cost	$26,297	$60,324	$20,709	$40,498	$27,406
Mean Per Tree Annual Management Cost	$63	$72	$21	$40	$33

Management Alternatives	Retained Tree Analysis		Lost Tree Analysis		Benefit/Cost
	Mean Net Value	Relative Ratio	Mean Net Value	Relative Ratio	
Control	$395,337	1.00	$61,411	1.00	0.76
Treatment	$749,793	1.90	$26,297	2.34	0.64
Preemptive Removal	$123,502	0.31	$64,757	0.95	0.33
Remove & Replant	$202,431	0.51	$79,467	0.77	0.29
No EAB	$813,048	2.06	$20,589	2.98	1.46

Legend	
	Most Desirable Outcome
	Least Desirable Outcome

Figure 2. Comparison of four emerald ash borer (EAB) management alternatives without EAB using methods of VanNatta et al. 2012 for a 1000 ash tree population. (Retained Tree Analysis: Relative ratio = Management alternative / Control option; Lost Tree Analysis: Relative ratio = Control option / Management alternative; management options include treatment, preemptive removal over five years, preemptive removal and replanting over five years, and no EAB)

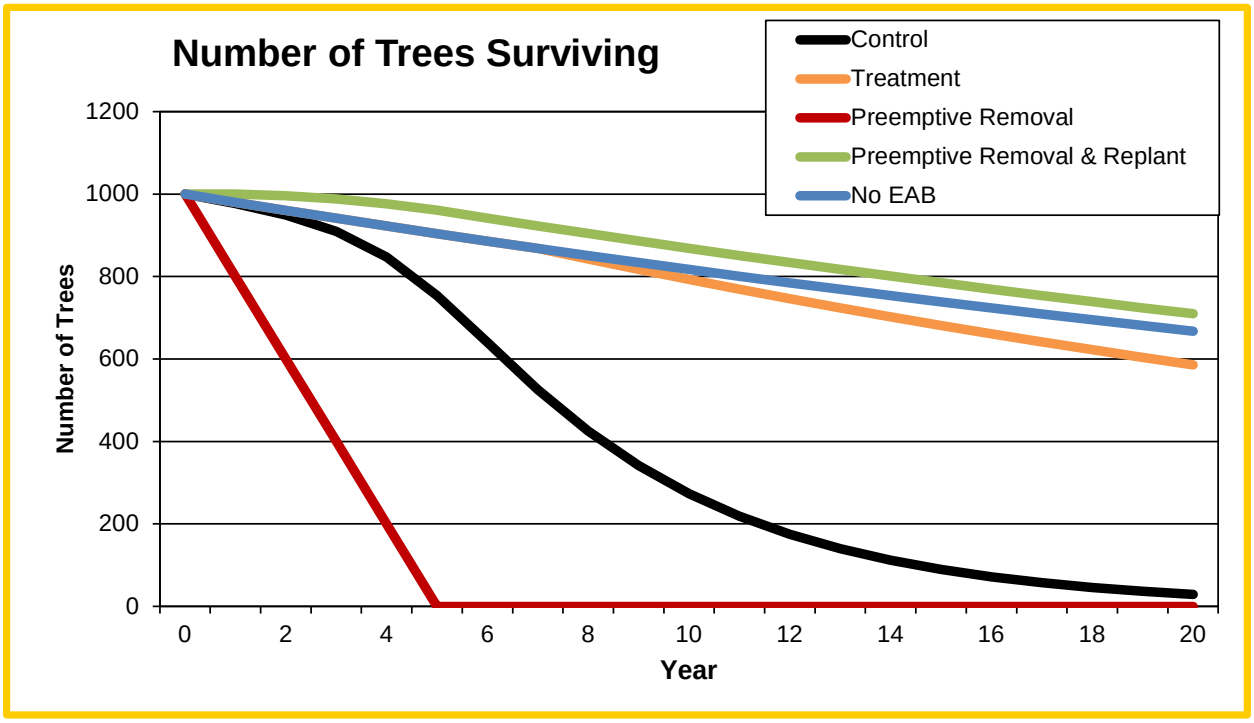

Figure 3. After 20 years few ash trees are left with the do nothing (control) approach compared to treatment, no EAB, and preemptive removal followed by tree replacement.