Save the Best and Replace the Rest

A City Planner's Perspective on the Emerald Ash Borer Infestation

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GreenStep Cities Program Workshop, 3/7/18

Introduction:

I love the GreenStep Cities Program. You all come from a wide range of disciplines and backgrounds and have an equally wide range of responsibilities. But to progress through the Program's Steps, you have to entice other city staff to leave their silos and participate in round-table discussions to improve your city's sustainability. You have to inspire and repeatedly ask for more from staff members who are already overwhelmed by constantly having to "do more with less" while they are understaffed, over scrutinized, and underappreciated. I salute you. I speak from experience. Prior to 2006, I had a 30-year career as a city planner and environmental manager for the City of Minneapolis.

In the 20 minutes I have, I will *pile on* with another issue you have to face: A *predictable disaster* that threatens 20% of your urban forest—the Emerald Ash Borer (EAB) infestation.

Ash trees in your cities probably constitute between 20-40% of your urban forests and EAB will kill every unprotected tree within 4-6 years of being infested. Your city plans probably call for expanding your tree canopy but you'll not have a chance for a generation unless you deal with this infestation.

But first I should introduce myself and explain why you should listen to a city planner talking about a tree infestation.12 years ago, I formed my own consulting company, ORANGE Environmental, LLC. I've prepared carbon baseline assessments for many of your cities. Four years ago, Rainbow TreeCare saw the need for EAB management plans for cities. So Jeff Hafner, who is Rainbow's Director of Municipal Consulting, told me (jokingly), "I know everything about trees but nothing about planning." I naturally replied (also jokingly), "I know everything about planning but nothing about trees. A collaboration was born, and we have developed EAB management plans for cities throughout the state.

(Slide 2) With the help of Jeff, I developed an article about enhancing the urban forest for the Metropolitan Council [1] and a model landscape ordinance for the GreenStep Cities Program, both from a city planner's perspective. [2]

Scientists soon learned that cities couldn't cut their way out of the EAB infestation. A mated female EAB beetle can fly about a mile a day in search of a host tree. Scientific studies show that a regional or, ideally, a statewide EAB management strategy is more cost-effective and better for the environment than a city-by-city approach. Jeff Hafner and I developed just such a statewide program 3 years ago, "Proposal to Create the *Minnesota Ash Tree Preservation Program*."

We've been lobbying the Legislature and state agencies since then with the Minnesota Shade

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[1] How to Enhance Urban Canopy Through Ordinance & Collaboration for Comprehensive Plans," https://metrocouncil.org/Handbook/PlanIt/Files/Expert-Article-Urban-Forest.aspx

[2] Available on the GreenStep Cities website: https://greenstep.pca.state.mn.us/modelOrdinances.cfm

Tree Advisory Committee to create a $12 million-per-year program that would help cities manage the infestation in the most environmentally sound and cost-effective manner. Even though the Legislature invested today's equivalent of over $500 million to help cities manage the Dutch Elm Disease back in the 1970s,[3] and EAB is an even more destructive invasive, I no longer have any confidence the Legislature will help cities this time.

Fortunately, 4 years ago Jeff Hafner and I developed the *Model EAB Management Plan*,[4] which brings me to the core of today's presentation.

Trees and soil as green infrastructure:
I want to sell you on two things: I maintain that cities should treat their green infrastructure on a par with their grey, and that goes double for trees. Secondly, if your city hasn't already done so, it should develop and implement an EAB management plan. What I will not try to sell you on is a specific company that could help you draft or implement a plan. I see a very bright line between consulting and selling.

(Slide 3) Everybody loves trees. It's easy to appreciate how they beautify our yards, define our streets, shade our parks and trails, and provide aesthetic relief to our bleak parking lots. (Slide 4) But there's so much more to trees:

- Reduce stormwater runoff
- Save energy
- Store carbon
- Improve air quality
- Improve human health
- Increase property values
- Reduce crime
- Reduce noise

(Slide 5) Scientists have also quantified the environmental, economic, and human health benefits. The average-sized, urban ash tree provides benefits worth $205 per year. When these benefits are weighed against the cost to purchase, plant, prune, protect, and eventually remove a tree, the benefits outweigh the costs by a margin of about three to one.

EAB infestation: A predictable disaster
(Slide 6) The slide shows what is called, the EAB "death curve." The adult beetles eat ash leaves but cause minimal damage. However, the beetle larvae burrow into the tree and feed on the inner bark and disrupt the tree's ability to transport water and nutrients. Healthy trees can tolerate an infestation for 3-4 years (this is the flat part of the EAB death curve), but then they reach a tipping point that leads quickly to death.

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[3] According to the 2008 Minnesota *Forest Protection Plan*, Minnesota invested "nearly $30 million a year for six years in response and replacement funds" during the initial years of Dutch elm disease. Since then, "State partnership with local governments in this control of invasive species, such as Dutch elm disease, has dwindled to no state appropriation." Figure in text based on the US Inflation Calculator.
[4] http://www.mnstac.org/uploads/2/0/9/3/20933948/mnstac_model_eab_management_plan.pdf

During the second phase of the death curve (the exponential phase), pest pressure builds, and tree deaths begin to parallel the exponential growth rate of beetle populations. Thousands of dead trees quickly overwhelm city crews, equipment needs, debris yards, and, very importantly, city budgets. Ash killed by EAB quickly become desiccated and brittle. They create serious liability risks to property, power lines, and people.

(Slide 7) The EAB is the most damaging forest insect ever to invade the U.S. The average management cost for a city in the region over a 12-20-year period: $800,000 to $1.5 million. (Slides 9-11) However, we know how to minimize the damage using science-based best management practices: SLAM (SLow Ash Mortality). Previous strategies to slow the spread by only removing trees failed. Wasted public resources to remove and replace healthy trees. Destroyed public investments in green infrastructure. Shifted the burden to property owners as the beetles attacked private trees. And, according to EAB expert, Dr. Dan Herms, the tree-removal strategy actually spread the infestation faster.

Six years ago, scientists concluded the key strategy was to reduce the rate at which EAB populations grow and spread; kill the bugs, not the trees. One of the authors of the SLAM study, Dr. Deborah McCullough, concluded, "There is no reason for a landscape ash tree to die from emerald ash borer anymore." Put simply, save the best and replace the rest.

Purdue University calculator:
(Slide 12) Purdue University provides a free, on-line calculator that allows for easy comparison of the costs of 3 scenarios over a 25-year time period. [5] It will consistently show saving the best trees and replacing the rest is the most cost-effective strategy. However, it does not calculate tree benefits, and if there were no benefits, no one would plant a tree.

Rainbow Treecare's EAB Analytical Model:
(Slide 13) Jeff Hafner and I developed our EAB Analytical Model. It is a cost/benefit analysis that uses 22 interconnected spreadsheets to model tree growth, costs, and 7 tree benefits of surviving trees and replacement trees over a 20-year study period.

The findings for a typical city, based on data from 18 Twin Cities suburbs, are as follows:

- Base Case: This is based on the original strategy of removing and replacing all trees as they succumb to EAB.
- Current Plan: This the science-based strategy based on the SLAM study. It assumes the treatment of all high-quality ash trees (40% of total ash trees) and removal and replacement of all other trees as they succumb to EAB.
- Charts 1 & 2: Compared to the Base Case, the Current Plan reduces costs by 17% by Year 20.
- Chart 4: Compared to the Base Case, every dollar invested in the Current Plan preserves more than twice as much cumulative tree value by Year 20.
- Charts 5 & 6: These charts focus on the peak period (Years 4-8) when cities were faced with so many dead trees they called it "a wall of wood." Compared to the Base Case, the Current Plan reduces peak-period costs and debris removal by about 40%.

[5] Purdue EAB calculator: https://int.entm.purdue.edu/ext/treecomputer/

- When compared to the Base Case, the advantages of a SLAM-based treatment plan increase as the treatment percentage increases. The more you treat, the more you save.

Model EAB Management Plan (Slide 14): The following summarizes key aspects of the 7 goals in the Plan:

Goal 1—Accurate Tree Assessment and Record Keeping, and Updating the City Code: Ask Public Works if they know the miles and condition of roadways and sewers or the type of HVAC equipment in city buildings, and they'll say "of course." Would you get the same answer if you asked the parks department about the size, location, species, and condition of public trees? If not, they should.

- **Public tree inventory and private tree survey:** This is essential activity.
- **Ash tree assessment:** The first priority is to identify the large, healthy ash trees located in high-priority areas. These are areas either within or within a clear view from public lands and rights-of-way (boulevards, front yards of public and private property, and the mowed areas of public parks and open spaces). These high-quality trees are most worthy of preservation.
- **Upgrading landscape requirements in the zoning code:** At a time when it is important to maximize tree canopy as a major strategy to mitigate the effects of climate change, EAB is destroying billions of trees. In order to take advantage of every opportunity to protect and plant trees, the city can harness the power of the private sector through the development review process. Since trees don't obey property lines, a city's zoning code should also protect offsite trees that may be affected by new developments. The Model Landscape Ordinance provides chapter and verse on this topic.

Goal 2—Early Infestation Detection and Suppression: The SLAM study emphasizes the importance of early detection and actions to confine the infestation within the lessened pest pressure stage, which is the flat part of the death curve.

Rather than remove low-value trees, they can serve a vital role as "trap trees." Studies have shown that EAB beetles are attracted to ash trees that have been stressed. They tend to lay more eggs on stressed trees than on healthy trees. The best way to accomplish this is by peeling off a ring of bark around the base of the tree. Called girdling, it will kill the tree in about a year.

Girdled trees organized in a grid pattern are very effective for assessing beetle distribution. They also can function as beetle population "sinks" to concentrate and then eliminate beetles by removing the tree before they can mature and reproduce.

Goal 3—Postpone and Decrease Peak Ash Mortality:
A key Herd immunity is the public health phenomenon where protection from a disease for a critical percentage of the population allows protection for untreated individuals in the population. The SLAM study calculated that the treatment of 20% of the total ash tree population is the amount needed to have a significant protective effect on the rest of the ash trees in the population. This is how treatment of a high percentage of public trees can help preserve private ash trees, especially in low-income areas where there are fewer trees per person and fewer resources to protect them.

Goal 4—Preserve the High-Quality Ash Trees:

- **Aggressive treatment period (high pest pressure, years 1-12):** This 3-year treatment protocol using trunk-injected, emamectin benzoate. Treat 1/3 of the trees each year to balance the workload and costs.
- **Maintenance period (low pest pressure, after year 12):** Treatments can be reduced to every 5 or more years because the infestation wave will have moved on after killing all untreated ash trees. A tree will have 3 or more pest-free years after a treatment, and then can tolerate 3 or more years as the infestation slowly builds again within it before another inoculation is needed. Treat 20% or less of the trees each year.
- **Safety:** The latest research from the experts clearly shows that the well-documented harm to the environment, the economy, and human health caused by the loss of untreated ash trees far outweighs whatever known and likely risks the emamectin benzoate pesticide may pose to the environment and non-target animals.[6] Treatments also buy time for science, which is constantly progressing, to provide even more effective strategies to minimize the devastation caused by this invasive pest.

Goal 5—Expand Tree Canopy and Improve Tree Diversity: The tree diversity guideline known as the "5-10-15 rule" is an arboriculture guideline to reduce the risk of catastrophic loss due to pests like EAB. It recommends that an urban forest be made up of no more than 5% of any one species, 10% of any one genus, and 15% of any one family. Establish a policy that replaces trees in high-priority areas with at least a one-to-one ratio from a diversified list of eligible trees.

Goal 6—Minimize Public Costs:

Goal 7—Enlist Private Tree Owners:

- **Education and communication:** Use all available city tools.
- **Public subsidy for private trees:** Cities should consider awarding vouchers to encourage private tree owners to save the best private trees.
- **Bulk-rate offer:** Some companies that have a contract to treat the public trees in a city will offer reduced treatment rates for private tree owners in the city.

Conclusion: (Slide 15) Save the best, replace the rest.

[6] "Counties around the country that have already seen emerald ash borers wipe out their ash trees have also seen increased [human] mortality from heart and lung disease. Based on the numbers of trees we expect to lose from emerald ash borers, we would expect to see heart and lung disease result in 100 more deaths in Minneapolis." Source: City of Minneapolis, 3/1/17, http://www.minneapolismn.gov/newsroom/WCMSP-195854

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GreenStep Cities Program Workshop, 3/7/18

ORANGE™ ENVIRONMENTAL

Introduction

HOW TO ENHANCE URBAN CANOPY THROUGH ORDINANCE & COLLABORATION FOR COMPREHENSIVE PLANS

Michael Orange, Principal
ORANGE Environmental, LLC

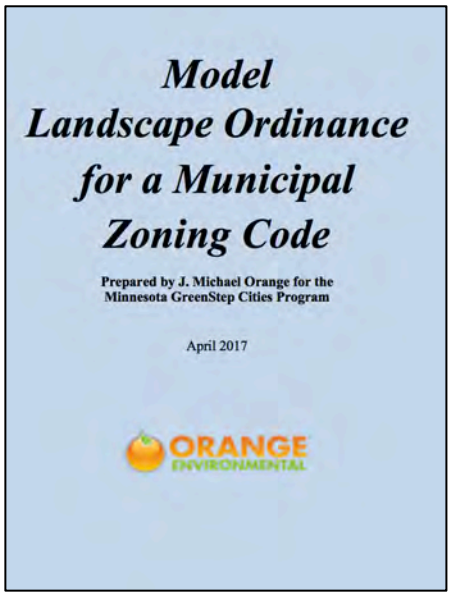
While it is easy to appreciate the beauty of trees and landscaping, the quantifiable environmental, economic, and health benefits are not as easy to grasp. When the values of trees are weighed against their purchase and maintenance, the benefits outweigh the costs by a margin of about three to one. Comprehensive plans should embed effective green infrastructure goals, policies, and implementation tools into practice in the following ways.

1. **"You don't know what you got 'till it's gone" - Urban Forest Inventory and Goals:**
   a. **Inventories:** Community inventories of public green infrastructure should include at minimum species location, size, and condition, and ideally, records of major maintenance activities (e.g. treatments for infestations, pests, and diseases). The parks section of your comprehensive plan should include urban forest canopy goals. Fortunately, several excellent tools are now available to estimate canopy cover.[1]
   b. **Plant diversity goals:** Cities should utilize the 5-10-15 guideline to increase species diversity. This rule suggests the urban tree population (and major development sites) include no more than 5% of any one species, 10% of any one genus, or 15% of any family.[2]

2. **Development Review Process:**
   a. **Mother Nature ignores property lines:** A city's control tools must account for both on and off-site impacts. Construction activities and changes to drainage can damage trees and destroy living soils.[3]
   b. **Do it right the first time:** A common misperception is that there is little difference between soil and dirt and between a mature tree and a new tree. As scientist, Peter Wohlleben writes, "There are more life forms in a handful of soil than people on the planet. A mere teaspoon contains many miles of fungal filaments. All of these work the soil, transform it, and make it so valuable for the trees."[4] It is crucial during land altering activities to preserve as much as possible all healthy soils and high-quality trees (i.e. trees that are healthy, large, and properly located). As for new trees, put the right tree in the right place.

3. **Emerald Ash Borer Infestation:** Ash trees constitute 20-40% of the public trees in the region's cities, and the Emerald Ash Borer (EAB) infestation will kill every unprotected ash tree. The EAB beetle is the most economically costly forest insect ever to invade the U.S. Some essentials to manage the infestation include:
   a. **Save the best and replace the rest:** Scientific advancements since the start of the infestation show that the preservation of high-quality ash trees and replacement of the other ash trees is the most economically and environmentally sound policy.
   b. **EAB management plan:** Cities must prepare EAB plans to address the sheer scale of the work ahead and the average management cost of $800,000 to $1.5 million.[5]

[1] Refer to the references at the end of the Model Landscape Ordinance prepared for the GreenStep Cities Program.
[2] The general rule used to be 10-20-30, but it implies the acceptability of suffering the loss of 20% of our urban canopy since both of the commonly planted ash species are highly susceptible to the Emerald Ash Borer infestation.
[3] The Model Landscape Ordinance mentioned above has suggested ordinance language to address these issues.
[4] Wohlleben, Peter. *The Hidden Life of Trees*, p. 66.
[5] Refer to the *Model Emerald Ash Borer Management Plan* (available upon request from this article's author)

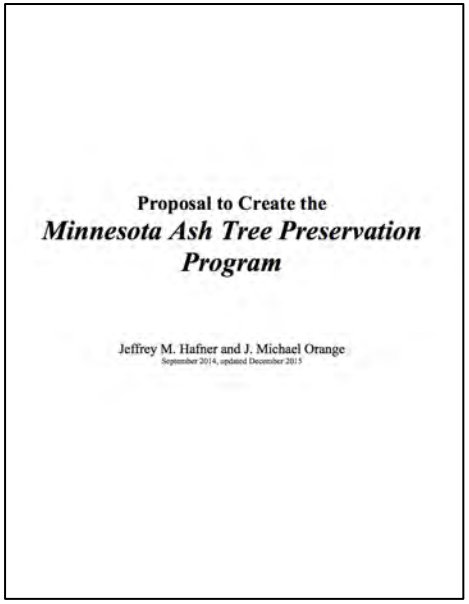


Model Landscape Ordinance for a Municipal Zoning Code

Prepared by J. Michael Orange for the Minnesota GreenStep Cities Program

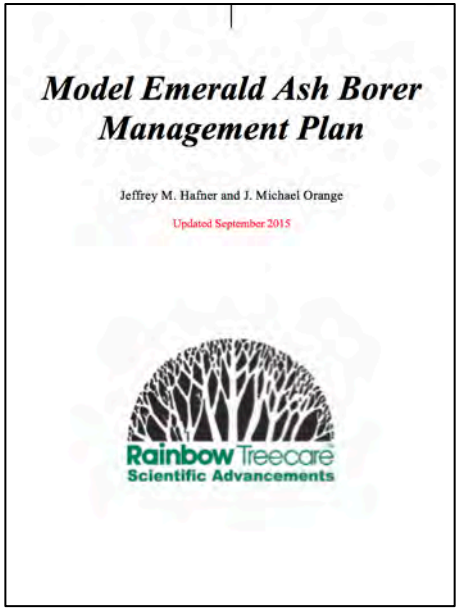
April 2017

ORANGE ENVIRONMENTAL



Proposal to Create the
Minnesota Ash Tree Preservation Program

Jeffrey M. Hafner and J. Michael Orange
September 2014, updated December 2015



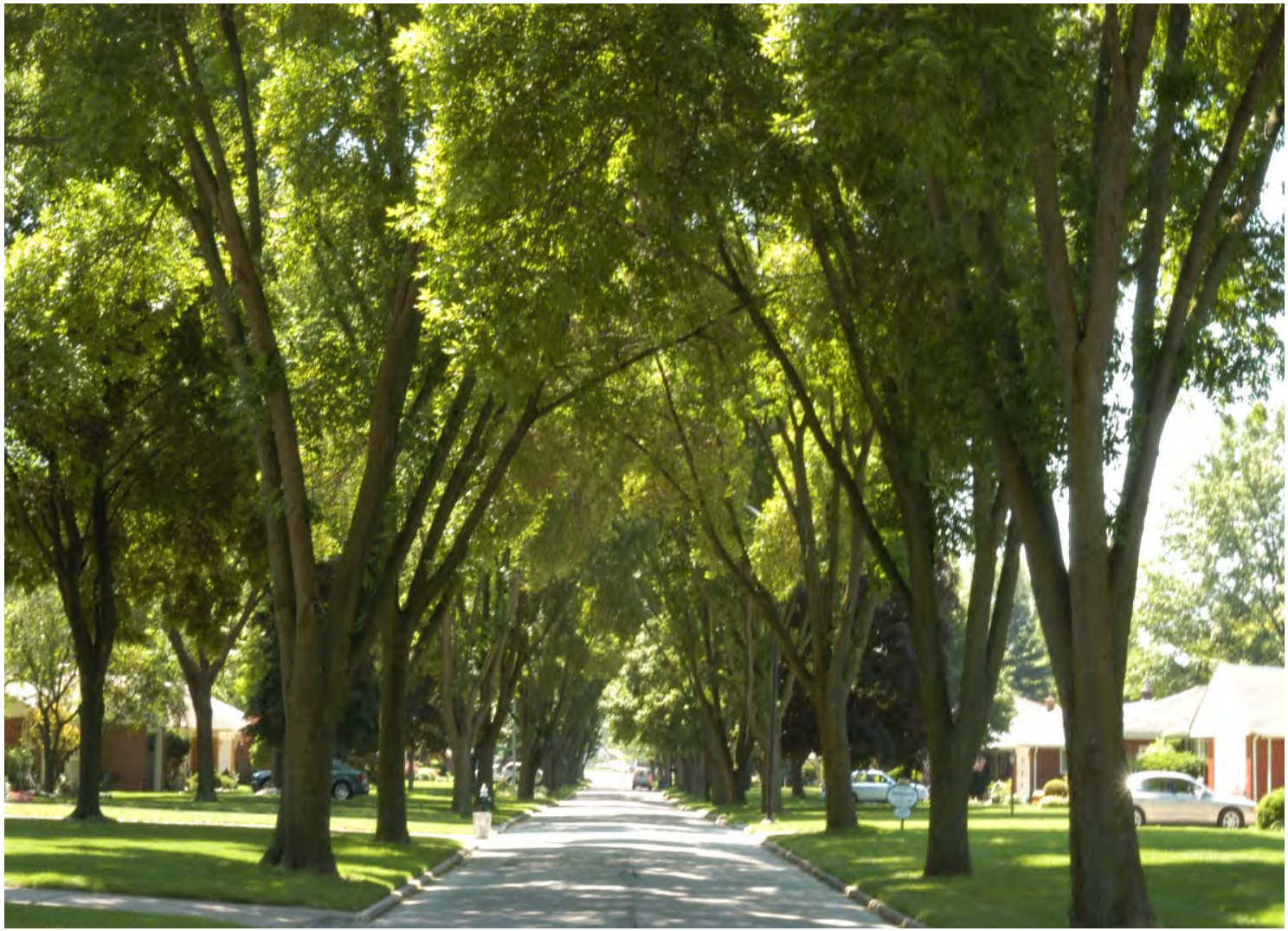
Model Emerald Ash Borer Management Plan

Jeffrey M. Hafner and J. Michael Orange

Updated September 2015

Rainbow Treecare
Scientific Advancements

Everybody loves trees



Photos courtesy Dr. Dan Herms

Trees: Infrastructure Superhero

- Reduce stormwater runoff
- Save energy
- Store carbon
- Improve air quality
- Improve human health
- Increase property values
- Reduce crime
- Reduce noise

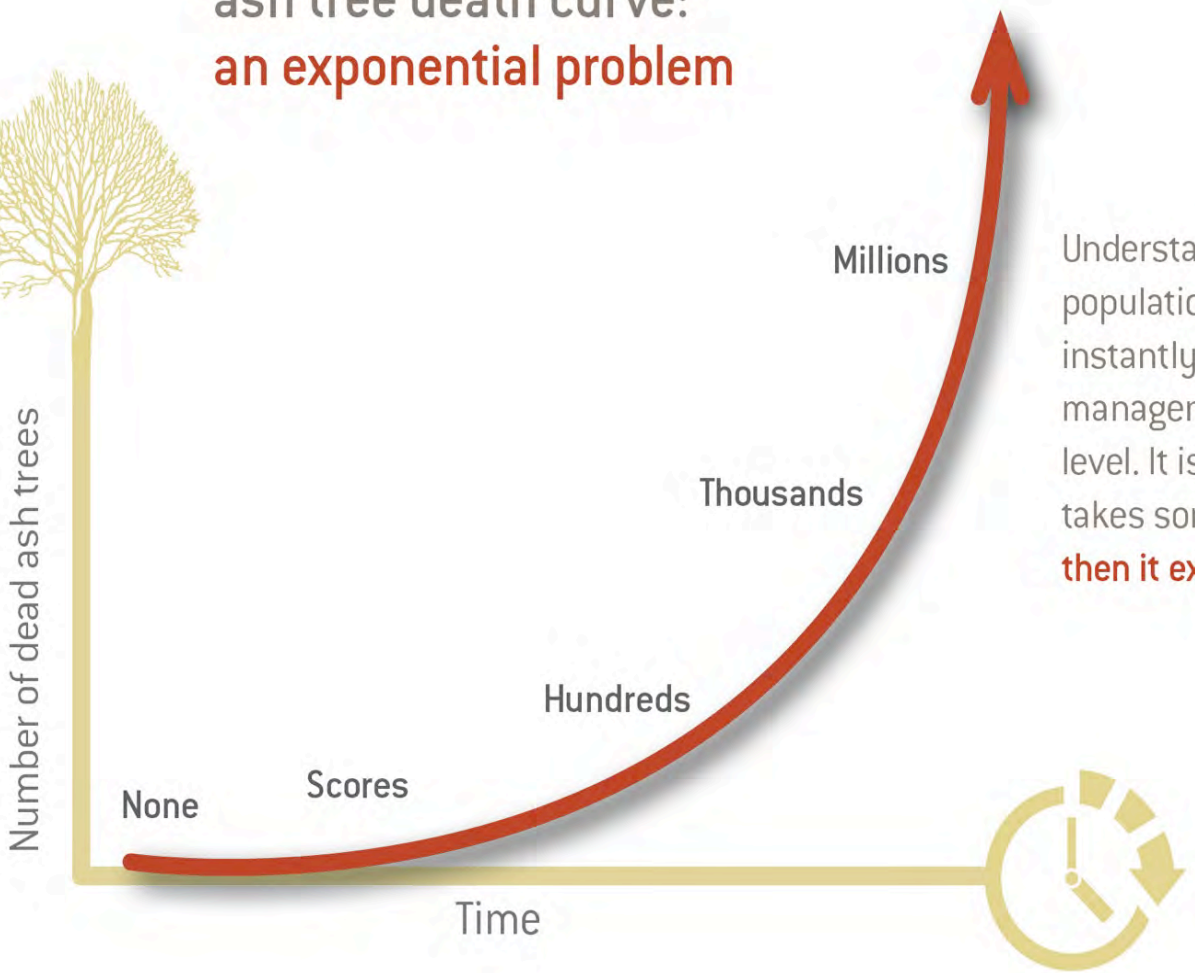
Photo courtesy of Rainbow TreeCare

Tree Benefits

- The average urban ash tree (21” DBH) provides benefits of $205 per year.
- Tree benefits outweigh tree costs by 3 to 1.

From the National Tree Benefits Calculator
www.treebenefits.com and Rainbow TreeCare

ash tree death curve:
an exponential problem

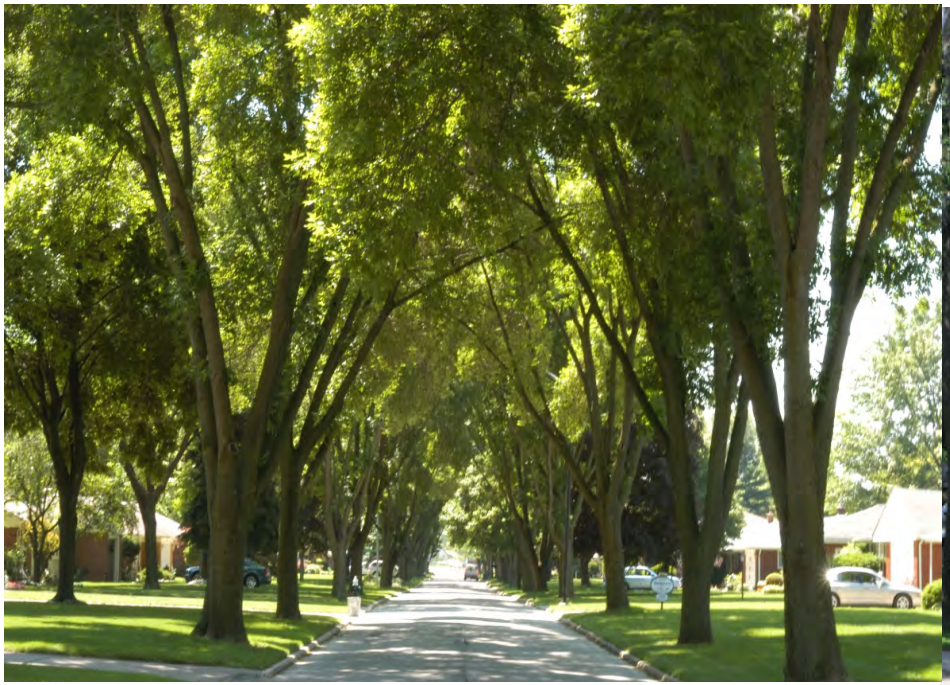


Understanding that the borer population doesn't explode instantly has changed EAB management at the municipal level. It is now known that it takes some time to build up, **but then it explodes exponentially.**

Emerald Ash Borer Infestation

Most damaging forest insect ever to invade the U.S.

A predictable natural disaster



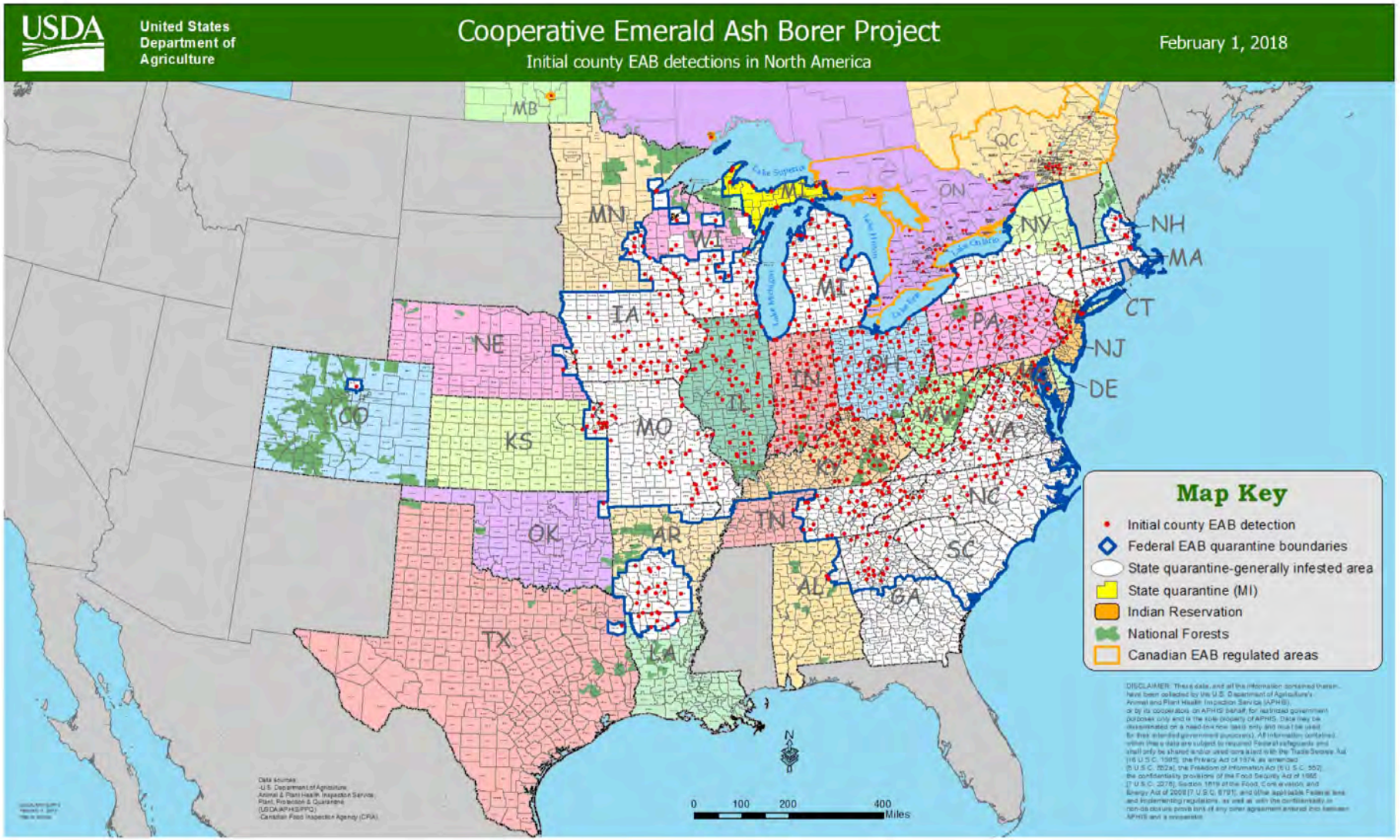
June 2006

Photos courtesy Dr. Dan Herms

Toledo, Ohio

June 2009

Average EAB management cost for a city in the region: $800,000 to $1.5 million over 12-20 years.



31 states and 2 Canadian provinces

For more information on EAB: www.emeraldashborer.info

SLAM (SLow **A**sh **M**ortality**)**

Evaluation of potential strategies to SLow Ash Mortality (SLAM) caused by emerald ash borer (*Agrilus planipennis*): SLAM in an urban forest

Deborah G. McCullough[a,b]* and Rodrigo J. Mercader[a,1]

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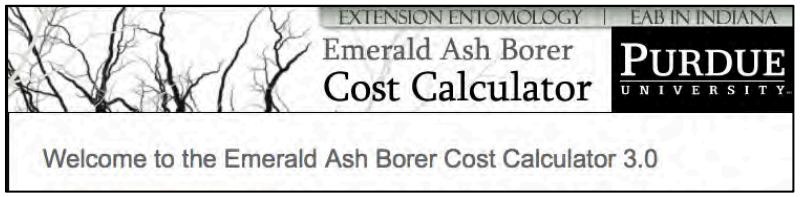
SLAM Study Conclusions

- Previous strategies to slow the spread by only removing trees failed:
  - Wasted public resources to remove and replace healthy trees.
  - Destroyed public investments in green infrastructure.
  - Shifted the burden to property owners as the beetles attacked private trees.
  - Dr. Dan Herms: Spread the infestation faster

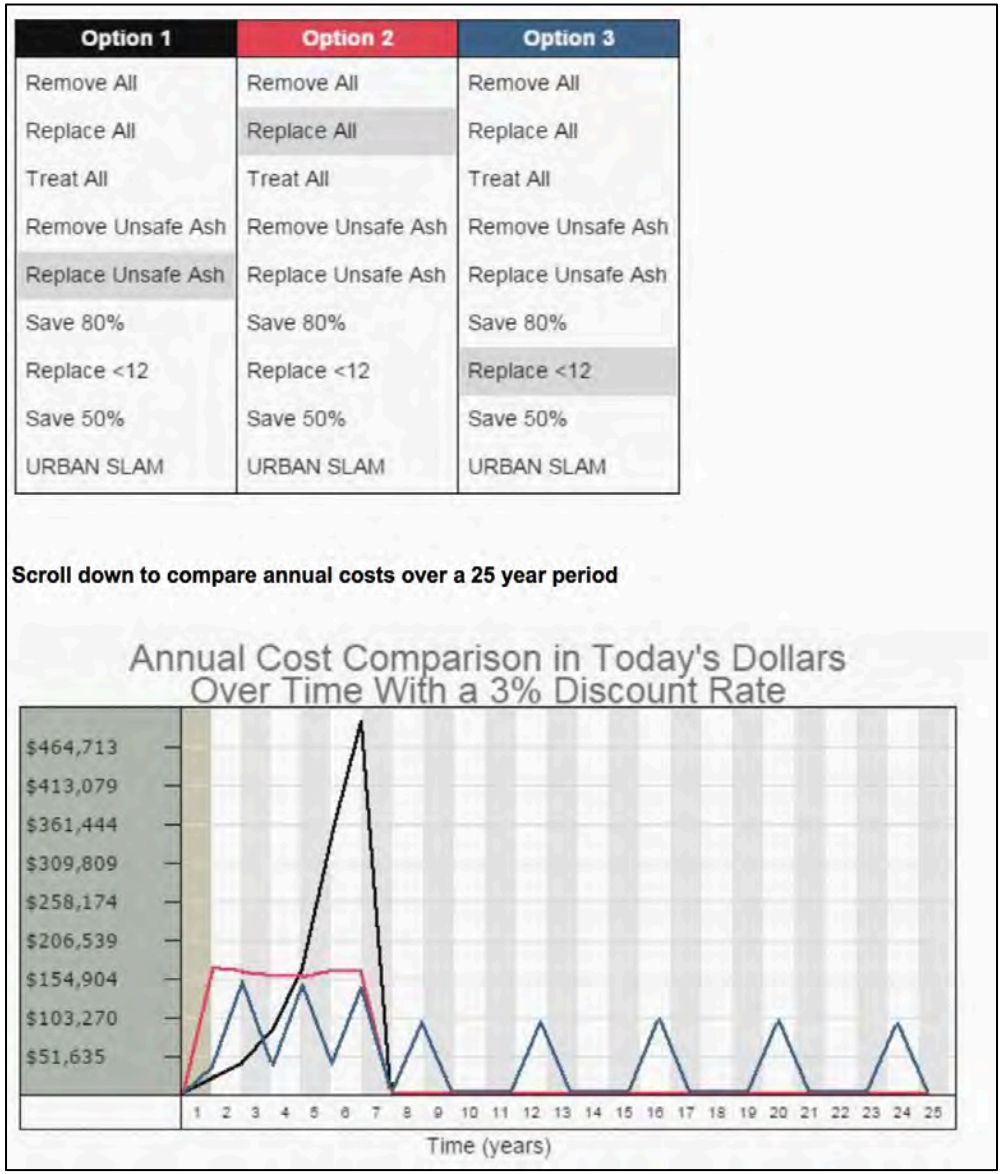
SLAM Study Conclusions

- Reduce the rate at which EAB populations grow and spread (kill the bugs, not the trees).
- "There is no reason for a landscape ash tree to die from emerald ash borer anymore." Dr. Deborah McCullough
  professor of entomology and forestry at Michigan State University
  (Source: "Emerald ash borer treatments costing less, working better," Minneapolis StarTribune, 8/8/13)

Save the best and replace the rest



- Free, on-line calculator.
- Compares costs of 3 treatment scenarios over a 25-year time period.
- Demonstrates saving the best and replacing the rest is most cost-effective strategy.
- Does not compare tree benefits.

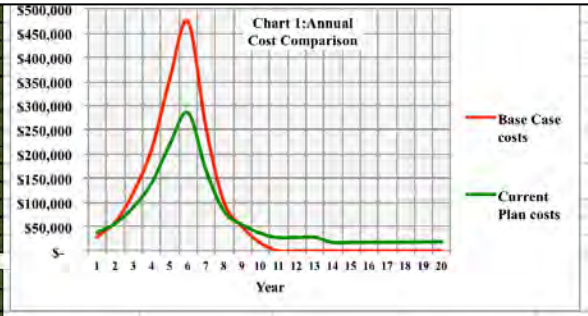


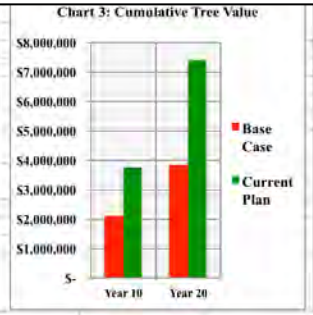
Rainbow TreeCare's EAB Analytical Model

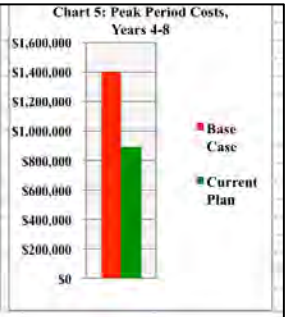
Tree data:	
Number of ash trees	2,400
DBH of high-quality trees	21.0
DBH of low-quality trees	13.0
Average DBH, all ash trees (calculated; do not change)	16.2
New tree DBH	2.5
Cost data:	
Removal cost per DBH	$ 15.58
New tree cost	$ 300.00
Treatment cost per DBH	$ 3.45
Actions:	
Replacement tree percentage	100%
Percentage of trees to be treated	40%
Treatment frequency during aggressive treatment period	33%

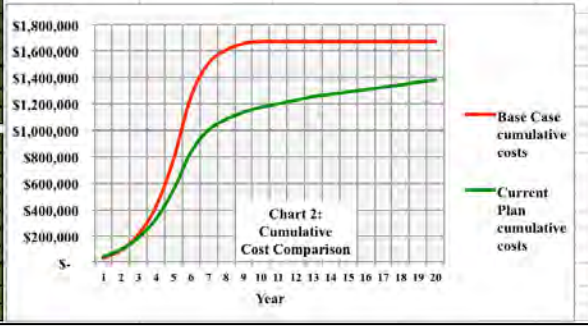
Years 1-10	Base Case	Current Plan
Costs:		
Removal costs	$ 791,803	$ 393,712
New tree costs	$ 878,400	$ 527,040
Treatment costs		$ 250,015
Total costs	$ 1,670,203	$ 1,170,767
Cost savings (over Base Case)		-30%
Cumulative tree value:		
Cumulative tree value	$ 2,091,885	$ 3,759,752
Additional tree value (over Base Case)		80%

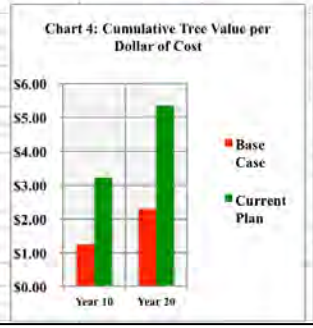
Years 1-20	Base Case	Current Plan
Costs:		
Removal costs	$ 791,803	$ 393,712
New tree costs	$ 878,400	$ 527,040
Treatment costs		$ 459,166
Total costs	$ 1,670,203	$ 1,379,917
Cost savings over Base Case		-17%
Cumulative tree value:		
Cumulative tree value	$ 3,825,696	$ 7,357,833
Additional tree value (over Base Case)		92%

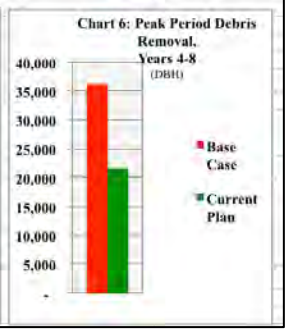










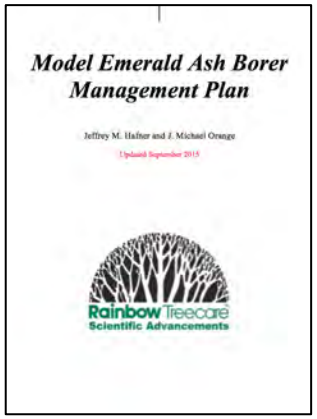


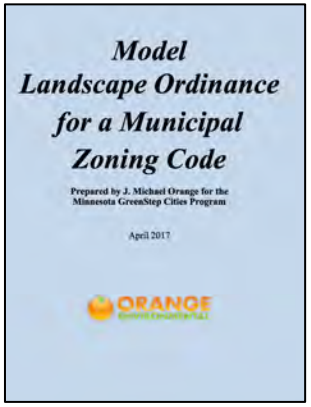
Findings:

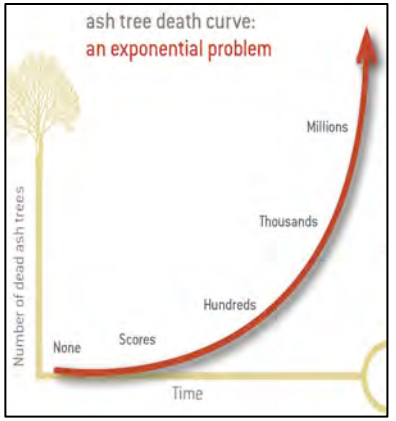
- **Base Case (original strategy):** Remove and replace all trees as they succumb to EAB.
- **Current Plan (SLAM strategy):** Treat all high-quality trees (40%) and remove and replace all other trees as they succumb to EAB.
- **Charts 1 & 2:** Compared to the Base Case, the Current Plan reduces costs by 17% by Year 20.
- **Chart 4**: Compared to the Base Case, every dollar invested in the Current Plan preserves more than twice as much cumulative tree value by Year 20.
- **Charts 5 & 6:** Compared to the Base Case, the Current Plan reduces peak-period costs and debris removal by about 40%.
- **Increased treatments:** The advantages increase as the treatment percentage increases.

Model Emerald Ash Borer Management Plan

- Goal 1: Accurate Tree Assessment and Record Keeping, and Updating the City Code
- Goal 2: Early Infestation Detection and Suppression
- Goal 3: Postpone and Decrease Peak Ash Mortality (herd immunity)
- Goal 4: Preserve the Most Valuable Ash Trees:
  - Aggressive treatment protocol (Years 1-12)
  - Maintenance treatment protocol (Years 13+)
- Goal 5: Expand Tree Canopy and Improve Tree Diversity
- Goal 6: Minimize Public Costs
- Goal 7: Enlist Private Tree Owners







Conclusion

Save the best and replace the rest

Save the Best and Replace the Rest

A City Planner's Perspective on the Emerald Ash Borer Infestation

J. Michael Orange
orange_michael@msn.com
GreenStep Cities Program Workshop, 3/7/18

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Introduction

HOW TO ENHANCE URBAN CANOPY THROUGH ORDINANCE & COLLABORATION FOR COMPREHENSIVE PLANS

Michael Orange, Principal
ORANGE Environmental, LLC

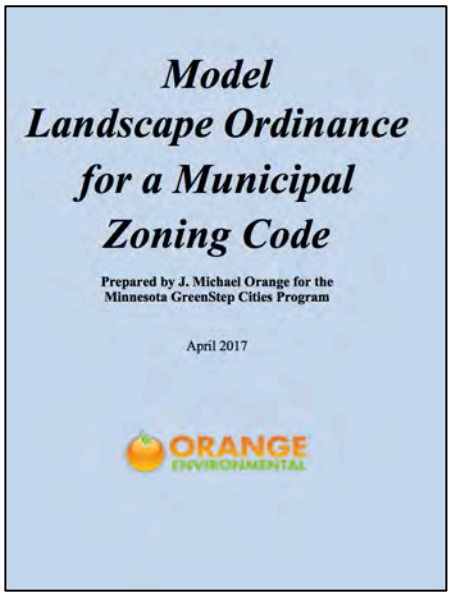
While it is easy to appreciate the beauty of trees and landscaping, the quantifiable environmental, economic, and health benefits are not as easy to grasp. When the values of trees are weighed against their purchase and maintenance, the benefits outweigh the costs by a margin of about three to one. Comprehensive plans should embed effective green infrastructure goals, policies, and implementation tools into practice in the following ways.

1. **"You don't know what you got 'till it's gone" - Urban Forest Inventory and Goals:**
   a. **Inventories:** Community inventories of public green infrastructure should include at minimum species location, size, and condition, and ideally, records of major maintenance activities (e.g. treatments for infestations, pests, and diseases). The parks section of your comprehensive plan should include urban forest canopy goals. Fortunately, several excellent tools are now available to estimate canopy cover.[1]
   b. **Plant diversity goals:** Cities should utilize the 5-10-15 guideline to increase species diversity. This rule suggests the urban tree population (and major development sites) include no more than 5% of any one species, 10% of any one genus, or 15% of any family.[2]

2. **Development Review Process:**
   a. **Mother Nature ignores property lines:** A city's control tools must account for both on and off-site impacts. Construction activities and changes to drainage can damage trees and destroy living soils.[3]
   b. **Do it right the first time:** A common misperception is that there is little difference between soil and dirt and between a mature tree and a new tree. As scientist, Peter Wohlleben writes, "There are more life forms in a handful of soil than people on the planet. A mere teaspoon contains many miles of fungal filaments. All of these work the soil, transform it, and make it so valuable for the trees."[4] It is crucial during land altering activities to preserve as much as possible all healthy soils and high-quality trees (i.e. trees that are healthy, large, and properly located). As for new trees, put the right tree in the right place.

3. **Emerald Ash Borer Infestation:** Ash trees constitute 20-40% of the public trees in the region's cities, and the Emerald Ash Borer (EAB) infestation will kill every unprotected ash tree. The EAB beetle is the most economically costly forest insect ever to invade the U.S. Some essentials to manage the infestation include:
   a. **Save the best and replace the rest:** Scientific advancements since the start of the infestation show that the preservation of high-quality ash trees and replacement of the other ash trees is the most economically and environmentally sound policy.
   b. **EAB management plan:** Cities must prepare EAB plans to address the sheer scale of the work ahead and the average management cost of $800,000 to $1.5 million.[5]

[1] Refer to the references at the end of the Model Landscape Ordinance prepared for the GreenStep Cities Program.
[2] The general rule used to be 10-20-30, but it implies the acceptability of suffering the loss of 20% of our urban canopy since both of the commonly planted ash species are highly susceptible to the Emerald Ash Borer infestation.
[3] The Model Landscape Ordinance mentioned above has suggested ordinance language to address these issues.
[4] Wohlleben, Peter. *The Hidden Life of Trees*, p. 66.
[5] Refer to the *Model Emerald Ash Borer Management Plan* (available upon request from this article's author)



Model Landscape Ordinance for a Municipal Zoning Code

Prepared by J. Michael Orange for the Minnesota GreenStep Cities Program

April 2017

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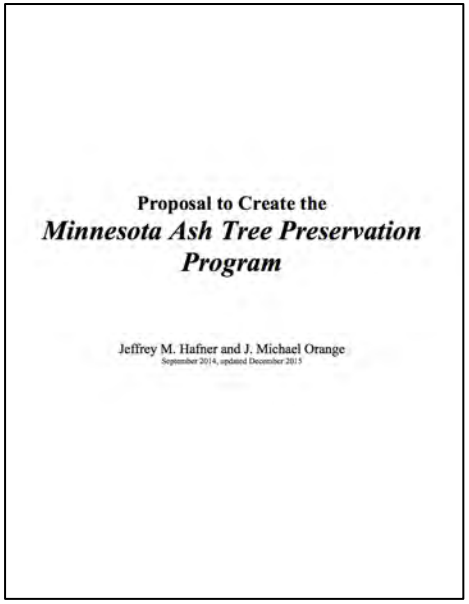
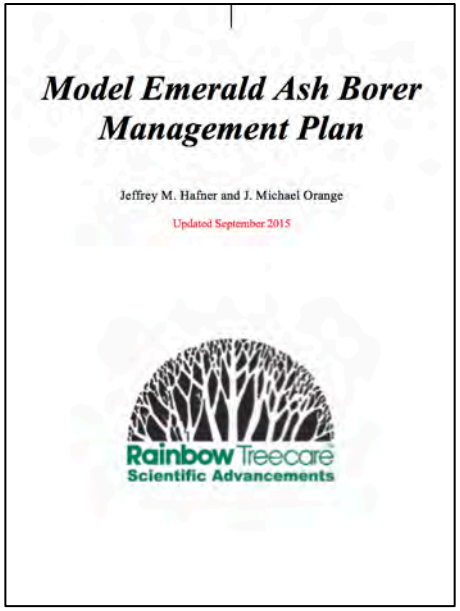


Proposal to Create the
Minnesota Ash Tree Preservation Program

Jeffrey M. Hafner and J. Michael Orange
September 2014, updated December 2015



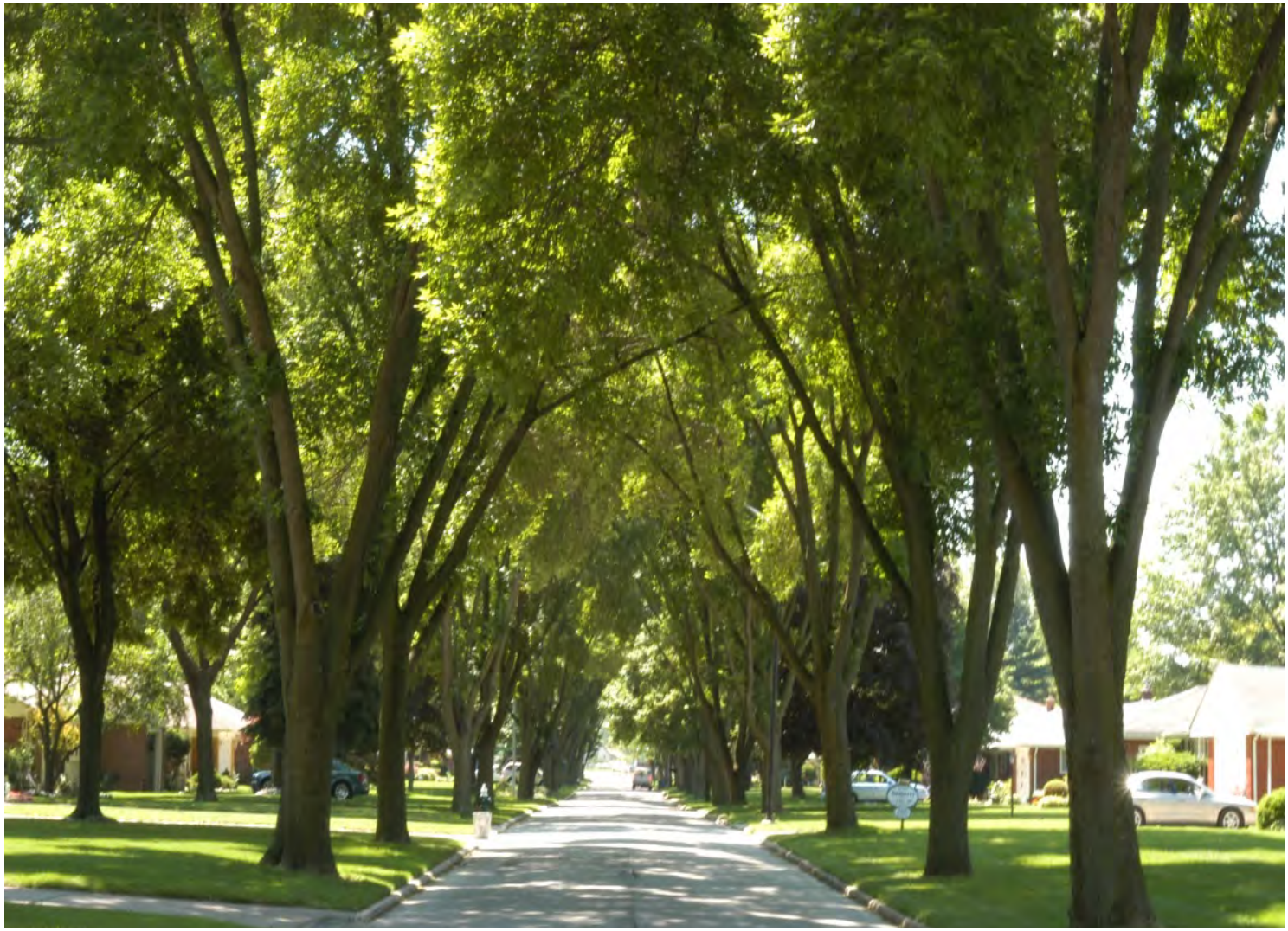
Model Emerald Ash Borer Management Plan

Jeffrey M. Hafner and J. Michael Orange

Updated September 2015

Rainbow Treecare
Scientific Advancements

Everybody loves trees



Photos courtesy Dr. Dan Herms

Trees: Infrastructure Superhero

- Reduce stormwater runoff
- Save energy
- Store carbon
- Improve air quality
- Improve human health
- Increase property values
- Reduce crime
- Reduce noise

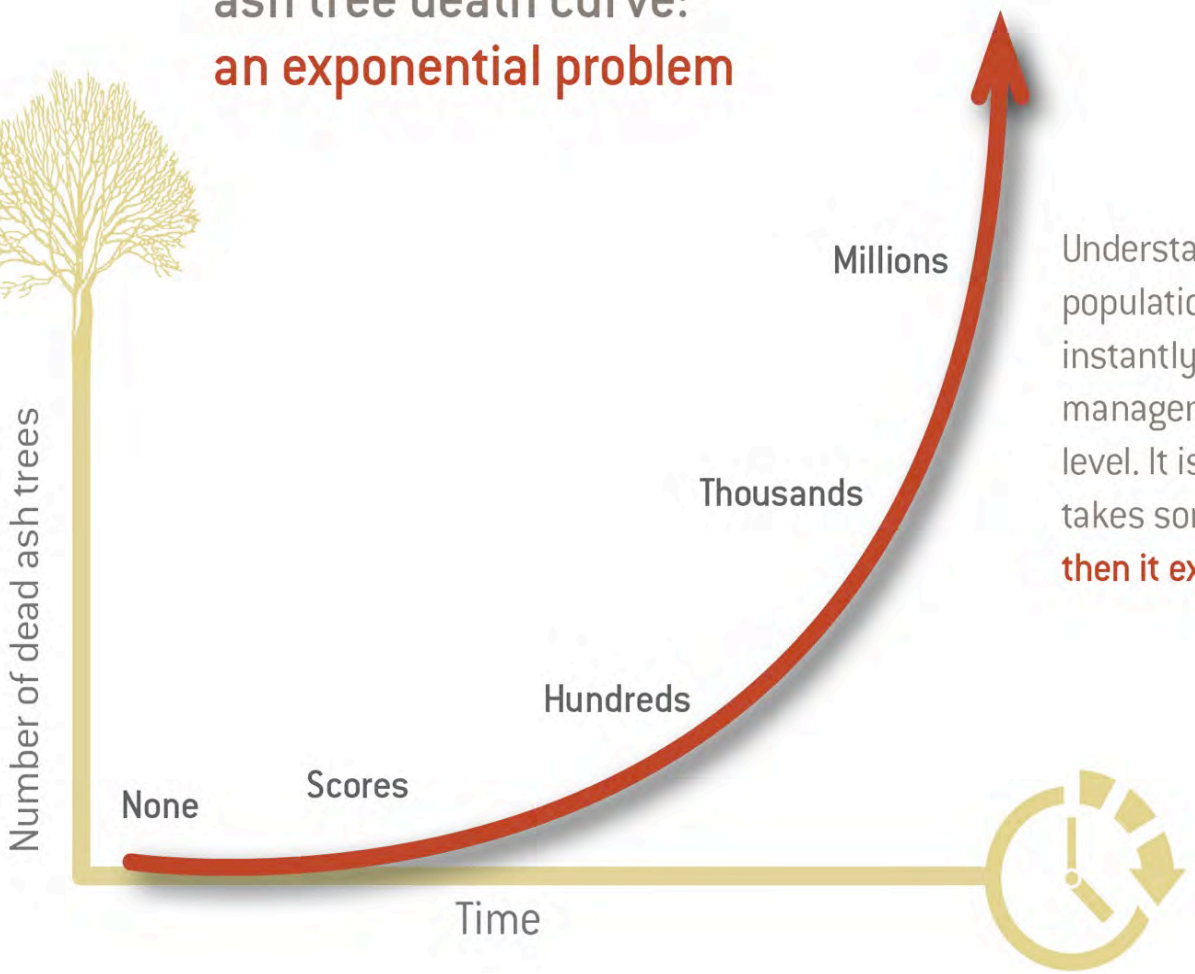
Photo courtesy of Rainbow TreeCare

Tree Benefits

- The average urban ash tree (21” DBH) provides benefits of $205 per year.
- Tree benefits outweigh tree costs by 3 to 1.

From the National Tree Benefits Calculator
www.treebenefits.com and Rainbow TreeCare

ash tree death curve:
an exponential problem

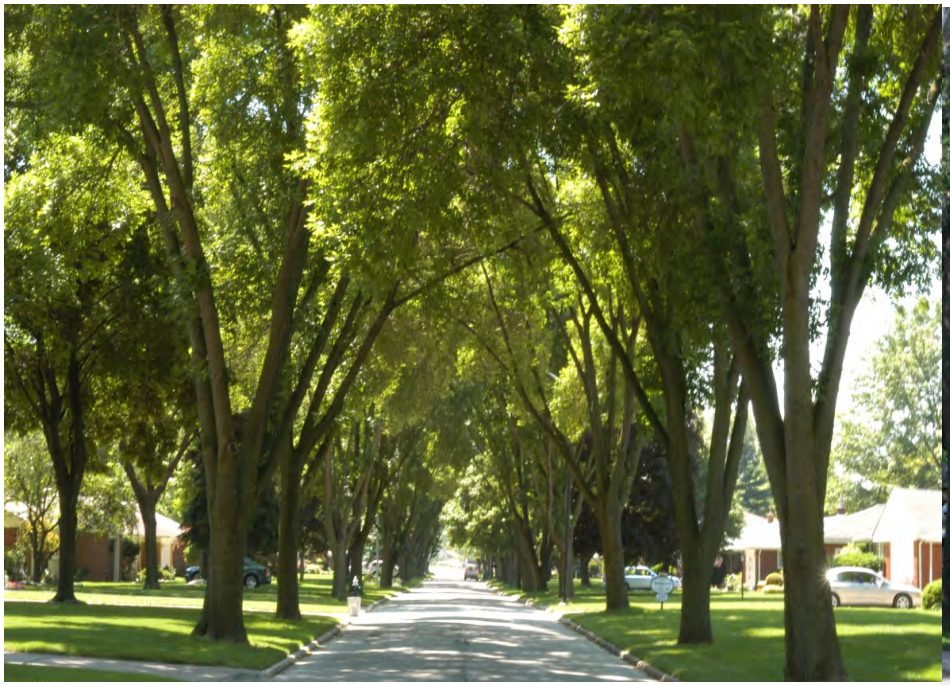


Understanding that the borer population doesn't explode instantly has changed EAB management at the municipal level. It is now known that it takes some time to build up, **but then it explodes exponentially.**

Emerald Ash Borer Infestation

Most damaging forest insect ever to invade the U.S.

A predictable natural disaster



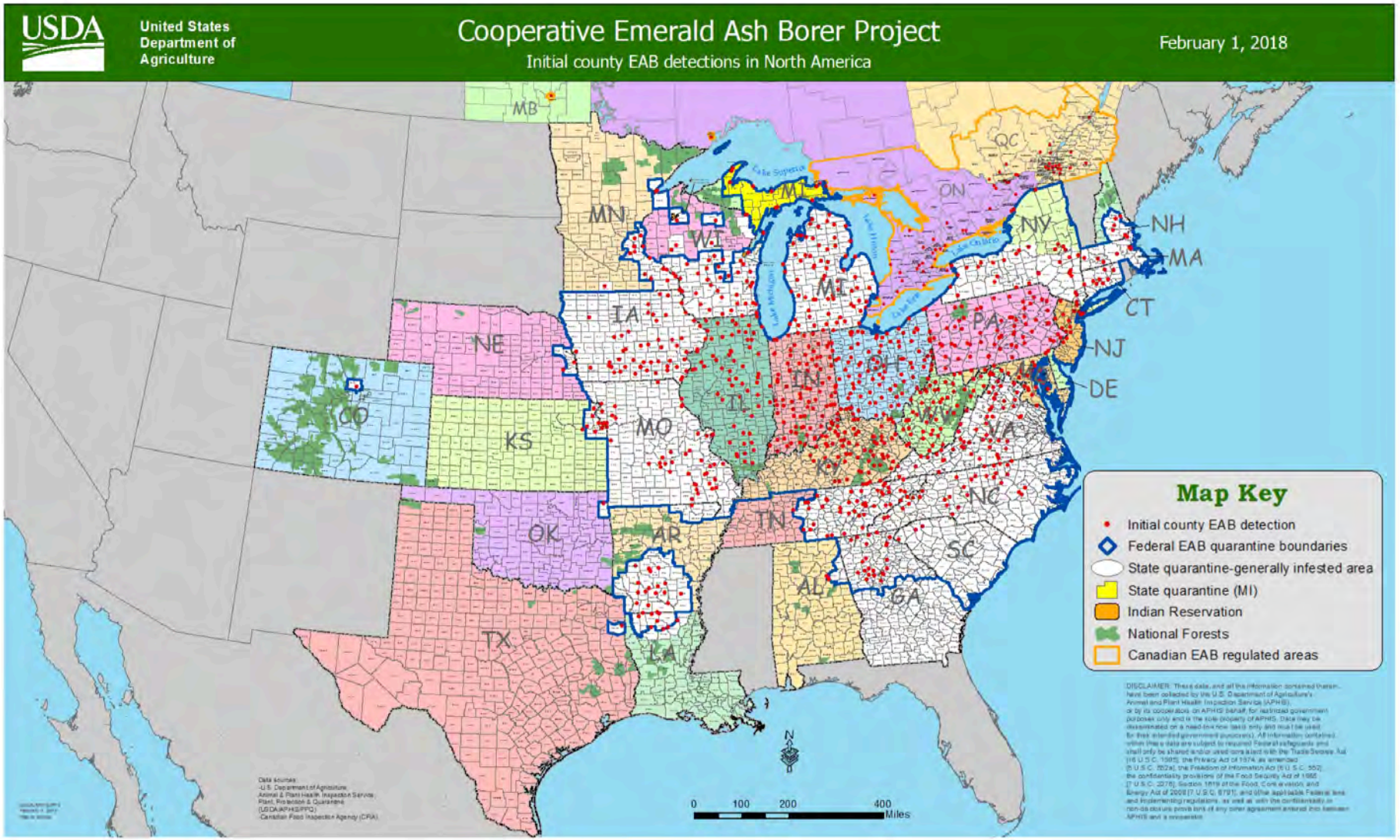
June 2006

Photos courtesy Dr. Dan Herms

Toledo, Ohio

June 2009

Average EAB management cost for a city in the region: $800,000 to $1.5 million over 12-20 years.



31 states and 2 Canadian provinces

For more information on EAB: www.emeraldashborer.info

SLAM (SLow **A**sh **M**ortality**)**

Evaluation of potential strategies to SLow Ash Mortality (SLAM) caused by emerald ash borer (*Agrilus planipennis*): SLAM in an urban forest

Deborah G. McCullough[a,b]* and Rodrigo J. Mercader[a,1]

[a]*Department of Entomology;* [b]*Department of Forestry, 243 Natural Sciences Building, Michigan State University, East Lansing, MI 48824, USA*

International Journal of Pest Management
Vol. 58, No. 1, January–March 2012, 9–23

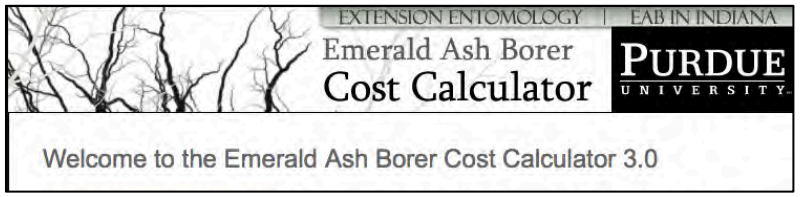
SLAM Study Conclusions

- Previous strategies to slow the spread by only removing trees failed:
  - Wasted public resources to remove and replace healthy trees.
  - Destroyed public investments in green infrastructure.
  - Shifted the burden to property owners as the beetles attacked private trees.
  - Dr. Dan Herms: Spread the infestation faster

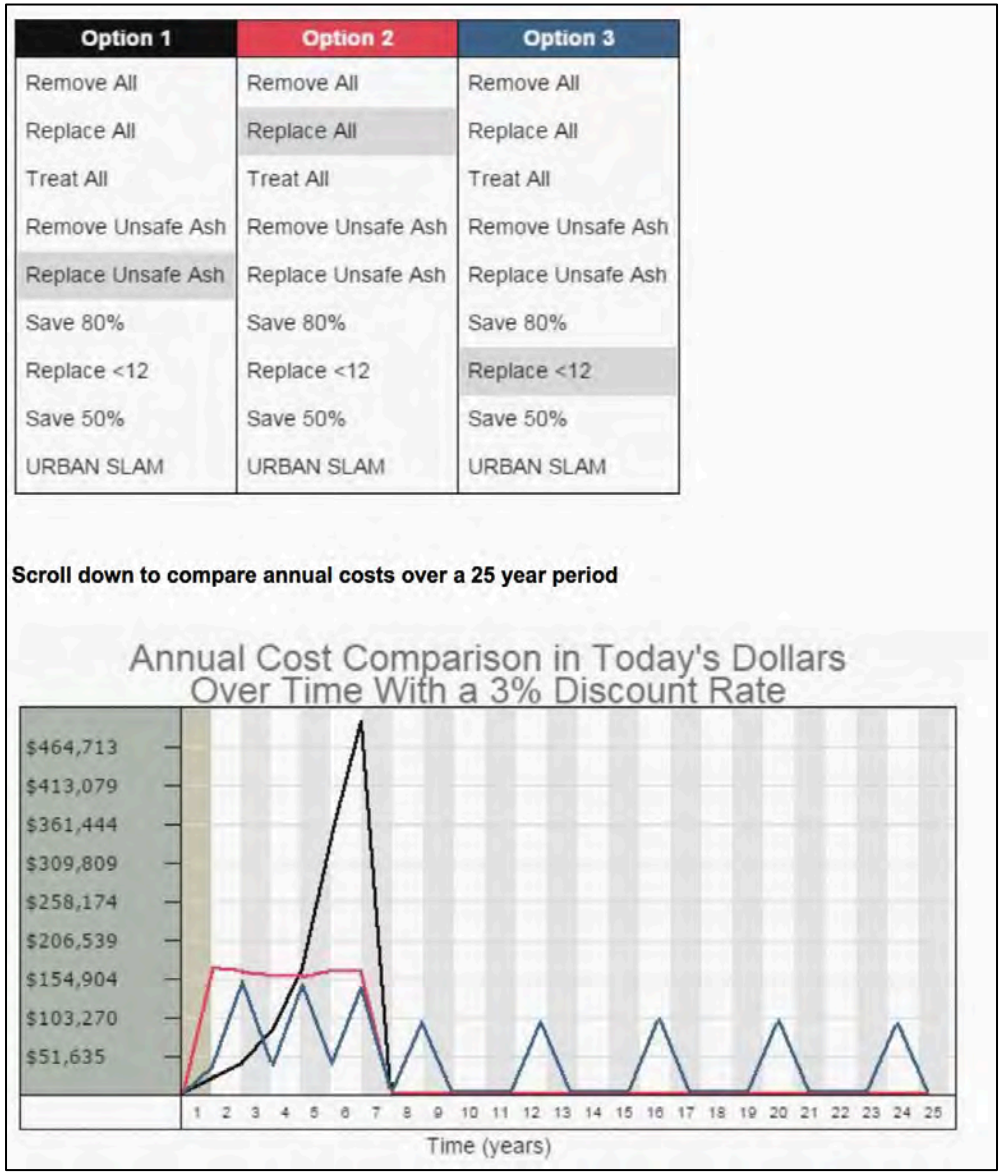
SLAM Study Conclusions

- Reduce the rate at which EAB populations grow and spread (kill the bugs, not the trees).
- "There is no reason for a landscape ash tree to die from emerald ash borer anymore." Dr. Deborah McCullough
  professor of entomology and forestry at Michigan State University
  (Source: "Emerald ash borer treatments costing less, working better," Minneapolis StarTribune, 8/8/13)

Save the best and replace the rest



- Free, on-line calculator.
- Compares costs of 3 treatment scenarios over a 25-year time period.
- Demonstrates saving the best and replacing the rest is most cost-effective strategy.
- Does not compare tree benefits.

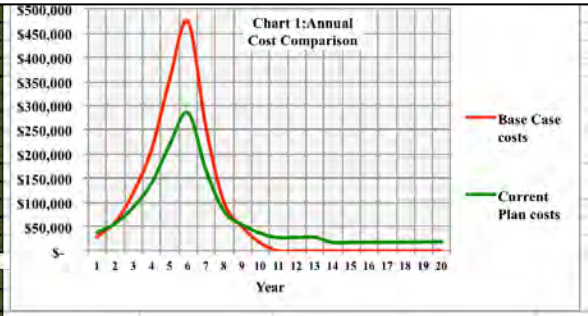


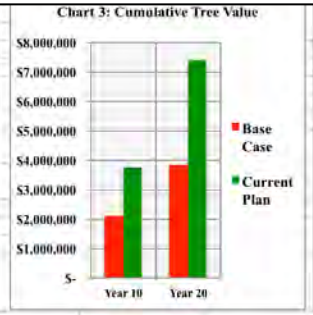
Rainbow TreeCare's EAB Analytical Model

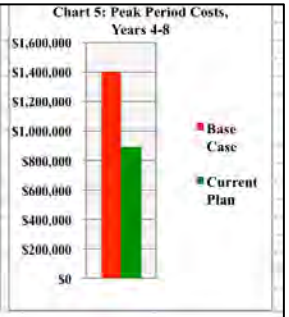
Tree data:	
Number of ash trees	2,400
DBH of high-quality trees	21.0
DBH of low-quality trees	13.0
Average DBH, all ash trees (calculated; do not change)	16.2
New tree DBH	2.5
Cost data:	
Removal cost per DBH	$ 15.58
New tree cost	$ 300.00
Treatment cost per DBH	$ 3.45
Actions:	
Replacement tree percentage	100%
Percentage of trees to be treated	40%
Treatment frequency during aggressive treatment period	33%

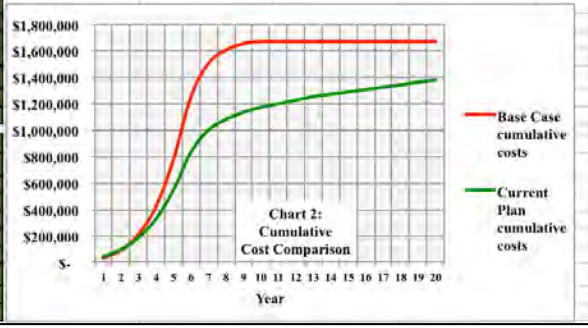
Years 1-10	Base Case	Current Plan
Costs:		
Removal costs	$ 791,803	$ 393,712
New tree costs	$ 878,400	$ 527,040
Treatment costs		$ 250,015
Total costs	$ 1,670,203	$ 1,170,767
Cost savings (over Base Case)		-30%
Cumulative tree value:		
Cumulative tree value	$ 2,091,885	$ 3,759,752
Additional tree value (over Base Case)		80%

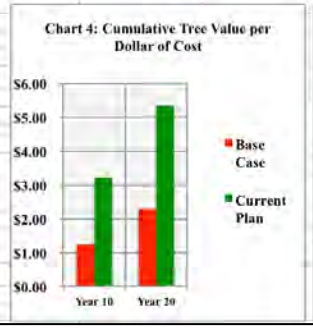
Years 1-20	Base Case	Current Plan
Costs:		
Removal costs	$ 791,803	$ 393,712
New tree costs	$ 878,400	$ 527,040
Treatment costs		$ 459,166
Total costs	$ 1,670,203	$ 1,379,917
Cost savings over Base Case		-17%
Cumulative tree value:		
Cumulative tree value	$ 3,825,696	$ 7,357,833
Additional tree value (over Base Case)		92%

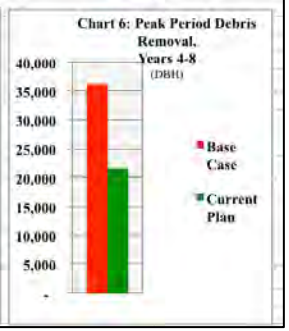










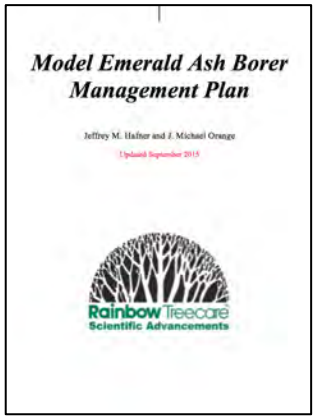


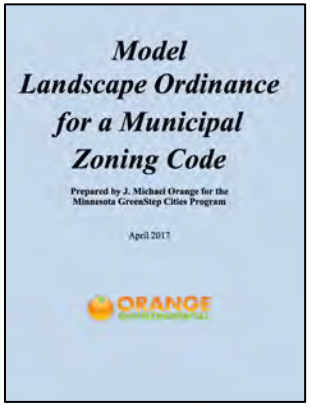
Findings:

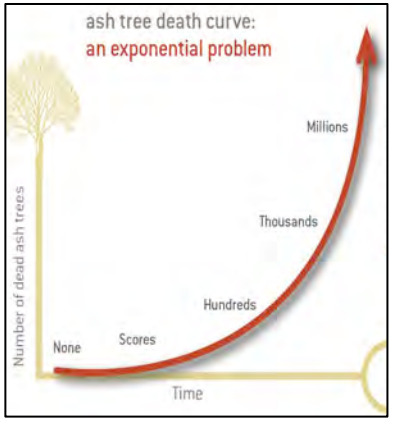
- **Base Case (original strategy):** Remove and replace all trees as they succumb to EAB.
- **Current Plan (SLAM strategy):** Treat all high-quality trees (40%) and remove and replace all other trees as they succumb to EAB.
- **Charts 1 & 2:** Compared to the Base Case, the Current Plan reduces costs by 17% by Year 20.
- **Chart 4**: Compared to the Base Case, every dollar invested in the Current Plan preserves more than twice as much cumulative tree value by Year 20.
- **Charts 5 & 6:** Compared to the Base Case, the Current Plan reduces peak-period costs and debris removal by about 40%.
- **Increased treatments:** The advantages increase as the treatment percentage increases.

Model Emerald Ash Borer Management Plan

- Goal 1: Accurate Tree Assessment and Record Keeping, and Updating the City Code
- Goal 2: Early Infestation Detection and Suppression
- Goal 3: Postpone and Decrease Peak Ash Mortality (herd immunity)
- Goal 4: Preserve the Most Valuable Ash Trees:
  - Aggressive treatment protocol (Years 1-12)
  - Maintenance treatment protocol (Years 13+)
- Goal 5: Expand Tree Canopy and Improve Tree Diversity
- Goal 6: Minimize Public Costs
- Goal 7: Enlist Private Tree Owners







Conclusion

Save the best and replace the rest