Arboriculture & Urban Forestry 2007. 33(1):48–54.

The Potential Economic Impacts of Emerald Ash Borer (*Agrilus planipennis*) on Ohio, U.S., Communities

T. Davis Sydnor, Matthew Bumgardner, and Andrew Todd

Abstract. A survey of 200 communities with individuals such as urban foresters who have assigned responsibilities for their urban tree resource was conducted to provide baseline data on ash density within Ohio communities. Sixty-seven communities responded, including the five largest cities in Ohio. Data represent 25% of the population of Ohio and 33% of communities surveyed. Losses in landscape value for ash trees within community boundaries were estimated to be between $0.8 (median-based) and $3.4 billion (mean-based) assuming the complete loss of ash resulting from the emerald ash borer (EAB), a recently introduced exotic pest of native ash species in the United States. Tree removal costs would be somewhat smaller and range between $0.7 and $2.9 billion based on reported medians and means, respectively. Tree replacement costs in Ohio communities, including streets, parks, and private properties, would range between $0.3 and $1.3 billion. In aggregate, the total losses for Ohio communities, including ash landscape losses, tree removal and replacements, are estimated to range between $1.8 and $7.6 billion for a single insect pest in a single state. The potential total costs in Ohio are estimated to be between $157,000 and $665,000 per 1000 residents. Communities can use these figures to begin developing contingency plans.

Key Words. *Agrilus planipennis;* economic impact; Emerald Ash Borer; *Fraxinus;* green ash; white ash.

Emerald ash borer (EAB) is a recently introduced exotic pest of native ash trees in the United States. The native range of this pest is in Eastern Asia (Akiyama and Ohmomo 2000). The insect was first described in the Detroit, Michigan, U.S., area in 2002 (USDA-APHIS 2003). Currently, this pest is found in Michigan, northwestern Ohio, and northeastern Indiana (Herms et al. 2004). This pest is in the order Buprestidae. Insects in this order are known as buprestids or metallic wood-boring beetles.

The bronze birch borer (*Agrilis anxius*) (a native buprestid) has been much more damaging to exotic birch than to native birch in Ohio's Shade Tree Evaluation Project (Herms 2002). Thus, the EAB (an exotic buprestid) is thought to have the potential to destroy all native ashes because they lack an evolutionary history with EAB leading us to calculate estimates for the potential complete loss of ash in Ohio. Indeed, all of the native ashes (*Fraxinus americana, F. nigra, F pennsylvanica, and F quadrangulata*) evaluated to date have been shown to be sensitive (Herms et al. 2005). Both urban and natural plantings of ashes appear to be sensitive to EAB and have been killed in southeastern Michigan where this pest was first discovered (USDA-APHIS 2003).

In recent years, white and green ashes have been widely planted in Ohio communities (D'Amato et al. 2002). Surveys were taken in 1995 and 2000 and the later survey predicted that 8.4% of all trees, including small ornamental trees expected to be planted in 2005, were to be ashes. Urban foresters also predicted an increasing demand for ashes between 2000 and 2005. Informal discussions with some of Ohio's nurseries suggested that as many as 70% of the canopy (large shade) trees planted and/or sold by Ohio's nurseries during the 2000 to 2003 periods were ashes. Of course, the percentage of ashes planted has changed because this survey was taken more than 2 years before EAB was identified in the Detroit area. Ash sales in Ohio have declined dramatically since 2003 (W. Stalter, pers. comm.).

Should EAB destroy native ashes in Ohio as it has done in southeastern Michigan (Landers 2005), it will be critical for communities to develop plans to deal with EAB. Any plan must have some notion of the scope of the problem so that contingency plans can be formulated and presented for implementation. The USDA Forest Service has maintained data on the composition of lands and forests in rural areas but has not collected data on urban areas (USDA-FS 2002). Thus, although the density of the ash component of rural areas is known, information was needed to identify the scope of potential problems as measured by the density of ash in urban areas of Ohio. This study was conducted to quantify the potential economic impact to Ohio if EAB were to destroy all native street, park, and private ash trees in Ohio communities.

The total impact of the losses will include the loss in landscape value, the costs of tree removal, including stumps where appropriate, and the cost of replacement trees (Council of Trees and Landscape Appraisers 2000). Loss in landscape value includes a variety of fiscal and environmental factors that are difficult to quantify such as increased heating and cooling costs, reduced property values, increased stormwater runoff, and reduced wildlife habitat as well as reduced aesthetic quality. Note that we are not considering the tree's timber value. Ash can be dangerous as a declining or dead tree and should be removed promptly to avoid tree or branch failures that can cause property damage or personal injury. Tree and stump removal are needed to prepare the site for a replacement tree. Sydnor et al. (2002) give guidelines for calculating replacement tree costs in Ohio.

MATERIALS AND METHODS

Ohio has 235 designated Tree City USA communities (Anonymous 2005), which work with Ohio's regional urban foresters throughout the year. The state's regional urban foresters contacted some 200 of Ohio's Tree Cities by mail or e-mail (whichever was available) to request their assistance in filling out the Ash Survey form, a simple one-page instrument with the questions listed in Table 1. The first request was made in October 2005 and a follow up with nonrespondents was made in November 2005. Some contact information was gathered but respondents were told that their response would be confidential. As promised, no individual responses are reported.

Data were entered into a Microsoft Excel 2003 worksheet for analysis. To compare the response of a small community with the response of a larger community, it was decided to normalize the ash tree data by population. Street, park, and private tree numbers as reported by the communities were multiplied by the percentage of ash reported to get the number of street, park, and private ash trees, which was then divided by the community's population in thousands to give the number of street, park, and private trees per 1000 residents. Communities were instructed to report only information they were comfortable in reporting, i.e., for which they at least had estimates. Reported data were entered to calculate all possible fields. Data are presented as means and medians with the number of category responses given.

Table 1. Questions appearing on the survey instrument used in the study.

No.	Question
1	Population of your community.
2	Estimated average household income of residents.
3	Estimated number of properties in your community.
4	Average age of commercial structures.
5	Average age of residential structures.
6	Estimated number of street trees.
7	Percentage of street trees that are ash.
8	Estimated average size of ash street trees.
9	Estimated number of park trees.
10	Percentage of park trees that are ash.
11	Estimated number of trees on private property in community.
12	Percentage of private trees that are ash.

Estimated average size of ash street trees was reported by the communities as diameter at breast height (dbh) defined as 1.4 m (4.5 ft) above the ground. It was noted that some older communities had larger numbers of larger street trees and some younger communities had larger numbers of smaller trees. To account for this, a normalized dbh for street trees was computed. For each community, the reported average dbh for ash street trees was multiplied by the number of ash trees in that community, which was, in turn, divided by the total number of ash street trees reported by all communities. The total of all the communities gives the normalized average dbh.

An initial evaluation identified some possible outliers in one or more fields. Representatives for the communities in question were contacted by telephone to enable us to further explore their responses. Various errors such as data entry errors were identified and corrected with the contact's agreement. In other situations, the investigators got a feel for the complexion of that community's urban forest and why the community gave the responses they did and the response remained as submitted. Still, outliers did create some skew in the data that resulted in differences between mean and median values and are discussed later.

It was anticipated that a community's size and age might have an effect on the occurrence of ash trees. To test this proposition, the responding communities were split into two groups based on reported population. A population of 10,000 residents was used to separate the communities into *smaller* and *larger* categories. This number was chosen on inspection of the distribution of responding communities, which showed a natural break at this point. This figure also resulted in relatively even sizes between the two groups. Similarly, the communities were split into two age categories (*younger* and *older*) based on the reported average age of residential structures. Again, on inspection of the distribution of responding communities, an average age of 60 years was used to divide the respondents. Comparisons were then made between the two groups using the nonparametric Wilcoxon rank sum test for the variables: ash street trees, park street trees, and private street trees (all per 1000 residents). A nonparametric test was chosen as a result of the relatively small sample sizes and skewness (positive) in the data.

Tree removal costs were determined by contacting commercial arborists representing the five most populous metropolitan areas in Ohio. A total of seven arborists responded by giving prices for tree and stump removal in five tree size

categories. Size categories were determined as natural breaks by the arborist contacted. Total costs include removing both the tree and the stump. Arborists were told to assume that the tree was readily accessible and not encumbered by proximity to buildings or utilities. Actual prices for a given site might be two to three times higher as a result of encumbrances. Median prices are reported because this represents an actual bid and follows the precedent set by the national tree valuation guidelines (Council of Tree and Landscape Appraisers 2000).

Calculations of the landscape values of the trees were made using the trunk formula method procedures set forth in *Guide for Plant Appraisal* (Council of Tree and Landscape Appraisers 2000). Location and condition values were determined as suggested by the national guide in that the first author visited a number of communities to develop an average value for location (60%) and condition (70%). Park trees were, in general, farther from structures or human activity and more likely to be in groups thus location values for park trees were estimated at 50%. The national guide remands basic prices, species values, and the size of the largest transplantable tree to the states or regions. The state guide used was *Guide to Appraisal of Trees and Other Plants in Ohio* (Sydnor et al. 2002). Simplistically speaking, the landscape value of a tree is its basic value as determined by the state guide multiplied by the species, condition, and location percentages expressed as decimal fractions.

RESULTS AND DISCUSSION

Sample Description

A total of 67 communities of the 200 contacted responded to the request for information for a response rate of 33%. Communities responding represented 2,815,945 citizens or 25% of Ohio's 2000 census population of 11,353,140 individuals (United States Census Bureau 2005). The average household income of responding communities was $43,909 and the median of responding communities was $38,000. These values are consistent with Ohio's median income of $40,956 (United States Census Bureau 2005).

Numbers of Ash Trees in Ohio Communities

Fifty-four communities reported the size of ash street trees in their communities. The average size reported by the communities was 34 cm (13.6 in) dbh. To adjust for variations in size as reported by different communities, normalized dbh was calculated as 31 cm (12.4 in) dbh. Normalized dbh will be used for future calculations.

Sixty-three communities reported the number of street trees in their community as well as the percentage of all ash trees such that the number of ash street trees per 1000 residents could be calculated. Considerable variation was seen with an average of 20.5 ash trees per 1000 residents, but a median of only 8.3 trees per 1000 residents (Table 2). This kind of spread between mean and median is believed to represent different kinds of communities and is discussed later. When the mean and median numbers are adjusted to account for Ohio's total population, the number of ash street trees is between 98,885 (median) and 232,739 (mean).

Table 2. Numbers of ash trees as street, park, and private trees per 1000 residents are given as reported by the responding communities[z].

Item	Street ash	Park ash	Private ash
Median/1000 residents	8.71	2.89	76.92
Mean/1000 residents	20.50	38.28	320.92
Number of responses	63	58	47
Ohio tree totals[y] (median-based)	98,885	32,811	873,284
Ohio tree totals[x] (mean-based)	232,739	438,598	3,643,450

[z]Total numbers of ash street, park, and private trees in Ohio adjusted for Ohio's total population are given.
[x]Mean-based totals = mean trees per 1000 residents/(Ohio population/1000 residents).
[y]Median-based totals = median trees per 1000 residents/(Ohio population/1000 residents).

Fewer communities ($n = 58$) reported the number and percentage of ash trees in their parks. Tree boards representing Tree Cities are often charged with responsibility for street trees but not park trees and have even less responsibility for private trees. The communities reporting identified an average of 38.3 ash trees per 1000 residents and a median of 2.9 ash trees per 1000 residents (Table 2). The amount of park land varies greatly among Ohio's communities as does the relative amounts of active and passive parks. Adjusting the mean and median to account for Ohio's total population, the number of ash park trees is between 32,811 (median) and 438,598 (mean).

Still fewer ($n = 47$) communities gave a complete response as to the number of trees on private property and an estimate of the percent of ash on private property but within community boundaries. Several communities informed us that they were less comfortable in reporting on private trees as they did not keep records on private trees. As a result, a number of communities did not report all of the requested data for park or private trees. Estimates from the 47 communities reporting had an average of 320.9 private ash trees per 1000 residents and a median of 76.9 ash trees per 1000 residents. Several calls were made regarding this category. We found that reporting communities we contacted were comfortable with their estimates and could normally explain their original estimates and why their estimates might vary from statewide averages. As expected, even more private trees were reported compared with street and park trees. When the mean and median numbers for private ash trees per 1000 are adjusted upward to account for Ohio's total population, the

total numbers of private ash trees within Ohio community boundaries is between 873,284 (median) and 3,643,450 (mean) trees.

Variation in responses and differences between means and medians are explained in part by differences in types of communities (Table 3). Reporting differences at the 10% level identifies smaller communities as having less ash street trees per 1000 residents than larger ones. This can be explained by the fact that many larger communities (≥10,000 residents) have active tree planting programs and ashes have been readily available and popular in recent years. Younger communities had more ash street trees than did older communities per 1000 residents. Younger communities have been planting street trees more recently and ash has been readily available from nurseries in recent years. There were no discernable differences among younger and older or smaller and larger communities for ash park trees. Differences also surfaced when comparing private ash trees in younger versus older communities. Younger communities had significantly more ash trees on private property than did older communities. This might be explained by the fact that many newer communities have expanded into second-growth forests and native ashes have been common pioneer species in old fields and riparian zones in Ohio.

To get an estimate of the total impact brought on by the potential complete loss of native ashes, one should add the number of ash street trees plus the number of ash park trees plus the number of ash trees on private property per 1000 residents. This yields an average of 379.7 ash trees per 1000 residents population and a median of 88.5 ash trees in Ohio communities. When adjusted for Ohio's population, this yields total numbers of ash trees in Ohio communities between 1,004,979 (median-adjusted) to 4,310,787 (mean-adjusted). When using these figures, younger and larger communities may get better estimates using the averages, whereas smaller and older communities may get better estimates using median numbers.

Table 3. Medians and results of Wilcoxon rank sum tests for street, park, and private ash trees per 1000 residents based on grouping by community population and age of residential structures.

Ash measure	Community grouping	n	Median	z approx.	*P*
Street ash/1000 residents	Smaller[z]	34	3.92	2.50	0.01
	Larger	31	15.17		
	Younger[y]	30	9.70	1.71	0.09
	Older	31	7.69		
Park ash/1000 residents	Smaller	31	1.83	1.08	0.28
	Larger	29	5.35		
	Younger	27	5.21	0.57	0.57
	Older	28	1.83		
Private ash/1000 residents	Smaller	22	85.52	0.20	0.84
	Larger	27	69.77		
	Younger	22	101.48	2.36	0.02
	Older	23	32.79		

[z]Smaller communities were defined as having a population of less than 10,000 residents.

[y]Younger communities were defined as having an average age of residential structures of less than 60 years.

Table 4. Median prices in dollars for tree, stump, and total removal costs for five tree size categories[z].

Tree size	Tree removal	Stump removal	Total costs
0 to 30 cm (0 to 12 in) dbh	300	75	375
30 to 61 cm (12 to 24.4 in) dbh	600	75	675
61 to 76 cm (24.4 to 30.4 in) dbh	1200	90	1290
76 to 91 cm (30.4 to 36.4 in) dbh	1500	125	1625
91 cm (38.4 in) dbh and larger	2000	150	2150

[z]Data represents seven bids from the five most populous metropolitan areas in Ohio.

Potential Fiscal Impacts of the Complete Loss of Ash in Ohio Communities

Fiscal impacts on Ohio communities are expected to take three forms. They are the landscape value of the existing tree that might be lost, the cost to remove the dead or declining tree, and replacement costs for a tree to replace the dead or damaged plant. The following analysis assumes the complete loss of all major native ash species in urban areas of Ohio. Economic impacts would be less if only a fraction of the ash component was lost.

Landscape value represents the loss of the existing tree and its contributions to the site and the environment as discussed earlier. The average size reported by communities was 34 cm (13.6 in). The normalized dbh 31 cm (12.4 in) will be used as a more conservative estimate of size. The basic value of a 30 to 31 cm (12 to 12.4 in) tree is $3,201 per tree according to the state guide. Species values are also given by the state guide and average for native ash was calculated as 60%. Recall that location and condition values for street and private native ash trees before EAB were estimated to be 60% and 70%, respectively. Thus, the landscape value is conservatively estimated to be $3,201 * 0.6 * 0.6 * 0.7 or $807 per 30 to 31 cm (12 to 12.4 in) private or street tree. Because park trees were estimated to have a location value of 50%, down from 60%, park trees would have an estimated landscape value of $672 per 30 to 31 cm (12 to 12.4 in) park tree.

Thus, the potential loss in landscape value of street trees ranges from $7,029 (median-based) to $16,543 (mean-based) dollars per 1000 residents (Table 5). Adjusting now to statewide totals and changing scale to millions of dollars, Ohio's loss in landscape value for street trees ranges from $80 (median-adjusted) to $188 (average-adjusted) million (Table 6).

Table 5. Potential losses per 1000 residents in dollars (to the nearest dollar) giving mean and median values for landscape value, tree removal costs, and replacement costs[z].

	Landscape values		Tree removal costs		Replacement costs	
	(median-based)	(mean-based)	(median-based)	(mean-based)	(median-based)	(mean-based)
Street trees	7,029	16,543	5,879	13,838	2,526	5,945
Park trees	1,942	25,724	1,734	22,968	838	11,101
Private trees	62,074	258,982	51,921	216,621	22,307	93,067
Totals	71,045	301,249	60,684	253,427	25,671	110,113

[z]Street, park, and private trees are given separately as are the totals for each. Table 5 is presented primarily to enable communities to estimate potential economic impacts of emerald ash borer.

The landscape value of Ohio's park trees in communities ranges from $22 (median-adjusted) to $292 (average-adjusted) million. The landscape value of private trees in Ohio communities ranges from $705 (median-adjusted) to $2940 million (average-adjusted). In aggregate, the landscape losses range from $0.8 to $3.4 billion and represent a potentially staggering impact on the state.

Tree removals are a real cost that likely will significantly impact Ohio communities. Unlike lost landscape values, which do not show immediately on the bank statement, tree removal costs reduce a community's fiscal options. Table 4 details the costs of tree removal and stump removal for five ranges of plant size. Because the normalized tree dbh was 331 cm (132.4 in) and the average dbh was 34 cm (13.6 in), we use the tree removal costs for a 30 cm to 61 cm (12 to 24.4 in) tree. For street and private trees, both tree removal and stump removal costs ($675) are included because these plants are normally replaced on removal. Park trees, on average, may not require stump removal; thus, only tree removal costs ($600) are considered when calculating costs. Statewide costs for ash street tree removal range from $67 (median-adjusted) to $157 (mean-adjusted) million. Removal costs for park trees range from $20 (median-adjusted) to $261 million (mean-adjusted). Removal costs for private trees in Ohio communities range from $589 (median-adjusted) to $2,459 (mean-adjusted) million. Potential statewide removal costs, including street, park, and private trees, range from $676 (median-adjusted) to $2877 (mean-adjusted) million. Tree removal costs are similar to landscape values and range from $0.7 to $2.9 billion and will need to be covered in public and private budgets, because ash declines rapidly when dead and rapidly becomes unstable.

Tree replacement costs are in some ways optional but most park trees, street trees, and private trees, with the exception of wooded areas, will be replaced. The state guide in Ohio suggests tree replacement costs. Common replacement sizes in Ohio range from 2 cm to 8 cm (3.2 in) dbh. Thus, we use a 6 cm (2.4 in) tree as a replacement for this article. A 6 cm (2.4 in) tree retails for $290 per tree in Ohio, including planting and a guarantee, when there are no confounding issues such as access (Sydnor et al. 2002). Costs for ash street tree replacements range from $29 (median-adjusted) to $67 (mean-adjusted) million (Table 6). Replacement costs for park trees will range from $10 (median-adjusted) to $126 (mean-adjusted) million. Replacement costs for private trees in Ohio communities range from $253 (median-adjusted) to $1,057 (mean-adjusted) million. Total replacement costs, including street, park, and private trees, range from $292 (median-adjusted) to $1,250 (mean-adjusted) million. Tree replacement costs are smaller than landscape values and tree removal costs, but still range from $0.3 to $1.3 billion and will need to be covered in public and private budgets.

A final appreciation for the impact of EAB can be obtained by looking at grand totals. Total costs for a median based cost, including landscape, removal, and replacement costs, are $1775 million. Using means to calculate the grand totals yields a grand total of $7,547 million as a potential loss resulting from EAB. The worst case scenario, i.e., mean-

Table 6. Potential statewide losses in millions of dollars (to the nearest million) giving mean and median values for landscape value, tree removal costs, and replacement costs[z].

	Landscape values		Tree removal costs		Replacement costs	
	(median-based)	(mean-based)	(median-based)	(mean-based)	(median-based)	(mean-based)
Street trees	80	188	67	157	29	67
Park trees	22	292	20	261	10	126
Private trees	705	2,940	589	2,459	253	1,057
Totals	807	3,420	676	2,877	292	1,250

[z]Street, park, and private trees are given separately as are totals.

based estimates of the complete loss of Ohio's urban ash, is a staggering $7.5 billion loss for a single pest in a single state. It is easy to see why Ohio, Michigan, and Indiana have been seeking federal assistance to deal with this pest. Even if the eradication efforts are not successful in eliminating the pest from the continent, slowing the advance of this pest will provide time for communities to deal with this serious financial threat.

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Résumé. Une enquête auprès de 200 communautés avec des individus – tels des forestiers urbains – qui ont des responsabilités assignées pour leur ressource arbre urbaine a été menée afin de fournir des données de base sur la densité en frêne dans leur communauté de l'Ohio. Soixante-sept d'entre elles ont répondu, dont les cinq plus grandes de l'Ohio. Les données représentent 25% de la population de l'Ohio et 33% des communautés sous enquête. Les pertes en valeur paysagère pour les frênes à l'intérieur des limites de ces communautés ont été estimées entre 0,8 (valeur médiane) et 3,4 millions (valeur moyenne) de dollars pour la perte complète du frêne dû à l'agrile du frêne, un insecte exotique ravageur des frênes indigènes et introduit récemment aux États-Unis. Les coûts d'abattage des frênes devraient être quelque peu plus faibles avec des montants entre 0,7 et 2,9 millions de dollars (valeurs médiane et moyenne respectivement). Les coûts de remplacement des arbres dans les communautés de l'Ohio – incluant à la fois les arbres de rues, de parcs et sur les propriétés privées – pourraient s'élever entre 0,3 et 1,3 millions de dollars. En combinant les pertes totales pour les communautés de l'Ohio, incluant les pertes de frêne dans les aménagements paysager, l'abattage et le remplacement des arbres sont estimés entre 1,8 et 7,6 millions de dollars pour ce seul insecte ravageur dans ce seul état. Les coûts potentiels totaux en Ohio sont estimés entre 157000 et 655000$ par 1000 habitants. Les communautés peuvent utiliser ces projections pour commencer à développer des plans de contingentement.

Resumen. Un censo de 200 comunidades con dasónomos urbanos, quienes tienen las responsabilidades con su recurso árbol urbano, fue llevado a cabo para proporcionar bases de datos sobre la

densidad del fresno dentro de Ohio. Sesenta y siete comunidades respondieron incluyendo las ciudades más grandes. Los datos representan el 25% de la población de Ohio y 35% de las comunidades encuestadas. Las pérdidas en valor del paisaje para los árboles de fresno dentro de las fronteras de la comunidad fueron estimadas ente $0.8 (basada en la mediana) y $3.4 billones asumiendo las pérdidas completas de fresno debido al barrenador esmeralda (EAB), una plaga exótica recientemente introducida de especies de fresno nativos en los Estados Unidos. Los costos de remoción de los árboles podrían ser más pequeños y encontrarse entre $0.7 y $2.9 billones con base en reportes de medias y medianas respectivamente. Los costos de reemplazo de los árboles en las comunidades de Ohio incluyendo calles, parques y propiedades privadas estarían entre $0.3 y $1.3 billones. Además, las pérdidas totales para Ohio incluyendo pérdidas en paisaje, remoción de árboles y reemplazo son estimadas entre $1.8 y $7.6 billones para una sola plaga de insectos en un solo estado. Los costos potenciales totales están estimados entre $157,000 y $665,000 por 1,000 residentes. Las comunidades pueden usar estas figuras para empezar a desarrollar planes de contingencia.

Zusammenfassung. Unter 200 Kommunen wurde eine individuelle Umfrage durchgeführt, darunter auch Fachleute aus der Branche, die Verantwortung für die Bäume in ihrem Umfeld übernehmen, um eine Datenbasis über die Dichte von Eschen in Gemeinden in Ohio zu erhalten. 67 Gemeinden einschließlich der 5 größten Städte in Ohio antworteten. Die Daten repräsentierten 25 % der Bevölkerung von Ohio und 33 % entsandten Umfragen. Die Verluste an Landschaftswert für Eschen innerhalb der Gemeindegrenzen wurden geschätzt zwischen $ 800 Millionen. (medianbasierend) und $ 3.4 Milliarden. (Durchschnitt) unter der Annahme des totalen Verlustes von Eschen durch den Eschenbohrer, einer kürzlich importierten exotischen Pest an einheimischen Eschenarten in den Vereinigten Staaten. Die Kosten der Baumbeseitigung würden etwas kleiner zwischen $ 700 Millionen und $ 2.9 Milliarden liegen bei gleichen Bemessungsmaßstäben. Die Kosten der Neupflanzung in den Gemeinden in Ohio inklusive Strassen, Parks und Privatgelände lägen zwischen $ 300 Millionen und $ 1.3 Milliarden. In Anbetracht der totalen Verluste in Ohio einschließlich des Landschaftsverlustes, Baumbeseitigung und Neupflanzung wurden die Kosten zwischen $1.8 und $ 7.6 Milliarden für ein Schadinsekt in einem einzigen Staat. Die möglichen Kosten in Ohio liegen schätzungsweise zwischen $ 157.000 und $ 665.000 pro Tausend Einwohner. Gemeinden können diese Zahlen benutzen, um Etats zu bilden.