Arboriculture & Urban Forestry 2011. 37(2): 84–89

Community Ash Densities and Economic Impact Potential of Emerald Ash Borer (*Agrilus planipennis*) in Four Midwestern States

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Abstract. A survey of 586 community representatives with urban tree canopy responsibilities was conducted to provide data on ash density within four states in the Midwestern U.S., and to examine potential economic losses should emerald ash borer (EAB) become established in their communities. One hundred twenty-three responses were received from communities of various sizes. Data represented 10.5% of the population of Illinois, Indiana, Michigan, and Wisconsin, U.S., and 21% of all communities surveyed. Assuming the complete loss of ash due to EAB, losses in landscape value for ash trees within community boundaries were estimated to be between USD $7.7 (median-based) and $15 billion (mean-based). The cost to remove those trees is somewhat smaller and would be between $3 and $5.8 billion. Replacing trees lost to EAB with smaller 5 cm trees in street, park, and private plantings would cost between $2.7 and $5.2 billion. The total loss of ash for communities in the four states surveyed, including landscape losses, tree removals, and replacements are estimated to be between $13.4 and $26 billion. The potential total costs per 1,000 residents in the four-state region is estimated to be between $395,943 and $769,687. The rates per 1,000 residents estimates can be utilized by communities to begin developing contingency plans should EAB impact them.

Key Words. *Agrilus planipennis*; Ash Tree Density; Cost of Ash Tree Removal/Replacement; Economic Impact; Emerald Ash Borer; EAB; *Fraxinus*; Green Ash; Survey; White Ash.

Emerald ash borer (EAB) (*Agrilus planipennis* Fairmaire) is an exotic pest of native ash trees in the United States and was first described in the Detroit, MI, U.S. area in 2002 (USDA-APHIS 2003). By 2004, this pest was found in Michigan, northwestern Ohio, and northeastern Indiana (Herms et al. 2004). The pest spread rapidly and had been found in 10 additional states by 2009, including Kentucky, Illinois, Maryland, Minnesota, Missouri, New York, Pennsylvania, Virginia, West Virginia, and Wisconsin (Anonymous 2009). This insect is in the order Buprestidae, which are known as buprestids or metallic wood boring beetles.

EAB is thought to have the potential to destroy essentially all native ashes, as North American ashes lack an evolutionary history with EAB (Herms et al. 2005). Commonly planted native ashes (*Fraxinus americana* L. and *F. pennsylvanica* Marsh.) (D'Amato et al. 2002) evaluated to date have been shown to be sensitive (Sydnor and Subburayalu 2009). Both urban and natural stands of ashes appear to be sensitive and have been killed in southeastern Michigan (USDA-APHIS 2003).

If the precedent of EAB devastation in southeastern Michigan and northwestern Ohio (Landers 2005) is repeated in other states, many communities will need to develop contingency plans including the scope of the concern. The USDA Forest Service's Forest Inventory and Analysis (FIA) Program has defined the ash component in forestlands for decades. More recently, FIA data have become available for some urban areas as well, but the numbers of communities are small relative to the number of communities in a state and communities evaluated to date have a tendency of being larger communities. Sydnor et al. (2007a) conducted a survey of community representatives with urban forestry responsibilities for 67 communities in Ohio to begin to determine information regarding urban ash densities and EAB economic impacts within the state. Similarly, the present study was conducted using the same methods to quantify the potential economic impact in Illinois, Indiana, Michigan, and Wisconsin communities should EAB destroy all native street, park (active and passive but excluding forested areas), and private ash trees. In another study, FIA data based on tree canopy of ash per hectare were used to develop community ash density estimates and associated costs of EAB damage (Kovacs et al. 2010). Different methods of determining urban ash densities can provide managers with options when seeking to better understand the potential impacts of EAB on their communities.

Once urban ash densities are determined, it is possible to develop estimates of costs associated with loss of ash to EAB. Calculated impacts include the loss in landscape value, the costs of tree removal including stumps where appropriate, and the cost of replacement trees. General national guidelines exist for determining landscape values of trees (Council of Tree and Landscape Appraisers 2000) when used in conjunction with state guidelines (Sydnor et al. 2007b). As used here, 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 storm water runoff, and reduced wildlife habitat, as well as reduced aesthetic quality. Site preparation costs for replacement trees include tree and stump removal costs if replacements are needed. These costs are a function of local economies. Costs associated with the complete loss of the community ash resource in these states were assessed, based on the impact of the bronze birch borer (*Agrilus anxius* Gory) (a native buprestid) on exotic birch as contrasted with native birch in Ohio's Shade Tree Evaluation Project (Herms 2002).

MATERIALS AND METHODS

State urban foresters in Michigan, Indiana, Illinois, and Wisconsin were asked to provide contact information for individuals responsible for managing their respective community's urban forest, including but not limited to Tree City USA communities. The first request was mailed in January 2009 with subsequent mailings conducted as state urban foresters provided lists for their respective states until April 2009.

It was assumed that the individuals identified by the state foresters had a reasonable understanding of their urban tree characteristics, as well as knowledge of community demographic information available from internal records and/or secondary sources, such as the U.S. Census Bureau. In the previous study of Ohio (Sydnor et al. 2007a), this method (based on collection of primary data from communities) resulted in comparable estimates of the number of urban ash trees in the state to that provided by Kovacs et al. (2010), who used FIA data to give ash density per hectare and the 2001 National Land Cover Database to identify and quantify the area of tree canopy in urban areas.

Materials and methods in this paper generally follow those set forth in Sydnor et al. (2007a), including the questions asked on the survey instrument. As discussed there, in order to compare responses of small communities with responses of large communities, ash tree data was normalized 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. These numbers were then divided by the community's population in thousands to give the number of street, park, and private trees per 1,000 residents. Communities were instructed to report information they were comfortable in reporting (i.e., for which they at least had estimates). Generally, respondents felt most comfortable in estimating street trees; as a result, the number of communities reporting data varied by category. Outliers did create some skewing in the data that resulted in differences between mean and median values, which will be discussed later.

Given that the prices used in Sydnor et al. (2007a) were based on Ohio data, tree removal and stump removal costs were determined using a survey of Tree Care Industry Association (TCIA) members in the four study states in the winter of 2009/2010. TCIA represents private tree care contractors and arborists. Members were asked for tree removal and stump removal costs for five size categories. Respondents were told to assume 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 due to encumbrances.

TCIA members also were asked to report the species adjusted basic price for 35 cm ash trees using the trunk formula method procedures set forth in *Guide for Plant Appraisal* (CTLA 2000) or the national guide. Location and condition values were determined as suggested by the national guide in that the first author had previously 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%. Finally, TCIA members were asked to report the replacement costs for a 5 cm tree for their community. Note that sample sizes for individual states were sometimes small, especially for basic prices.

RESULTS AND DISCUSSION

Sample description

A total 123 communities of the 586 contacted across the four states responded, for an overall response rate of 21% (Table 1) after two e-mail surveys and one mail survey. Such a response rate is common to survey research, especially to surveys without extensive follow-up (Malhotra 1996). Responding communities represented 3,549,246 citizens or 10.5% of the four-state census population of 33,802,345 individuals, as of the year 2000. By comparison, cities used by Kovacs et al. (2010) in the four states included seven cities: Chicago, IL; Indianapolis, IN; Livonia, MI; Milwaukee, WI; Palatine, IL; Troy, MI; and Urbana, IL. The smallest community was Urbana IL, with a population of nearly 39,000, while the break between large and small communities in the current study was 10,000. The average household income of responding communities was $57,383, and the median of responding communities was $50,000. These values are consistent with the 2007 national median income of $50,740 (U.S. Census Bureau 2000).

Table 1. State and total response rates plus population estimates based on 2000 Census data.

State	Number of responses	Response rate (%)	Proportion of population (%)	Population (2000 Census)
IL	40	20.9	9.4	12,419,660
IN	6	22.2	6.9	6,080,485
MI	25	21.2	6.3	9,938,492
WI	50	20.0	23.4	5,363,708
Overall	123[z]	21.0	10.5	33,802,345

[z] State was unknown for two responses.

Number of Ash Trees in Midwest Communities

Data were aggregated from respondents across the four states for analysis. This was justified in several ways. First, the four states included in the study (Indiana, Michigan, Illinois, Wisconsin) are contiguous and well within the natural range of white ash (*Fraxinus americana*) and green ash (*Fraxinus pennsylvanica*), respectively (Burns and Honkala 1990). Second, the ashes (*Fraxinus* spp.) make up a similar but minor component of each states respective growing stock volume, ranging from 4.9% in Michigan to 7.5% in Indiana in 2007 (USDA Forest Service). Lastly, there was not a statistical difference among the states for total ash per 1,000 residents, summing street, park, and private ash trees ($p = 0.11$) based on a Kruskal-Walis test.

A separate analysis determining the total number of street, park, and private ash trees by using individual state population and ash densities, and then summing across states to reach a grand total, generally resulted in comparable estimates to the aggregated results shown in Table 2 (within 5% and 3%, respectively, for mean- and median-based estimates of street trees; within 24% and 11%, respectively, for estimates of park trees; and within 11% and 14%, respectively, for estimates of private trees).

To facilitate response, only the diameter of street trees was requested on the survey instrument. The average size of ash street trees reported by the communities was 33 cm DBH. To adjust for variations in size as reported by different communities (Sydnor et al. 2007a), normalized dbh was calculated as 34 cm DBH and was used in subsequent cost calculations.

One hundred and eleven communities reported the number of street trees in their community, as well as the percentage of ash trees, such that the number of ash street trees per 1,000 residents could be calculated (Table 2). Minor skewness was seen with a mean of 60 ash trees per 1,000 residents and a median of 51.4 trees per 1,000 residents. When the mean and median numbers are adjusted to account for total population, estimates of the number of ash street trees in the four states were between 1,737,441 (median-based) and 2,028,141 (mean-based) trees.

Fewer communities ($n = 97$) reported the number and percentage of ash trees in their parks. Citizen advisory boards representing communities are often charged with responsibility for street trees but not park trees and have even less responsibility for private trees. The reporting communities identified a mean of 29.9 ash trees per 1,000 residents and a median of 8.4 ash trees per 1,000 residents (Table 2). The amount of park land varies greatly among Midwest communities as does amounts of active and passive parks, thus there was some skew evident in the distribution. Adjusting the mean and median to account for the four state total population, estimates of the number of ash park trees were between 283,940 (median-based) and 1,010,690 (mean-based).

Still fewer ($n = 70$) communities gave a complete response as to the number of trees on private property, thus impacting the estimate of the percent of ash on private property but within community boundaries. Several communities informed the study authors they were less comfortable in reporting 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 private trees. The reporting communities had a mean of 331.7 private ash trees per 1,000 residents and a median of 156.1 private ash trees per 1,000 residents. Several follow-up calls were made regarding this category. It was discovered that the reporting communities contacted were comfortable with their estimates and generally could explain their estimates and why their figures might have varied from more typical responses. When the mean and median numbers for private ash trees per 1,000 are adjusted upward for the four-state population, estimates of the numbers of private ash trees within the community boundaries were between 5,276,546 (median-based) and 11,212,238 (mean-based) trees.

Table 2. Numbers of ash trees as street, park, and private trees per 1,000 residents as reported by the responding communities. Estimated total numbers of ash street, park, and private trees in four Midwest states adjusted for total population.

Item	Street Tree Ash	Park Ash	Private Ash
Median ash/1,000 residents	51.4	8.4	156.1
Mean/ 1,000 residents	60.0	29.9	331.7
Standard deviation	52.4	63.9	469.2
90% Confidence interval	51.7, 68.2	19.2, 40.7	238.2, 425.2
Number of Responses	111	97	70
Four-state Tree Totals [z] (Median-based)	1,737,441	283,940	5,276,546
Four-state Tree Totals [y] (Mean-based)	2,028,141	1,010,690	11,212,238

[z] Median-based totals = median trees per 1,000 residents * (four-state population /1,000 residents)

[y] Mean-based totals = mean trees per 1,000 residents * (four-state population/1,000 residents)

In order to get an estimate of the total impact of the potential complete loss of native ashes, one should add the number of ash street trees, plus the number of ash park trees, and finally the number of ash trees on private property per 1,000 residents. The total of street, park, and private trees yields a mean of 421.6 ash trees per 1,000 residents and a median of 215.8 ash trees per 1,000 residents in the four-state region. This is a narrower spread than reported for Ohio (Sydnor et al. 2007a), where the mean-based estimate was 379.7 per 1,000 residents and the median-based estimate was 88.5. While the mean-based estimates were quite similar, the median-based estimate was higher in the present study, due mostly to higher figures for street and private ash. When adjusted for the region's population this yields the total estimated number of ash trees within community boundaries in the four Midwestern states between 7.3 million (median-based) to 14.3 million (mean-based) trees. This is comparable to the estimate of 9.2 million ash trees in developed areas within communities in the four Midwestern states reported by Kovacs et al. (2010). However, current estimates are less than that reported by Kovacs et al. (2010) for ash on all developed land (inside and outside community boundaries) of 25.7 million ash trees in the four-state region. As discussed later, the former (and similar) comparison is likely the most direct.

Similar to the past study (Sydnor et al. 2007a), it was found that younger communities (average age of residential structures less than 60 years) were likely to have significantly more private ash trees per 1,000 residents than older communities (medians of 217.1 and 88.2, respectively; Wilcoxon rank sum test $p = 0.05$), and that larger communities (10,000 residents or more) tended to have more street ash per 1,000 residents than did smaller communities (medians of 52.7 and 33.3, respectively; $p = 0.07$). Thus, although the above figures for median- and mean-based total numbers of ash are not as widely dispersed as in previous studies (Sydnor et al. 2007a), younger and larger communities still might realize better estimates using the higher mean-based value, while older and smaller communities might realize better estimates using the lower median-based value, although these are generalizations and conditions will vary by community. For example, the tendency for younger communities to have more private ash might be related to expansion of neighborhoods in city suburbs into second-growth forests or converted farmland where native ashes are common pioneer species.

Potential Fiscal Impacts of the Complete Loss of Ash

As described in Sydnor et al. (2007a), fiscal impacts of EAB on communities were expected to take three forms: 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 assumed the complete loss of all major native ash species in urban areas. Economic impacts would be proportionately less if only a fraction of the ash component were lost. All costs for the fiscal analyses were based on results of the cost survey previously discussed (Table 3; Table 4). Given that there were no statistical differences detected among the states for any of the cost types ($p = 0.16$ for tree and stump costs, based on a Kruskal-Wallis test; $p = 0.94$ for landscape cost or basic prices; $p = 0.40$ for replacement costs), the overall median was used for each cost analysis. Median prices were used because outliers are removed and thus are preferred in many circumstances (CTLA 2000), such as forensic situations.

Table 3. Median prices in dollars for tree and stump removal costs by state, and a four-state median for five sizes of tree.

State	Median Tree & Stump Removal Costs				
	0–30 cm	30–61 cm	61–76 cm	76–91 cm	> 91 cm
Illinois (n = 8)	$270	$515	$848	$1,230	$1,859
Indiana (n = 8)	$156	$338	$613	$893	$1,305
Michigan (n = 9)	$215	$440	$650	$950	$1,500
Wisconsin (n = 7)	$144	$348	$565	$855	$1,500
Four-state median (n = 32)	$184	$413	$670	$1,048	$1,563

Table 4. Median base prices and replacement costs for four states and the four-state median.

State	Basic Price	Replacement Cost
Illinois (n = 2,6)	$3,136	$393
Indiana (n = 1,4)	$2,200	$425
Michigan (n = 5,8)	$4,276	$345
Wisconsin (n = 4,7)	$2,173	$300
Four-state median (n = 12,25)	$2,539	$365

Landscape value represents the loss of the existing tree and its contributions to the site and the environment, including but not limited to shading, stormwater mitigation, pollution abatement, and impacts on property values. The basic value of a 33 cm ash tree was $2,539 per tree according to the survey. Recall that location and condition values for street and private native ash trees were estimated to be 60% and 70%, respectively, using the national guide. As such, the landscape value is conservatively estimated to be $2,539 * 0.6 * 0.7 or $1,066 per private or street tree. Since park trees were estimated to have a location value of 50%, park trees would have an estimated landscape value of $889 per park tree.

Thus, estimates of the potential loss in landscape value of street trees would be between $54,792 (median-based) and $63,960 (mean-based) per 1,000 residents (Table 5). Scaling up to region-wide totals and changing scale to millions of dollars, estimates of the region's loss in landscape value for street trees would be between $1,852 (median-based) and $2,162 (mean-based) million (Table 6).

Estimates of the landscape value for the four-state region's park trees in communities would be between $252 (median-based) and $899 (mean-based) million. Estimates of the landscape value of private trees in the region's communities would be between $5,625 (median based) and $11,952 million (mean-based). In aggregate, the landscape losses range from $7.7 to $15 billion.

Tree removals are another cost that will significantly impact communities. For example, Toledo, OH, had incurred costs exceeding $2 million and had removed about half of the affected ash prior to 2008 (Schaar 2008). Unlike lost landscape values, which do not show immediately on the bank statement, tree removal costs reduce a community's fiscal options. Since the normalized tree DBH was 34 cm and the average DBH was 33 cm, the tree removal costs for a 30–61 cm tree were used. For street and private trees, both tree removal and stump removal costs (Table 3: $413 total) will be included because these plants are normally replaced upon removal. Park trees, on average, may not require stump removal, thus only tree removal costs ($331, data not shown in Table 3) will be considered when calculating costs.

Estimates of the aggregated four-state costs for ash street tree removal would be between $718 (median-based) and $838 (mean-based) million (Table 6); for park trees, between $94 (median-based) and $335 million (mean-based); for private trees in Illinois, Indiana, Michigan, and Wisconsin communities, between $2,179 (median-based) and $4,631 (mean-based) million. Potential region-wide removal costs, including street, park, and private trees, range from $2,991 (median-based) to $5,804 (mean-based) million. Again, tree removal costs will appear directly on both public and private budgets.

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. Common replacement sizes range from 2.5 to 8 cm DBH. Thus, a 5.1 cm tree was used as a replacement size for this paper. A 5.1 cm tree retailed for $365 per the cost survey including planting and a guarantee. Estimates of aggregated four-state costs for ash street tree replacements would be between $634 (median-based) and $740 (mean-based) million (Table 6); for park trees, between $104 (median-based) and $369 (mean-based) million; for private trees, between $1,926 (median-based) and $4,092 (mean-based) million. Total re-

Table 5[z]. Potential losses per 1,000 residents in dollars (to the nearest dollar) giving mean and median values for landscape value, tree removal costs, and replacement costs. Street, park, and public trees are given separately as are the totals for each.

	Landscape Values		Tree Removal Costs		Replacement Costs	
	(median-based)	(mean-based)	(median-based)	(mean-based)	(median-based)	(mean-based)
Street Trees	$54,792	$63,960	$21,228	$24,780	$18,761	$21,900
Park Trees	$7,468	$26,581	$2,780	$9,897	$3,066	$10,914
Private Trees	$166,403	$353,592	$64,469	$136,992	$56,976	$121,071
Total	*$228,663*	*$444,133*	*$88,477*	*$171,669*	*$78,803*	*$153,885*

[z] Table 3 and Table 4 are presented primarily to enable communities to modify estimates of potential economic impacts of EAB for their community.

Table 6. Potential region-wide losses in millions of dollars (to the nearest million) giving mean and median values for landscape value, tree removal costs, and replacement costs. Street, park, and private trees are provided separately as are totals.

	Landscape Values		Tree Removal Costs		Replacement Costs	
	(median-based)	(mean-based)	(median-based)	(mean-based)	(median-based)	(mean-based)
Street Trees	$1,852	$2,162	$718	$838	$634	$740
Park Trees	$252	$899	$94	$335	$104	$369
Private Trees	$5,625	$11,952	$2,179	$4,631	$1,926	$4,092
Total	*$7,729*	*$15,013*	*$2,991*	*$5,804*	*$2,664*	*$5,201*

placement costs including street, park, and private trees varies between $2,664 (median-based) and $5,201 (mean-based) million. While tree replacement costs are smaller than landscape values and tree removal costs, they still will need to be covered in public and private budgets (assuming replacement of lost trees).

A final appreciation for the impact of EAB in this four-state region can be obtained by looking at grand totals. Total median-based cost estimates including landscape, removal, and replacement costs are $13.4 billion. Using means to calculate the grand total yields $26 billion as a potential loss due to EAB. Previous research estimated that under the worst case scenario (i.e., mean-based estimates of the complete loss of urban ash in Ohio), a $7.5 billion dollar loss was possible (Sydnor et al. 2007a).

SUMMARY AND LIMITATIONS

Readers are reminded that several assumptions, discussed throughout the paper, were behind the estimates presented. The biggest assumptions related to the ability of managers to estimate ash densities in their respective communities (particularly for ash on private lands), that ash densities generally are similar across the states in the region, and that reasonable estimates of costs could be developed for the four-state region, especially during a time of economic recession. Size estimates as solicited were based on street trees only (34 cm), as urban foresters were judged to be more familiar with trees under their control. Industry size ranges used for removal cost estimates were for 31 to 61 cm trees, thus removal costs would be valid for trees up to 61 cm in diameter. With these limitations in mind, the results can help communities begin planning for the impacts of EAB, and the paper presents a framework whereby different prices or densities can be inserted and recalculated by others if new or different information is available.

The present study found a similar mean-based total urban ash density (including street, park, and private ashes per 1,000 residents) for the four-state region as a previous survey-based study of Ohio (Sydnor et al. 2007a). Also, the overall result for ash quantity in the four-state region appears comparable to that derived by others using secondary data sources for ash on developed land within communities, but is lower than estimated regional ash quantities on all developed lands (inside and outside communities) in the four states (Kovacs et al. 2010). Given that the present survey was aimed at community foresters, the "within community" estimate might be a more direct comparison, but it is unclear to what extent some respondents might have included adjacent but unincorporated developed lands in their responses. This distinction is important to consider in conducting future survey-based studies. By any measure, the results of this and other studies suggest that EAB poses a substantial financial threat to community forests.

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Résumé. Un sondage a été mené auprès de 586 communautés représentatives qui ont des responsabilités en regard du couvert arboré urbain, le tout afin d'obtenir des données sur la densité en frêne dans quatre états du Midwest américain et aussi afin d'étudier les pertes économiques potentielles dans l'hypothèse où l'agrile du frêne parviendrait à s'établir au sein de leurs communautés. Cent vingt-sept réponses ont été reçues de communautés de différentes tailles. Les données représentaient 10,5% de la population totale de l'Illinois, de l'Indiana, du Michigan et du Wisconsin, soit 21% de toutes les communautés couvertes par le sondage. En assumant la perte complète de tous les frênes due à l'agrile du frêne, la perte en valeur monétaire contributive dans les aménagements paysagers à l'intérieur des limites des communautés a été estimée entre 7,7 (médiane) et 15 (moyenne) milliards de dollars. Le coût pour abattre ces arbres est en quelque sorte plus faible puisqu'il se situerait entre 3 et 5,8 milliards de dollars. Remplacer les frênes abattus à cause de l'agrile du frêne par la plantation de nouveaux arbres de 5 cm de diamètre le long des rues, dans les parcs et sur les propriétés privées coûterait entre 2,7 et 5,2 milliards de dollars. La perte totale des frênes au sein uniquement des communautés sondées dans les quatre états, incluant la perte en valeur monétaire contributive, les frais d'abattage et la plantation de nouveaux arbres, a été estimée entre 13,4 et 26 milliards de dollars. Le coût potentiel total de de la perte des frênes par 1000 habitants au sein de ces quatre états est estimé entre 395943$ et 769687$. Les taux estimés par 1000 habitants peuvent être utilisés par les communautés pour développer des plans de contingence si l'agrile du frêne venait à leur causer des impacts.

Zusammenfassung. In vier Staaten des mittleren Westens der USA wurde eine Umfrage unter 586 Repräsentanten von Kommunen durchgeführt, die eine Verantwortung im Bereich urbaner Baumkronenbedeckung tragen, um Daten zur Dichte von Eschenbeständen zu erhalten und um die potentiellen ökonomischen Verluste zu untersuchen, falls der Eschenprachtkäfer sich in ihren Kommunen etablieren sollte. Einhundertdreiundzwanzig Antworten verschiedenen Ausmaßes wurden von den Kommunen zurück gesandt. Diese Daten repräsentieren 10,5 % der Population von Illinois, Indiana, Michigan und Wisconsin und 21 % aller befragten Kommunen. Unter der Annahme des totalen Verlustes von Eschen durch den Eschenprachtkäfer, wurde der Verlust an Landschaftswert der Eschenbäume innerhalb der kommunalen Grenzen zwischen $ 7,7 Milliarden und $ 15 Milliarden geschätzt. Die Kosten zur Entfernung dieser Bäume liegen etwas darunter und würden $ 3- 5,8 Milliarden betragen. Wenn durch den Eschenprachtkäfer zerstörte Bäume durch Bäume mit einem Durchmesser von weniger als 5 cm in den Straßen, Parkanlagen und privaten ersetzt würden, betrügen die Kosten zwischen $ 2,7 und $ 5,2 Milliarden. Der totale Verlust von Eschen innerhalb der Kommunen aus den vier untersuchten Staaten einschließlich er Landschaftsverluste, Baumentfernung und Nachpflanzung wird auf $ 13,4 bis $ 26 Milliarden geschätzt. Die potentiellen Kosten pro 1.000 Einwohner in diesen vier Regionen liegen zwischen $ 395.943,- und $ 769.687,- Die geschätzten Raten pro 1.000 Einwohner können von den Kommunen für die Entwicklung von Haushaltplänen verwendet werden, sollte der Eschenprachtkäfer diese Region betreffen.

Resumen. Una encuesta de 586 comunidades representativas con árboles urbanos se llevó a cabo para proveer datos de la densidad de fresnos dentro de cuatro estados en el medio-oeste de los Estados Unidos, y se examinaron las pérdidas potenciales económicas debidas al barrenador esmeralda del fresno (EAB) en sus comunidades. Se recibieron 120 respuestas de comunidades de varios tamaños. Los datos representaron 10.5% de la población de Illinois, Indiana, Michigan y Wisconsin, y 21% de todas las comunidades encuestadas. Asumiento la pérdida completa de los fresnos debida a EAB, las pérdidas en valor del paisaje para árboles de fresno dentro de las fronteras de la comunidad fueron estimados entre $7.7 y $15 billones de dólares. El costo de remoción de estos árboles es más pequeño y podría estar entre $3 y $5.8 billones. El remplazo de los árboles por EAB con árboles más pequeños de 5 cm en calles, parques y predios privados podría estar entre $2.7 y $5.2 billones. Las pérdidas totales de fresnos para las comunidades en los cuatro estados incluyeron pérdidas de paisajes, remoción de árboles, y remplazo, estimadas entre $13.4 y $26 billones. Los costos totales potenciales por 1,000 residentes en los cuatro estados de la región es estimado entre $395,943 y $769,687. La tasa por 1,000 residentes puede ser empleada por las comunidades para empezar a desarrollar planes de contingencia cuando el EAB les impacte.