

# Obstacles to Community Participation in Reporting Pest-Related Tree Damage

Julia Bell, Salsabil Chebli, Megan Clampitt,  
Evan Courtney, Sylvanus Newstead, Nitin Ramesh

Under the supervision of Dr. Caroline Boules

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Gerrit Knaap, NCSG Executive Director

Uri Avin, PALS Director

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## Executive Summary

For our Environmental Science and Policy Capstone project at the University of Maryland, we were assigned a Montgomery County Parks project. The goals of this capstone project were to inspire and increase community involvement to report invasive insect and disease pests and to inform residents about invasive tree pests, particularly educating residents on how to find and identify potential invasive pests. The hope was to decrease the spread of pests and protect the parks' biodiversity and, while saving the Parks Department money on future mitigation practices.

To achieve these goals, the team reviewed current communication strategies for reporting invasive tree pests to Parks and identified obstacles to reporting. This report recommends three approaches. First, develop effective venues to inform and engage the public in detecting and reporting invasive pests. The second product is potential reporting methods. Finally, the report examines messaging examples that will help accomplish the goals.

The team's findings, based on literature reviews, interviews, and surveys, overwhelmingly indicate that while almost all park officials and Master Gardeners believe that public engagement is important in stopping the spread of invasive species, they believe the three main reasons people don't report infestations are apathy, ignorance, and not knowing how to report infestations.

The team determined that the most successful reporting methods are phone applications and email hotlines. While the team doesn't have the resources to create a phone application, we advertised the Parks' tree incident email hotline as a way to report infestations.

Lastly, the team created educational visuals in the form of "wanted posters," a fun and engaging way the Parks Department can inform the public about two invasive pests and diseases. These one page visuals can be printed as fliers or posters, and placed in schools, grocery stores, parks, and other locations. It can also be posted on the Montgomery County Parks website, or shared on their social media pages to educate more people.

Our research led to recommendations that can help control the spread of invasive species in the future. The first recommendation is to educate the public about invasive species by creating fliers or informational pamphlets. The next recommendation is to invest more time educating Master Gardeners and Weed Warriors in spotting and reporting invasive species. Based on findings that phone applications are the most successful reporting methods the final recommendation is that County Parks develop a phone app that can be used to map and report infestations.

Overall, the team's research was successful and, while stopping the spread of invasives completely may be impossible, we believe that this research and recommendations will help Montgomery County Parks better manage invasive species damage.

## Introduction

### ***Description of Problem***

Montgomery County, Maryland is bracing for an invasion of several invasive tree pest species and diseases. These invasives can destroy entire forests and ecosystems, and the County Parks Department is hoping that their land will not be negatively impacted by these species. However, in the past, they have been unable to lessen the effects, particularly of Emerald Ash Borers, for several reasons, including lack of reporting on infestations by park visitors.

The Parks Department believes that greater public engagement in reporting tree pests and tree damage when they see it would help. The Department asked the team to figure out why park visitors don't report infestations, and how the Department can change this behavior. Reporting could help catch potential infestations early, and lessen the damage done to parks by invasive species.

### ***Objectives, Goals, and Research Approach***

The team's research objective was to determine the obstacles to public reporting of tree infestations and the most effective reporting method for County Parks could implement. The goal is an effective reporting method that could be easily accessed and used by park visitors. This information will allow the Department to successfully combat potential invasive species.

The team gathered information by interviewing park officials and Master Gardeners. The team also conducted background research to determine how programs in other communities have successfully educated the public about invasive species and encouraged reporting and how this could be applied in Montgomery County.

## Background Research

### ***The Asian Longhorned Beetle***

As global trade and human migration have increased, so has the movement of species around the world (Liebhold et al 2012). This movement has led to the migration of invasive species: non-native species that, when introduced to an area, can outcompete native species and harm the local ecosystem.

The effects of invasive species are often the subject of eradication programs. Invasive species alone, have contributed directly to the decline of more than 42 percent of threatened and endangered species (Liebhold et al 2012). One of the most recent and most prolific invasive species is the Asian Longhorned Beetle, which originated in China in 1980 and is believed to have spread to North America in 1992 through the wood trade and wood packaging materials (Haack et al. 2010). The beetle can spread through live trees, fallen timber, and firewood (Haack et al. 2010). As a result, Asian Longhorned Beetle infestations have since been reported in New York, Massachusetts, Chicago, and Ohio.

To prevent future infestations, successful eradication methods, such as quarantines and tree removals, must be established, so that infestations can be stopped quickly. One of the most important ways to stop these infestations is by ensuring that infestations are detected early (Hu et al. 2009). The earlier an infestation is detected, the fewer trees are likely to be infected. This will lead to fewer dead trees, and a lower potential for future infestations.

Research and management of Asian Longhorned Beetles must be done by parks services to ensure early detection and successful eradication (Dodds and Orwig 2011). Knowing the biology and life cycle of the Asian Longhorned Beetle, can help scientists and park officials develop better eradication methods that are specific to this invasive species. Increased research can help park officials spot infestations sooner, and be prepared to apply eradication methods. The earlier a species is detected, the earlier it can be quarantined and stopped.

Because early detection is so important in stopping the spread of invasive species, public education can assist with detection and stopping infestation. To detect an infestation, the public needs to know its signs and consequences.

The public must also know how to report an infestation to park officials. If they don't know how to report an infestation, they can't help stop its spread. The reporting method must also be convenient to make reporting easy.

Finally, the public must be taught how to stop the spread of Asian Longhorned Beetle. For example, not moving firewood, that may be infested with beetles that can move to new locations with the firewood. The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA APHIS) has tried to educate the public, particularly children, by creating fun and interactive games and educational tools to spot and report Asian Longhorned Beetles (Educate, 2018).

These challenges with citizen detection and reporting were experienced by Montgomery County Parks with the invasion of the Emerald Ash Borer. Because the Parks Department was unprepared and citizens

were unable to detect and report infestations, the infestation spread quickly and decimated ash trees. If no changes are made, the Asian Longhorned Beetle has the potential to cause similar destruction of trees in Montgomery Parks.

Research has shown that people are unlikely to report invasive species due to apathy, ignorance, and lack of knowledge of reporting methods, making it important to educate the public on signs of infestation and how to report them as well as on the negative effects of infestations to motivate public reporting.

### ***Thousand Cankers Disease***

Thousand Cankers Disease (TCD) predominantly affects *Juglans nigra*, or black walnut trees. The scientific community has yet to pinpoint the disease's exact origin because it was only recently discovered, but the first sightings in the U.S. were in New Mexico and Colorado in the late 1980s and early 1990s (Grant 2011). It is caused by *Geosmithia morbida*, a fungal pathogen (Tisserat 2011). Each time a beetle digs inside a tree, it leaves an entrance hole that develops into a canker, an elliptical formation that the fungus inhabits. *Geosmithia morbida* works in concert with the beetle to cause the cankers to grow and expand further into the tree's tissue. As the number of cankers increase, the tree deteriorates, blocking nutrients and water from flowing through the phloem, the tree's internal vascular tissue, leading to the tree's decay and eventual death.

Initially, it was thought TCD spread because of a regional drought as sites that were prone to drought stress experienced more rapid decline. However, this was disproven in 2004 when mortality rates increased after a year of normal precipitation, leading scientists to look for a different explanation (Tisserat 2009).

Foresters began to remove the trees affected by TCD and by the fall of 2008, over 700 trees had been removed in Boulder, Colorado alone. The decline originally detected in Colorado Springs and Boulder had spread to the greater Denver area, with comparable mortality rates.

TCD has been confirmed in several West Coast states, including Washington, California, Nevada, Idaho and Utah. In 2010, a large TCD outbreak was found in the Knoxville, Tennessee area. The cause of the spread is still uncertain, but as a precaution, quarantines have been issued across the Midwest and the East Coast as there have been confirmed sightings in Ohio, Pennsylvania and Virginia, all of which are near Maryland. The threat of TCD in Maryland should not be underestimated (Grant 2011).

Once TCD takes over a tree, it cannot be reversed. The most effective preventative methods are early detection and quarantining locations likely to be affected along the disease vector. This is where citizen detection and reporting is vital. Master Gardeners and park staff cannot single-handedly scan every tree for cankers. Citizens who are aware of the indicators of TCD—yellowing, wilting, and the proliferation of cankers—can help by reporting this information to the Montgomery County Parks Department, so that TCD doesn't become a catastrophe like the Emerald Ash Borer.

### ***Citizen Science Programs and Invasive Species***

Citizen science programs are becoming increasingly popular and have great potential to aid in reporting and managing invasive species. Citizen science is an opportunity to monitor invasive species, a problem

scientists and policy makers are often unable to effectively control (Crall, 2010). Through a properly structured education program and adequate reporting options, the layperson can effectively contribute useful data on invasive species.

Citizen science programs are most successful when they offer sufficient training, they recruit from existing well-established programs, and they have a connection with local stakeholders (Gallo, 2011). Providing exceptional training, both in and outside the classroom, ensures that citizen scientists are confident in their reporting. This is essential because studies show that citizen scientists are typically uncomfortable making advanced scientific decisions, which can undermine a program's effectiveness (Gallo, 2011).

Additionally, recruiting from existing programs (such as Naturalist groups), can target individuals with existing knowledge and a strong interest plant health. In Montgomery County, Maryland the Weed Warrior and Master Naturalist programs could both serve as recruitment hotspots, and for different reasons. Weed Warriors are trained individuals who are already removing invasive species in their communities. Master Naturalists are more focused on natural resource conservation and community education. Both of these well-established programs recruit individuals who are interested in park stewardship and fieldwork and who could serve as strong citizen scientists.

However, citizen science programs are about more than just data. They can also play an important role in raising public awareness about incoming invasive species (Gallo, 2011). Overall, there is potential for citizen science to help effectively manage incoming invasive species in Montgomery County.

## Methods

### Expert Interviews

The first step in obtaining information about invasive species and general public reporting trends were interviews of master gardeners and other subject matter experts. The team chose to interview people most likely to be responsive and informative. The team used these interviews to obtain more contacts who could be interviewed, a snowball sampling method. Each interview consisted of an approximately 30-minute phone call with several questions on invasive species and the expert's experiences with them, as well as the most successful eradication methods they'd used (see Appendix A). Five interviews were conducted. While the snowball sampling didn't work very well, the team was able to obtain the information needed by creating an online survey sent to Master Gardeners.

### Interview Summary

#### Interviews for Obstacles to Community Participation in Reporting Pest-Related Tree Damage Project

No.	Date	Interviewer (responsible to write up the interview)	Respondent's organization and location	Respondent's name and title	Interview Summary
<b>Invasive Pest Experts and Other Experts</b>					
1.	3/26/18	Julia Bell	Department of Natural Resources	Jonathan McKnight, Coordinator for Invasive Species Responses	People don't report infestations due to ignorance, apathy, and lack of knowledge of reporting methods.  Email hotlines are effective reporting methods because they don't need to be constantly manned, and allow photos to be attached to reports.
2.	3/29/18	Evan Courtney	Mass. Dept of Agricultural Resources	Jennifer Orth	It's important to include the public in developing a reporting page.  Reporting invasive pests has highs and lows. When the pest first arrives, the reporting will be high because it is a relevant issue. Eventually, reporting steadily drops as people lose interest.  False reporting of native plant species occurs when plants breed and first come out, causing reports to spike.
3.		Salsabil Chebli	Montgomery County Parks	Marilyn Sklar	Focused on social media outreach, and how to involve community members.  Email hotlines to report pest problems and hashtags are effective.



					Suggested conducting surveys in parks to gauge people's thoughts on the issue of tree pests.
4.	2/29/18	Julia Bell	Assistant Director, Public Affairs  USDA APHIS LPA	Suzanne Bond	Important to engage the public when dealing with invasive species.  Phone mapping applications have been successful, as well as informational websites and group reporting.
<b>Master Gardeners</b>					
7.	2/28/18	Megan Clampitt	Master Gardeners UMD Extension	Steve Dubik	People don't report tree pests and diseases because they are not aware of the importance of reporting and they're not able to recognize pests and diseases.  Need earlier and better recognition.  Need to address this problem from a grassroots level.  Use organizations like Master Gardeners and UMD Extension to tackle the problem.

### **Online Master Gardener Survey**

As mentioned above, the team struggled to contact with and interview Park officials and Master Gardeners; they are busy and it was hard to schedule phone interviews. To overcome this, an online survey (using GoogleForms, see Appendix B) was distributed by Steve Dubik (see table above) to a Master Gardeners ListServ whose members are likely to be most knowledgeable about invasive species and community outreach. The survey questions gave the team insights into why people don't report.

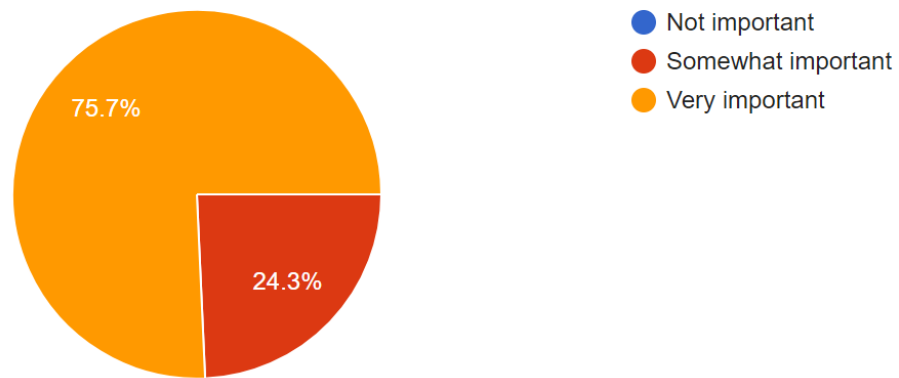
The online survey generated a much larger response rate—75 Master Gardeners. The team then conducted qualitative analysis of the responses to create the report.

## **Survey Results**

### **Master Gardener Survey**

1. How important do you think it would be if we could increase the amount of public engagement around the issue of tree pest problems?

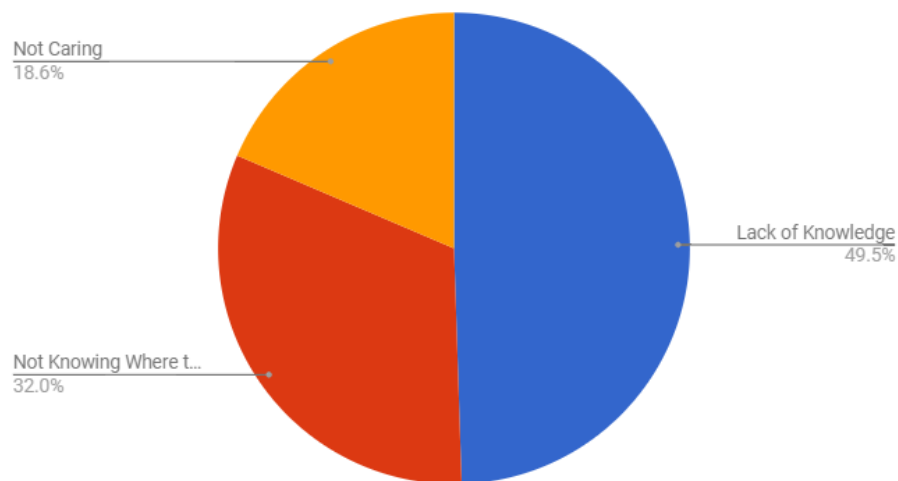
70 responses



**Figure 1: Survey respondents opinions on the importance of public engagement.** More than 75 percent of respondents believe that public engagement is “Very important” regarding the issue of tree pest problems.

2. What do you see as the greatest barriers for the general public for reporting their observations of tree pest problems?

### Barriers For Reporting



**Figure 2: Survey respondents opinions on the greatest barriers to reporting for the general public.** The greatest barrier to invasive pest reporting is a lack of knowledge about invasive pest species. Not knowing where to report the presence of invasive species was the next greatest barrier. In our survey, this question was open-ended and a large percentage of responses identified both a lack of knowledge and a lack of knowing where to report together, in the same answer. The third greatest barrier is that people simply do not care or are uninterested in reporting.

### ***Why People Fail to Report***

The three main reasons that people fail to report:

- Apathy
- Ignorance
- Lack of knowledge about how to report

Survey respondents believe that people simply don't know how or what to report, or don't care enough to report. This was worrisome, because 100 percent of the Master Gardeners who took our survey believe that public engagement is at least "Somewhat important" when stopping infestations. Accordingly, it is clear that the public must be informed about invasive species and incentivized to care.

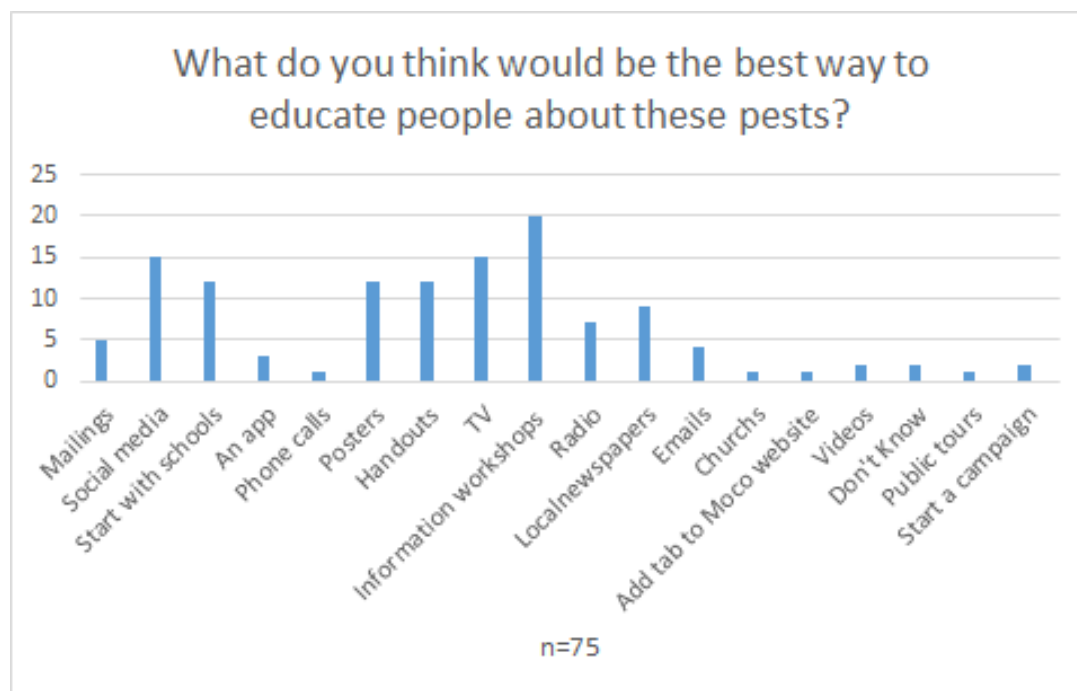
The team used this information about why people fail to report infestations to help craft recommendation for an educational visual. The survey results indicate that the general public is uneducated about invasive species, and the team decided to create a one-page visual that could easily be distributed as a flyer, poster, postcard, or web image. This medium will be able to reach and educate the largest number of people and inform them on how to report infestations by including the email hotline.

Since the survey indicated that infestations are also not reported due to apathy, it was important that the visual was made to be fun and creative, to engage people and make them care about the effort. This led to the idea of a "Wanted" poster for the Asian Longhorned Beetle and Oak Wilt. These posters displayed the necessary information, while also being entertaining and humorous. These posters will be read by more people because they are funny and attention grabbing, and will make them want to report "Wanted" invasive species (see Appendix C).

Qualities of good educational products are:

- Creative
- Fun
- Attention-grabbing

3. What do you think would be the best way to educate people about these pests?



**Figure 3: Survey respondents' opinions on the best way to educate the public about potential pest infestations.** Master Gardeners believe Informational workshops to be the most effective method of public education on pest species. Other popular methods include television, newspapers, and social media.

### ***How to Educate the Public***

Master Gardeners think the most effective methods of educating the public are through informational workshops, social media, and television. Workshops hosted by Montgomery Parks could be held in community centers throughout the County and present information about different environmental threats. Community members will learn about invasive species and diseases endangering trees. This approach is very hands-on and will take a lot of effort. However, it also ensures people in each neighborhood know what to look for and how to report it.

The other suggestion was using television. Master Gardeners support a public television announcement in which experts talk about new threats to trees such as invasive species and raise awareness about relevant issues. There would also be additional links on these TV announcements for more information.

Finally, a lot of people use social media sites for news and general entertainment (Kwak et al. 2010). Knowing this, it makes sense to reach out to community members through these sites because they are on them already and ensures the information will have a higher chance of being viewed.

Survey respondents recommended sending out informational pamphlets or postcards, and posting signs or posters in schools and parks. This would ensure that the information is seen and reaches a larger audience. In addition, if signs are posted in the parks, people will have the information where it is most important to report. It would guarantee that people most likely to care about nature and reporting pests are the ones being educated the most.

Placing signs in parks, schools, and other public places has been implemented elsewhere (Figure 4). Although Master Gardeners are key to helping report tree pest problems, branching out to other members of the community is crucial. Finding an audience interested in the environment in different communities is another way to ensure people will report if and when they see tree pests in their communities.

Finally, the team looked into collaborations between Montgomery County Parks and the University of Maryland Extension Program. Besides the Master Gardener Program, UMD Extension offers an array of programs that provide environmental education, such as the Master Naturalist Program. Master Naturalist volunteers undertake training and hands-on educational experiences to become Masters. The Master Naturalist Program offers volunteer opportunities such as environmental restoration projects, education, public awareness campaigns, and field research.

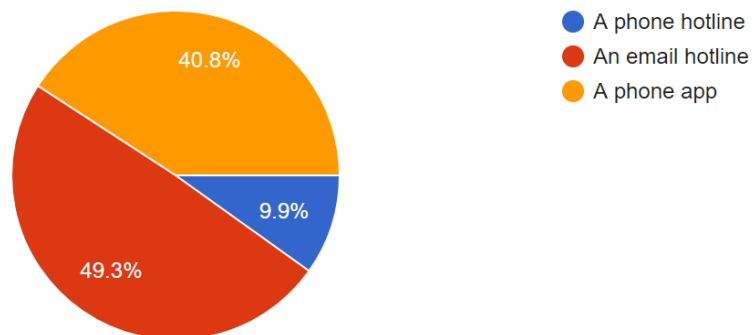
This program's public awareness campaigns could effectively increase pest reporting and general awareness. The Master Naturalist and Master Gardener programs overlap, with slightly different missions. Nonetheless, both programs could be valuable collaborators with Montgomery County Parks. Additionally, UMD Extension offers a general forestry course for those interested in expanding their understanding of trees and forest management. Collaborating with these programs through the UMD Extension could be effective in achieving Montgomery County Parks' goal.



**Figure 4: Invasive Species Sign:** This poster, created by the Central Park Conservancy, can be seen near water bodies in New York, where the snakehead fish is rampant. It instructs the public on what to do if they catch a snakehead.

#### 4. What do you think would be the best way for people to report potential pests?

71 responses



**Figure 5: Survey respondents opinions on the best way for the public to report infestations.** Email hotlines are believed to be the best way for people to report potential pests. Phone applications are also a popular method.

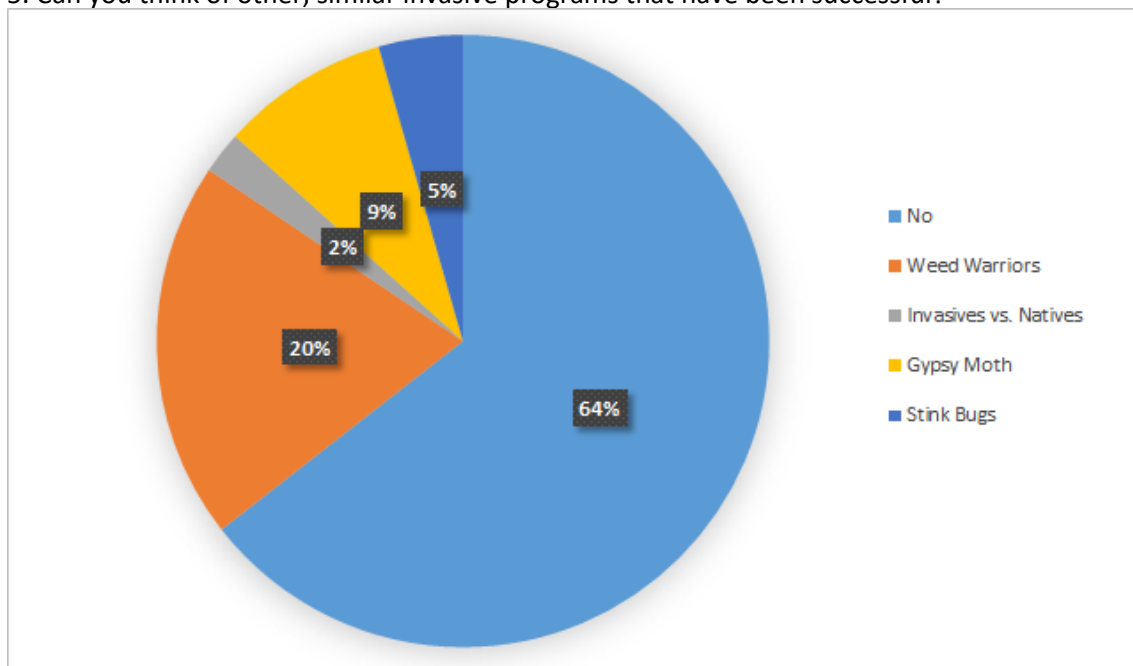
#### ***The Most Effective Reporting Methods***

Our survey found that Master Gardeners overwhelmingly believe the best way for people to report infestations were through phone applications or email hotlines. Survey respondents stated that phone hotlines were a poor choice because they have to be constantly manned to take calls. This is expensive and insufficient. Park officials are also interested in receiving pictures of potential infestations so that they can be verified. This is not possible over the phone.

Montgomery County Parks already has an email hotline for tree-related issues, which can also apply to the tree pests. The survey revealed that continuing to use this email and expanding it to include invasive species would be the best method to use for reporting infestations.

While a phone application was also a popular choice among Master Gardeners, the team does not currently have the ability or resources to create an application specifically for reporting pests.

5. Can you think of other, similar invasive programs that have been successful?



**Figure 6: Survey respondents opinions on successful invasive species programs.** The majority of survey respondents are not aware of successful invasive species programs. However, many Master Gardeners knew of the Weed Warriors, a volunteer group devoted to the identification, removal, and management of non-native plant species.

## Recommendations

### Create a Phone Mapping Application

An overwhelming number of Master Gardeners (40.8 percent) believe that a phone application would be an effective method for public reporting of pest sightings because it would allow people to submit photos of pests or diseases, as well as tracking their exact location. This would make it much easier for park officials to confirm the sighting and combat the problem.

The team thought that creating an app would be a great reporting method to incorporate in Montgomery County Parks, but lacked the knowledge and resources required to create such an app.

Several states have already implemented such apps (Graham et al. 2011, Figures 7 and 8). They allow parks departments to educate the public with pictures and information on what to look for and instructions for what to do if an invasive is spotted. These apps have been created for both invasive pests and diseases. While these may be difficult to create, they are wide-spread, and other parks may be willing to share their code so other states can implement similar applications.



**Figure 7: IPM Fruit Disease App.** The MyIPM smartphone application was originally developed in 2012 by Clemson University for South Carolina peach and strawberry growers, but has since expanded into a tool that serves all fruit growers



**Figure 8: Aqua Invaders Phone Mapping Application.** This app uses the power of crowd-sourcing data collection. Each record collected is verifiable since it is comprised of a photo and relevant metadata. Records are also geo-located using the phone's inbuilt GPS capabilities. The app also includes photographic ID guides so that users can distinguish non-natives from similar looking indigenous plants.



This app is not limited to reporting invasive pests. It could also be used for tree-related issues such as fallen trees or general tree health. Using borrowed code (such as the aquainvaders), would make it easier for Montgomery Parks to implement.

In addition, the Web Mapping Application that the other Montgomery Parks team created could easily be used in the ESRI Collector app, which allows users to make reports right on the app. To do this, Montgomery Parks would need an ArcGIS Online subscription. However, the app could only be accessed by Parks officials and not the general public. But, if it were implemented, it could be used by Master Gardeners and Weed Warriors to more accurately report pest infestations.

#### *Educate Master Gardeners and Weed Warriors*

People recommended to be part of early-detection programs are:

- within existing, well-established programs
- out in nature frequently
- members of naturalist groups.

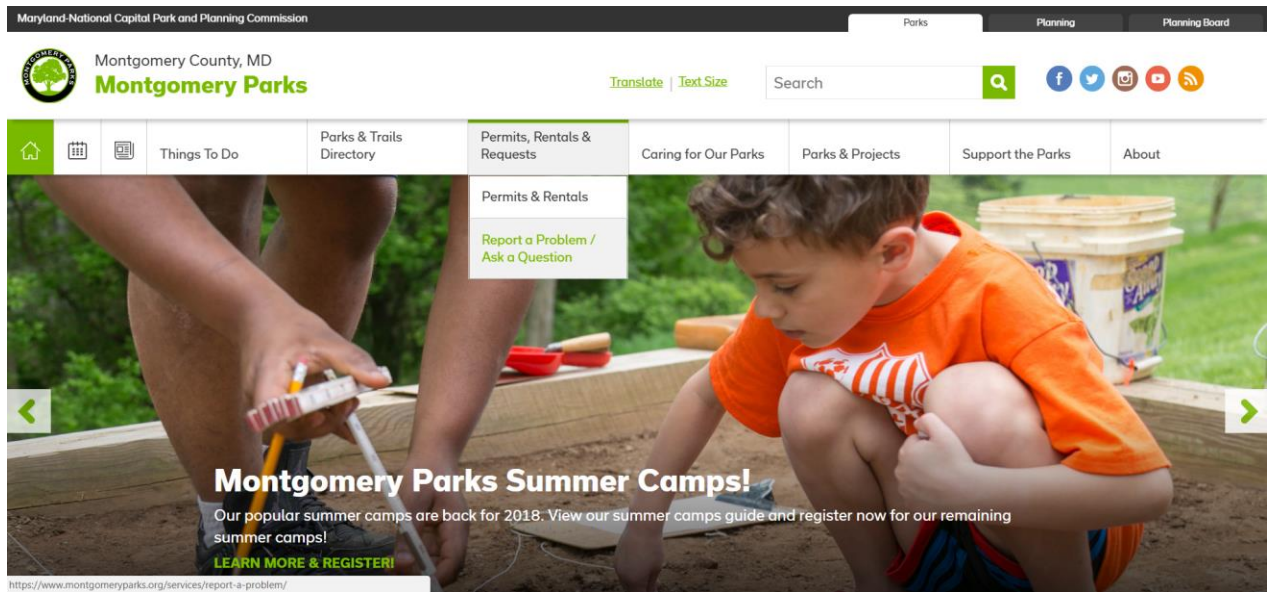
Throughout the research process, the team received feedback that it would be wise to use existing expert groups, such as the Master Gardeners, to communicate tree pest and disease infestations. Community members with a strong interest in plant health are the County's best bet for identifying new pests and diseases before they spread. Additionally, experts would be able to educate their local communities on the signs of tree pests and diseases.

The survey included a question about successful invasive species programs that 20 percent of respondents answered with "Weed Warriors." The Weed Warriors program trains individuals to act in their local communities and remove weeds on their own schedule. To become a Weed Warrior, participants complete a two-part online course, attend a classroom training session, and participate in field training with Park staff.

There is great potential for Montgomery Parks to partner with the Weed Warriors program to mitigate the risk of incoming pests. The program could simply add the warning signs of Thousand Cankers Disease and the Asian Longhorn Beetle to their existing training program. Thus, trained Weed Warriors would be able to identify and report any signs of these two incoming invasive species. This partnership would successfully utilize an existing program to manage incoming invasive species. The team created slides about invasive species that were presented in a Master Gardener class. It is recommended that these slides become part of future Master Gardener and Weed Warriors classes.

#### *Increase the Hotline's Visibility on the Website*

Changing the location of the hotline or "Report A Problem" webpage could increase views. Currently the webpage is located under the website's "Permits, Rentals & Requests" tab and someone who has never visited or explored the site may not find the page under that category.



**Figure 9: Montgomery Parks website.** This page shows how to report a pest on the Montgomery Parks website.

The current location of this service on the website is not easy to find. An improvement could be to create a unique “Reporting” tab on the website’s homepage so site visitors can clearly see where to report a problem. This tab would also allow Montgomery County Parks to provide additional pest information (including the “wanted posters”) on this tab, further educating people while they make reports.



**Figure 10: Massachusetts introduced a pest project website.** This page shows how to report a pest on the Introduced Pest Project Website. It is much easier to find where to report on this website than that of Montgomery Parks.

Figure 10 is a good example of an easy way to report pests, most notably the Asian Longhorned Beetle. While the site is primarily focused on pests, its success in Massachusetts, which was confirmed in an interview with Jennifer Orth, could carry over to the Montgomery Parks website.

Parks should consider a social media campaign on its various social media accounts to educate the public about tree pest problems and how to report evidence of pests. This campaign could be both informational and could be a way to get the word out to thousands of followers on how the public can report. It would be useful to monitor the amount of traffic that both the Parks website and the “report” tab of the site receive while the campaign is active compared to when it is not.

### *Community Informational Workshops*

Community informational workshops are a great way to educate on pest risks and impacts, and show how and why reporting is important. Also, they are a great way to get community feedback about reporting and public communication. These workshops, which could be held monthly by Montgomery Parks, would be targeted toward citizens who are interested in helping their community and learning more about invasive pests. Meeting Information could be advertised on the Parks website or mailed to County residents. Further, creating a listserv that people choose to join, that sends a newsletter with educational information on tree pests and ways to intervene, could be a catalyst in educating a larger group of people.

The EPA encourages public participation in environmental decision-making. But successful participation requires a good communication method based on community size. For large groups, the EPA suggests using mass media and the internet to provide complete access to all the information. For smaller groups, they suggest in-person and hands-on communication, like public meetings and workshops.

The International Plant Sentinel Network uses workshops in its programs to identify and diagnose Asian Longhorned Beetles. They offer a two-day workshop that provides a detailed introduction to monitoring and surveying techniques for harmful plant pests and pathogens. More specifically, they are looking for Longhorn Beetles in South China. The workshop’s first day is a detail introduction to the family of beetles that includes the longhorned, and the second day is in the field with trainers to identify pests, recognize signs of damage, and learn management and trapping techniques.

### *Social Media and Community Outreach Campaign*

Social media is a widespread means of communication and one of its many positive uses is the possibility to use platforms like Facebook and Twitter to reach and rally community members to generate action. A 2016 study identified four qualities of social media that benefit community outreach campaigns: “online searches, initial encounters before direct verbal dialogue, ice-breaking, and snowballing” (Chan & Holosko, 2016).

Online searches refers to community members seeing social media posts and following up by searching for a campaign’s website (increased viewership). Initial encounters before direct dialogue and ice-breaking refer to community members becoming more aware and more informed of a campaign before

choosing whether or not to join it. Finally, snowballing refers to individuals seeing social media posts about campaigns and in turn telling someone they know about it.

It is also important to consider the content that other community outreach organizations incorporate into their posts. In a study done on organizations running outreach campaigns and their tweets related to these campaigns, researchers found that all the tweets fell on a three-dimensional spectrum: “information oriented, community oriented, and action oriented” (Lovejoy & Saxton, 2012). Most of the tweets fell somewhere in the middle of this spectrum and were not completely one sided.

Montgomery Parks would benefit from a social media campaign targeting pests like the Asian Longhorned Beetle and would likely see an increase in the number of informed citizens and an increase in reporting as well. The Parks Department should consider a social media campaign utilizing its various social media accounts to educate the public about tree pest problems and how people can report evidence of pests. This campaign could be both informational and get the word out to thousands of followers on where exactly the public can report.

### *Social Media Language*

Figure 11 is an example of an image that could be part of a social media post with the following specific language. Note that this language presents the information in a way that represents the community, is informative, and contains a call to action.

“Non-native tree pests and diseases could be moving into your neighborhood. These bugs and diseases harm Montgomery County neighborhoods and backyards by decimating tree populations and your property. If you see the signs of any pest or disease please report it to Montgomery Parks at <https://www.montgomeryparks.org/> as soon as possible.”



**Figure 11: Signs of invasive pest infestation.** This tree that been attacked by the Emerald Ash Borer. (From the Montgomery Parks *EAB Management Plan*.)

## Discussion

### ***Discussion of Survey Results***

The survey of Master Gardeners yielded many of the same results as the expert interviews, but gave much more insight into how the public viewed invasive species and reporting, because the Master Gardeners have so much experience with these issues. Overall, the survey revealed that engaging the public was extremely important when attempting to combat invasive species. Invasive species can occur so many places that it is important to have as many people as possible reporting them. The Master Gardeners also believe the lack of reporting can be summed up as apathy, ignorance, and lack of knowledge of reporting methods. Accordingly, they believe that people would be most responsive to email hotlines and phone applications that are easy to use and allow the public to convey a lot of information to park officials.

As far as educating the public, the Master Gardeners believe a wide distribution of postcards and pamphlets with information on local invasive pests, would reach more people. They favor workshops about invasive species to educate experts and the general public. Many people are willing to help, but they don't know how. Because of this, a lot of Master Gardeners suggested reaching out to Weed Warriors, who have been successful in removing invasive plants. If the Weed Warriors could expand their scope to tree pests, stopping the spread of invasive species would be much more successful. Other than that, there were not many other successful invasive programs that the Master Gardeners were aware of.

### ***Limitations***

Although the team was happy with the results obtained, there were a few limitations.

#### ***Difficulty Reaching People***

From the start, phone expert interviews were a primary research method. However, it was difficult to successfully reach the identified experts. Despite emails and phone calls, we sometimes never heard back from people. Aware of the fact that people are busy and may not have time to assist with the project, the team realized that a short, online survey may be more effective in reaching experts. Steve Dubik of UMD Extension helped distribute the survey to the Master Gardener community.

#### ***Lack of Time for a Community Survey***

Based on the success of this Master Gardener survey (80 responses), the hope was to conduct a similar survey with community members. Unfortunately, this idea was considered too late into the project's timeline. The 10-week timeline didn't leave enough time to effectively create, distribute, and analyze results from a community member survey.

#### ***Survey Bias***

The results of the survey, which led to many of the team's recommendations, were solely from the Master Gardeners. There was a large sample size (N=80), however the responses came from a specific community. The Master Gardeners are trained individuals with a strong interest in plant health and

conservation. Thus, using them as the only audience led to bias. Conducting further surveys in parks, schools, and broader communities could eliminate this bias.

### ***Future Research***

#### *Surveying the Public*

It would be beneficial to interview and survey the public to understand why people are unlikely to report infestations. While there wasn't enough time to survey both Master Gardeners and the public, this process could also be used to gauge potential interest in community workshops and other educational events. In the future it would be beneficial to create and conduct these surveys because the results would help Montgomery County Parks determine why people don't report.

#### *More Effective Eradication Methods*

While researching the Asian Longhorned Beetle and Thousand Cankers Disease, the team learned about different eradication methods. Many of these methods—quarantines, pesticide injections, and tree removal—can't be completed by the general public (Dodds & Orwig, 2011). However, citizens can do some simple things, such as not moving firewood, to help lessen the spread of invasive species.

In the future, researching other simple prevention methods would be valuable and would make residents feel that they were doing their part to help their communities. These methods could be included on the handouts about invasive species distributed by Montgomery Parks and could also be taught at community workshops. While getting the public to report infestations is a good first step, they can take action to lessen the spread as well.

#### *Research Other Invasive Species*

Given the timeline and resource, this report covers only the Asian Longhorned Beetle and Thousand Cankers Disease. However, there are many more invasive species present in the U.S., and many that could potentially reach Maryland and Montgomery Parks. A future recommendation would be to research the species and diseases, such as Oak Wilt and the Gypsy Moth, to learn their effects. The early detection of invasive pests is key, and knowing more about them will help Montgomery Parks to lessen their damage and spread (Dodds & Orwig, 2011).

## **Conclusion**

The team learned that the main reasons people fail to report pest infestations are apathy, ignorance, and lack of knowledge of where to report. The survey helped determine that Montgomery Parks needs to establish effective ways of educating the public about invasive pests and how to report an infestation. That education should be informative, as well as fun and captivating. Montgomery Parks should follow the report's recommendations and work with the Master Gardeners to most effectively educate the public about invasive species and make them more likely to report infestations.



## Appendix

### ***Appendix A: Expert Interview Questions***

1. How important do you think it would be if we could increase the amount of public engagement around the issue of tree pest problems?
2. What do you see as the 3 greatest barriers for the general public for reporting their observations of tree pest problems? (ex: knowledge, interest, time, etc.)
3. What do you think would be an easy way for people to report (ex: email, text, hashtag)?
4. Can you think of other, similar programs that have been successful?
5. Would you recommend that we meet with the general public to ask directly about this issue? If so, what types of locations do you think would be best to find people? (They might have meetings with the general public that you could attend to interview people).
6. If we have an online form of this questionnaire, would you be able to send out, or are you able to give us a list of people to send it to?
7. Is there anyone you can refer me to who can have information for us?

#### Master Gardener-Specific Questions:

Have the MGs have had any programs in the past to educate the public about reporting tree pest problems?

## Appendix B: Invasive Tree Pests Survey

QUESTIONS

RESPONSES

80

### Invasive Tree Pests Survey

We are Senior Environmental Science and Policy students at the University of Maryland, College Park. For our capstone project, we are working with Montgomery County Parks Service and Jody Fetzer, to help them better understand the obstacles to community participation in reporting pest related tree damage. Please answer this survey to help us with our project.

How important do you think it would be if we could increase the amount of public engagement around the issue of tree pest problems?

- ☐ Not important
- ☐ Somewhat important
- ☐ Very important

What do you see as the greatest barriers for the general public for reporting their observations of tree pest problems?

Long answer text

What do you think would be the best way to educate people about these pests?

Long answer text

What do you think would be the best way for people to report potential pests?

- ☐ A phone hotline
- ☐ An email hotline
- ☐ A phone app

Can you think of other, similar invasive programs that have been successful?

Long answer text

Are there any people that you can refer us to who may be able to help us as well?

Short answer text



# WANTED

★ DEAD OR ALIVE ★



**Thousand Cankers Disease**  
(*Pityophthorus juglandis*)

Wanted for killing trees by blocking the  
flow of water and nutrients through its  
internal tissue

Be on the lookout for deterioration of bark  
in oval shapes all over trees

Last spotted in Colorado, but suspected to be moving east

**REWARD: Less Dead Trees**

Report any outlaw sightings to:  
[Service.Center@MontgomeryParks.org](mailto:Service.Center@MontgomeryParks.org)

# WANTED

★ DEAD OR ALIVE ★



**Asian Longhorned Beetle**  
(*Anoplophora glabripennis*)

**Wanted for Killing Trees and  
Destroying Ecosystems**

**Be on the lookout for trees with  
perfectly round exit holes**



**REWARD: *Less Dead Trees***

**Report any outlaw sightings to:  
[Service.Center@MontgomeryParks.org](mailto:Service.Center@MontgomeryParks.org)**



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