FOREST INVASIVES RESPONSE PLAN

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CONTENTS

OVERVIEW

Purpose of This Plan

The purpose of this plan is to outline actions that tribes can take if various invasive forest insects and diseases arrive in the Ceded Territories. These provisions are intended as strategies to limit the spread of the EAB and other non-native, invasive forest insects and diseases off-reservation, though they may work as on-reservation strategies as well. These strategies are offered as suggestions, with the recognition that the tribes maintain sovereignty to enact law and policy, including the direction of GLIFWC's programmatic activities.

Non-native forest insects and diseases present a major threat to Ceded Territory forests. Two major invasives, the emerald ash borer (*Agrilus planipennis*) and the oak wilt fungus (*Ceratocystis fagacearum*) are already having an impact in portions of the Ceded Territories, and continue to spread. The hemlock woolly adelgid or HWA (*Adelges tsugae*) and balsam woolly adelgid or BWA (*Adelges piceae*) are both established in eastern North America. The HWA has been found on nursery and landscape hemlock in 6 counties in Lower Michigan since 2006. The two most recent Michigan HWA sites were discovered in the summer of 2015, natural forest at the southern edge of the 1836 Ceded Territory (MDARD 2015). Native to western North America, the mountain pine beetle or MPB (*Dendroctonus ponderosae*) has invaded the Canadian boreal forest and may also arrive in the Ceded Territories in a matter of years (NRC 2015).

The Asian longhorn beetle or ALB (*Anoplophora glabripennis*) and its close relative the citrus longhorned beetle (*Anoplophora chinensis*) are major threats to treaty resources. The ALB has become established and subsequently eradicated at several sites in North America, with two large and troublesome populations in Massachusetts and Ohio still extant. If eradication efforts continue to be successful, the ALB may never become established in the Ceded Territories. On the other hand the ALB or another highly destructive invasive could show up in a campground or a Great Lakes port tomorrow. Today's global economy has made it possible for new invasives to show up almost anywhere.

Many of the strategies contained within this plan focus on increasing awareness about forest invasives. Education and awareness-building are the first steps in changing the human behavior that facilitates the introduction and long-distance spread of these beings. Early detection of the EAB and other forest invasives can allow for a greater range of management options than detection after a population is well established over a wide area (WI DATCP and WI DNR 2014). These strategies include the development of quarantines, biological controls, and eradication when possible.

As part of this project GLIFWC has completed two reports dealing with the threat of non-native forest invasives to native forest trees in the Ceded Territories. In September 2013 GLIFWC completed a scientific literature review which assessed and summarized the risks of non-native forest insects and diseases to native trees, forests and treaty resources (Garske 2015, posted at https://data.glifwc.org/archive.bio/Project%20Report%2013-03.pdf). In June 2015 GLIFWC

completed a forest invasives regulatory review, compiling, organizing and analyzing existing regulations and enforcement strategies currently in effect and being implemented in the Ceded Territories (Garske and Kebec 2015).

Documents produced as part of this project will be posted on the GLIFWC website. These include outreach materials such as pamphlets and flyers, Mazina'igan articles, forest invasives risk maps, and reports.

It is helpful to remember that conditions on the ground are constantly changing. The ever-expanding range of the EAB and other forest invasives, the arrival of new invasives from overseas, new ways of dealing with these invasives, climate change, increasing human population, and the loss of forests and other natural habitats are only some of the factors that will require new or revised strategies. This response plan will need to be updated periodically (every few years or so) so that it remains relevant to conditions in the Ceded Territories and adequately addresses the threat of forest invasives.

Integrating Ojibwe Tribal Perspectives

Whereas traditional people developed a relationship with the natural world through daily observation and direct reliance on natural ecosystems to supply every need, most people today spend little time in nature, depending on the cash-based economy for food, clothing, housing and medicines. Many of the products used to sustain modern life are shipped from far-away countries. Today's globalized economy has created many opportunities for forest insects and diseases to "hitchhike" all over the world, and the interstate transport of nursery stock, firewood, timber and logs can quickly move them to new areas. Slowing or stopping the movement of forest invasives may require a shift in human lifestyle and thinking back to a more traditional mindset, with greater emphasis on local economies and increased awareness of how one's personal activities can affect the larger community or a forest ecosystem.

From a traditional perspective, these introduced organisms and diseases are not malicious or bad. Instead they are recognized as being part of creation. They are simply carrying out the instructions that the creator provided to them. The destructive effect that these beings are having on native forests is due to the assistance they receive from human beings. Human activities are being carried out on a scale and with a purpose that has put us out of balance with natural processes.

For centuries the Ojibwe have had a close relationship with these trees (Figure 1). For the forest to be truly healthy this relationship needs to be restored. Tribal harvest must become part of the management.

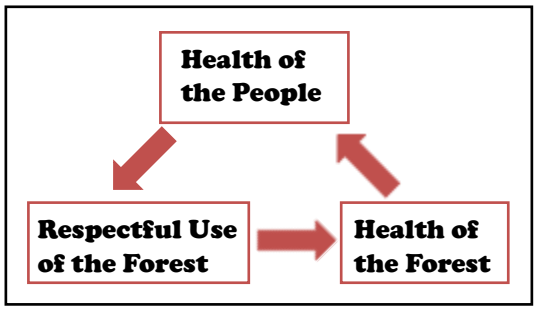

Figure 1. Traditional relationship between the Anishinaabe people and the forest.

At a meeting held between the tribes and federal, state and local government agencies held in Red

Cliff (Bayfield County, Wisconsin) in March 2015 as part of this project, several Ojibwe tribal elders including Mary and Leonard Moose (Ghost River, Ontario and Mille Lacs, Minnesota respectively) and Cleorah and Dennis White (White Earth, Minnesota and Lac Courte Oreilles, Wisconsin) commented on how greed, arrogance and a lack of respect towards *aki* (the Earth) and its many inhabitants was the root cause of many of the problems the forests are facing, from introduced invasives to global climate change. Cleorah and Dennis commented that "we need to preserve and live our culture" and keep traditional skills and values in order to preserve the forest. Cleorah and other elders also mentioned the need to remind some gatherers not to overharvest and to harvest with respect.

Leonard Moose reminded us of how *asemaa* (tobacco) should be used to invite the spirits to the meeting. He spoke of how *asemaa* should be offered to anything you take from *aki*, and how you should ask permission to the tree or other spirit you wish to gather from, and respectfully tell it what you want to use it for before taking something from it. Leonard ended by saying we need to open our third eye, and see what we can do for *aki*.

Another suggestion was to protect the forests through buybacks of private lands by the tribes, similar to what the Red Cliff tribe did to establish Frog Bay Tribal National Park (see http://redcliff-nsn.gov/Postings_Files/Red-Cliff-Visitor-Guide-1-1.pdf).

As explained by Sault Ste. Marie Chippewa tribal member and Dartmouth University Professor Nicholas Reo, Indian communities see plants and animals not just as physical resources, but as living, spiritual entities (Reo 2009). Reo suggests that anyone working on an emerald ash borer project should consider connecting with traditional basketmakers, because they hold many generations worth of traditional ecological knowledge relevant to their project (Reo 2009). He also recommends working with staff from tribal and first nation natural resource and cultural offices. He points out that tribal, first nation, federal, state, nonprofit and private entities must all work together to devise management strategies that will reduce the damage the EAB is causing to ash and to the environment (Reo 2009).

As a tribal agency, GLIFWC is committed to infusing Anishinaabe culture and values into all aspects of its mission. Throughout this project, staff has worked with tribal elders, harvesters and leaders to integrate cultural teachings and the Ojibwe perspective into the project. In the second year of the project, GLIFWC held meetings at each of its 11 member tribes to gather traditional ecological knowledge regarding trees at risk for forest invasives. The Voigt Intertribal Task Force has also provided feedback and direction on this aspect of the project. Our goal is to fully incorporate those perspectives into this report.

PREVENTION AND PREPARATION

Awareness is the key first step in preventing the establishment and limiting the spread of the EAB and other forest invasives. As these invasive beings have become established on the North American continent, state and federal agencies, local governments and other organizations such as the Nature Conservancy have focused on five core messages (detection, control, regulatory, personal responsibility, and compliance) to raise public awareness and

support for the effort to manage EAB, and to encourage the public to help by not moving untreated firewood (Rabaglia and Chaloux 2011; Campbell and Schlarbaum 2014).

A similar public information strategy might also work for tribal communities, using a messaging approach that is consistent with cultural values and practices. Awareness-building could include cultural activities designed to rekindle relationships between tribal members and forest beings, including the trees the Ojibwe have historically harvested. Encouraging and facilitating increased traditional use of trees by tribal members may prompt them to take action to protect trees vulnerable to infestation. It may also strengthen the resiliency of these trees, when they know that the Ojibwe still need them for life-sustaining activities.

While education initiatives alone will not stop the EAB at this point, education is critical to delaying the arrival and slowing the spread of the EAB and other forest invasives (Willow 2011). If significant numbers of tribal gatherers are aware of these invasives and the damage they cause, the chances of early detection increase considerably. Early detection can make control and eradication possible.

Early Detection

If a new forest invasive population is detected while it is still small, eradication is often possible. There is at least one account of an EAB infestation (the first infestation found in Upper Michigan, in Brimley State Park in 2005) being caught early and eradicated (Storer et al. 2009). The HWA infestations found in several Lower Michigan counties have been eradicated (with the help of the brutally cold winter of 2013-2014), though two new ones have recently been found (John Bedford, pers. comm. by email, October 3, 2014; MDARD 2015). The USDA-APHIS and partners have also eradicated several nascent ALB populations since the first North American infestation was found in Brooklyn, NY in 1996.

For early detection to work, members of the public need to have some basic skills in identifying signs of infestation and information on who to contact in case they find something unusual.

Elements of a tribal early detection strategy could include the following:

- Provide tribal members with resources and education on the signs of forest invasives
  Printed materials available at GLIFWC and registration stations
  - Web-based materials
  - Displays available for use by tribal natural resource departments, possibly including interactive materials that can be used at tribal workshops
  - Workshops held in tribal communities with those who gather
  - Curriculum for use in tribal headstart through tribal college programs

- Establish contacts within tribal natural resource departments and GLIFWC for the reporting of possible infestations
  - Identify tribal staff who can respond quickly to reports of infestations made by tribal members, and investigate reported infestations or forward that information

on to designated state and/or federal agencies
    - Create a GLIFWC hotline number and email address to report possible occurrences, with staff available to quickly respond

- Develop tribal systems to verify the identity of forest invasives and eradicate discrete populations, or develop protocols to work with state and federal agencies involved in detection and eradication efforts

Because an alert public is the first line of defense, education is key to catching new infestations as early as possible. It is critical that tribal members are aware of these invasive species and the symptoms they cause, so if they see evidence of an infestation they will recognize it and know where to report it.

Tribal Gathering Areas

Another possible early detection strategy would be for tribal staff to monitor areas where tribal members frequently harvest tree materials. These would include sites where ash, oak, and firewood are harvested. They could also include areas set aside as “operation plan” areas, such as the lands LDF requested and received for fuelwood harvest on the CNNF, and the fuelwood lands for the Keweenaw Bay Indian Community (KBIC) (KBIC and USFS 2014).

Risk Maps

GLIFWC risk maps

As part of this project, risk maps for these invasives were produced using GIS overlay analysis. This analysis followed an analytic hierarchy process (AHP) for decision-making, developed by Saaty (1977) and adapted for use in GIS by Eastman et al. (1995). These risk maps were produced using environmental factors (in this case, GIS layers) that are considered to be important in influencing the ability of various forest invasives to become established and spread in the Ceded Territories. Factors were ranked from most to least important based on "expert opinion", which may range from traditional ecological knowledge to peer-reviewed scientific research. Multiple GIS risk factor layers were overlayed with each other in geographic space, in order to highlight apparent high-risk areas. These maps are intended to be used as tools when deciding where increased monitoring and public outreach may be appropriate. For more on how these models were calculated as well as the models themselves, see the GIFWC website at http://www.glifwc.org/Forest_Pests/index.html .

The calculation of risk maps is based on the fact that certain areas are significantly more likely to show up on some places than others. For example, the ALB has repeatedly been intercepted in international ports and cities with manufacturing facilities that use heavy equipment (shipped in crate and other wood packing material from overseas). The EAB also first arrived in a port city (Detroit, Michigan). Initially much of the spread of the EAB was through nursery trade, but after the shipment of ash nursery stock from quarantine areas (and the entire state of Michigan)

was banned, transport of ash firewood and logs became the primary method of spread. By contrast, a potentially significant risk factor for the introduction of the BWA to the Ceded Territories may be Christmas tree farms, some of which obtain seedlings from fir seedling growers in the southeastern US where the BWA is already established. The HWA showed up in several Lower Michigan locations several years ago, on hemlock nursery stock illegally shipped from out east. (A combination of aggressive treatment by the Michigan Department of Agriculture and the brutally cold winter of 2013-2014 appears to have eradicated them.) Other risk factors may be helpful in predicting where other forest invasives are most likely to show up first in the Ceded Territories.

Forest Health Technology Enterprise Team (FHTET) risk maps

A similar approach to risk assessment has been used by the Forest Health Technology Enterprise Team (FHTET) of the USDA Forest Service, to predict risks from multiple forest invasives to US forests. For non-native invasives the FHTET approach breaks the risk assessment process into two parts: susceptibility, which they define as the potential for introduction and establishment in a forest or forested region within 15 years, and vulnerability, defined as the potential for mortality above a certain rate (they chose 25%) over a 15-year period. Forests are therefore only vulnerable if they are susceptible. The FHTET risk maps are available at http://www.fs.fed.us/foresthealth/technology/products.shtml and links. See Krist et al. (2010) for more information.

Training

Tribal Natural Resource Department Staff

Tribal Natural Resource Department (NRD) staff have an important role in the detection and identification of EAB and other forest invasives. In order to effectively respond, tribal wardens and natural resource staff need to be able to recognize the signs and symptoms of these invasives. They must know whether there are any tribal quarantine areas, what materials are regulated, how to handle these materials, and the dangers of transporting them. They must also know how to respond to reports of invasives from tribal gatherers and others. GLIFWC may be able to provide workshops tailored to the needs of NRD staff, along with providing them reference materials developed during this project to assist in the development of sufficient expertise to answer questions about forest invasives and respond to reports of infestations.

Once NRD programs have developed expertise and protocols to deal with forest invasives, GLIFWC could also compile contacts within member tribes' NRD programs and publicize their availability to provide community workshops, answer questions, investigate or otherwise respond to reports of new infestations.

Registration Station Clerks

Because registration station clerks interact with tribal gatherers on a regular basis, they are in a key position to answer basic questions, hand out materials, and inform tribal members about tribal quarantines and other measures in place to slow the spread of these organisms. Registration clerks meet at the GLIFWC main offices each fall. These meetings provide a good opportunity to provide information about forest invasives, and to let them know how they can help spread the word. They also provide an opportunity for GLIFWC staff to provide them with up-to-date information on applicable tribal regulations, signs and symptoms of infestations, and where tribal members can report suspected infestations.

Tribal Gathering

Information on forest invasives and the threat they pose to the environment and treaty resources should be provided with all harvest permits. GLIFWC has prepared a number of informational flyers, BMPs and other outreach materials that could be included when tribal harvesters receive their permits in person or by mail. Eventually the permitting system will become at least partly automated, in which case informational flyers could be included as part of the permit tribal members download from a computer.

Tribal gatherers are as likely as anyone to run across infestations of EAB, oak wilt and other invasives. It is very important for them to be able to recognize these invasives when they see them, so that they don't move logs, boughs and other infested material and so they know to report them. Ideally they should take photos and possibly specimens (using proper techniques so the organisms don't escape), and note the location as closely as possible. Tribes may want to establish a "hotline" for tribal members to report invasive species finds.

GLIFWC will be distributing 250 metal "Don't Move Firewood" signs to tribal communities for placement at tribal campgrounds, powwow grounds, reservation boundaries and other key areas. GLIFWC will also be holding workshops on forest invasives in tribal communities in 2016.

Tribal Youth

Engaging tribal youth in education and hands-on activities is an excellent way to make the next generation aware of the problem of invasive forest species. Activities benefitting youth could include workshops by tribal elders and gatherers, basketmakers, canoe builders and others who practice traditional skills, along with natural resource staff. Workshops on invasive forest species could be held at tribal community colleges.

GLIFWC summer interns could take part in activities that include tree identification, ecology, traditional uses and cultural significance, and monitoring for EAB and other forest invasives. In July 2015 two of GLIFWC's interns spent a day learning about how to identify ash trees, what the EAB is and what it does, and how to place purple panel traps to try and detect them. They then traveled to the Ottawa National Forest where they placed three more traps in three

different campgrounds there.

In the coming months GLIFWC will be contacting tribal community colleges to see whether they can use poster displays and educational materials for their forestry and biology classes. We also hope to provide trainings to high school and college students in the spring, including insect and disease identification and detection.

Cooperative Associations

Over the last decade or so Cooperative Weed Management Associations (CWMAs) and (in Michigan) Cooperative Invasive Species Management Areas (CISMAs) have become popular ways for individuals and organizations to band together to address the problems of invasive plants. These associations may include local citizens, landowners, non–profit groups and businesses along with city, county, state, tribal and federal governments and agencies, to cooperate and coordinate invasive plant work across jurisdictional boundaries (Kearns 2013). They range from informal partnerships and groups working on specific projects to groups with written agreements between participants and strategic plans that help them prioritize projects and seek grant funding. They typically do public outreach, trainings and control projects. Some even include aquatic invasives and forest invasives in their work. The first CWMA in Wisconsin was the Northwoods CWMA, based in Ashland. (GLIFWC was a founding member of this group.) It continues to be active to this day. For more on these cooperative associations, see Kearns (2013) and MI DNR (2015).

This cooperative structure seems to have been more successful than most at working on invasive species issues over the long term. Tribes might consider working with existing groups or starting their own groups to address the issues surrounding forest invasives and other invasive species.

FOREST INVASIVES DISCOVERY

Despite the extensive nationwide EAB purple panel trap survey conducted annually by the USDA-APHIS, targeted searches of high-risk areas by federal and state agencies, inspections of nursery stock and other measures, most new invasives populations are discovered by the public at large. This is particularly true for large, showy insects such as the ALB. Effective methods for detecting the ALB, BWA, HWA and most other forest invasives over large areas are effectively nonexistent. Beginning with a population found in Brooklyn, NY in 1996, all the North American ALB populations detected over the years have been found by alert local residents, homeowners and warehouse workers. A Michigan state nursery inspector discovered the HWA in an Emmet County tree nursery, but the rest were reported by individual citizens. In that case a media campaign by the state following the discovery of the HWA-infested nursery stock resulted in additional infestations being identified by the public.

The three Ceded Territory states do track oak wilt infestations. While the Michigan DNR doesn't do formal surveys for oak wilt, they do delineate it and treat it when they find it on state land

(William Cook, pers. comm. by phone, October 14, 2014). The Wisconsin DNR conducts aerial surveys over most of the state, with surveys focused on the northern part of the state, where oak wilt is still relatively rare but advancing (Becky Gray, pers. comm. by phone, October 1, 2014). In the summer of 2014 the Minnesota DNR did a fly-over across the northern border of the currently infestation area, which includes the southwest portion of the 1837 Ceded Territory north of the Twin Cities. The aerial photos from the flyover are being evaluated, and the Minnesota DNR plans on doing another flyover in 2016 (Jana Albers, pers. comm. by phone, September 19, 2014). As with other invasives, new oak wilt infestations are often found by alert landowners, hunters and others.

Discovery by a tribal member or agency

If evidence of a new population of the EAB or other major forest invasive is discovered by GLIFWC or its member tribes, or reported to them by a tribal gatherer, the find should first be verified by a tribal forester or other appropriate tribal natural resources staff. Unless the staff are experts in the identification of the invasive in question, they should consult appropriate references, such as those in Table 1. If staff are reasonably confident that the report is accurate, the find should be reported to the appropriate state Department of Natural Resources, Department of Agriculture or University Extension, or directly to the USDA-APHIS (see Table 1). The report should include the location of the find (including latitude and longitude if at all possible), along with the date, any samples and photos, and other relevant information.

While some forest invasives like the EAB and ALB are relatively distinctive and often can be reliably identified by informed members of the public, it does take some practice and experience to accurately recognize the symptoms of oak wilt, for example. When it comes to properly identifying invasive forest insects and diseases, it is very important to have them verified by taxonomic experts before making a public announcement.

Communication

In order to respond quickly and efficiently to a new infestation of EAB, ALB or other major forest invasive on-reservation or anywhere else in the Ceded Territories, it's critical that the tribes to have an effective system of communication in place. Tribal government officials should be informed as quickly as possible, including the Tribal Chairperson of the affected tribe. Members of the Voigt Task Force should also be informed.

It would be advisable for each tribe to designate an individual or a set of individuals that would coordinate communications with affected parties. Typically this would be the head of the tribal Natural Resources Department and/or one or more forestry staff. This contact would be responsible for contacting the tribal government (including the tribal chairperson) as well as the people on the ground. This includes tribal wardens as well as tribal gathering permit-holders, so that they can be informed as quickly as possible that certain areas where they may gather are infested. The NAGFA database used by GLIFWC and the registration stations can be used to query tribal members who hold permits and harvest in the vicinity of the new infestation.

Table 1. Sources for identifying and reporting EAB and other forest invasives. While some invasives are not considered "reportable" in certain jurisdictions, it would still be a good idea to report them to the USDA-APHIS and appropriate state agencies using the contact information below. Occurrences of any of these invasives may also be reported to GLIFWC: 1-715-682-6619. Ask for the Forest Ecologist or other Wildlife Section staff.

Invasive	Identification and Information	Where to Report
EAB	www.emeraldashborer.info	**National EAB Hotline:** (866) 322-4512. **Michigan:** (800) 292-3939. Lower Michigan is considered "generally infested" so only Upper Michigan infestations need to be reported. **Wisconsin:** (800) 462-2803, or see http://datcpservices.wisconsin.gov/eab/reporteab.jsp for more options. **Minnesota:** Arrest the Past Hotline: (888) 545-6684, or see http://www.mda.state.mn.us/plants/pestmanagement/arrestthepest.aspx for more options.
ALB	USDA-APHIS: http://asianlonghornedbeetle.com/ ALB look-similars: http://www.aphis.usda.gov/publications/plant_health/content/printable_version/alb_look_alikes.pdf Michigan State University and MI Department of Agriculture: http://asianlonghornedbeetle.com/wp-content/uploads/2013/06/ALB-info-sources-final.pdf .	**USDA-APHIS:** (866) 702-9938, or http://asianlonghornedbeetle.com/report-your-findings/ . **Michigan:** Email MDA-Info@michigan.gov, contact MSU Diagnostic Services at (517) 355-4536, or see www.pestid.msu.edu for more options. **Wisconsin:** (608) 266-8931, or email invasive.species@wi.gov. **Minnesota:** Arrest the Past Hotline: (888) 545-6684, or see http://www.mda.state.mn.us/plants/pestmanagement/arrestthepest.aspx for more options.
BWA	Ragenovich and Mitchell 2006; CABI 2015.	**Michigan:** MDA-Info@michigan.gov, or call MDARD Customer Service Center at (800) 292-3939. **Minnesota:** Arrest the Past Hotline: (888) 545-6684, or see http://www.mda.state.mn.us/plants/pestmanagement/arrestthepest.aspx for more options.
HWA	Costa and Onken 2006; Havill et al. 2014; MDARD 2015	**Wisconsin:** (608) 266-8931, or email invasive.species@wi.gov. **Minnesota:** Arrest the Past Hotline: (888) 545-6684, or see http://www.mda.state.mn.us/plants/pestmanagement/arrestthepest.aspx for more options.
Oak Wilt	Carlson et al. 2010; O'Brien et al. 2011.	**Michigan:** Call (517) 284-5895 or email DNR-FRD-Forest-Health@michigan.gov. **Minnesota:** Arrest the Past Hotline: (888) 545-6684, or see http://www.mda.state.mn.us/plants/pestmanagement/arrestthepest.aspx for more options.
MPB	The MPB belongs to a taxonomically difficult group of bark beetles. See http://www.mda.state.mn.us/plants/insects/mpb.aspx for more information.	**Wisconsin:** (608) 266-8931, or email invasive.species@wi.gov. **Minnesota:** Arrest the Past Hotline: (888) 545-6684, or seehttp://www.mda.state.mn.us/plants/pestmanagement/arrestthepest.aspx for more options.

Quarantines

All three Ceded Territory states and the federal government implement county quarantines for the EAB and ALB. As the gypsy moth advances west through western Wisconsin and into eastern Minnesota, WI DATCP and the Minnesota Department of Agriculture (MDA or MNDA) continue to implement quarantines for gypsy moth as well. The USDA-APHIS then quarantines the same counties. These quarantines will not apply to Ojibwe tribal members in the Ceded Territories, though, unless the tribes themselves take action to adopt the quarantine areas.

Because early attempts by APHIS to quarantine portions of counties or areas defined by other boundaries often resulted in confusion by the public as to where the quarantine boundaries were, the federal and state governments generally only implement quarantines by county. The tribes have the authority to define and implement tribal Ceded Territory quarantine areas for their members however they wish, though. Tribes can establish quarantines to slow the movement of the EAB or other forest invasives, and would have the option of establishing quarantines based on criteria of their choosing. Movement of firewood and other regulated materials onto tribal lands by anyone (not just tribal members) could also be regulated.

The Voigt Treaty Off-Reservation Conservation Code [Rev. 2015] authorizes the GLIFWC Director of Biological Services to order the closure of harvest of any species in part or all of the Ceded Territory "whenever in his or her professional opinion and judgement the continuation of the harvest is likely to result in a harvest exceeding the harvest goals and quotas adopted pursuant to Section 7 of the *Chippewa Intertribal Agreement Governing Resource Management and Regulation of Off-Reservation Treaty Rights in the Ceded Territory* or may otherwise cause biological harm to the species involved." The Code also states that the tribe must be consulted and approval obtained beforehand if possible, but that closure may be ordered without this approval if circumstances require, in which case the tribe must be notified as soon as feasible.

In response to an outbreak of oak wilt on the Chequamegon-Nicolet National Forest, this emergency closure authority was used to close areas of the forest in Oconto and Forest Counties to tribal oak firewood harvest from October 5, 2001 through October 4, 2002 (emergency closure order #2001-01). This was followed by emergency closure order #2002-01 (in effect from October 5, 2002 through October 4, 2003), closure order #2004-01(November 4, 2004 through November 3, 2005), and closure order #2005-01 (November 4, 2005 through November 3, 2006). This emergency closure authority could be used to establish tribal quarantine areas.

Possibilities for tribal quarantine areas:

- Establish a quarantine zone up to a certain distance away from the edge of a known infestation. This distance might be 10 miles, 25 miles, 50 miles or some other distance that works for each tribe.

- Establish quarantine zones defined by major roads, rivers and various other natural features or administrative boundaries. Areas based on well-known boundaries would of course be the easiest for tribal members to observe.

- Establish quarantine zones that mirror the quarantine zones established for the general public by USDA-APHIS and the state where the infestation was discovered. This would be the “safe” approach as far as avoiding imposition of state regulations. A major drawback would be that these quarantines might turn out to be inconvenient or even unworkable for some tribal gatherers.

EMERALD ASH BORER

The emerald ash borer is well on its way to being the most destructive forest insect ever introduced to North America. Wherever it has become established, it has killed nearly all ash trees in its path (Figure 2). It also is notoriously difficult to detect in the early stages of infestation, spreading far and wide by the time the infestation is discovered.

It takes 2 to 3 years for a tree to show symptoms of EAB infestation, making early detection very difficult. EAB infestations often turn out to be more widespread than initially determined. Whether due to more opportunity to hitch a ride or more people around to notice signs of infestation, new EAB infestations have a strong tendency to show up in cities and towns. While the EAB traps deployed each year by the USDA-APHIS occasionally turn up new populations (such as the one found on a purple panel trap in Rhinelander, Wisconsin in fall of 2014), no long-distance pheromones have been found in EAB (Herms and McCullough 2014), and existing traps baited with host volatiles are not very effective at detecting EAB at low numbers (Poland and McCullough 2006; McCullough et al. 2011; Mercader et al. 2012; Mercader et al. 2013).

The potential loss of ash from the landscape is a major concern for traditional black ash basketmakers and other tribal members. Black ash basketmaking is an important part of Ojibwe culture and tradition, as well as an important source of income for many (April Stone-Dahl, Regulatory Meeting, 2015 March 19). Many are concerned about the diminishment or loss of black ash and other plants for basketmaking, but also for the loss of the traditions that accompany their respectful harvest and use (April Stone-Dahl, Regulatory Meeting, 2015 March 19; Kathy Kae, pers. comm.).

Figure 2. The emerald ash borer is the most destructive forest insect ever introduced to North America.

Monitoring and Early Detection of EAB

Traps

Purple (or green) panel traps

Traditionally surveys for EAB have used the familiar three-sided purple prism traps, baited with chemical “lures” that mimic volatile compounds released by ash trees (Figure 3). The traps are covered with tanglefoot, which captures insects that touch the outside of the trap. Efficacy of the traps is a combination of color, chemical attractants used and location. Traps have typically been baited with a packet of manuka oil (derived from New Zealand tea tree, *Leptospermum scoparium* J. R. and G. Forst) and a packet of (3Z)-hexenol, a green leaf volatile. Recent research has shown that manuka oil provides negligible increase in trap efficacy so only (3Z)-hexenol is currently recommended (USDA-APHIS-PPQ 2015).

Each summer the USDA-APHIS deploys purple panel traps across the US. This risk-based survey assigns trap locations to 1 km^2 (0.39 mi^2) cells, with high-risk cells having a higher probability of receiving a trap. Cells closer to infested counties and cells with higher estimated populations of ash have a higher chance of receiving a trap. Quarantined counties are not included in the survey.

Traps do have certain advantages over girdled trap trees including lower cost, uniformity of sampling unit, greater safety, fewer logistical problems, and more precision in sampling (USDA APHIS PPQ 2015). These highly visible traps also serve as a reminder to the public that the EAB is a threat and that it’s important to report signs of the EAB if they find them. Though nowhere near 100% effective, traps are more effective in detecting earlier stage infestations than visual surveys (Marshall et al. 2009). Traps can be used to determine the extent of a new EAB infestation or to monitor the spread. See USDA APHIS PPQ (2015) for their EAB trapping protocol and for trapping techniques.

Figure 3. KBIC forester Gerald Jondreau places a purple panel trap in a black ash swamp on the KBIC reservation, June 2013.

Recently a female-produced pheromone attractant (a complex lactone-based compound) has been discovered (Silk et al. 2011; Silk et al. 2015). While this compound (and its geometrical isomer) are expensive to produce in a lab, a nearly identical compound is relatively easy and cheap to produce (Silk et al. 2015). This compound, (3Z)-dodecan-12-olid or (3Z)-lactone, has now replaced Manuka oil in most trapping programs. (3Z)-lactone also holds promise as a pheromone disruptor, which could be used to confuse males, as a female-produced pheromone of the European gypsy moth is routinely used to reduce mating success of that invasive species.

Double-decker panel traps

"Standard" double-decker traps are constructed by placing two panel traps (purple or green) around a 10-inch diameter, 7.9 ft tall PVC post. One purple panel trap is placed around the pole and attached near the top, while the other is attached at about head-height. These traps are placed in an open area. Purple double-decker traps appear to be the most effective panel-trapping method to date, outperforming green double-decker traps, as well as purple panel traps hung in ash trees and sticky bands attached to girdled trees (McCullough et al. 2011, Poland and McCullough 2014). The main drawback is that they are more material- and labor-intensive to place and monitor.

Multifunnel traps

In a study by Crook et al. (2014), baited fluon-coated green multifunnel traps (Figure 4) were significantly more effective than glue-coated, baited purple panel traps at detecting EAB beetles in higher beetle density areas, and about the same as the panel traps in low density areas. These multifunnel traps consist of a series of small cups (typically 12) filled with propylene glycol ("RV antifreeze"). Like other artificial traps, multifunnel traps should be baited with (3Z)-hexenol and (3Z)-lactone.

Multifunnel traps do not use glue and have the advantage of being reusable from year to year. They should be monitored every 2 weeks, to remove insects and replenish the antifreeze. GLIFWC has obtained 11 green multifunnel traps to try out in 2016.

Girdled ash trees

Girdled living ash trees are attractive to adult EAB, which are naturally attracted to stressed trees for reproduction. These girdled trees can be monitored for EAB adult visitation and later cut and peeled to look for evidence of EAB presence. Trees selected for girdling should be open grown and exposed to the sun if possible. Ungirdled ash trees may also be felled, peeled and examined for the presence of EAB as part of a survey. Trees that are in areas at high risk for introduction of EAB but where girdling is not possible, in proximity to known infested trees, or are showing signs or symptoms of possible infestation by EAB are best candidates for peeling and inspection without prior girdling.

Figure 4. Multifunnel EAB traps are reusable.

Girdling selected ash trees is probably the most effective method to attract and detect the EAB at low population levels, but is labor-intensive and relatively expensive to do over large areas. This method could be useful for monitoring at campgrounds and powwow grounds, near sawmills and around other high-risk areas though. Trees should be taken

down and peeled in the fall though, because any trees left standing could become hazards and would also become EAB nurseries if it is present in the area.

Ash branch sampling

Sampling of ash branches can also be used to detect infestation by EAB. Ryall et al. (2011) have developed a sampling protocol for urban trees, where short sections of two branches are peeled and examined for larvae or other signs of infestation. They found that the most efficient sampling method was to sample two 19.7 inch (50 cm) long pieces from the base of a branch from the middle canopy that was at least 2.4 inches (6 cm) diameter. This sampling method detected about 75% of asymptomatic trees known to be infested. Besides being the most effective method of detecting low levels of EAB to date, this method is faster than sampling whole trees and doesn't kill the trees.

Visual surveys

Visual surveys can be useful for detecting well-established EAB infestations, and for determining the extent of newly-discovered infestations. Visual surveys will generally only detect populations that have been established for 3-5 years or more though, as visible symptoms are difficult to identify in newer infestations. Trees generally do not show visible symptoms at all in the first year of infestation.

During visual surveys ash trees that appear to be dying back from the top of the canopy or that show other symptoms of EAB are examined more closely for epicormic shoots or suckering, woodpecker damage, exit holes, vertical splits in the bark, and serpentine larval galleries under bark (Figure 5). If an EAB infestation has been established for several years or more, it is quite possible that larvae or even adult beetles can be found. (Beetles can be present from late May through early September, with their peak emergence in July.) The USDA-APHIS suggests doing visual surveys for a distance of two miles beyond the initial EAB detection site (USDA-APHIS 2015a).

Figure 5. This dying ash shows obvious symptoms of EAB infestation, including thinning canopy and dark green epicormic shoots from the lower trunk. September 2015, Superior, Wisconsin.

Monitoring of high-risk areas

Tribes could consider actively monitoring high-risk areas for EAB, oak wilt and other forest invasives. While it would probably not be practical or even desirable for tribes to conduct large-scale surveys for EAB or other forest invasives, tribes have a unique opportunity to complement the USDA's annual EAB trapping survey.

The USDA survey selects 0.39 mile square grid cells within which traps are placed, based on a computer-generated stratified random sampling scheme. Using a probability modelling method, trap placement is weighted towards high-risk areas such as areas within 50 miles of a known infestation. While this method provides an unbiased sampling method that efficiently distributes traps across a large (multistate) survey area, high-risk locations such as hardwood processing facilities, campgrounds and powwow grounds are often missed. Individual tribes could easily fill in the gaps with strategic placement of modest numbers of traps (or surveying using other methods) in these high-risk areas. Off-reservation monitoring sites could include National and State Forest campgrounds. On-reservation sites might include tribal campgrounds and powwow grounds.

What Happens When EAB is Discovered?

The existing response framework

Federal and state agencies have an established protocol for verifying new finds of EAB and other forest invasives (Cruse and Kuhn 2015; USDA-APHIS 2015a). In general, reports of new populations of EAB are funneled through the USDA-APHIS, Plant Protection and Quarantine (PPQ), which is responsible for official verification of the find. The PPQ then informs the departments of agriculture and natural resources in the affected state. On paper at least, tribes are considered partners equivalent to the states and should be notified at this time (Eric Oliphant, Great Lakes Agency, BIA, pers. comm.) Next, local governments and affected private landowners are notified, and finally a press release is issued. For more details see the Appendix below.

After affected parties are notified, the state EAB Operations Group will organize a local response unit (LRU). This LRU coordinates the response to the infestation in the geographic area determined to be practical for the response (Norwood 2013). This LRU would ideally include staff to conduct EAB surveys, implement quarantines and/or other regulatory measures, and conduct outreach and education activities. If the infestation were on or near tribal land, a BIA forester (Eric Oliphant in northern Wisconsin, for example) would also be included. If the EAB find is limited to a small enough area on the reservation, the local response unit might consist entirely of tribal and BIA staff (Norwood 2013), subject to approval by the tribal council of the affected tribe.

Response Strategies

Addressing the EAB directly

At the March 19, 2015 regulatory meeting several elders talked about how human greed and materialism was destroying *aki*. Two of these elders (Mary and Leonard Moose) spoke at length about these problems. Leonard related how people don't invite the spirits of the trees to our meetings and ask for their help. He pointed out that the EAB and other forest invasives also have spirits that should be considered, and that it is humans that have caused an imbalance by

bringing them here. (This mirrors comments made by renowned forest invasives researcher Deb McCullough of Michigan State University, who has also pointed out that it's not the EAB's fault it's wiping out North America's ash, but the fault of people who "screwed up" and brought it here.) Leonard suggested giving a feast for the emerald ash borer, where people could offer *asemaa* to the EAB and ask these insects to leave our trees alone.

Having a feast in each community for the EAB would add a missing component in the struggle to save Turtle Island's ash trees, and would help to raise community awareness about the impact it is having on North American forests.

Assessing the extent of an infestation

Whenever a new population of EAB is discovered, the first step should be to figure out the extent of the population, and (if possible) how long it has been established. This information is indispensable in determining what areas should be quarantined. It can also indicate whether eradication might be possible or whether actions to slow the spread and mitigate the damage make more sense.

The USDA National Response Framework (Rabaglia and Chaloux 2011) recommends that these three criteria apply before considering an eradication campaign:

- The new population can be traced to a single introduction, such as a nursery, a load of firewood or logs, or other regulated materials
- The population can be shown to be less than 2 years old based on dendrochronological studies and a delimiting survey
- The population is considered eradicable by the EAB management team, using current technologies and methods.

Quarantines

Once the extent of the EAB infestation is reasonably well understood, it is recommended that a tribal quarantine zone be established. This quarantine zone could be designed to encompass an area some straight-line distance from the edge of the known infestation, or it could be defined by major roads, rivers and various other natural features or by administrative boundaries. Alternatively tribes could establish tribal quarantine zones based on county boundaries, as is currently done by the USDA-APHIS and the states.

Eradication

New infestations of the EAB are usually discovered only after the insect has been established for 3 years or more (Rabaglia and Chaloux 2011). Once the EAB has been established for several years, eradication is generally no longer possible. It is possible to eradicate an EAB infestation if it is caught early though. In 2005, the first EAB infestation found in Upper Michigan

(UP) was discovered at Brimley State Park in Chippewa County (Storer et al. 2009). The insect probably reached the park through the movement of firewood, with the first adults emerging in 2003. EAB exit holes were found in one ash tree in July 2005. In October 2005, more than 50 trees were felled and peeled. Eleven of these had exit holes and/or larvae. Eradication efforts at Brimley State Park apparently were successful. Unfortunately in 2007 infested trees were found near Moran and in Straits State Park, both in Mackinac County.

Harvesting ash from infested sites

Areas that are important for black ash harvesting could be monitored for EAB. The Bay Mills tribe has set aside a black ash reserve of about 9.66 acres on their lands in the eastern UP. Information gathered could include the approximate number, size, and health of the trees (Willow 2011).

After the EAB arrives and the ash start to die, invasive, non-native plants such as reed canary grass, glossy buckthorn and purple loosestrife are likely to invade black ash swamps in particular. Populations of these plants in close proximity to these stands could be eradicated where feasible. Reed canarygrass is very common across much of the Ceded Territories and is notoriously difficult to control.

Black ash splints and strips

The USDA-APHIS generally requires that infested ash trees be treated to destroy any living EAB before they are shipped out of quarantined areas. The most common way of doing this is to chip the trees into chips that are less than one inch thick on two sides. When black ash is pounded to separate the rings, the resulting splints are only a small fraction of an inch thick and usually less than one inch wide as well, and should also be free of living EAB and safe to transport. Therefore if ash logs are processed into rings on or near the site where they're harvested, the chances of spreading EAB should be negligible.

Preserving black ash logs

Underwater storage of black ash logs is a traditional practice that maintains wood quality for months after the trees are harvested. It can also be effective in eradicating EAB from the logs. In a study by Siegert et al. (2014), heavily-infested green and black ash bolts 9.8 inches (0.25 m) long were submersed for extended periods of time in a lab at room temperature. They found that a high percentage of prepupae (the stage between larva and pupae) survived complete submersion in the bolts for at least 6 weeks and successfully emerge as adults afterwards. Survival rapidly decreased thereafter though, and none survived 8 weeks of submersion. A subsequent study by Poland et al. (2015) found that no EAB survived in logs submerged in a river for 14 weeks in spring or 18 weeks in winter. (The differences in time needed to eliminate the EAB from the logs in these studies is likely due to water temperature, with the EAB larvae growing and metabolizing more slowly and therefore surviving longer in colder water.)

Underwater storage can provide a way for infested trees to be transported out of infested areas

after soaking, without the risk of spreading the EAB. Flowing water is recommended as the logs tend to rot in standing water.

Biological control of EAB

Since it first became operational in 2009, the USDA APHIS Biological Control Production Facility (BCPF) in Brighton, MI has reared and released over two million EAB parasitoid wasps. (Parasitoids are insects whose larvae feed on another insect's eggs or larvae, eventually killing them.) These insects had been released in nineteen states as of September 2014. While one of these tiny wasps (*Spathius agrili*) has poor survival in the north, the other two (*Oobius agrili* and *Tetrastichus planipennisi*) have become established at multiple sites, including in the Ceded Territories. Another EAB parasitoid (*Spathius galinae*) has gone through testing and is scheduled for release in late summer 2015. This insect was discovered attacking EAB larvae in Korea and Russia, where the climate is colder than the region of China where *S. agrili* originated.

Rearing these insects is time and labor intensive. For this reason, and so the EAB biocontrol program can monitor the establishment and impact of these parasitoids on EAB populations, researchers and cooperators receiving parasitoids from the BCPF must agree to submit their release and recovery data to a centrally managed, online, searchable database (www.mapbiocontrol.org). A hand-held computer with a built-in GPS unit can be used to collect data in the field, or the data can be written down and entered online. The protocol strongly recommends that parasitoids be released in areas of natural forest, woodlots, wooded wetlands, and riparian zones. Release sites with high human activity such as parks, powwow grounds and golf courses should be avoided, as should sites that may be logged or developed in the next five years. The process of releasing and effectively tracking establishment and survival is fairly time- and data-intensive (though certainly do-able) for cooperators. For more information see Gould et al. (2015).

Traditionally the GLIFWC tribes have been wary of supporting or participating in releases of biological control agents, out of concern that these agents would begin to attack native, non-target organisms, and that releasing them would just add to the invasive species problem. While these EAB biocontrol organisms (all small parasitoid wasps so far) have undergone extensive testing, it is always possible that they may begin to switch to native host insects at some point. An alternative view is that the benefits outweigh the risks, and by helping to spread these organisms the target organism (the EAB in this case) can be brought back under control by its natural predators, as native insects are controlled by theirs.

Lingering ash

There is a bit good news in what has long been a sea of bad when it comes to the future of North America's ash trees. In southeastern Lower Michigan and northern Ohio, where the EAB has been established the longest (since the 1990s), small numbers of more-or-less healthy ash have been discovered. These "lingering ash" (all green ash or white ash so far) still have

healthy crowns, even though the ash trees for miles around are dead. "Lingering ash" tend to occur in small colonies of apparently related trees that may be either genetically resistant and/or not attractive to the EAB for some reason. Some of these trees are being monitored to see if they will survive indefinitely, and cuttings for grafting and seeds are being propagated (Knight et al. 2014). So far no “lingering” black ash have been found.

If tribal staff and tribal gatherers are aware that resistant ash may be out there, they could keep an eye out for them and report ash populations that remain alive and reasonably healthy after long-term EAB infestation. These trees could provide seed that could be the basis for reintroduction and restoration of locally-adapted strains of ash to the Ceded Territories.

For more information on lingering ash, see the powerpoint presentation by Knight et al. (2011) at http://www.ucanr.edu/sites/tree_resistance_2011conference/files/121544.pdf .

Seed collection and preservation

Collecting seeds and putting them in long-term storage is one way of preserving the genetic diversity needed to recreate local populations of a plant following a catastrophic event such as the EAB. Ash seeds dried to a specific, low moisture content and stored at a constant temperature and humidity can remain viable upwards of 20 years. The GLIFWC Forest Ecologist is working with the US Forest Service North Central Research Station towards entering into a MOU for seed cleaning and storage in an existing seed bank. This effort is focused primarily on black ash because of its cultural and spiritual significance to Ojibwe communities.

ASIAN LONGHORNED BEETLE

The Asian longhorned beetle probably has an even stronger tendency than the EAB to show up in urban areas. It has repeatedly arrived in North American ports in solid wood packing material from overseas (especially China), typically ending up around manufacturing sites and in warehouses. Once established it can easily be transported in logs and firewood.

Since the first North American infestation was discovered in Brooklyn, New York in 1996, this infestation and subsequent ones in Chicago (1998), New Jersey (2002, 2004) and Toronto (2003) have been eradicated. Four other infestations, including extensive ones in suburban Massachusetts (2008) and semi-rural southern Ohio (2011) are still being eradicated. Unlike earlier infestations, these last two infestations include areas of natural forest.

In its native range the ALB attacks a wide variety of trees, including maple, horse chestnut, elm, birch, aspen and willow (USFS-UVT 2012). In North America though, the ALB has so far almost exclusively attacked any and all available maple (*Acer* spp.) trees. If the ALB ever became permanently established in North America, it would devastate the Ceded Territory’s northern hardwood forests, which are dominated by its preferred host - sugar maple.

Monitoring and Early Detection

Traps

Attempts to find and develop effective attractants to lure adult beetles to traps have so far proven elusive. Research by the USDA-APHIS to find effective pheromone attractants for the ALB continues (USDA-APHIS 2015b).

Visual surveys

Because effective traps for the ALB have not yet been developed, visual surveys are still the only effective means to detect ALB infestations. Signs of infestation include shallow cone-shaped depressions chewed into the bark where the females lay their eggs (egg deposition pits), large-diameter tunnels under the bark and through the wood, round exit holes a bit smaller than a dime, frass (chewed up sawdust-like wood) under the exit holes, in angles of the branches, or even on the ground, and dead or fallen branches. Surveyors typically walk through neighborhoods and industrial areas with binoculars and a data logger of some type, checking susceptible tree species for signs of infestation.

The large (0.75-1.5 inch long), more-or-less shiny black beetles with white markings are most active from early summer to early fall. Similar-looking beetles include the spotted pine sawyer (*Monochamus scutellatus* Say), a native wood-boring beetle that is common across the Ceded Territories (see USDA-APHIS and MDAR 2012). The spotted pine sawyer attacks dead and dying conifers, while the ALB generally only attacks deciduous species. Maple (*Acer)* species are the preferred host in North America but elm (*Ulmus* spp.), ash (*Fraxinus* spp.), birch (*Betula* spp.), willow (*Salix* spp.), aspen or poplar (*Populus* spp.) and mountain ash (*Sorbus* spp.) are also attacked, especially when maple is scarce.

What Happens When ALB is Discovered?

The ALB is so potentially destructive to North American forests that when a new infestation is found, the USDA-APHIS moves quickly to eradicate it. APHIS cooperates with state Departments of Agriculture and Natural Resources as well as local governments and volunteers to determine the extent of the infestation and quarantine infested areas. A quarantine on logs, branches and other regulated materials is established, and infested and high-risk host trees are chipped and removed. APHIS and state plant regulatory agencies currently establish quarantine boundaries of 1.5 miles from a tree with ALB exit holes, and 0.5 miles from a tree with egg deposition pits only (USDA-APHIS 2015c).

Asian longhorned beetle populations have proven much more feasible to eradicate than EAB populations. While ALB adults are capable of flying as much as 1.2 miles (2000 m) in a season, they typically fly only a few hundred feet or less, and often reproduce on the same tree that they emerged from. They are also much larger and more noticeable than EAB adults, so infestations

are usually detected sooner. Still this eradication program has cost APHIS more than $500 million, additional millions for cooperators, and has resulted in the removal of more than 120,000 trees (Campbell 2015).

The USDA-APHIS has produced a draft environmental impact statement for its Asian longhorned beetle (ALB) eradication program. See USDA-APHIS (2015c) for more information.

Quarantines

Like the EAB, the ALB is most likely to be spread to new areas in hardwood logs, firewood, or other regulated materials. Unlike EAB quarantine areas, which the USDA-APHIS and the three Ceded Territory states implement by county, quarantines implemented for the ALB are closely targeted to include the infested area plus an 0.5 or 1.5-mile buffer. An affected tribe could implement a quarantine that overlays the federal-state quarantine area. This could help to avoid confusion among tribal members and non-members alike as to where the quarantine boundaries are, and make enforcement consistent for tribal and non-tribal enforcement personnel.

OAK WILT

Background

Unlike the EAB, the federal and state governments have not implemented regulations regulating oak wilt (OW). There are no state or federal quarantines prohibiting the movement of infested oak logs, firewood, raw lumber, etc., or the fungus that causes the disease. Thus it is legal to move firewood from OW-infested areas to uninfested portions of the Ceded Territories, as long as quarantines for the EAB or other invasives don't prohibit it. While restrictions on the movement of hardwood logs, firewood and other regulated materials (aimed at slowing the spread of the EAB and more recently, thousand canker disease of walnut) might also help slow the spread of OW to some degree, they are clearly inadequate. For more on regulations pertaining to the movement of firewood within the Ojibwe Ceded Territories see Garske and Kebec (2015).

Figure 6. These pin oak trees are victims of oak wilt. September 2015, Burnett County, Wisconsin.

The oak wilt fungus (see Figure 6) spreads relatively slowly on its own, either underground through root grafts between trees, or by being carried from infested trees to uninfested, injured trees by relatively weak-flying sap beetles. As a result susceptible oak trees are often killed in expanding clusters called disease centers. Long-distance spread is due to human transport of infested logs and firewood

(generally of red and black oaks), often associated with damaging living oak trees at their destination. Oak wilt infestations (at least those of limited size, say 100 acres or less) can be eliminated by installing a root graft barrier around the perimeter of the infestation with a vibratory plow installed on a tractor or other piece of heavy equipment, and then removing and debarking or chipping the oaks (at least the red and black oaks) inside the perimeter. It is highly recommended that someone with experience in treating oak wilt help with locating the barrier. For more information see Carlson et al. (2010).

Natural overland spread of oak wilt is facilitated by several species of sap beetles. In the fall or following spring after red oaks die, the oak wilt fungus often forms spore-producing pads under the bark that split the bark open. (Though rare these pads have been found on white oaks.) The pads release a fruity odor that attracts sap beetles. The sap beetles feed on the fungus, spreading the spores to any injured oaks in the area. It is recommended that people avoid damaging oaks between the first warmup in spring, and mid-summer when sap beetle abundance drops considerably. Avoiding harvesting or damaging oaks from April 1 through August 1 should be adequate to prevent sap beetles from spreading oak wilt.

Oak wilt is potentially very controllable, provided people are aware of the symptoms of this disease, and do not move infested oak logs or firewood to uninfested areas.

Oak Wilt in the Ceded Territories

Oak wilt is still uncommon and localized in the Ceded Territories. If oak wilt is found on lands open to tribal gathering, tribes would have the opportunity to establish tribal quarantines to limit the spread of this disease. In order to be effective quarantines would need to be implemented in conjunction with an education campaign on the threat of oak wilt to oak in the Ceded Territories, and the steps tribal members can take to avoid spreading this disease. Avoiding moving firewood long distances is the most effective step people can take to keep from spreading this disease.

BALSAM AND HEMLOCK WOOLLY ADELGIDS

Background

The balsam woolly adelgid (BWA) and hemlock woolly adelgid (HWA) are both relatives of aphids or “plant lice”. The BWA was introduced to Maine in the late 1800s, on nursery stock from Europe. It feeds on the starch reserves of true fir trees including balsam fir. It is established in the northeastern US and adjacent southeastern Canada, and in the Pacific Northwest. It has not yet been found in the Ojibwe Ceded Territories.

The hemlock woolly adelgid (in a broad sense) is native to the northern Rockies and the Pacific Northwest, as well as mainland China, Taiwan, and Japan. These populations are genetically unique, consisting of one or more distinct genetic strains or “lineages” (Havill et al. 2006). The HWA is also found in eastern North America, from northern Georgia to southern Maine, and

west to the Ohio border. This eastern North American population spread from a population discovered in a Richmond, VA park in 1951. It consists of a single lineage that is genetically identical to a lineage from southern Japan, indicating that it was introduced from there (Havill et al. 2006; Havill et al. 2014). Both the BWA and the introduced, eastern HWA lineage are decimating their host tree populations in their introduced ranges.

Since 2006 HWA populations have been discovered at about 8 sites in 6 different counties in Lower Michigan. All of these infestations originated from shipments of infested hemlock trees from nurseries out east, in violation of Michigan's external quarantine law. When an HWA infestation is found in Michigan, the Michigan Department of Agriculture and Rural Development (MDARD) requires the removal and destruction of the infested trees, treats hemlocks in close proximity to those infested trees with insecticides, and conducts follow-up surveys. While most of these infestations are now believed to be eradicated, two new sites were found in west central Lower Michigan in 2015 (MDARD 2015). Both these sites (in northeast Ottawa and southeast Muskegon Counties) are within the 1836 Ceded Territories and both include natural forest. Meanwhile the HWA continues to expand its introduced range north and west towards the Ceded Territories, at about 12.5 miles per year on average (USDA Forest Service 2013).

Detection

While there have been some attempts to detect the BWA and the HWA using aerial surveys, the only reliable method of detecting these insects is by individuals finding them on trees. As with the EAB and the ALB, it is important that tribal wardens, natural resource staff, and gatherers are aware of these beings and be able to recognize the signs and symptoms of infestation if they come across them. Balsam bough gatherers may well be on the front lines when it comes to detecting the BWA in the Ceded Territories.

As with firewood or other gathering sites for tree resources, areas that are commonly used to gather balsam boughs could be monitored periodically (such as once a year) for signs of BWA.

Biological control

Recently the focus has been on introducing biocontrol insects to reduce populations of the HWA enough so that hemlock will remain reasonably healthy. Insects introduced to the eastern US so far include *Laricobius nigrinus* , an HWA predator beetle native to the Pacific Northwest, and a close relative (*L. osakensis*) from Japan (Mausel et al. 2010). Several other introduced insects and fungal pathogens from western North America and from eastern Asia have also been tested by the USDA-APHIS and are being released, with varying success at controlling HWA. After years of rearing and introducing these biocontrol organisms, they now appear to be reducing HWA levels significantly in some areas.

In contrast to the increasingly successful effort to find effective biocontrols for the HWA, attempts to find effective biocontrols for the BWA have largely failed. Starting in the 1950s more than 20 biocontrol insects have been introduced to North America, but only 6 are known to have

become established and none have significantly impacted BWA populations (CABI 2015).

The USDA-Forest Service maintains a website with up-to-date information on the HWA and efforts to control it at http://na.fs.fed.us/fhp/hwa/ .

What happens if the BWA or HWA are discovered?

Michigan has implemented an external quarantine for both the BWA and HWA (see Garske and Kebec 2015 for details). If a population of the BWA were found in Michigan, the MI DARD would undoubtedly react quickly, as they have when HWA populations have been found in Lower Michigan. The state has the authority to treat or destroy infested trees even on private land. If they cannot find the target insect on the trees however, they are only allowed to treat (with herbicide, generally) the trees. The state of Wisconsin has prohibited the HWA and HWA-infested materials, and would presumably take similar action. Hemlock is rare and local in Minnesota, reaching the western edge of its range in the northeast portion of the state. Neither Wisconsin nor Minnesota has implemented regulations pertaining to the BWA, so it is unclear what actions they would take.

If the BWA or the HWA ever become permanently established within Ceded Territories (and chances are that they will eventually) the tribes could establish quarantine areas and amend various tribal laws to prohibit the movement of balsam fir or hemlock (as appropriate) materials from infested areas within the Ceded Territories to uninfested areas. As with the EAB, movement of boughs and other regulated materials onto tribal lands could be prohibited.

The best time to look for HWA infestations is from late October through mid-July, when the insects are growing and maturing, and have the fresh, waxy coatings that make them look like tiny cotton balls. The US Forest Service FHTET (Costa and Onken 2006) has produced a very helpful guide on how to detect and monitor HWA populations, available at http://na.fs.fed.us/fhp/hwa/pubs/proceedings/2006/fhtet_2006.pdf . These methods should work well for surveying for BWA also. It would be helpful to keep in mind though, that while the survey protocols in this guide are geared towards detecting HWA in natural forests, at this point the HWA is most likely to show up in the Ceded Territories in housing developments or other “suburban” settings.

APPENDIX - EXISTING RESPONSE FRAMEWORK FOR EAB

When a specimen of EAB or another serious forest invasive, or an unknown insect or other organism is collected and submitted to a state agency, State Plant Health Director (SPHD) or APHIS representative, the specimen is forwarded to the USDA-APHIS lab in Romulus, Michigan, where its identity is verified by a designated USDA-APHIS entomologist. It is then forwarded to an USDA Agricultural Research Service (ARS) Systemic Entomology Lab (SEL) for final confirmation. (See http://www.ars.usda.gov/main/site_main.htm?modecode=80-42-05-80 for more on the SEL).

If a new EAB or other infestation of an introduced forest invasive is confirmed, notification is sent to the Domestic Diagnostics Coordinator with USDA-APHIS-PPQ National Identification Service (NIS) (USDA-APHIS 2015a). The NIS then notifies Emergency and Domestic Programs staff, who in turn notify the respective State Plant Regulatory Official (SPRO) and SPHD, tribal governments, and other involved parties. This whole process can take as little as a week (Cruse and Kuhn 2015).

If the invasive was previously unknown in the US, the New Pest Advisory Group (NPAG) of APHIS meets to determine if it is of significance and requires action (Cruse and Kuhn 2015). If it is not considered a significant threat, a decision to take further action is left to the state or tribe.

The lead federal agency responsible for responding to EAB infestations is the USDA-APHIS, Plant Protection and Quarantine (PPQ), with the USDA-Forest Service (USFS) also participating (Rabaglia and Chaloux 2011). The USDA-APHIS-PPQ works with state departments of agriculture to survey for EAB, establish and implement the regulatory framework, and provide technical assistance. APHIS also provides funds to states to support regulatory, response and outreach activities. The USFS provides technical and financial assistance that support ongoing activities in ash utilization, biological research, monitoring, communication and outreach, and management actions in affected areas. The goal is to limit the spread of EAB through surveys, regulatory actions, and containment procedures.

The USDA-APHIS meets with the affected state decide whether they or APHIS will make the first public announcement of the new find (USDA-APHIS 2015a). This meeting includes the National Policy Manager, National Operations Manager, and the SPHD and SPRO in the affected state to determine who will provide first notice and to discuss the timing of the notices. Suspect invasive species are sent to USDA-APHIS for confirmation. Upon confirmation, APHIS notifies the State Plant Health Director and State Entomologist. As sovereign governments, the tribes are considered partners to the state and notified before local units of government (Norwood 2013).

State notification structure: In Wisconsin the state's Department of Agriculture and Consumer Protection (WI DATCP) is notified. The WI DATCP notifies the Wisconsin Department of Natural Resources (WI DNR) and the UW-Extension by phone, with a possible follow-up by email (Wisconsin EAB Operations Group 2015). Within 1-2 days WI DATCP (currently Brian Kuhn) notifies the EAB working groups (Advisory, Operations, Science, and Communication). WI DATCP also notifies the County Executive/County Board Chair and the County Conservationist of the county where the infestation was found, along with officials of any additional counties that will be quarantined as a result of the new detection. The WI DNR notifies local chief elected official and local forestry contacts, and any affected landowners.

Minnesota's draft response plan for responding to EAB finds in new counties involves the implementation of an Incident Command System (ICS). In Minnesota the Department of Agriculture (MNDA) is the first state agency to be notified. The MNDA notifies the Minnesota DNR of all confirmations and any state, county, municipal or private landowner affected by the new find. Reports of suspect invasive species from state, county, municipal or private entities are funneled through established lines of communication to the MNDA.

On non-tribal and non-National Forest land, the state Unified Command (UC) is comprised of a representative from the MNDA, MN DNR, and the USDA-APHIS-PPQ. On tribal or National Forest land, the UC is comprised of a representative from the tribe or US Forest Service, plus the MNDA, MN DNR and PPQ. Once affected landowners have been notified, MNDA submits a public news release.

After the above process plays out, new finds are announced via GovDelivery, followed by a press advisory. The first finds in additional municipalities in an already-quarantined county will be announced bi-weekly or as needed, in a GovDelivery summary only. Anyone interested in being notified of new EAB finds in Wisconsin can sign up to the automated distribution list, at http://datcp.wi.gov/Gov_Delivery/EAB/index.aspx.

Response units: In Wisconsin an Advisory Group has been assembled, consisting of the USDA-APHIS, the USFS, and the state DNR, DATCP and University of Wisconsin Extension (WI DATCP and WI DNR 2014). This group is charged with advising the Governor and senior management of state agencies. The Advisory Group also acts as liaison to other groups (including tribes), develops and updates strategic programs and response plans for EAB, and sponsors the Outreach and Communications, Science Panel, and the EAB Operations Group. The EAB Operations Group in turn is responsible for organizing a local response unit, which would coordinate the local response to infestations in the geographic area determined to be practical for the response (Norwood 2013). This local response unit would ideally include staff to conduct EAB surveys, implement quarantines and/or other regulatory measures, and conduct outreach and education activities. If the infestation were on or near tribal land, a BIA forester (Eric Oliphant in northern Wisconsin) would also be included. If the EAB find is limited to a small enough area on the Reservation, the local response unit might consist entirely of tribal or BIA staff (Norwood 2013), subject to approval by the tribe's Tribal Council.

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