



CITY OF CONCORD

REPORT TO THE MAYOR AND CITY COUNCIL

FROM: Beth Fenstermacher, Senior Planner
David Gill, Parks & Recreation Director
Chip Chesley, General Services Director

DATE: April 4, 2016

SUBJECT: Impact of invasive insect species within the City of Concord

Background

Recently, the Concord area has been subject to invasive insect species that will have a major impact on the tree populations within the City. The species include the **Emerald Ash Borer**, **Hemlock Woolly Adelgid**, and the **Red Pine Scale**. All three species are fatal to the infected trees though it may take several years for the trees to succumb after the initial infestation. Based on these three species it is estimated that approximately 20% of the trees on City owned parks, and cemeteries will succumb to invasive insects in the next 5 years. This 20% is in addition to normal loss of trees due to natural tree decline and weather related damages. All ash trees within the City will succumb to EAB by 2020-2023. Because of this it is imperative that the City establish a framework for invasive insect species management to detect, contain, and mitigate the impacts.

Of the three, the Woolly Adelgid is the most treatable, mainly by “painting” the tree trunks with an insecticide. The Emerald Ash Borer can also be treated by an insecticide, but involves an injection system which can be expensive over time and is usually focused on trees of historic significance or where the cost of removal outweighs the cost of treatment. Some predators of the Emerald Ash Borer have recently been released in the Concord area by the New Hampshire Division of Forests and Lands Forest Health Program, but it is too early to assess any results. There are no recommended treatments for trees infested with the Red Pine Scale, though small ornamental shrubs could be treated with certain pesticides. Harvesting infected trees during winter months will prevent spread of the scale.

The Emerald Ash borer was discovered in Concord in 2013 and early hopes that it was a very limited infestation proved to be short-lived. Subsequent investigations found infestations throughout Concord and several surrounding Towns. Merrimack County is an Emerald Ash Borer Quarantine Zone. In collaboration with the State of NH, the City’s General Services Department treated Emerald Ash Borer infested trees at Thompson Park, White Park, McKee Square and the Arena by injecting to slow the impacts of the infestation. However, the City

recognizes that this treatment will only prolong the inevitable loss of these trees. Infested trees were removed from the Winant Park parking lot due to the potential hazard to park users; however, additional infested trees remain within the park.

A small infestation of Woolly Adelgid was found on the Penacook Lake watershed along District 5 Road in 2014. The Division of Forests and Lands Forest Health Program personnel treated the site but some Adelgid was again found there in 2015. The State will look at the site in the Spring of 2016, but numerous infestations recently found in Merrimack County indicates that the pest has apparently become established in central New Hampshire.

In 2015, it became apparent that many of the Red pines along Interstate 93 and the red pine plantation at Rollins Park were infested with the Red Pine Scale. Unfortunately, many of the red pines in the Concord area are found in groups that were planted for either aesthetic or reforestation purposes and the red pine scale spreads very rapidly in such situations. The Parks and Recreation Department plan to address the infestation at Rollins Park is to remove the over 200 infected trees and replace with a diversified selection of species.

In response to the infestation and future impacts to the landscape of Concord, in January 2016 several City Departments, including General Services, Parks and Recreation, and Community Development met to address the infected tree issues within the City and develop a response.

Discussion

Hemlock Woolly Adelgid

This small, wingless, sap-sucking insect attaches itself to the base of the hemlock needles and sucks out the nutrients carried in the water/sap as part of the tree's evapotranspiration process. A heavy infestation will eventually defoliate the tree which stops the photosynthesis process and kills the tree. In the past, frigid winter weather had kept the Adelgid from moving into New Hampshire, but warmer winters due to climate change have allowed the Adelgid to move north and it has become established in southern New Hampshire.

Hemlock is considered a low value timber species in today's markets and has been for quite some time. However, hemlock has tremendous value as winter shelter for a variety of wildlife species including deer, rabbit, ruffed grouse, turkey and smaller songbirds. According to a report from the City Forester (see attached report), there are many Stands of hemlock found throughout the City Forests, though the pure Stands tend to be located on wetter sites or on the northern aspect of steep hillsides. Hemlock Stands found on drier sites are typically managed for wildlife habitat and wet sites are avoided in harvest operations on City land to protect the watersheds. Therefore, as a result, the loss of hemlocks due to the Woolly Adelgid will have a minor economic impact to the City Forest program, but will have a major impact to wildlife habitat.

Emerald Ash Borer

The Emerald Ash Borer (EAB) lays its eggs in the bark of the three ash species (White, Green and Black) found in the Concord area. As the eggs hatch, the larvae eat the cambium layer just under the bark and eventually girdle the tree preventing the passage of nutrients. The NH Department of Agriculture has identified the EAB as the most destructive forest pest in North America, and infestations can kill ash trees in just 3 to 5 years. The City of Concord is included in the Quarantine imposed by the State which states that no hardwood firewood, ash nursery stock and ash wood products may leave Merrimack County.



Of the three species, white ash timber is the most valuable and is considered medium to high in value. It is mainly found on damp sites and in drainages. White ash makes up a very small component of the City Forests and is often associated with riparian zones where harvesting is restricted, though scattered stems can be found on upland areas. Unfortunately, white ash has been planted throughout the City proper for ornamentals and shade trees. Green ash is limited to the floodplain along the Merrimack River and is part of a floodplain forest ecosystem that also contains silver maple and American elm, though most of the elm has since died off from the Dutch elm disease. The City owns several tracts along the Merrimack River that contain green ash, though the stocking levels of the ash vary greatly. Lastly, black ash is fairly rare in the City and limited to bog-like ecosystems. Because black ash is found in bogs and seldom grows to sawlog size, it is not considered a timber species.

Whereas white ash tends to like wetter sites or is found along streams and wetlands, very little has been harvested on City Forests in order to protect the riparian zones. But since the discovery of the Emerald Ash Borer, white ash has been marked to be harvested as part of the more recent City Forest timber sales as long as their removal does not negatively impact wetlands. To date, harvested white ash volumes have been quite minimal due to the low overall stocking in the uplands on City Forests. Heavy stockings of green and white ash can be found in Healy Park and Terrill Park. The other parks and City Forests along the Merrimack River contain both white ash and green ash, but not in significant quantities.

The Division of Forests and Lands Forest Health Program has set up an EAB infestation study site at Terrill Park. They have created an entrapment site in an un-used part of the Park and have treated ash trees in the more developed portions with an insecticide. Program Administrator Kyle Lombard has requested that the ash trees be left alone in the Park unless they become hazardous. The Program has also released insect predators of the Emerald ash borer in the Concord area. It is too early in that study to assess the results, however, the intent of the predator release is to build up the parasitoid population enough to slow the spread of the ash borers to outlying Towns, not to stop the outbreak in Concord.

Red Pine Scale

This insect attacks the tree in a manner similar to the Woolly Adelgid, but then allows another insect, the turpentine beetle, to infest the weakened tree and bore into the tree trunk causing staining of the wood, making it worthless for sawtimber. Although red pine is native to the area, it was a relatively minor species and typically quite scattered throughout the County. Red pine plantations were planted as a substitute for White Pine, which was susceptible to the white pine blister rust fungus and the white pine weevil. Unfortunately, it was eventually discovered that the *fomes annosus* fungus infected red pines. The plantation scenario provided ideal conditions for the spread of the disease and many red pine plantations became infested after they were thinned. Eventually, planting red pine was discontinued or limited to aesthetic uses such as ornamentals or for buffer zones.

There were several red pine plantations on the City-owned lands but until the mid to late 1980's there was not much of a market for small diameter red pine stems. As a result, the plantations were not thinned and tended to be heavily overstocked. The Red Pine plantation behind the Waste Water Treatment Plant on Hall Street was thinned in 2006 when it was noticed that it had become infected with the *fomes annosus* fungus, and eventually clear-cut in 2015 when it was discovered to be infested with the *fomes annosus* fungus and Red Pine Scale. A plantation located off Hutchins Street in Penacook was thinned in 2010 and is so far disease free, but is being monitored and will be clear-cut if and when it becomes infected.

It was discovered in the summer of 2015 that a red pine plantation located on the tract of land north of West Locke Road recently acquired from UNITIL in a land swap was heavily infected with the red pine scale and had already suffered some mortality. The remaining red pines were harvested in conjunction with an adjacent agricultural field improvement operation. Whereas red pine is considered a low to medium valued species and is now limited to the plantation on Hutchins Street, the loss of the species will have a very minor impact to the City Forest program. However, it will have a major impact to the ornamentals planted within the City's parks and along local roads and highways.

The clear-cut approach is currently being employed by the State and other municipalities in NH. Most notably, approximately 225 acres of red pine were harvested from Bear Brook State Park from 2013-2015. In addition, the City of Manchester Water Works plans to cut 400 acres of impacted Red pine timber in the Massabesic Watershed over the next four years.

Public Outreach and Education

According to the US Forest Service, regulatory measures coupled with robust outreach and public education activities are the most effective tools currently available for early detection and to prevent human assisted movement of invasive insects. In addition, education is important to help Concord residents understand how and why the landscape of Concord will drastically change in the near future. Further, the issue of infestation is not confined to City-owned land, and it is

important for residents to understand their responsibility for addressing infested trees on their private property.

The outreach can be accomplished through the distribution of fact sheets (see attached for examples), public information sessions, and graphic visualizations of the anticipated change in the landscape. The City should work closely with the Concord Monitor to develop periodic news releases and updates. Additionally, the City should work with local, state and Federal agencies for advice and assistance.

Residents concerned about insect infestations on their private property should contact the UNH Cooperative Extension Forestry and Wildlife: <http://extension.unh.edu/Natural-Resources/Forests-Trees>, or contact the Merrimack County representative Tim Fleury at 603-796-2151, tim.fleury@unh.edu. **UNH Extension is scheduled to provide a Community Workshop about Emerald Ash Borer in on May 4, 2016, at 6pm at the Heights Community Center (former Dame School).**



Red Pine Scale infested trees



EAB infested tree



EAB infested tree

Recommendations

We recommend that Council direct City staff to develop a framework for invasive insect species management within the City. This framework is based on the U.S. Forest Service national strategic framework.

1. Prevention and Detection

Organize and implement public outreach program, collaborating with state and federal agencies. This program should also include education for private property owners. While only the three infestations identified in this report have been found in Concord, there are

other insects found in New England, including the Asian Longhorned Beetle, which could potential move into Concord. It is best to educate the public about these threats to prevent the spread of these devastating infestations.

2. Control and Management

Implement response for new infestations to rapidly suppress invasive insect species populations and minimize the impacts. Develop tools, methods and budgetary process to prioritize and implement effective invasive insect species management and eradication.

3. Restore and Rehabilitate Infested Areas

Develop a budget to replace the urban trees that are affected and will eventually have to be removed. Proper species selection and diversification is important to the health of these areas in the future. Maintaining the health and diversity of plantings provides greater resilience to future insect and disease infestations.



Before: Ashes along D'Amante Dr.



After: D'Amante Dr. if ashes are lost to EAB without a restoration plan in place

In addition, we recommend that City Council support the plan to restore and rehabilitate the Red Pine Scale infested plantation at Rollins Park. This plan will include a public meeting, educational materials notification and graphics to help visualize the new landscape. The scope of the project is to remove more than 200 Red Pines. The area will be re-vegetated with a diverse species of trees and groundcover to create passive park land.

In addition, we recommend that the City Council support an injection program for Ash trees that have been treated by the State in the summer of 2015 as a test program.

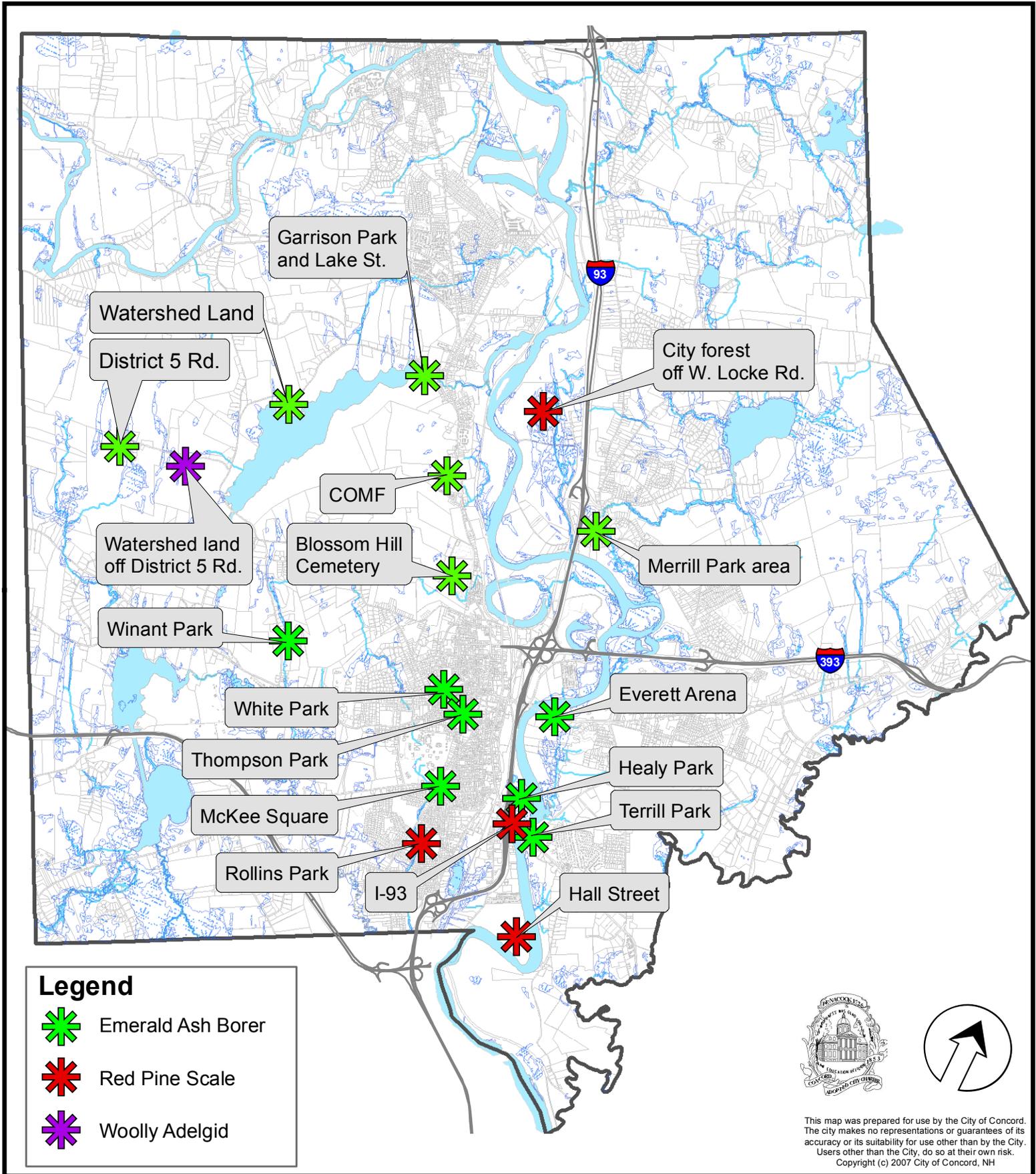
ATTACHMENTS

*Report from City Forester
City Map*

*Report from Tree Supervisor
Rollins Park Map*

Fact Sheets

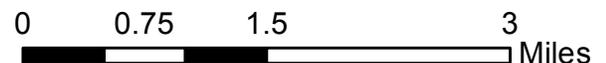
Known Invasive Insect Infestations on City-owned Land*



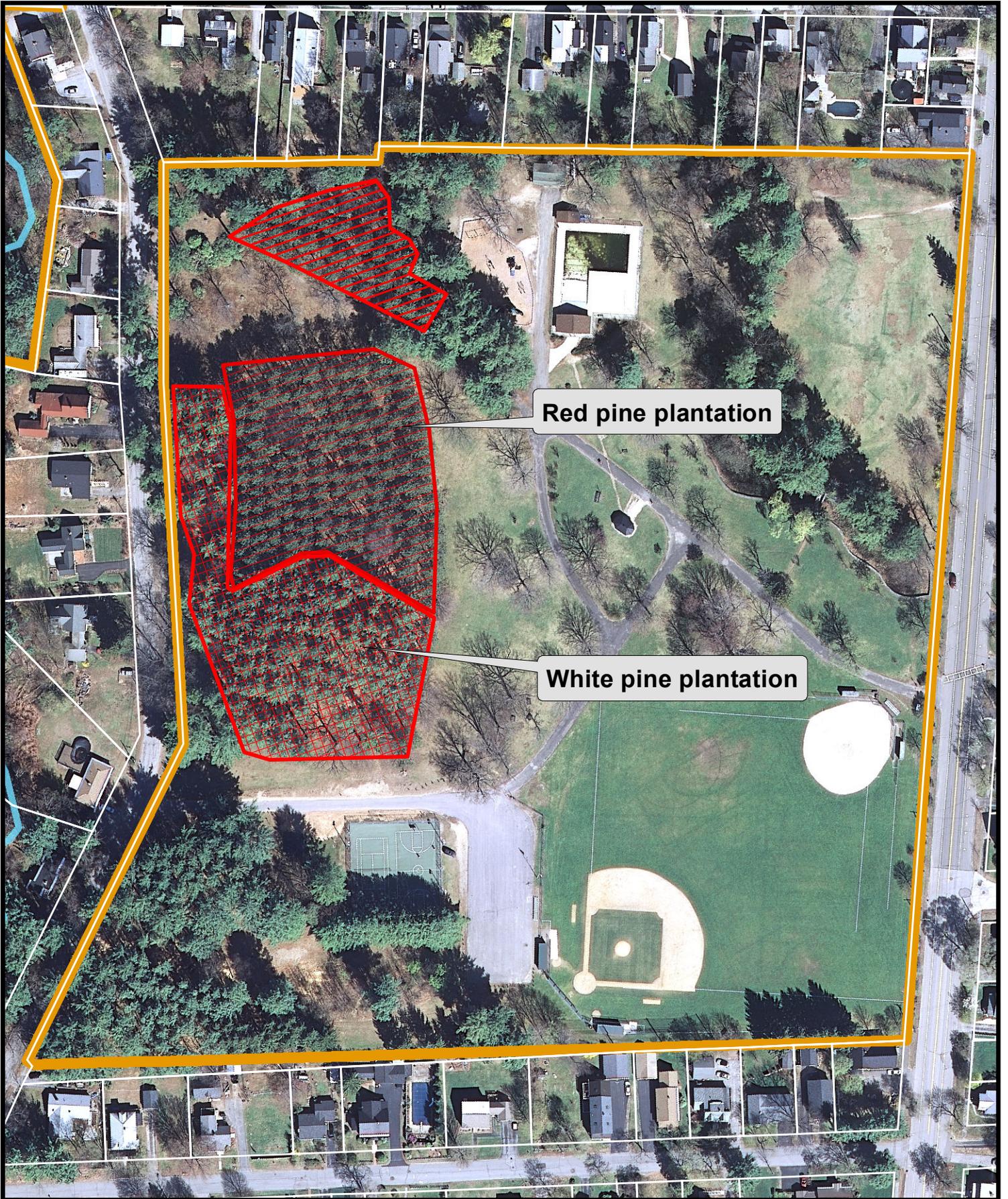
This map was prepared for use by the City of Concord. The city makes no representations or guarantees of its accuracy or its suitability for use other than by the City. Users other than the City, do so at their own risk. Copyright (c) 2007 City of Concord, NH

* The purposed of this map is depict known infestations on City-owned land only, and does not depict infestations on private properties.

Date: 3/15/2016



Rollins Park



Red pine plantation

White pine plantation



PEST ALERT



State of New Hampshire
Department of Resources and Economic Development
Division of Forests and Lands
Forest Protection Bureau—Forest Health Section

HEMLOCK WOOLLY ADELGID
Adelges tsugae

The hemlock woolly adelgid (HWA) is a small aphid-like insect that feeds on hemlock (*Tsuga* spp.). This insect was introduced to Virginia in the early 1950's from Japan and has since spread north to Maine and south to Georgia. Left untreated HWA can kill trees in the northeast within 10 years. Trees weakened by HWA often succumb to other diseases and woodboring insects such as hemlock borer.

Description: This insect can be recognized by the presence of a dry, white woolly substance on the young twigs of hemlock. This "wool" can generally be found year round, but it is most abundant and conspicuous in the spring when egg masses are present. The wool covers the insect in all but its earliest life stages. As they feed their woolly covering expands—the "wool" is a waxy material that comes out of pores on the insect's body.



Life Cycle: Hemlock woolly adelgid completes two overlapping generations a year. During March and April, adults of the overwintering generation each lay up to 300 eggs within their woolly covering. Crawlers hatch from April through May, and then settle on the twigs near the bases of the needles where they insert their piercing and sucking mouthparts. There they feed throughout their development. This spring generation matures by the middle of June, and deposit an average of 75 eggs each. The crawlers hatch in early July and settle on the new growth. They are generally settled and dormant by the beginning of August. In mid October feeding resumes and the characteristic woolly covering begins to develop. Nymphs feed during the winter and mature by spring.

Cultural Control: Because birds, squirrels and deer are important dispersal agents, any effort to discourage these animals from visiting hemlocks—such as removing bird feeders in the spring and summer—will reduce the risk of those trees becoming infested. Care should also

be taken when moving any material from infested areas onto uninfested property. Plan any hemlock cutting in and around infested areas for August through February to limit risk of spreading this insect.

Maintaining good growing conditions can play an important role in the survival of hemlock. Because hemlock is often shallow rooted, it is particularly prone to stress in dry periods. Therefore, during periods of drought, important ornamental hemlocks should be watered to ensure that they receive 1 inch of water per week (including rainfall) over the area beneath the dripline of the crown. Apply water slowly to allow uptake by the tree. Pruning and reducing crowding of target trees may encourage new shoot growth and help support vigor. Although fertilizer may improve the growth and vigor of uninfested trees, the added nitrogen also enhances adelgid survival and reproduction—*do not fertilize hemlocks in or near adelgid infested areas.*

Chemical Control: Chemical control is an important part of managing the health of HWA infested ornamental hemlocks. It is important to understand that periodic treatments will be necessary over the life of the infested tree to maintain its health and value as an ornamental. The initial decision of whether to use chemicals should weigh the value of the trees relative to the anticipated cost of long term treatments. Consider identifying individual trees or groups of trees that have special value or significance on the property and concentrating control efforts on those trees. Several pesticides are registered for control of HWA. Some are available for homeowner use, while others are available for commercial use only by a licensed pesticide applicator. Systemic insecticides with the active ingredient imidacloprid can be applied as a soil drench or soil injection. Research from the Connecticut Agricultural Experiment Station demonstrates that the lowest labeled rate is effective on trees up to two feet in diameter at breast height; larger trees require the higher labeled rates. Systemic insecticides with the active ingredient dinotefuran can be applied as a spray on the stem. Horticultural oils can also be sprayed on the foliage but complete coverage can be difficult and it may also kill natural predators leading to outbreaks of spruce spider mites.

Caution: For your own protection and that of the environment, apply pesticides only in strict accordance with laws, labels and precautions. Special care should be taken near water when using these pesticides.

Quarantine: This insect is subject to quarantine and movement of hemlock material is restricted. Details are available online: <http://nhdfi.org/forest-health/hemlock-woolly-adelgid.aspx>

Signs and Symptoms of the Emerald Ash Borer

Mary Wilson, MSU Extension. Eric Rebek, Michigan State University Dept. of Entomology

Adult



Michigan State University



Michigan State University

- Bright, metallic green (Figs. A, B).
- 1/2 inch long, flattened back (Figs. A, B).
- Purple abdominal segments beneath wing covers.

Larva



D. Cappaert, MSU

- Creamy white, legless (Fig. C).
- Flattened, bell-shaped body segments (Fig. C).
- Terminal segment bears a pair of small appendages.

Canopy Dieback



E. Rebek, MSU



E. Rebek, MSU

- Begins in top one-third of canopy (Fig. D).
- Progresses until tree is bare (Fig. E).

Epicormic Shoots



J. Smith, USDA APHIS PPQ



J. Smith, USDA APHIS PPQ

- Sprouts grow from roots and trunk (Figs. F, G).
- Leaves often larger than normal.



MICHIGAN STATE UNIVERSITY EXTENSION



Bark Splitting



J. Smith, USDA APHIS PPQ



A. Storer, Mich. Tech. Univ.

- Vertical fissures on bark (Fig. H) due to callous tissue formation (Fig. I).
- Galleries exposed under bark split.

Serpentine Galleries and D-shaped Exit Holes



D. Cappaert, MSU



D. Cappaert, MSU

- Larval feeding galleries typically serpentine (Fig. J).
- Galleries weave back and forth across the wood grain.
- Packed with frass (mix of sawdust and excrement).
- Adults form D-shaped holes upon emergence (Fig. K).

Increased Woodpecker Activity/Damage



D. Cappaert, MSU



Karen D'Angelo, MSUE

- Several woodpecker species (Fig. L) feed on EAB larvae/pupae.
- Peck outer bark while foraging (Fig. M).
- Create large holes when extracting insects (Fig. M).



PEST ALERT

State of New Hampshire
Department of Resources and Economic Development
Division of Forests and Lands
Forest Protection Bureau—Forest Health Section

Red Pine Scale

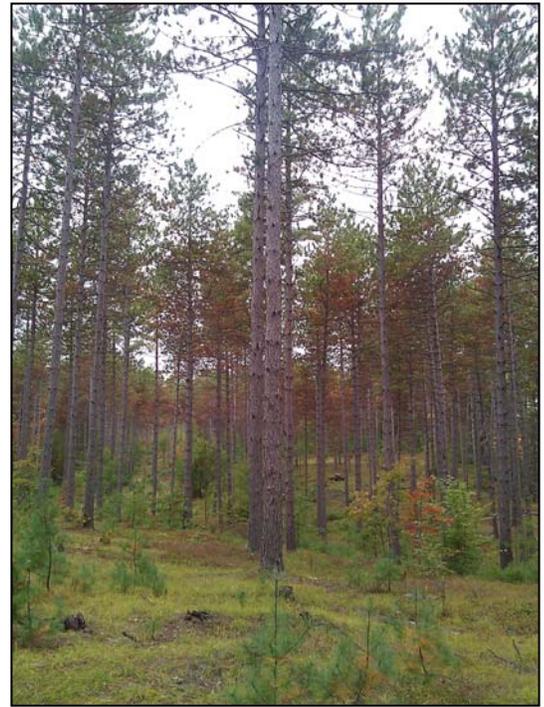
Matsucoccus resinosae

Host: Red Pine (*Pinus resinosa*) in the US

Distribution: Throughout southern New England, New York, New Jersey and eastern Pennsylvania. First reported in Connecticut in 1946 and New Hampshire in 2012. Most likely it was introduced to the US on exotic pines planted at the NY World's Fair in 1939.

Identifying symptoms: Foliage color changes slowly from light green to yellow to red appearing first on individual branches on the lower part of the crown then gradually over the entire crown. Masses of cottony white filaments become visible on the branches when infestations are heavy. Weakend trees may also be attacked by bark beetles causing rapid tree mortality.

Life History: The red pine scale has two generations per year. Adult females are brownish red and wingless. Preadult males resemble females but are smaller and soon after emergence become true winged adults inside a waxy cocoon. Although adult males are winged they do not fly. The summer generation lay their eggs in early spring and these mature in early August to lay the Fall generation. First stage larvae resemble adult females but are smaller and transform into an intermediate legless stage. The fall generation overwinters as first stage crawlers under bark scales and become adults the following Spring.



Symptomatic pines at Bear Brook State Park

Control: Several species of native predators attack red pine scale but are not abundant enough for effective control. Trials in Connecticut of introduced predators have also been ineffective. There are no effective chemical controls for plantations. Maintaining tree vigor may aid in slowing tree mortality and attack by bark beetles but avoid fertilizing as this only favors the scale. Harvesting during winter months will prevent spread of the scale.



Intermediate stage nymphs

Other Notable Pests: There are two other known piercing and sucking insects on red pine in the northeast. Both are adelgids and one is exotic and believed to have arrived with the red pine scale. *Pineus coloradensis* is native and feeds on the needles. *Pineus boernerii* is exotic and feeds on the needles as well as the branches and may be confused with the red pine scale. Damage has not been noted by either of these insects.

CITY OF CONCORD

GENERAL SERVICES

Urban Canopy Health Observations and Recommendations 2015-2016

Ryan Rambeau, ISA certified arborist NE-6760A

Tree Supervisor, Highways and Utilities Division

February 2016

City of Concord, NH. Urban canopy health observations and recommendations 2015-2016

Introduction on the Effects of the Invasive Insect Species on the Urban Canopy

Over the past few years my crew and I have encountered a lot of trees that have been affected by invasive insects and noticed that they are taking their toll on the urban tree canopy. There are a lot of trees that are on private property that we have noticed as well and at this point they don't impact the right of way or City property but eventually they will, therefore it's important to educate the public as a whole so that they can start taking steps themselves to try and prevent any hazards to the Right of Way and City owned property such as Parks and Cemeteries.

Observations on Emerald Ash Borer (EAB)

EAB is present in most of the Parks and Cemeteries the city owns. Known infestations are; Garrison, Merrill, Kiwanis, Whites, Thompson, McKee Square, Terrill Park, Blossom Hill and Horsehill Cemetery. At this point in time one can assume that all ash trees (public and private) within the South End are being affected by EAB. EAB has also been established in East Concord as far as Hot Hole pond. The beetle has also moved on larger private landscape properties that abut the roadway. One large example is all ash trees bordering D'mante Dr. These properties include, Home Depot, Shaw's and all of the malls landscaping. There are numerous other private and public landscapes that are being attacked as well. It is important to not only look at large scale loss but also loss on a smaller scale. The significance of one or two may not seem noteworthy, but if you add up these losses in an overall area they begin to add up quickly. Much of the beetle's mobility comes from human aid via firewood, chips and lumber. Although the beetle does have flight capabilities of up to 2-4 miles, with pregnant females flying the longest distance.

What to expect from EAB:

Based on information gathered from its initial USA finding (Southeast Michigan) one can assume within 10 years 99% of ash trees over 1inch in diameter will be dead. Since EAB was found in Concord (more likely here 3-8 years earlier) in 2013, one can assume 90% or higher mortality by 2020-2023. Mortality could be delayed as remote ash trees would generally be attacked after larger stands were exhausted. Attacks on these remote trees would inevitably extend EAB's range throughout Concord.

Expect faster loss of EAB affected trees as USDA projected mortality is based on a completely dead state. Trees owned in fee that are abutting private/public properties will need to be removed before they get to a completely dead state, I.E before they become a hazard. Trees not owned in fee within the right of way will also need to be addressed before they become a public hazard. At this point in time if a tree shows signs of EAB, it should be removed.

Management recommendations:

City of Concord, NH. Urban canopy health observations and recommendations 2015-2016

There is a chemical control that can be injected into the base of ash trees to try and slow down mortality. The pesticide that is injected into the base of the trees is Emamectin benzoate. The State had a program that the City took advantage of and injected all ash trees within Thompson Play lot, all ash trees abutting Loudon Rd at the Arena, selected ash trees within White's Park, selected ash trees within McKee's Square. All of the above locations showed various signs of EAB. All these trees will need another round of injections in the spring of fiscal year 2018. I am recommending further injections be funded for all of the above locations at an approximate cost of \$3,200.

Biological control for this 10 year time frame should not be relied on too heavily. Treated trees are "safe" for approximately 3 years after injection. I do have concerns about repeated injections girdling the trunk of the tree over time. All other sites should be prepared for replacement with suitable species. It will also be important to educate the public of what is going on around them and offer help to where they can get further guidance and information. Owners of trees that pose a threat to the traveling public outside the right of way should be put on notice. Commercial properties should be monitored for green space mortality as they may no longer meet the planting requirements' established during initial construction.

Observations of Red pine needle scale:

As already stated by Mr. Ronald Klemarczyk, City Forester, much of our red pine is located within stand type locations. Much like EAB we need to look at this scale not just at a large scale outbreak but also on individual trees within the landscape. Much of its movement can be projected from prevailing winds between the months of May-Oct. Other forms of movement include animals, humans, nursery stock and lumber.

I am seeing unconfirmed signs throughout Concord. Many of these trees are not within the public right of way but most likely will pose a threat to the traveling public in the next 2-3 years. We are currently removing declining red pines abutting the access road into the well fields/ shooting range off Pembroke Rd after multiple problems with accessibility to both facilities. The presence of the scale has not been confirmed for the decline.

What to expect from Red pine needle scale:

We will most likely be able to handle small scale outbreaks within city owned parcels and deeded right of ways. Larger scale outbreaks will need to be handled with outside vendors. Larger parcels I see becoming a viable issue are; Rollins Park, red pines abutting roadway on city parcel off Pembroke Rd, Pembroke, red pines abutting Little Pond Rd. near Walker State Forest ,city owned parcel abutting Woodlawn Cemetery and mixed stand abutting Lakeview near the water pipe line from the Contoocook River crossing into watershed. There will also be numerous private trees that will become a problem.

Management recommendations:

City of Concord, NH. Urban canopy health observations and recommendations 2015-2016

Non stand red pines showing signs should be removed. Owners of trees that pose a threat to the traveling public outside the right of way should be put on notice. Commercial properties should be monitored for green space mortality as they may no longer meet the planting requirements' established during initial construction.

Future pests being monitored:

Southern pine bark beetle:

The State of NH has begun setting traps for this more southern known pest. The pest has the ability to attack multiple pine species but most notability attacks pitch pines. Keach Park will be a place to monitor going into the future.

Winter moth:

Moth feeds on; oaks, maples, basswood, elm, apple, and select spruce. This pest is frequent in Mass and bordering southern NH areas.

Spotted Lanternfly:

Relatively new pest recently found in Pennsylvania in 2014. The USDA has found it can feed on apples, plums, cherries, oak, walnut and poplar to name a few. I would expect movement via wood or nursery stock or any smooth surface item to harbor egg masses. Quarantine regulations within sections of Pennsylvania restrict movement of more than bio mass products such as siding, tarps, ATV's and outdoor stone work. These items would all be considered regulated items within a quarantine zone.

Asian long horned beetle:

Its ability to feed on multiple tree species makes this extremely dangerous for our canopy. Some of the species showing the highest favorability and larva survivability are sugar maple and red maple. The beetle is extremely devastating within an urban canopy scenario and has the ability to spread fast within a forest setting. An example of how a city can be hit with this pest is Worchester, MA.

Although control is somewhat possible it requires substantial funding. Control methods are also severe, requiring whole host removal. Flight tests show similar flight capacity of EAB, approx 2 mile. The large beetle size does limit distance however. I would assume movement into Concord would come from firewood or planting stock. I have seen this pest first hand while working in the commercial sector contracted by the USDA in Worchester.

Final notes:

City of Concord, NH. Urban canopy health observations and recommendations 2015-2016

Concord's location to the highway and local nursery make it an ideal location for out of State pests to arrive via human aid. However, native and non-native pests are not new to Concord's canopy. I have been dealing with many of these throughout my time here. Major diseases that have been affecting our urban canopy are Dutch Elm disease (DED), and various forms of needle cast /blight diseases. The Parks and Cemeteries continually have mature tree mortality due to these diseases. Right of way mortality is also high. Abiotic mortality is considered a very high factor as well.

Concord's canopy decline will continue even faster with the colonization of present pests, new pests, along with future pests. It is vital funding for urban canopy improvement projects within Parks, Cemeteries and public ROW's begin now. We need to begin rebuilding a more suitable future canopy using the most up to date techniques. We can achieve this by incorporating up to date nursery varieties, soil improvements, pest monitoring techniques, more detailed inventories and sustainable long term funding.

Communication to the public is also very important. Educating residents of known pests within the area and potential pest would greatly improve management plans/monitoring and canopy health.

Any further questions regarding my staffs observations please don't hesitate to ask.

Respectfully submitted,

Ryan Rambeau, ISA certified arborist NE-6760A

Tree Supervisor, Highways and Utilities Division

**POTENTIAL IMPACT OF RECENT INVASIVE INSECT SPECIES
ON THE CONCORD CITY FORESTS
January 27, 2016**

INTRODUCTION

FORECO has been retained by the City of Concord since 1987 to assist the City with its Forest Management program on City-owned lands. Most of FORECO's involvement has been on City Forests, but occasionally get involved with projects in the City Parks and other recreation areas as well as private land with Conservation Easements where the City has a deeded interest.

Recently, the Concord area has been subject to invasive species that will have a major impact on the tree populations within the City. The species include the Hemlock Woolly Adelgid, the Red Pine Scale and the Emerald Ash Borer. All three species are fatal to the infected trees though it may take several years for the trees to succumb after the initial infestation. Of the three, the Woolly Adelgid is the most treatable, mainly by "painting" the tree trunks with an insecticide. The Emerald Ash Borer can also be treated by an insecticide, but involves an injection system which can be expensive over time and is usually focused on trees of historic significance or where the cost of removal outweighs the cost of treatment. Some predators of the Emerald Ash Borer have recently been released in the Concord area by the New Hampshire Division of Forests and Lands Forest Health Program, but it is too early to assess any results. There are no recommended treatments for trees infested with the Red Pine Scale, though small ornamental shrubs could be treated with certain pesticides. Unfortunately, many of the red pines in the Concord area are found in groups that were planted for either aesthetic or reforestation purposes and the red pine scale spreads very rapidly in such situations. In 2015 it became apparent that many of the ornamental red pines along Interstate 93 and the red pine plantation at Rollins Park were infected with the red pine scale which led to a meeting in January 2016 attended by several City Departments to address the infected tree issues within the City.

POTENTIAL IMPACTS TO CITY FORESTS

Hemlock Woolly Adelgid

This small, wingless, sap-sucking insect attaches itself to the base of the hemlock needles and literally sucks out the nutrients carried in the water/sap as part of the tree's evapotranspiration process. A heavy infestation will eventually defoliate the tree which stops the photosynthesis process and kills the tree. In the past, frigid winter weather had kept the Adelgid from moving into New Hampshire, but warmer winters due to climate change have allowed the Adelgid to move north and it has become established in southern New Hampshire. A small infestation was found on the Penacook Lake watershed along District 5 Road in 2014. The Division of Forests and Lands Forest Health Program personnel treated the site but some Adelgid was again found there in 2015. The State will look at the site in the Spring of 2016, but numerous infestations recently found in Merrimack County appears to mean that the pest has now become established in central New Hampshire.

Hemlock is considered a low value timber species in today's markets and has been for quite some time. Demand for hemlock pulp periodically spikes and there is a temporary increase in value, but it has never been sustained for very long. However, hemlock has tremendous value as winter shelter for a variety of wildlife species including deer, rabbit, ruffed grouse, turkey and smaller songbirds. There are many Stands of hemlock found throughout the City Forests, though the pure Stands tend to be located on wetter sites or on the northern aspect of steep hillsides. Hemlock Stands found on drier sites are typically managed for wildlife habitat with emphasis on trying to keep the live crowns close to the ground through timely thinning and the removal of non-hemlock species that do not produce nuts or acorns. Wet sites are avoided in harvest operations on City land to protect the watersheds so hemlocks found in those sites are usually left un-cut. Scattered hemlock stems found in upland areas are often left to promote forest diversity. As a result, the loss of hemlocks due to the Woolly Adelgid will have a minor economic impact to the City Forest program, but will have a major impact to wildlife habitat. White pine is the softwood substitute for winter habitat in the Concord area, but the limbs of white pine are not as stiff as hemlock and cannot hold the snow in the same way hemlock limbs do. As a result, white pine is a poor, but unfortunately, the only substitute for the winter cover currently being provided by hemlock. White pine regeneration should be encouraged on the City Forest lots to make up for the potential loss of hemlock cover.

Red Pine Scale

This insect attacks the tree in a manner similar to the Woolly Adelgid, but then allows another insect, the turpentine beetle, to infest the weakened tree and bore into the tree trunk causing staining of the wood, making it worthless for sawtimber. Although red pine is native to the area, it was a relatively minor species and typically quite scattered throughout the County. When many local farms were abandoned in the early 1900's the white pines that grew into the fields created pure Stands that were susceptible to the white pine blister rust fungus and the white pine weevil. As a result, red pine, which is susceptible to neither, was planted as a substitute for white pine. Unfortunately, it was eventually discovered that the *fomes annosus* fungus infected red pines. The plantation scenario provided ideal conditions for the spread of the disease and many red pine plantations became infested after they were thinned. It also turned out that the red pine lumber was much less desirable than white pine lumber. Eventually, planting red pine was discontinued or limited to aesthetic uses such as ornamentals or for buffer zones.

There were several red pine plantations on the City-owned lands but until the mid to late 1980's when the wood energy industry started in New Hampshire, there was not much of a market for small diameter red pine stems. As a result, the plantations were not thinned and tended to be heavily overstocked. Trees tended to grow fairly tall, but often remained small in diameter. When such stands are thinned, the residual trees tend to bend over. For this reason, a very remote red pine plantation located on the east side of Penacook Lake was clear-cut in 1989. The plantation behind the Waste Water Treatment Plant on Hall Street and another on the Penacook Lake Watershed along Hutchins Street were both thinned in the early 1990's. The Hall Street plantation was again thinned in 2006 when it was noticed that it had become infected with *fomes annosus*. The Hutchins Street plantation was thinned in 2010 and is so far disease free, though it has had several blowdowns. The plantation off of Hall Street became heavily infested with both the *fomes annosus* fungus and the red pine scale around 2013 and was clear-cut in 2015. It was discovered in the summer of 2015 that a red pine plantation that was located on the tract of land north of West Locke Road that the City

recently acquired from UNITIL in a land swap was heavily infected with the red pine scale and had already suffered some mortality. The remaining red pines were harvested in conjunction with an adjacent agricultural field improvement operation. The plantation along Hutchins Street is being monitored and will be clear-cut if and when it becomes infected. A basal area variance will need to be obtained in order to clear-cut the pines along the road and the process is easier after the Stand becomes infected. Whereas red pine is considered a low to medium valued species and is now limited to the plantation on Hutchins Street, the loss of the species will have a very minor impact to the City Forest program. However, it will have a major impact to the ornamentals planted within the City's parks and along local roads and highways. Not only will the aesthetics be lost, there will also be an expense to remove and replace those trees. There may be enough volume in the Rollins Park plantation, especially if the adjacent white pine plantation is also thinned, to cover their removal costs.

Emerald Ash Borer

The Emerald Ash Borer was found in Concord in 2013 and early hopes that it was a very limited infestation proved to be short-lived. Subsequent investigations found infestations throughout Concord and several surrounding Towns. The Ash Borer lays its eggs in the bark of the three ash species (White, Green and Black) found in the Concord area. As the eggs hatch, the larvae eat the cambium layer just under the bark and eventually girdle the tree preventing the passage of nutrients. Of the three species, white ash is the most valuable and is considered medium to high in value. It is mainly found on damp sites and in drainages. White ash had already started to decline in the area due to the "ash yellows" disease, which is one reason the Ash Borer was not noticed as quickly as it had been in other parts of the Country. White ash makes up a very small component of the City Forests and is often associated with riparian zones where harvesting is restricted, though scattered stems can be found on upland areas. Unfortunately, white ash has been planted throughout the City proper for ornamentals and shade trees. Green ash is limited to the floodplain along the Merrimack River and is part of a floodplain forest ecosystem that also contains silver maple and American elm, though most of the elm has since died off from the Dutch elm disease. The Federal Flood Control program has minimized flooding along the river which has allowed some of the upper floodplain zones to start to "dry out" and allow upland species such as oak and white pine to migrate into the floodplain and outcompete the green ash and silver maple. Green ash and silver maples also need periodic flooding to encourage regeneration of those species and the flood control program has greatly reduced the regeneration rates of those two species. However, the river corridor is also heavily infested with the Asian bittersweet which has killed off many of the trees that the vines have entangled. More trees have probably died from being overwhelmed by the bittersweet than by the ash borer. The City owns several tracts along the Merrimack River that contain green ash, though the stocking levels of the ash vary greatly. Lastly, black ash is fairly rare in the City and limited to bog-like ecosystems. Because black ash is found in bogs and seldom grows to sawlog size, it is not considered a timber species.

Whereas white ash tends to like wetter sites or is found along streams and wetlands, very little has been harvested on City Forests in order to protect the riparian zones. But since the discovery of the Emerald Ash Borer, white ash has been marked to be harvested as part of the more recent City Forest timber sales as long as their removal does not negatively impact wetlands. To date, harvested white ash volumes have been quite minimal due to the low overall stocking in the uplands on City Forests.

There are six large City-owned tracts of land along the river. Four are City Forests and include Healy Park, located on the west side of the river between Manchester Street and Loudon Road; Knight-Morono Park located on the west side of an old river meander on the south side of Second Street; Oxbow Bluff Open Space located on the south side of another old river meander north of Garvin Falls Road; and lastly, the Marge Swope Greenway (so-called) located on the east side of the river between West Portsmouth Street and Garvin's Falls and contains forests, wetlands and leased cornfields. There is tract of City land located on the east side of the river between Manchester Street and Loudon road that contains Terrill Park on the south end and leased cornfields on the north end. The last tract of City-owned land along the river contains the City's Wastewater Treatment Plant and leased cornfields. Heavy stockings of green and white ash can are found in Healy Park and Terrill Park. The other parks and City Forests along the river contain both white ash and green ash, but not in significant quantities as most of the terrain is well above river flooding.

The Division of Forests and Lands Forest Health Program has set up an Emerald Ash Borer infestation study site at Terrill Park. They have created an entrapment site in an un-used part of the Park and have treated ash trees in the more developed portions with an insecticide. Program Administrator Kyle Lombard has requested that the ash trees be left alone in the Park unless they become hazardous. The Program has also released insect predators of the Emerald ash borer in the Concord area. It is too early in that study to assess the results, however, the intent of the predator release is to build up the parasitoid population enough to slow the spread of the ash borers to outlying Towns, not to stop the outbreak in Concord.

Healy Park is the only City-owned tract with commercial quantities of green and white ash, most of which are infested with the Emerald Ash Borer and Asian bittersweet. Some infested ash trees within the Interstate 93 right-of-way have already been cut and removed by the New Hampshire Department of Transportation (DOT) as the stems had died and were posing a potential threat to traffic. Basically, all of the ash within Healy Park should be harvested and will produce both firewood and sawtimber. This may require a Basal Area variance to cut over 50% of the basal area along the highway and the Merrimack River. Fortunately, there are probably enough silver maples to prevent the site from looking like a total clear-cut and some areas that are heavily cut may open up views of the Merrimack River. The highway right-of-way boundary is not marked by a fence in the northern end of the Park as it is at the southern end, so there will have to be some coordination with the DOT. Warning signs may also be needed along I-93 on the days when the trees are cut near the highway right-of-way to prevent motorists from being startled by falling trees. The City's sewerage interceptor line and associated service road runs through the lot and needs to be protected during harvest activities. The wetlands found on the lot are part of the seasonal floodplain and may be difficult to harvest unless they are extremely dry or frozen. Access to the lot itself runs under the Manchester Street bridge and that route is flooded when the river rises. In order to maintain the legal bridge clearance of 13.5 feet for the access road underneath the bridge, the grade was lowered under the bridge, bringing it below the typical riverbank elevation causing it to flood when the rest of the floodplain remains dry. Any build up of snow or ice under the bridge in the winter months will make that route unusable for logging trucks. As a result, the harvest should be limited to mid-Fall when the chance of flooding rains is less. Trucking quarantine restrictions on ash logs are eased after October 1, so any Fall-time harvesting should only occur after that date.

Whereas Healy Park is also an arboretum of invasive species, any harvesting should require that the cutting and skidding equipment be steamed-cleaned before leaving the site. Once the ash trees are cut, there will be a tendency for invasive species, especially the glossy buckthorn and bittersweet, to dominate the forest openings created by the tree removal. An invasive species control program should be set up before the ash harvest to address the potential increase of invasive species after the harvest. The most effective way in dealing with the invasive species found on the site is herbicides, which may take several applications to be effective. Removing the invasive species could make this riverside Park more attractive for walkers, hikers and bikers, especially if a sidewalk is built through the Park to connect Manchester Street with Loudon Road as part of the Interstate 93 widening project through Concord. The NH Department of Transportation should also be contacted about the project to see if any City land within the park is planned to be cleared for the wider highway and if the clearing could then be incorporated with the ash tree removal.

GENERAL CONCERNS

There have been many hours invested in blazing and painting the boundaries of almost all of the City Forest lots. Well identified boundaries limit the City's forest management activities to the intended tract and helps prevent encroachments on the part of the abutters. Unfortunately, hemlock and ash trees often dominate the wetter sites and are therefore the trees most commonly blazed to mark the boundary in those sites. Loss of those species may require additional boundary maintenance to blaze other species, such as red maple, to prevent the current boundary lines from being lost.

Another concern is the City's extensive formal network of hiking trails found throughout the City Forests and occasionally on private land. Numerous hemlocks and scattered ash trees can be found along many of the hiking trails, though seldom in the volumes needed to set up a separate salvage harvest. As a result, trees that have become infested along the trails and around trailhead parking lots should be monitored for their hazard potential. Also, if groups of trees along the trails die off, the additional sunlight on the forest floor will encourage shrub growth and forest regeneration. This will then require more frequent "brushing" of the affected trails until the forest canopy closes in and once again shades the trails. In the past, such trail maintenance has been done by volunteers from the Trails Committee as well as paid FORECO personnel.

Respectfully submitted,

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