



Hemlock Woolly Adelgid

Silviculture
management in the
Bancroft Minden Forest



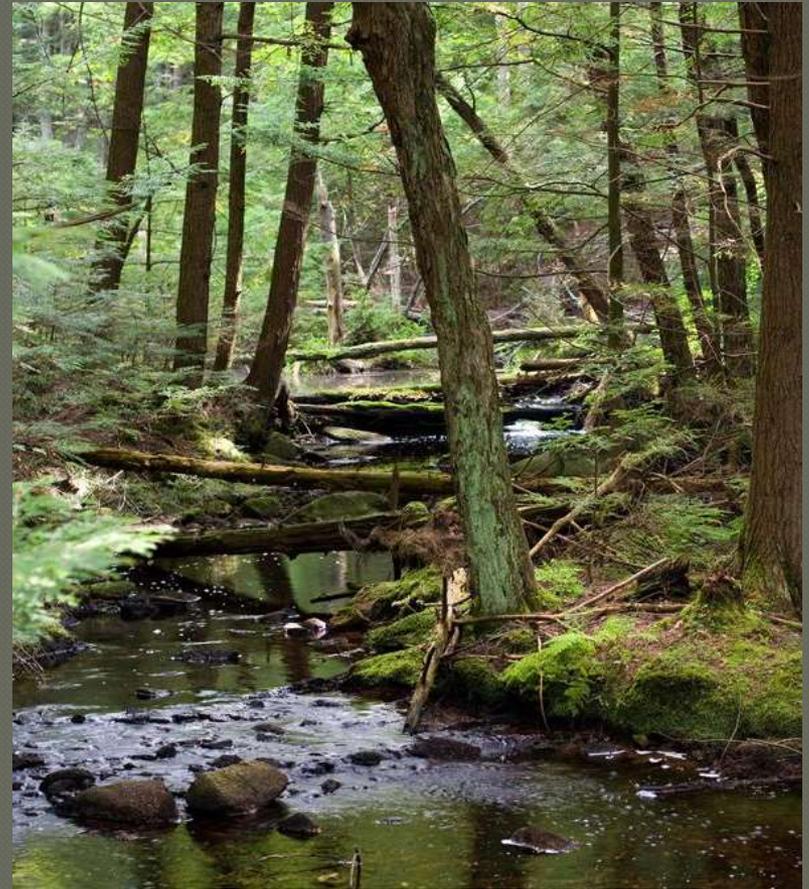
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Background on Hemlock

- ❖ Eastern Hemlock is the most shade tolerant and long-lived species in eastern North America.
- ❖ Hemlock cannot tolerate drought and is often found in riparian areas where it maintains cool stream water temperatures, critical for many aquatic insects & native brook trout (1-2.5°C cooler than hardwood forests)



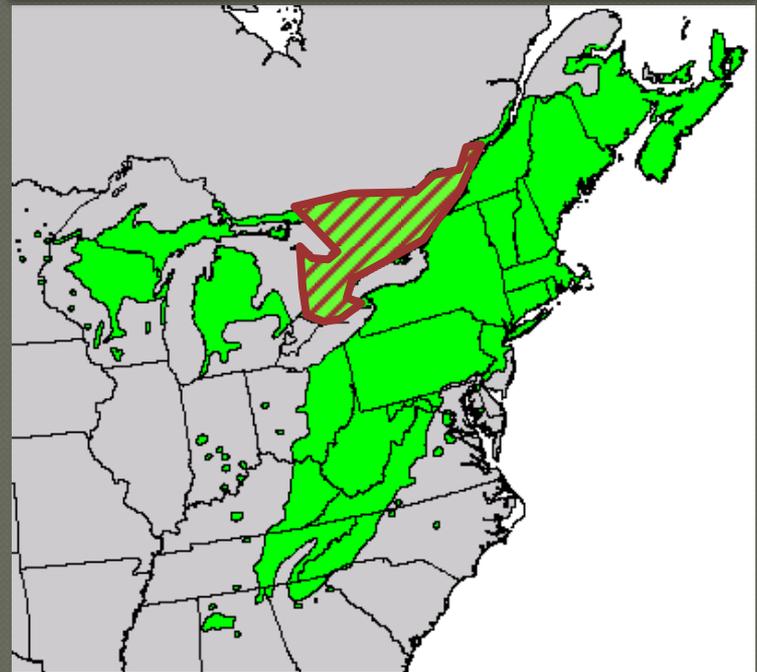
“The Guardian of Brook Trout”

**Hemlock’s ecological role
in eastern forests far**

Hemlock Woolly Adelgid (the threat)

- ❖ Hemlock woolly adelgid (HWA) is native to Asia.
- ❖ It was first reported in Virginia in the 1950's.
- ❖ Recently found in Nova Scotia in 2017.
- ❖ Two detections were reported in Southern Ontario in 2011 & 13, but the populations were eradicated (trees were cut and burned).

Range of eastern hemlock



As of 2015, 90% of the range of hemlock in North

HWA migrates at a rate of 8-20 km/year; transported by wind, birds & humans.

HWA Detection

- ❖ Unlike most insects, HWA feeds, grows and reproduces during the winter.
- ❖ HWA has 2 generations per year (winged and non-winged):
 - ❖ Non-winged = all female & produce up to 300 eggs/female!
 - ❖ Mobile crawlers exist between April and July when they can be seen more easily*
- ❖ Populations build quickly and are difficult to detect at low



Snow and HWA Egg masses on hemlock tree



HWA Egg mass

Death from HWA

HWA Feeding



❖ HWA feeds on needles, depleting hemlock's stored nutrient reserves. This causes water stress, which results in:

- Reduction in new shoot production
- Premature bud and shoot dieback
- Premature needle loss
- Thinner, greyish-green crown
- Dieback of twigs and branches



Susceptibility of Hemlock to HWA



- ❖ No sites are immune from HWA damage once insects are firmly established...
- HWA attacks all sizes and ages of hemlock from seedlings to mature canopy trees, with infestations just as likely whether trees are in a hemlock-dominated system or in a mixture with



- ❖ But timing and severity of mortality is influenced by several site factors, including elevation, topography & structure.
- ❖ Extreme cold (-20°C) for even a few hours can cause severe HWA population reductions.
- ❖ However... The threshold at which HWA populations are stable (mortality balanced by fecundity) is 91% mortality, meaning only 9% of HWA outbreaks have to survive winter to sustain the population.

Treatment options

❖ BIO-CONTROL

- ❖ Species of introduced predators that feed on HWA in its natural range have been released in the U.S. with varying success rates.



❖ CHEMICAL

- ❖ Many options in the U.S.
- ❖ In Canada, trunk injection the only option & only practical on high value trees due to high \$\$.

❖ SILVICULTURE

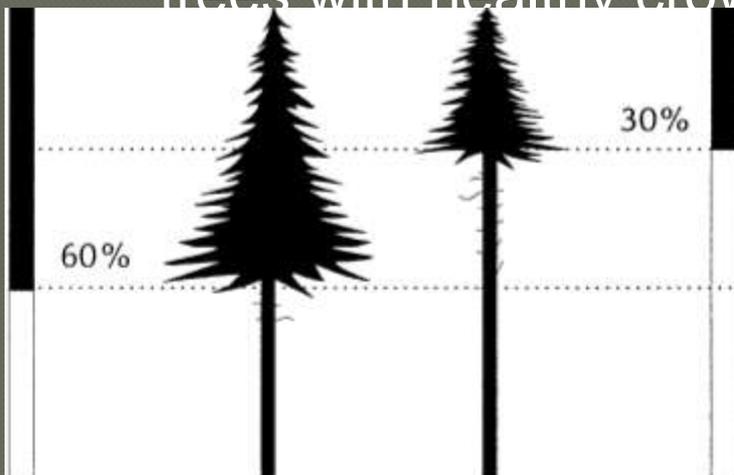
- ❖ Positive results in the U.S., especially if performed at least 5 years prior to infestation.



What we know from studies on HWA

❖ Light is important!

- ❖ Increased light levels & heat on infested seedlings has allowed them to survive much longer.
- ❖ Hemlock on forest edges that receive more light are also found to survive much longer.
- ❖ Hemlock that only receive light from the top with small crowns are 2 times more likely to decline than overtopped trees with healthy crowns.



Live crown ratio the most important factor in prolonging the life of hemlock.

Without management...



- Infested hemlock die in 2-15 years.
- Light to forest floor increases.
- Stimulates woody & herbaceous plants.
- Hemlock are eventually replaced by deciduous species like birch and maples.

Mortality rates of 30% observed after 10 years of heavy infestation in Southern U.S. & 80% after 5

Silviculture mgmt. research from our Southern neighbors



❖ In August 2011 presented promising results from new silviculture strategies for managing Hemlock under threat of HWA.

❖ Research proves:

- Hemlock trees that survive the longest have the highest live-crown ratios and competitive crown positions;
- By thinning, prior to infestation (> 5 year), we can improve these features to build resilience and give hemlock a 'fighting chance.'
- Silviculture treatment is likely the most economical means of managing HWA because it:
 - Provides revenue &

Hemlock stands in the Bancroft Minden Forest

In the BMF, hemlock stands generally occur in two main site types:



1) Moist soils on lower and north facing slopes, typically in Northern portion of the unit; associated with hard maple, red maple, beech and yellow birch.



2) Shallow soils impeded by bedrock in the Southern portion of the unit; associated with red maple, red oak, white birch and white pine.

Hemlock stands in the Bancroft Minden Forest

Hemlock also

occur:



- in the understory of other stands like white pine, where we generally practice a final removal with SGR: PWus – HEsel
- as pockets < 4ha within hardwood forest units. These are hard to track spatially, found at the prescription writing & tree marking stage.

Current hemlock Mgmt. practice

- ❖ Hemlock is currently managed as a selection forest unit: **HEsel** with a target residual BA of 20m²/ha OR 1/3rd removal.
- ❖ Conventional Rx is to target removal of UGS hardwoods first and then thin hemlock from below to release highest quality dominant & co-dominant crowns.
- ❖ This practice has created dense, overstocked hemlock stands that are



Our Strategy

❖ THIN HEMLOCK

- Select stems with highest quality and Live Crown Ratio (LCR)* and give a 2 -3 sided release by removing adjacent & lesser quality stems.
- As a general guideline, stands will undergo a 30-40% removal rate (using caution not to over thin stands making them drought prone)

❖ RETAIN HARDWOODS

❖ REPLACE THERMAL COVER



Hemlocks can respond to thinning regardless of age as long as LCR > 30%

Next Steps...



- ❖ Make best use of FFT funding to treat as much hemlock area as we can over the next three years.
- ❖ Continue to work with HWA Silviculture working group to keep abreast of new research, detection survey updates and management options.
- ❖ Identify high value hemlock stands (e.g. around sensitive brook trout habitat) in the hope we can focus conservation efforts here.

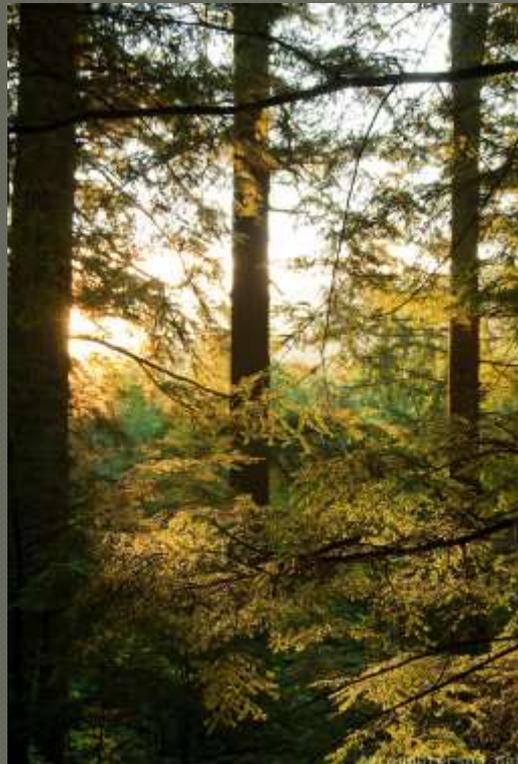
Everyone Can Help!

- ◉ Monitor and report. Early detection is very important!



Loggers and woodlot owners can have a positive impact!

- Practice adaptive silviculture, the hemlock and all the species that rely on them will



Thank

you!

