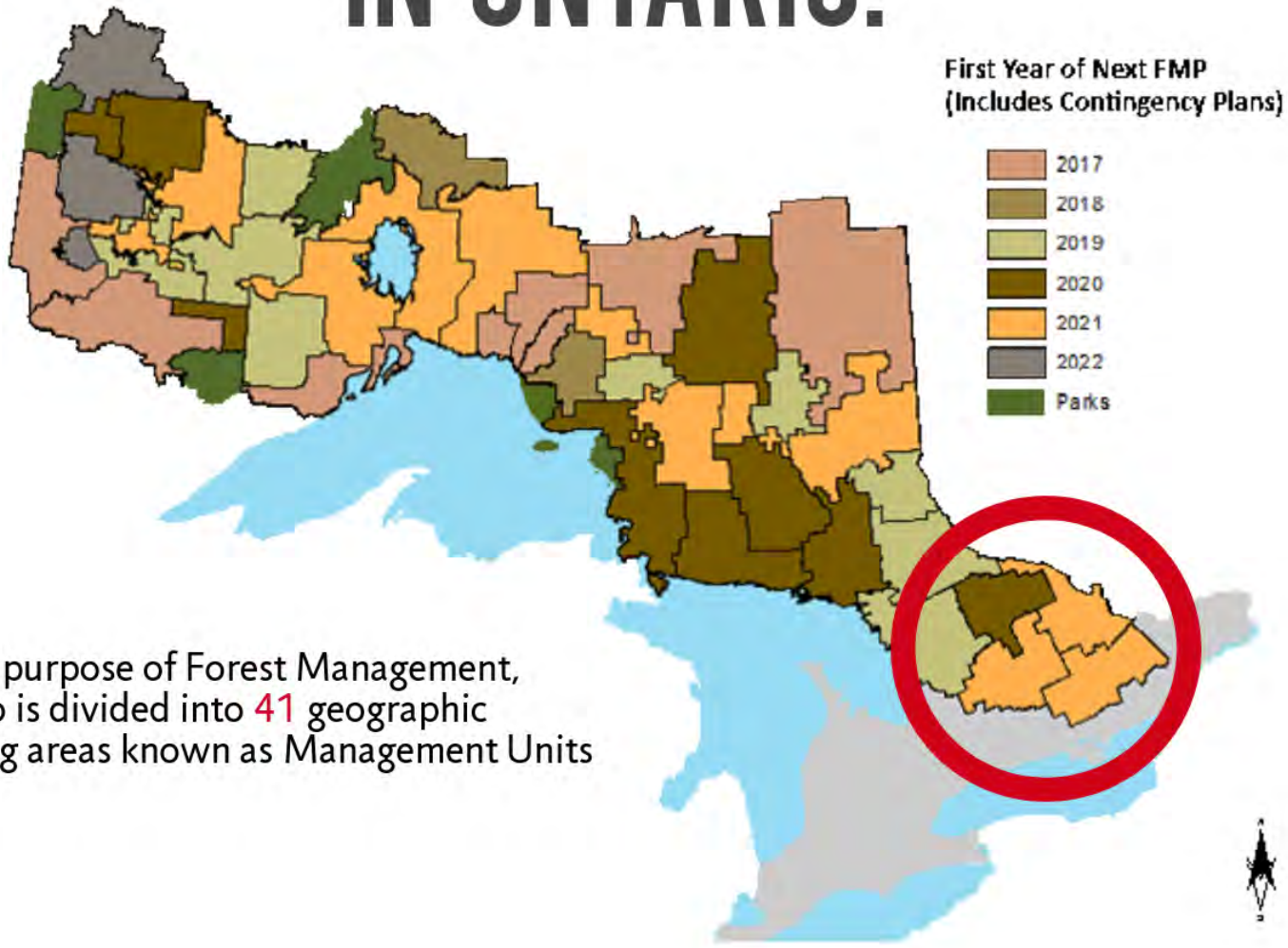
Beech Bark Disease Mgmt. in the Bancroft Minden Forest

Funded by:

BMFC
Bancroft Minden Forest Company

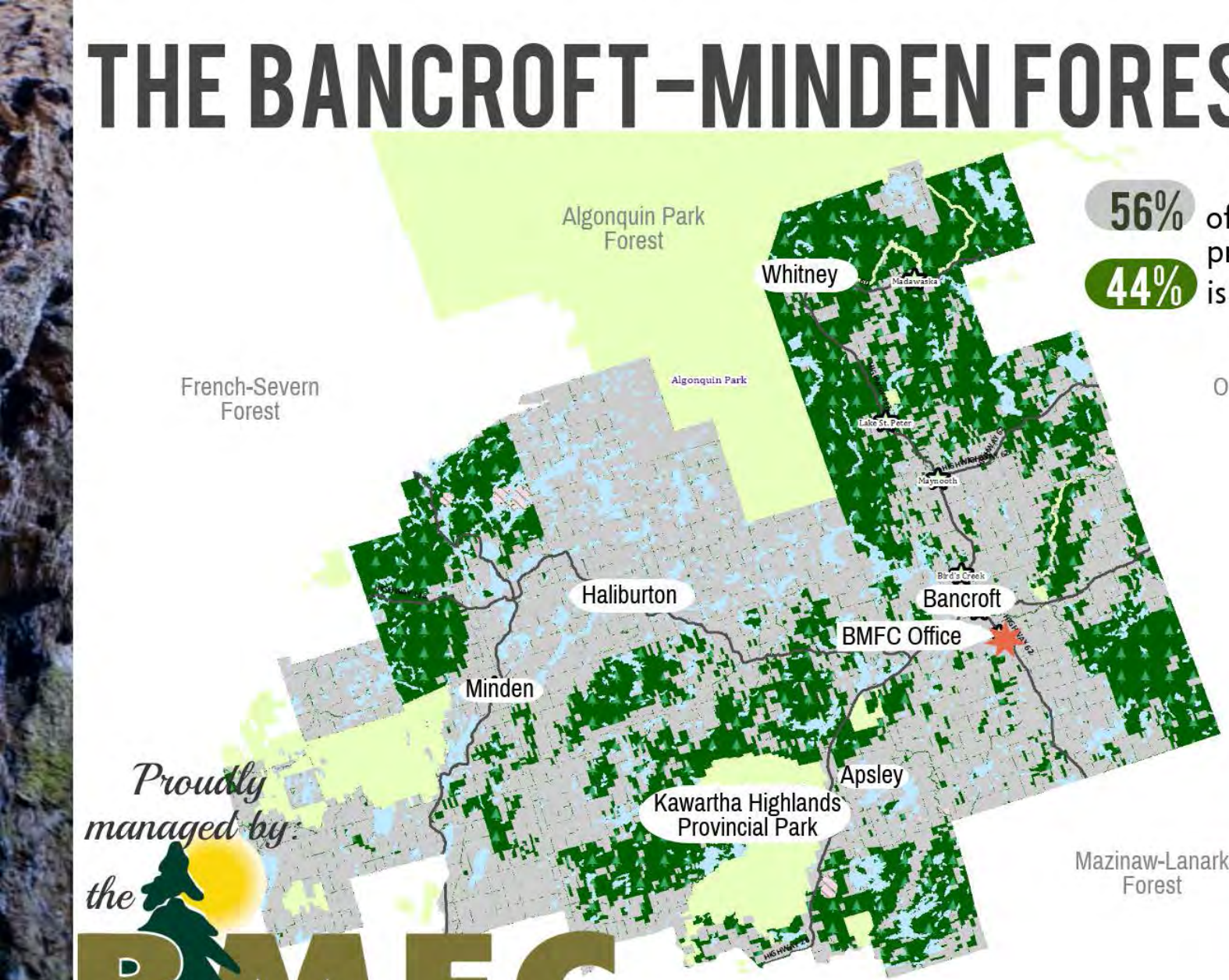
Forestry Futures Trust Ontario

FOREST MANAGEMENT UNITS IN ONTARIO:



For the purpose of Forest Management, Ontario is divided into 41 geographic planning areas known as Management Units

THE BANCROFT–MINDEN FOREST



56% of the forest is private land

44% is Crown Land

Proudly managed by:

the **BMFC**

BANCROFT MINDEN FOREST COMPANY *since 1998*

FSC
www.fsc.org
FSC® C111205

The mark of responsible forestry

Certified in 2012

OUR MANDATE:

PLAN

Develop a Forest Management Plan (FMP) every 10 years, with the assistance of a Local Citizens' Committee, local First Nations and the Ministry of Natural Resources & Forestry (MNRF)

Develop an Annual Work Schedule which outlines activities to take place during the fiscal year from harvest to renewal & tending.

PREPARE

Conduct field work & write prescriptions for each operation.

MONITOR

Ensure all our operations comply with the FMP & minimize adverse impacts,

RENEW

All harvest areas are regenerated to ensure the future of the forest.

REPORT

Prepare annual reports which describe progress to achieving goals in our FMP.

THE GLSL is a COMPLEX FOREST

- Diversity of tree species & high within-stand heterogeneity
- Proximity to large population centres
- Public & Private land interactions
- Long history of utilization
- Legacy of past management
- Poor Forest Resource Inventory information
- Acid rain
- Prolonged drought
- Insects & Disease
- Others……

TREE MARKING

Tree marking is practiced in both partial harvest systems: selection and shelterwood. Before any harvesting is done, a Forester will develop tree marking direction and a certified tree marker will follow it by marking trees to retain for wildlife value and trees to remove (UGS) to create conditions suitable for future stand development.

A TREE MARKERS RECIPE TO PROVIDE FOR WILDLIFE NEEDS:

- **10** LARGE CONIFERS PER HECTARE
- **10** SEED OR NUT PRODUCING TREES PER HECTARE, E.G. OAK
- **10** LIVING CAVITY TREES PER HECTARE
- AT LEAST **1** SUPERCANOPY TREE PER FOUR HECTARES

TREE MARKING IMPROVES STAND QUALITY

PRE-HARVEST	1ST CUT	2ND CUT

UGS Unacceptable growing stock

AGS Acceptable growing stock

Ernie Demuth showing a diseased beech tree near Dorset, ON.

State of Practice of Managing BBD in Ontario (2018) – E. Demuth

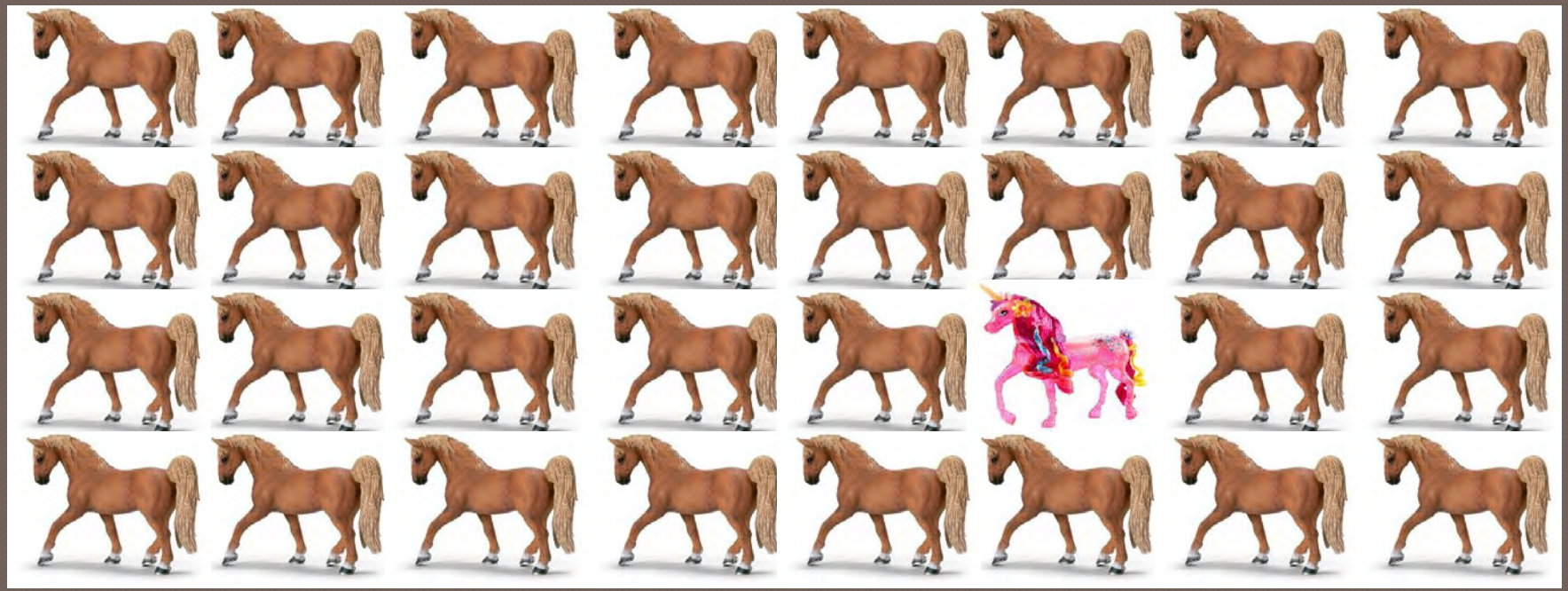
This Presentation made possible by:

The hard work of Ernie Demuth, R.P.F.

Enter beech bark disease…

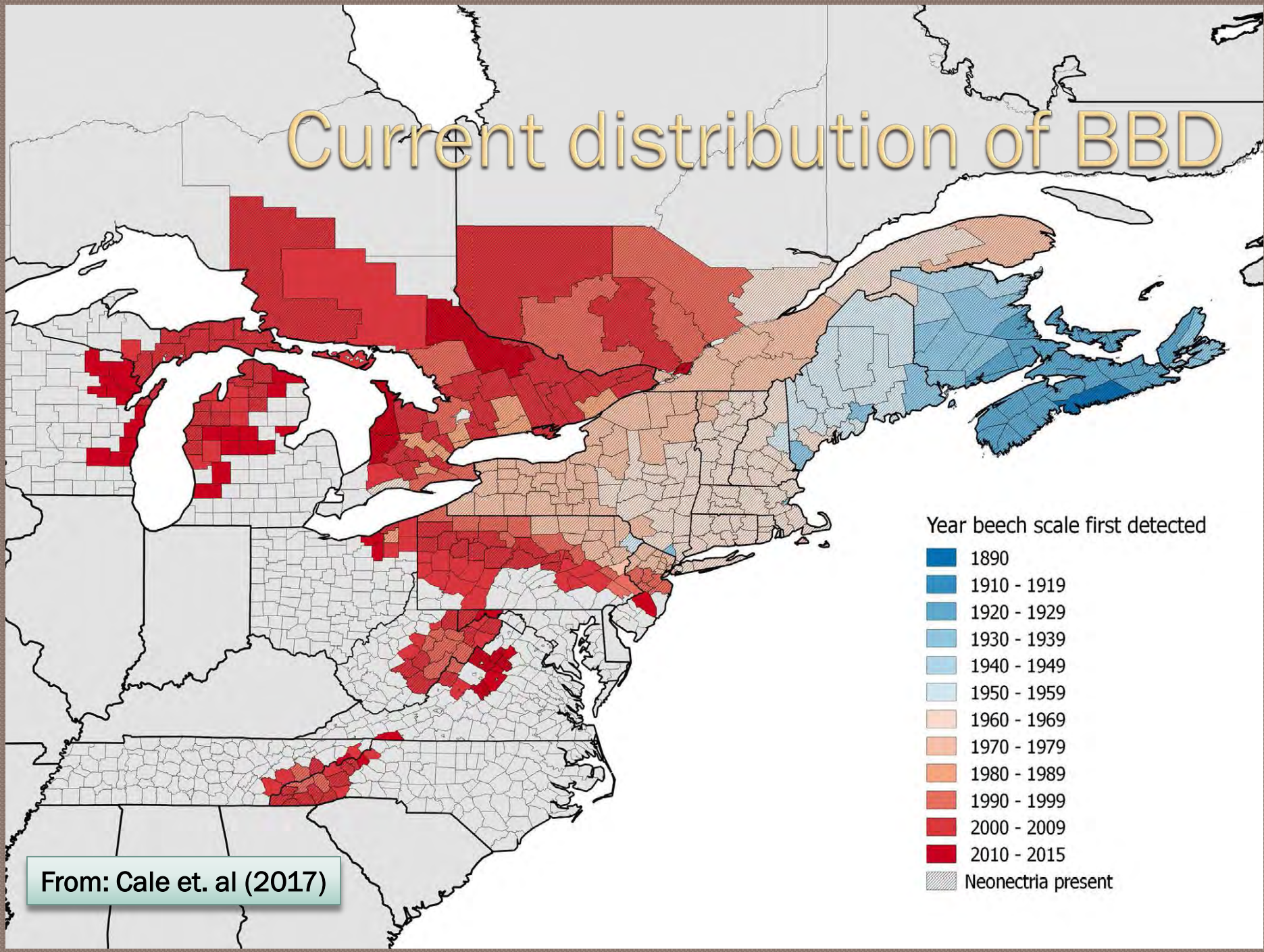
Things we already know…

- >99% of beech in Ontario will be affected = DEATH
- Some resistance MAY occur (<1% estimated), but its currently impossible to predict the winners

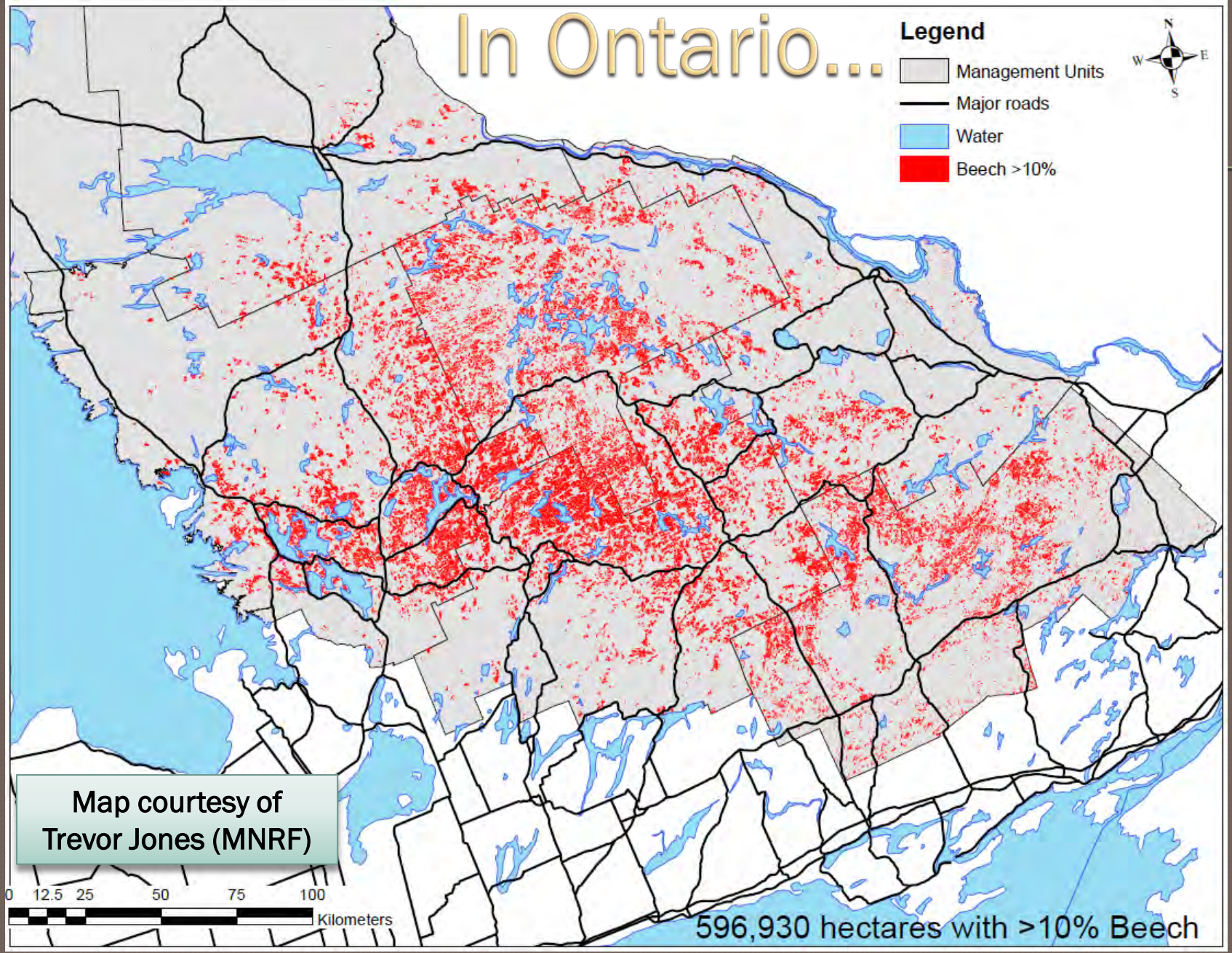


- Its going to cause some silvicultural problems…

Current distribution of BBD



From: Cale et. al (2017)


In Ontario...
Legend
Management Units
Major roads
Water
Beech >10%
N
W
E
S
Map courtesy of
Trevor Jones (MNRF)
0 12.5 25 50 75 100
Kilometers
596,930 hectares with >10% Beech

Phases of BBD infection

1) Advancing Front

- Beech scale arrives
- Rapid expansion
- Little evidence of fungus
- Little to no beech mortality
- Beech snap can occur at this stage (e.g. Killbear Provincial Park)

Phases of BBD infection

2) Killing Front

- High populations of beech scale
- Heavy overstory mortality from fungal infection (canker)
- 90-100% of beech impacted
- Increased canopy gaps
- Beech snap and snags

- Mortality of mature trees*
  - 20% in 2 years
  - 50% in 10 years
  - 80-100% over time

*Trees > 28 cm dbh show highest susceptibility to mortality.

Phases of BBD infection

3) Aftermath Forest

- Lingering, diseased mid- or understory trees
- Disease remains endemic
- Beech thickets

Aftermath Forests: Beech Thickets!!

BBD represents the first known case where a specialist plant disease increases the density of its host! (Garnas et al., 2011)

Unfortunately, machine travel encourages re-sprouting of beech.

- Beech re-sprout aggressively from damaged root sprouts
- 60-90% of stems will come back from root sucker origin
- But a few stands can have as much as 75% seedling origin

Beech Thickets!!

- Beech saplings will cluster around dead canopy trees or… highly diseased, cankered beech.
- Majority of root suckers develop within 10 metres of the parent tree.
- Overall, there is a shift toward younger, smaller forests over time as beech thickets take hold.

Understory Beech Growth

- Under shade, beech exhibits:
  - Greater vertical growth than sugar maple (5.2 cm/year vs. 2.8 cm/year)
  - Greater later growth (6.2 cm/year vs. 2.8 cm/year)
  - With a more efficient leaf display, beech outcompete other understory species and become dominant.

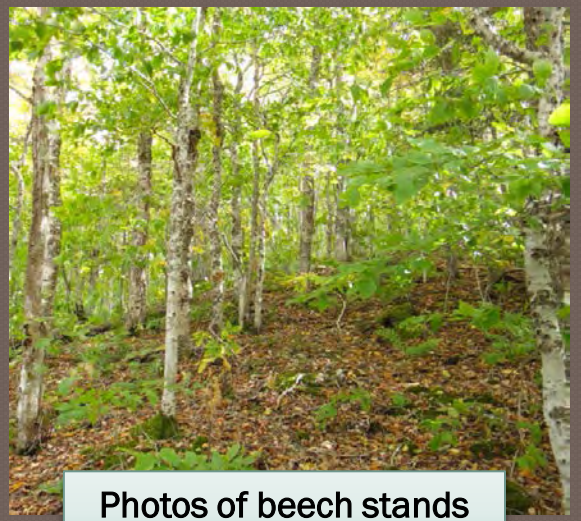
Progression of Aftermath Forest

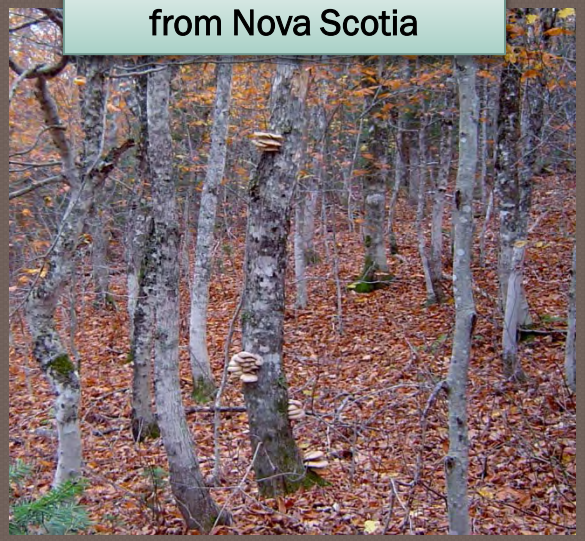
10 – 30 years later…

- Lingering midstory beech may still persist
- Beech sprouts increase in dbh & height… to sapling sizes
- Increased understory competition from beech dominance

30 – 50 years later…

- Beech sprouts continue to slowly increase in size
- Some beech sprouts reach lower to mid-canopy positions
- Decrease in other desirable species abundance





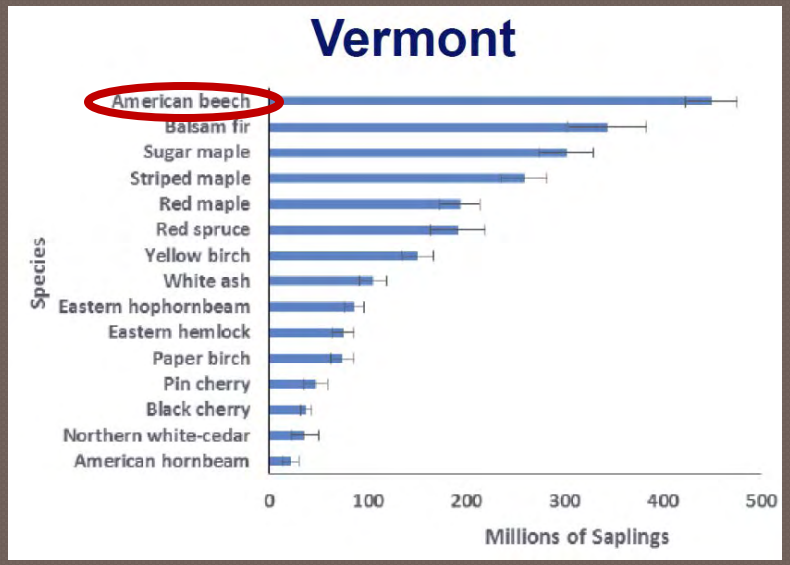
Photos of beech stands from Nova Scotia

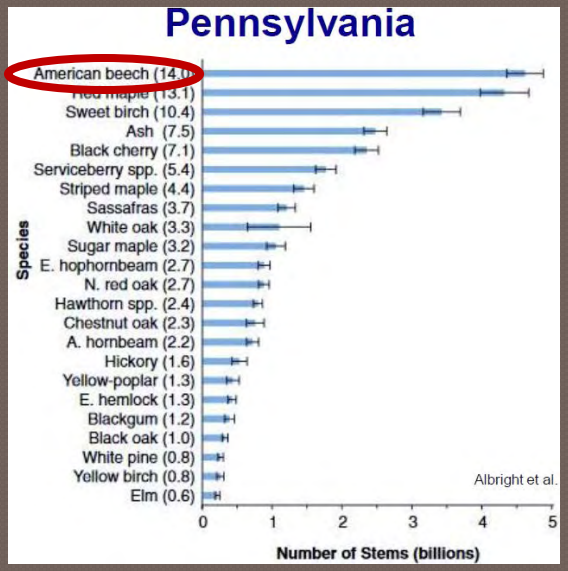
Typical healthy specimens of American beech with smooth bark and the ability to grow to large mature trees.

This tree may be typical of what a “nice” American beech will look like in our northern hardwoods in the future without much ability to develop into a large, healthy specimen.

Beech now most common understory species in Northern U.S.!

- New York, Vermont and Pennsylvania can now claim that beech is the most prevalent understory species.
- New York witnessed a 24% increase in beech saplings between 1993 and 2007, and a further 14% increase between 2007 and 2012.





Bohn, 2018

Consequences on Wildlife

- At least 20 wildlife species that eat beech nuts.
- Beech mast density in the fall has a large affect on annual bear population size.
  - In Maine, 80% of sows reproduce after mast year vs. 22% in poor nut year.
  - Beech nuts have 1-6 times more fat than other sources:

Component	Beechnut	Oak	Herbs	Corn
Protein	11%	6%	16%	11%
Fat	17	14	4	3
Carbohydrate	30	61	40	80
Fiber	27	18	26	2

McNulty, USDA

Other factors of concern

- Deer don't like to browse on beech and will always choose a maple, oak or birch over a beech.
- Accumulating leaf litter from beech changes the soil composition, further favoring beech.
- Overall, diversity decreases

Plant Diversity

Component	Non-thicket	Thicket
Mean beech sapling density (stems/m2)	0.12	0.55
Mean litter depth (cm)	1.48	2.25
Plant species	34	22
Fern species	12	6
Mean shrub species	6.5	1

McNulty, USDA

How much beech is too much?

Studies have proved:

"Where understory beech exist, beech will prevail."

(…even at low levels)

(*Beland et al.* 2013 – shelterwood, selection system, patch cuts)

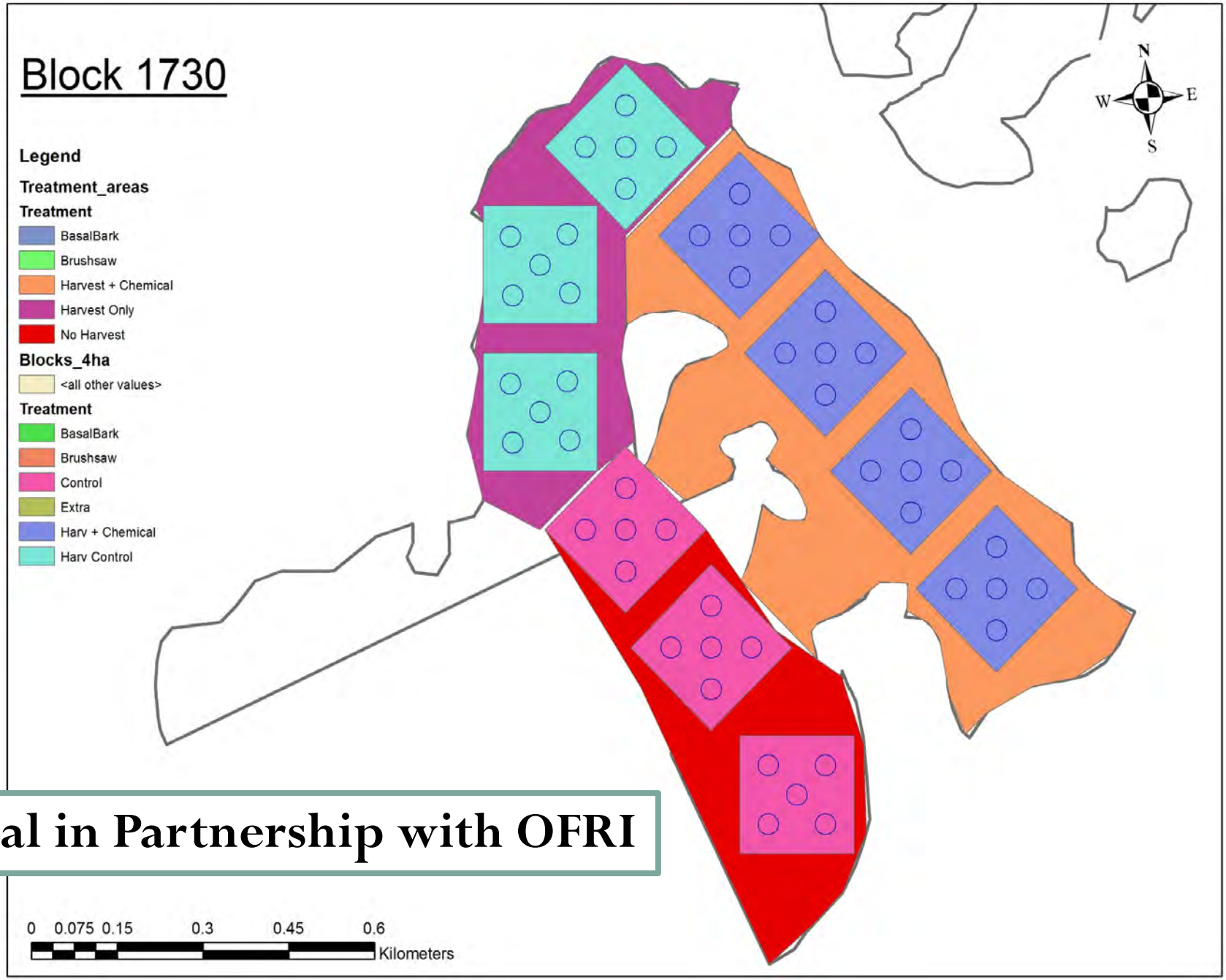
(*Gottlesman & Keeton.* 2017 – selection system, structural complexity enhancement)

What to do with the aftermath forest?

- In 2016, BMFC submitted a FFT proposal to control beech regeneration and were successful.
- A summary of treatments to date:

Chemical (Basal Bark)	2016	2017	2018
# hectares (ha) treated	46.6 ha	49.8 ha	58.9 ha
Productivity	2.22 ha/person/day	1.17 ha/person/day	1.0 ha/person/day
Cost of Chemical	$575/ha	$700/ha	$750/ha

Mechanical (Brush Saw)	2016	2017	2018
# hectares (ha) treated	15 ha	9.2 ha	9.1 ha
Productivity	1.0 ha/person/day	0.35 ha/person/day	0.75 ha/person/day
Cost of Mechanical	$575/ha	$725/ha	$715/ha



Trial in Partnership with OFRI

Aims to Address following questions:

- What is the relationship between abundance of overstory beech & abundance of beech regeneration? If we knew the abundance & distribution of overstory beech, could we predict where the most prolific thickets will form?
- What treatments will work best in the understory?
- Does timing of treatment matter? Is it most effective to treat before, during or after harvest?
- Are multiple treatments needed in order to promote the regeneration of other species?
- Can these beech control tending operations assist in establishing other important mast & wildlife species? Can they increase tree species diversity at the stand & landscape scale?
- What will the cost be of doing these treatments operationally?
- What are the short- medium- & long-term stand-level growth & yield consequences of treating or not treating these stands?

Typical stand pre-treatment

Understory Silvicultural Treatments

Used to treat beech thickets and promote other more desirable (healthy) regeneration.

Performed:

- Prior to harvest (ideal)
- After harvest
- No harvest

Mechanical treatment

Brush Saw

Pros:

- Cottagers love it because its not a chemical…
- Can be done without a pesticide applicators license

Cons:

- Encourages re-sprouting
- Likely need to retreat
- Slow/inefficient
- Does not kill neighboring stems
- Very labor intensive
- Potentially more dangerous for the operator than chemical

Chemical treatment

Basal Bark

*Chemical is Triclopyr (Garlon 4a) applied at 10-20% solution in oil

Pros:

- 99% effective
- Can be applied to stems as small as 1”
- Can be applied any time of year

Cons:

- Costly
- Not efficient with high density of stems

Chemical Treatment

Hack and Squirt

Glyphosate applied as 40-50% solution during June-November.
Frill cuts must penetrate through bark, applying:
one incision/inch in diameter

Pros:

- 99% effective
- Can treat small trees, but generally used for trees > 5 – 6”
- If parent trees treated, will kill about 50% of attached root suckers under 1” dbh

Cons:

- Not efficient with high density of stems
- Cannot treat very small stems

Chemical Treatment

Cut Stump

Glyphosate applied as 50-60% solution during June-November

Pros:

- Results in dieback of attached root sprouts
- Can be applied within a week of cutting tree

Cons:

- Not useful as a sole means of treating thickets
- Cannot treat very small stems

Typical stand post-treatment

Other silviculture (harvest) options

Single-tree selection (STS) doesn't work anymore!

Long-term compositional outcomes of STS = homogenization of spp. composition towards sugar maple and American beech (following repeated application of single-tree selection on rich and moderate sites).

Advanced yellow birch regeneration

Beech patch

Advanced hardwood understory, declining Mh overstory (final removal)

All scenarios in the same stand!

Textbook hardwood selection

Oak regen.

Poplar patch

It is not uncommon to encounter a tolerant hardwood stand with 15 unique species tallied in a pre-Rx cruise.

Irregular shelterwood

Irregular silviculture DOES:

- Rely primarily on structural retention and advanced regeneration (fundamental of shelterwood system)
- Maintain, increase or create heterogeneity within stands & allow complexity to develop through time
- Regenerate shade-intolerant and intermediate shade-tolerant species simultaneously

Unlike STS, Irregular shelterwood DOESN'T:

- Balance the age classes
- Use a dbh distribution as a target structure

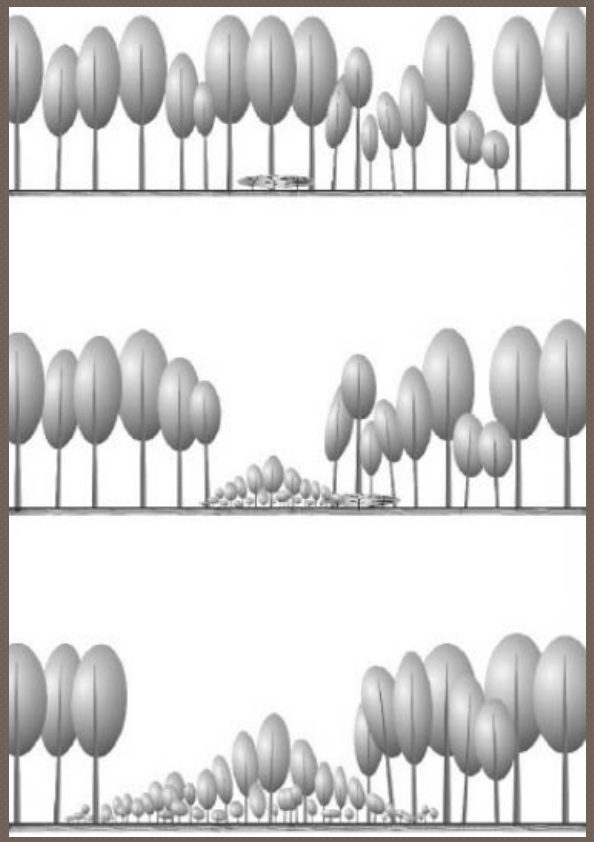
In the field…

Instead of taking a basal area control (e.g. 18 m^2/ha) and applying that across an entire stand, irregular shelterwood requires the tree marker to assess each area at the tree level and think critically about what the intentions are for that species or 'patch' based on its silvical needs.

E.g. Advanced acceptable regeneration is encountered: remove competing UGS overstory (similar to final removal)

Concept of "Expanding Gap"

- A patch of yellow birch is encountered surrounded by marginal quality sugar maple. Create openings around yellow birch to create space for further yellow birch regeneration.



Embrace the Diversity!

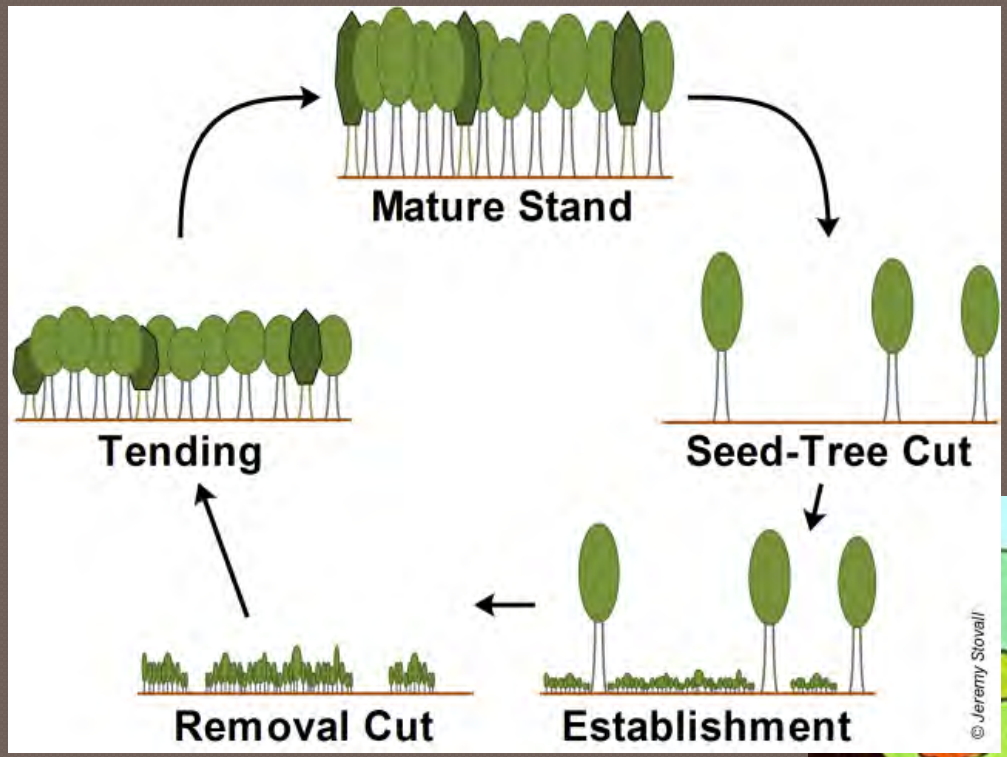
- Other typical field examples:

Beech patch – cut all beech and create a group opening (monitor for future tending needs)

Immature tol. Hwds. (poles & smalls) – thin through – stand improvement with crop tree release

Red oak – retain and cut around it to promote regeneration

Clearcut with yellow birch seed tree



Before (beech 50% of overstory):

Challenges so far…

- Beech understories tend to be patchy in nature making mapping them a challenge.
- Patchy beech can make establishing a proper rate for treatment difficult.
- Forest practitioners from the south have expressed that treating stands 5 to 10 years before harvest is ideal. We tend to focus on stands that will be harvested within 2 years…

Treatments are very costly and beech is abundant!

Cost…

- Currently BMFC (20%) and Forestry Futures Trust (80%) are covering cost of the experimental and some operational treatment:

$575-1000/ha

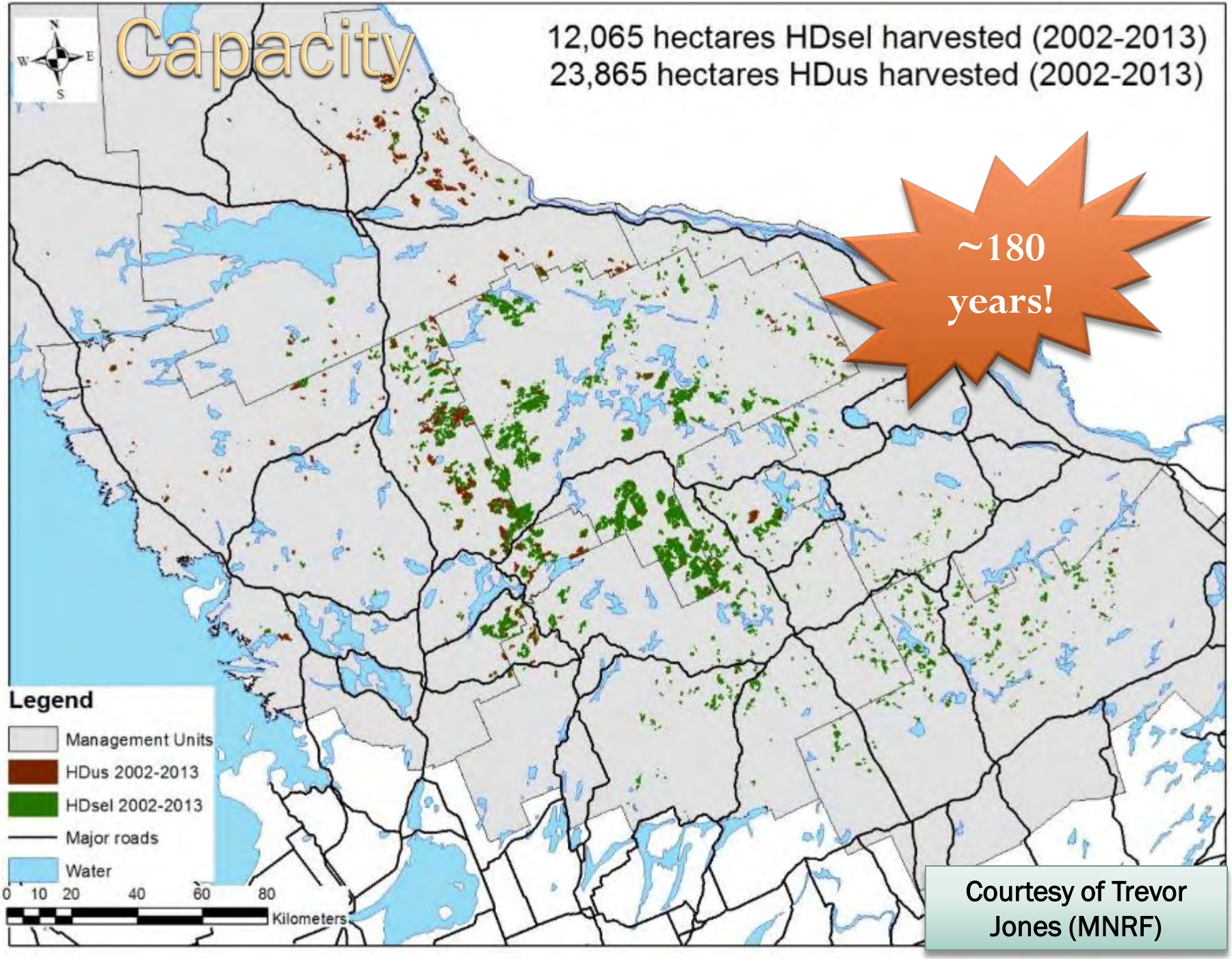
Available $ for treatment (from stumpage)

- SFL receives ~$110 ha for selection
- SFL receives ~$140 ha for shelterwood

From that:

- ~$70 goes to tree marking
- Most of rest goes to prescription, auditing, monitoring, overhead

Capacity


12,065 hectares HDsel harvested (2002-2013)
23,865 hectares HDus harvested (2002-2013)
~180 years!
Legend
Management Units
HDus 2002-2013
HDsel 2002-2013
Major roads
Water
0 10 20 40 60 80
Kilometers
Courtesy of Trevor Jones (MNRF)

Take away

Our Southern neighbors tell us:

"Understory vegetation management of beech needs to be a **regular** and **repeated** silvicultural activity."

Therefore, we must:

- Prioritize treatment of stands with Be regen. to ensure other species
- Map beech thickets to understand the extent
- Find efficiencies in treatments
- Secure funding

More information & Literature Cited

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