Restoring Northern White Cedar in the Great Lakes Region

MISAF-2014 “Challenges in Forest Regeneration”

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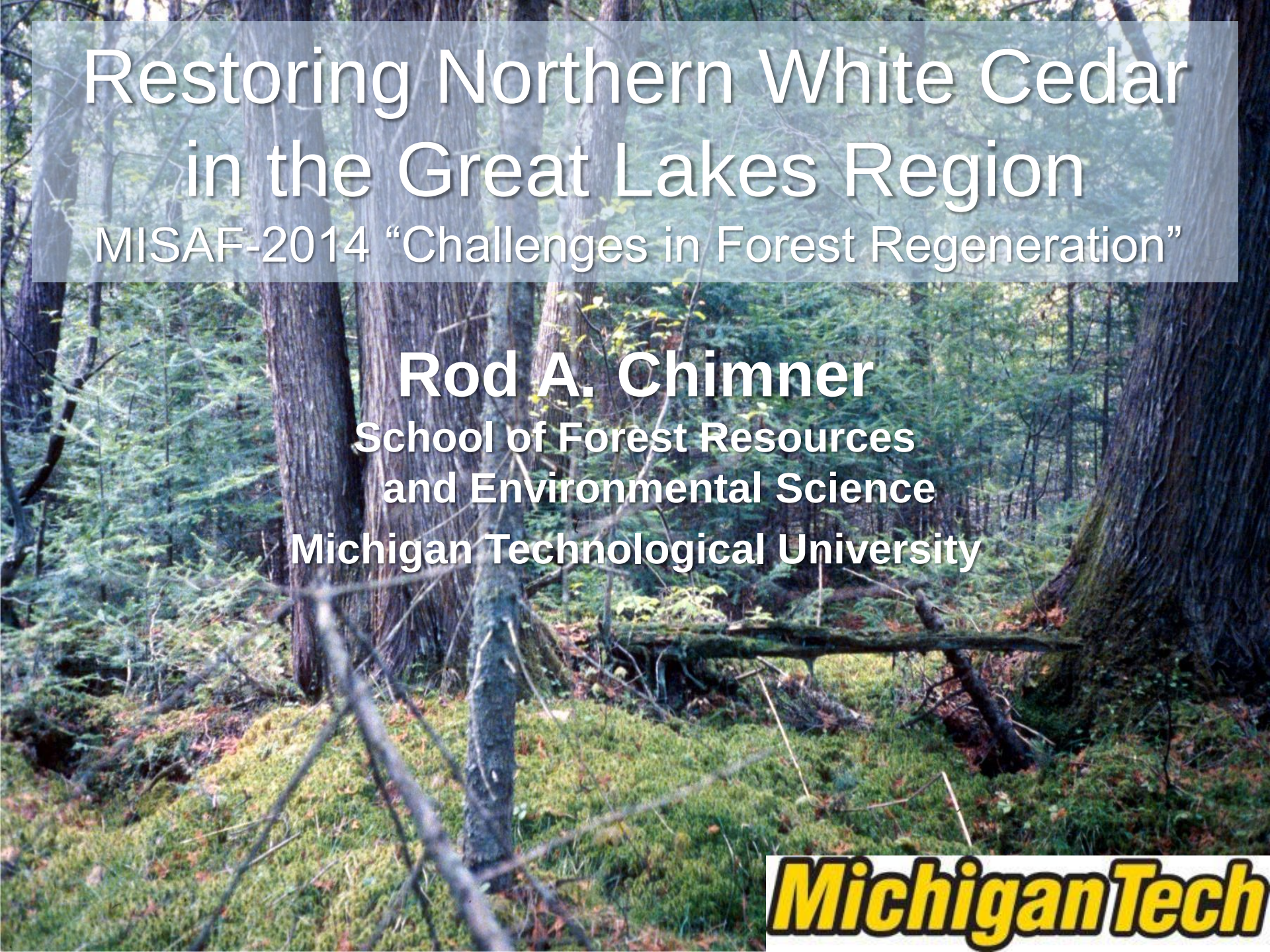


Northern white-cedar

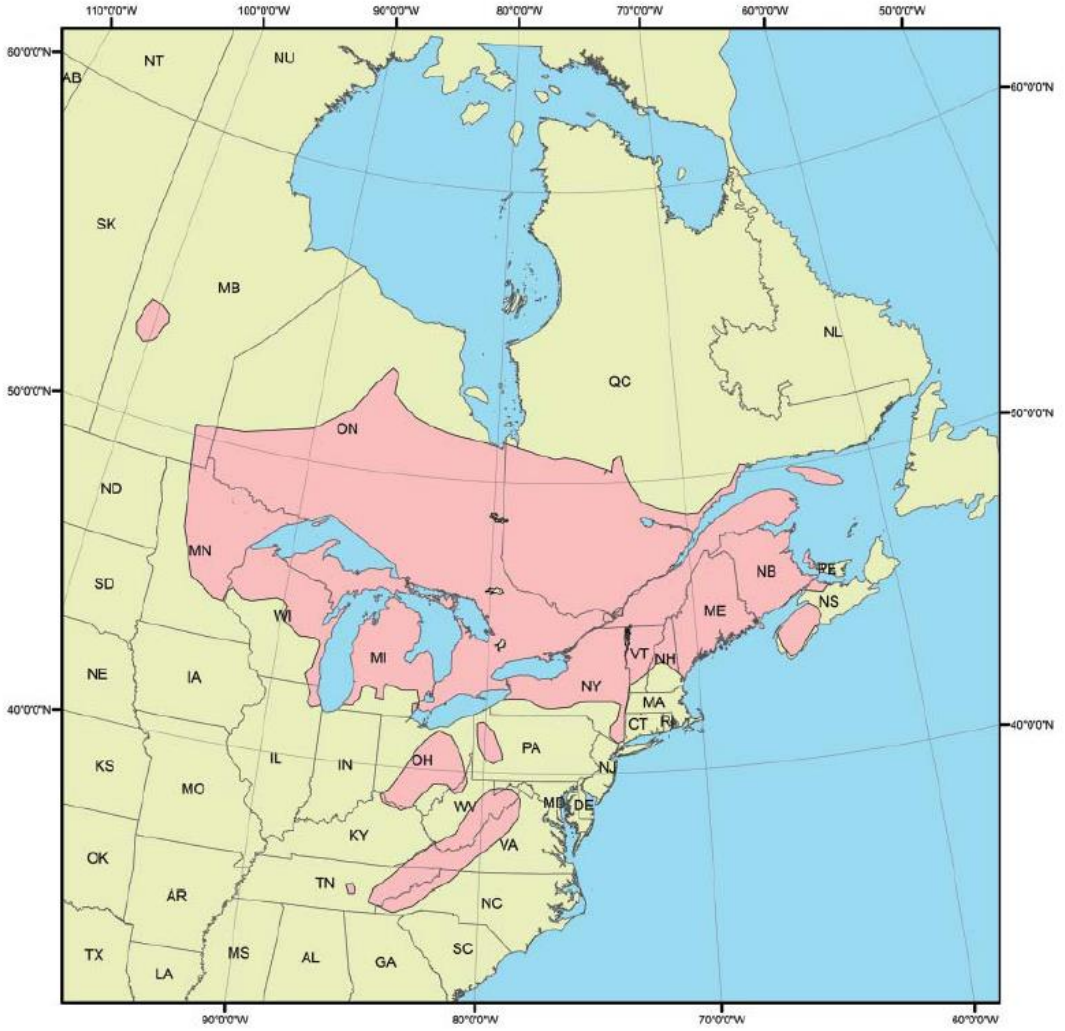
Cupressaceae (*Thuja occidentalis*) L.

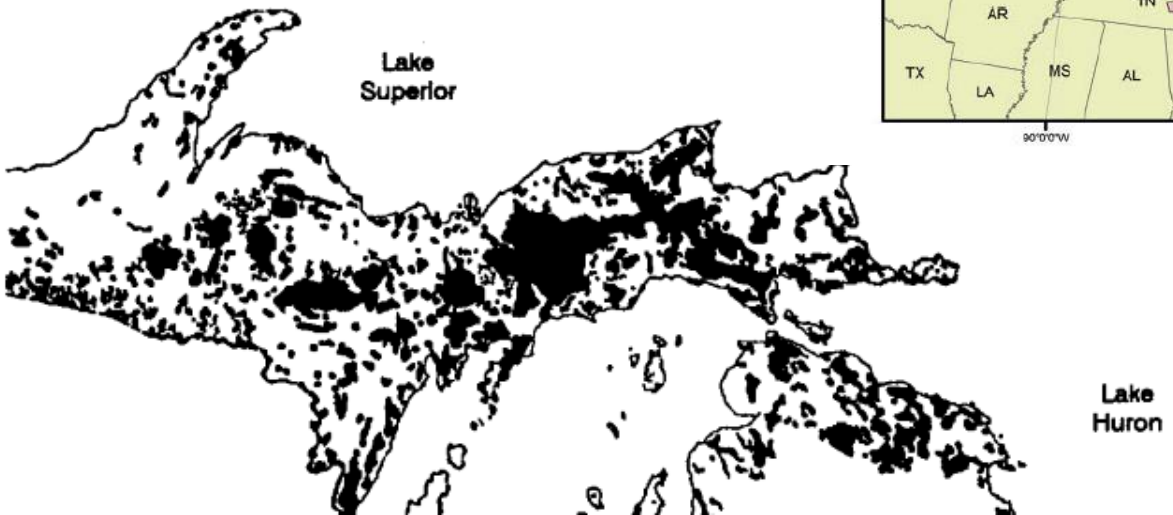
- **The genus *Thuja* contains about 5 species world-wide native to North America [2] (*T. plicata* and *occidentalis*) and Asia [3] (Japan and China).**
- **Related to cypress, redwoods, sequoia, western red cedar, fitzroya, juniper, but not cedars (*Cedrus*).**
- **There are no recognized subspecies, varieties, or forms.**

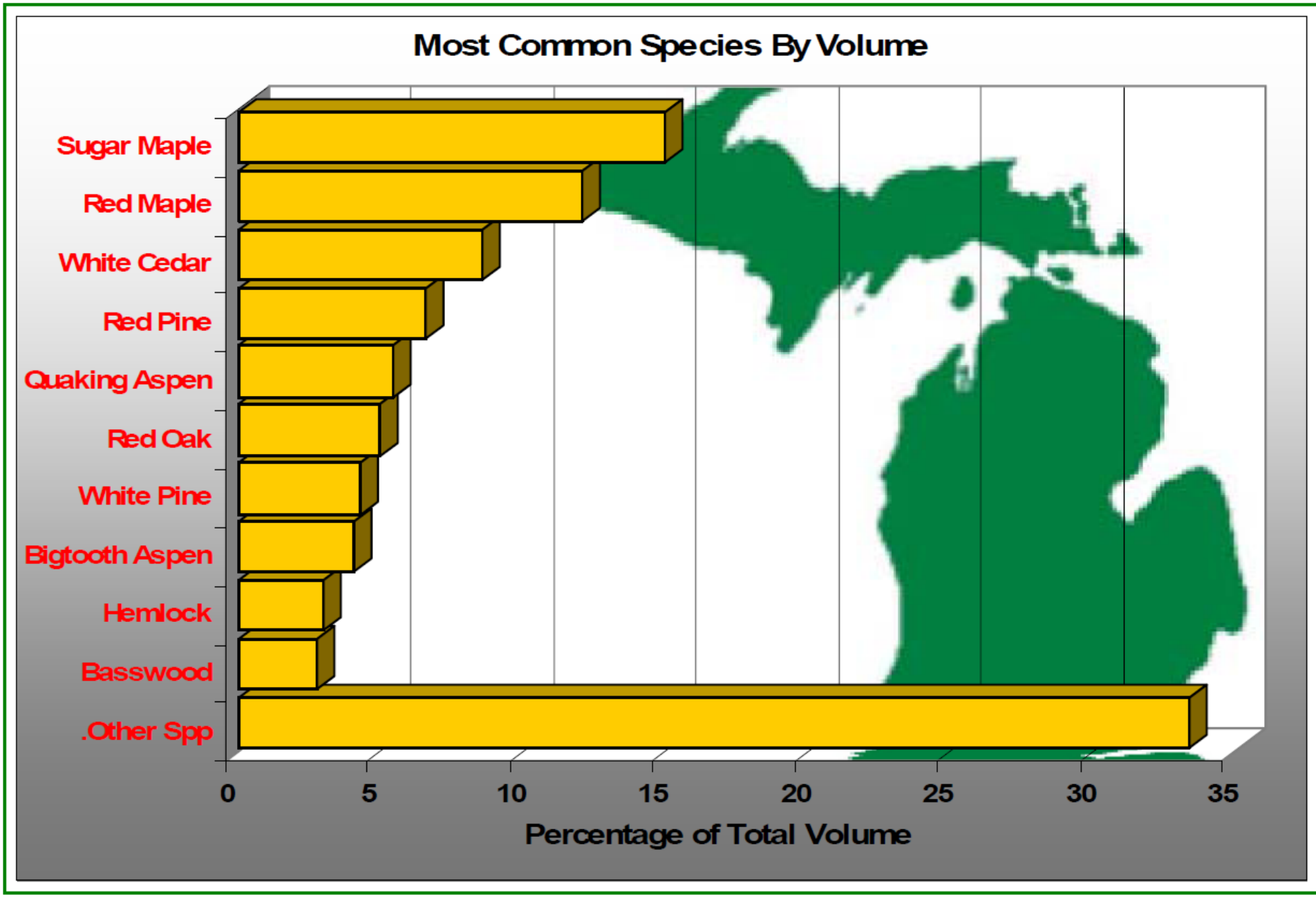
Area:

540,000 ha in MI
(1,334,000 acres)
(2,085 sq miles)

370,000 ha in UP
(920,000 acres)
(1,429 sq miles)







MICHIGAN STATE UNIVERSITY EXTENSION

Prepared by Bill Cook, MSU Extension, January 2006.

Importance and Uses

The rot- and termite-resistant wood is used principally for products in contact with water and soil (e.g., fence posts, decks, saunas, furniture, singles, and homes).

It is a widely planted ornamental.

Importance

- Northern white-cedar is valuable for wildlife habitat, particularly for deeryards during severe winters for thermal cover and browse.
- White-cedar is also utilized by such mammals as the snowshoe hare, porcupine, and red squirrel. Its browse is generally rated as highly preferred by hares and is sometimes heavily utilized.
- Birds common in white-cedar stands during the summer include several warblers (northern parula, black-throated green, blackburnian, black-and-white, and magnolia), white-throated sparrows, and kinglets. The pileated woodpecker commonly excavates cavities in mature white-cedars to feed upon carpenter ants.

Issues

- There continues to be a demand for cedar products, but there has been a problem regenerating cedar for over 70 years.
- Cedar is least studied commercial tree in NA
- Goal of talk is to give some guidelines for managing or restoring cedar.

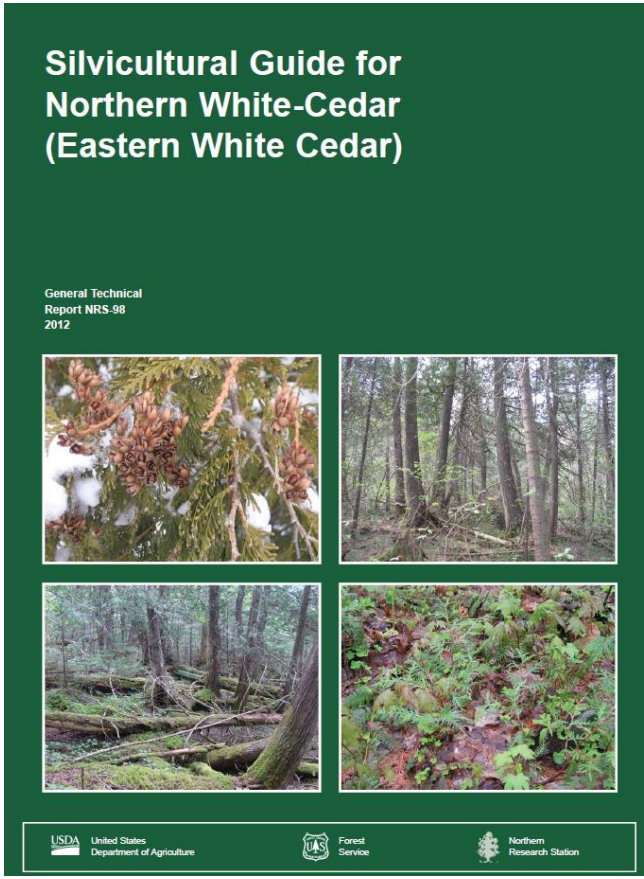
What you need to know to regenerate cedar

1. What type of habitat-peat, mesic, riparian…
    1. Seed source, hydrology, mycorrhizae, ect.
2. Basic cedar ecology
    1. Seed timing, cold stratified, distance, substrate
3. Hydrology
    1. Microtopography, light, bryophytes
4. Herbivory
    1. Fencing, tubes, snow depths

Silvicultural Guide for NW Cedar

GT Report NRS-98, 2012

1. Upland-shallow mineral soils, outcrops
2. Upland-deep, well drained
3. Lowland-deep mineral soils
4. Lowland-organic soils



*Why does this matter? Seed source, hydrology, microtopography, mycorrhizae, silvicultural and harvesting techniques, management…

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Ecology

Cedar are shade tolerant, slow growing and long-lived pioneer/climax trees.

Reproduction both vegetatively and from seeds

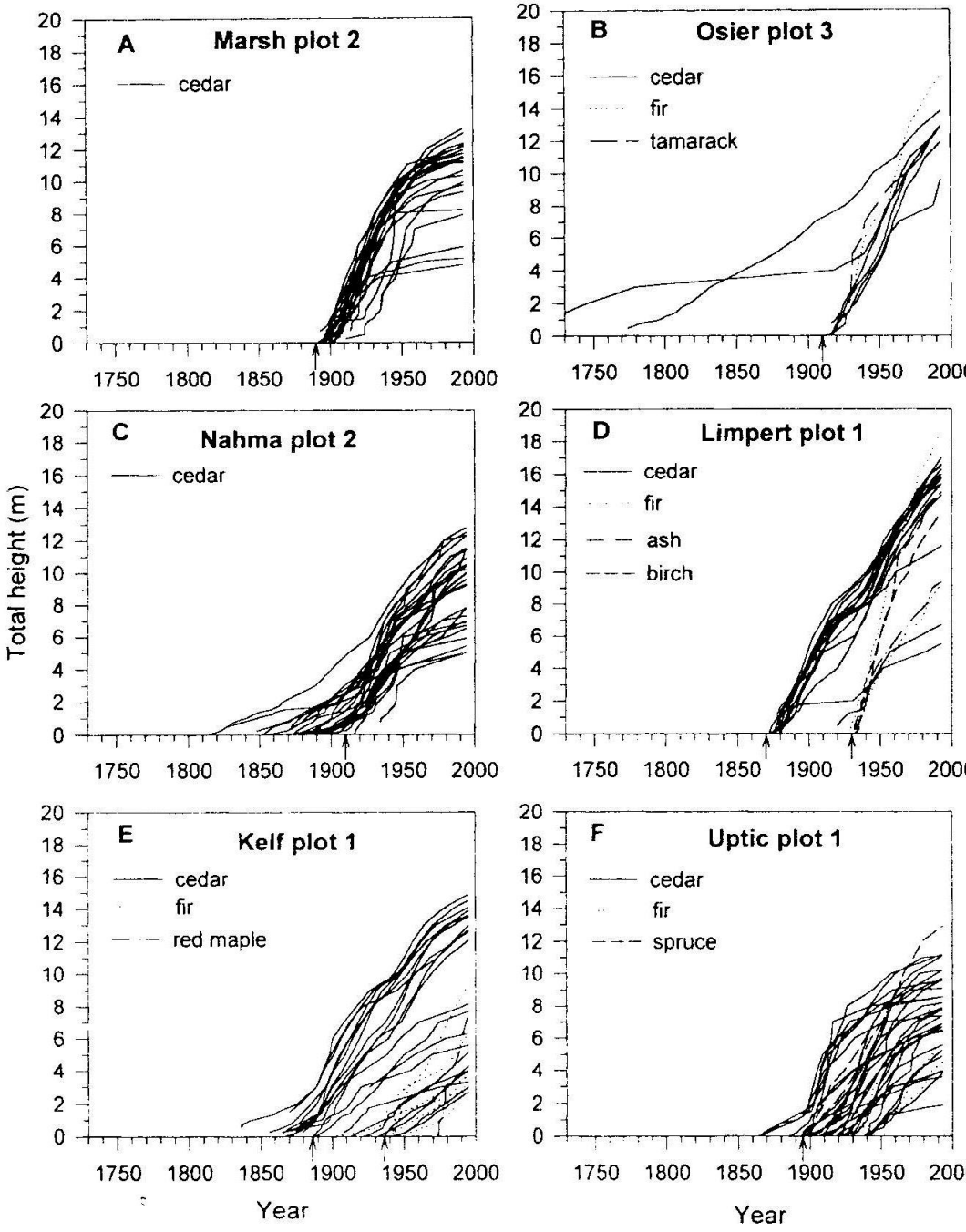
Can reproduce under the canopy, in canopy gaps, or stand replacing disturbances

Blows over easily

Most of the current cedar came in after large disturbance events (logging) between 1870 and 1935. Only 3% of all cedar established after 1945.

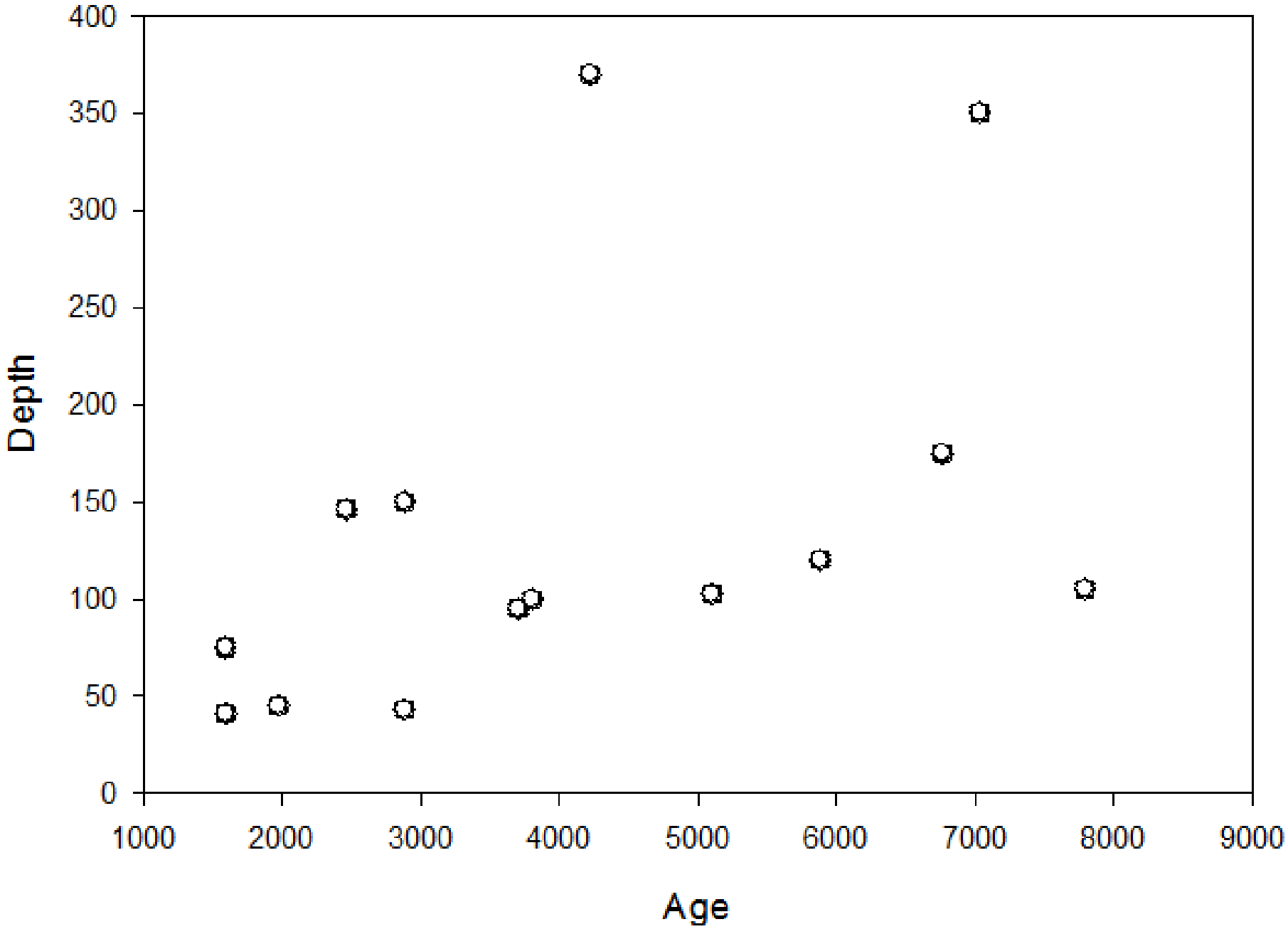
Likely disturbance released existing seedlings/saplings

What was the pre-logging forest like?



Data from Heitzman et al. 1997

How old are cedar swamps?


400
350
300
250
200
150
100
50
0
Depth
1000
2000
3000
4000
5000
6000
7000
8000
9000
Age

Vegetative Reproduction

- Northern white-cedar can send out roots from any part of a branch or stem if moisture conditions are favorable **(adventitious rooting).**
- Layering generally accounts for more than half the stems of white-cedar reproduction in northern Michigan swamps.
- Cedar also reproduce asexually by tree fall leaving a straight line of trees.

Seeds

Seed production starts at ~30 years and is best after 75 years (60,000-260,000 seeds)

Seeds dispersal range <200’, 60’ optimal (wind)

slight internal dormancy (winter)

Viable <1 year

Seed Substrates

decayed nurselogs

peat or humus

mineral soil

Very susceptible to drought mortality

decayed litter

Sphagnum moss

Can have difficulties with thick feathermosses

FIRE??

Seedlings

- Seedlings are very susceptible to drought
- Prefer an intermediate light level (~50 crown cover?).
- Seedling growth is slow. Annual height growth averages 3 inches (8 cm) in the first few years.
- Can withstand suppression for many year, and still respond to being released (but not always)
- Very susceptible to herbivory (>25% of foliage browsed can result in mortality)

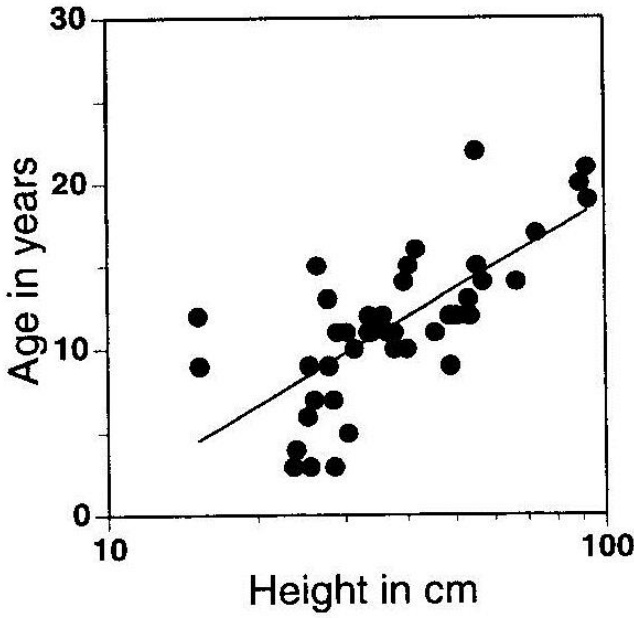
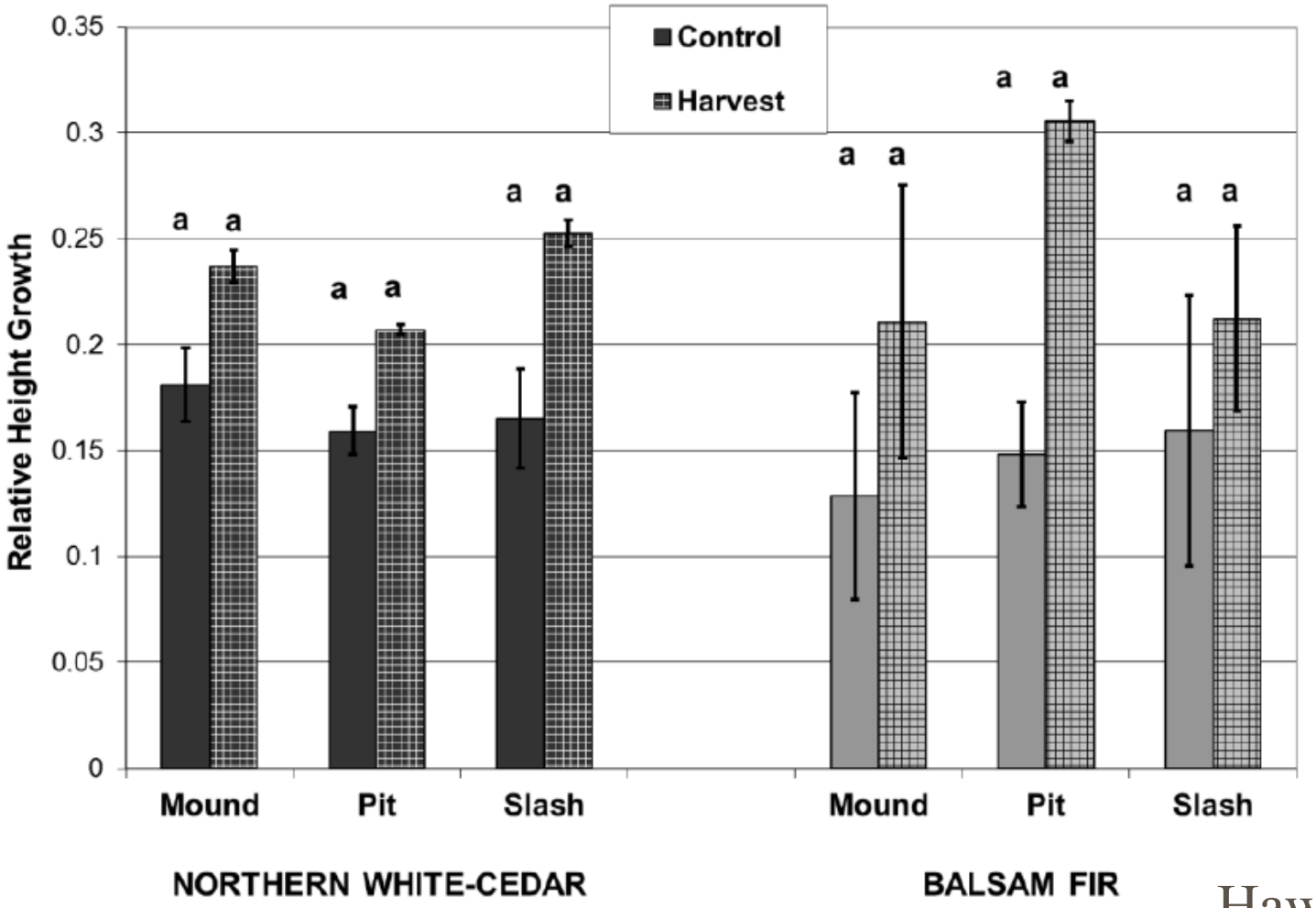


Figure 2.8. Control vs. Harvest comparison after four years in the field of northern white-cedar and balsam fir seedling growth in overstory x microsite interactions for (a) relative height growth and (b) relative diameter growth. Tukey's HSD test for means was performed between columns; means with the same letter (A,B; a,b) are not significantly different (n = 2 or 3, $\alpha = 0.05$).

(a)



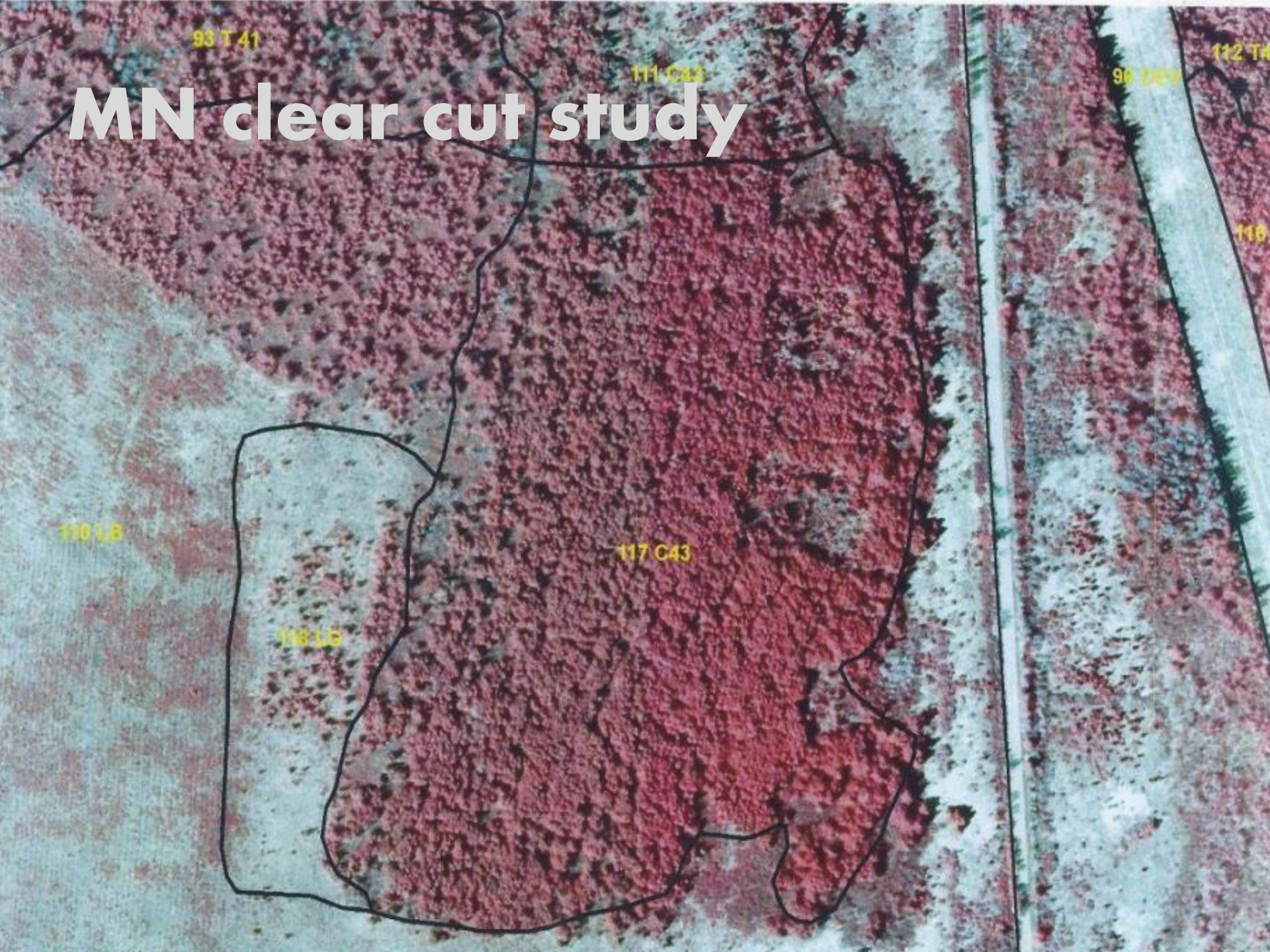
Haworth 2011

Silvicultural Management Options

"A combination of clearcut and shelterwood strips is currently recommended for harvesting mature stands of northern white-cedar and reproducing new ones, although other possible methods should be investigated [Johnston 1977]. If there are less than 10 northern white-cedar advance regeneration stems per miliacre (2.5 stems/sq m), a prescribed fire after clearcutting is recommended to eliminate heavy slash, set back competition, and prepare a seedbed [Johnston 1977, Lanasa 1989,Verme and Johnston 1986]. "

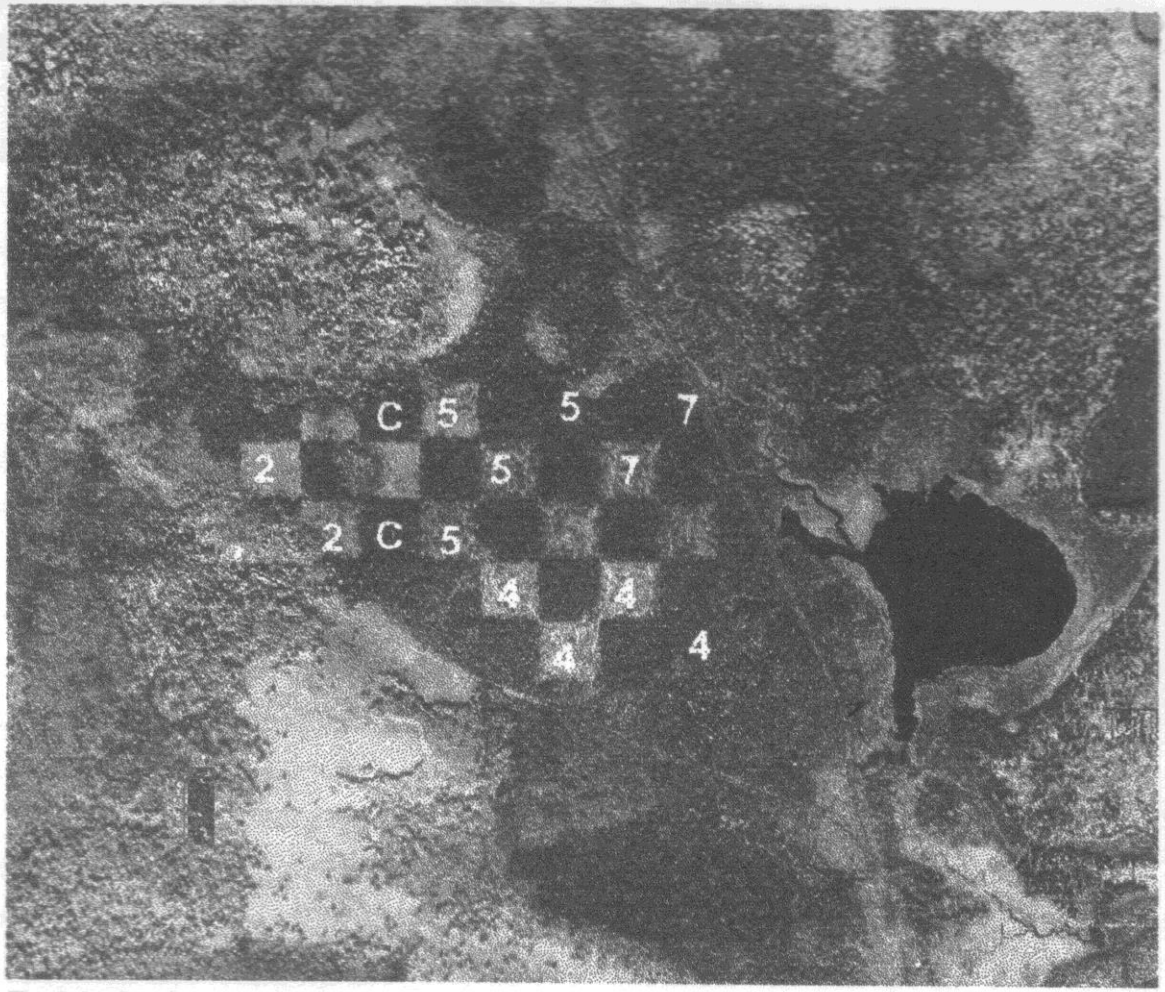
Carey, Jennifer H. 1993.

MN clear cut study



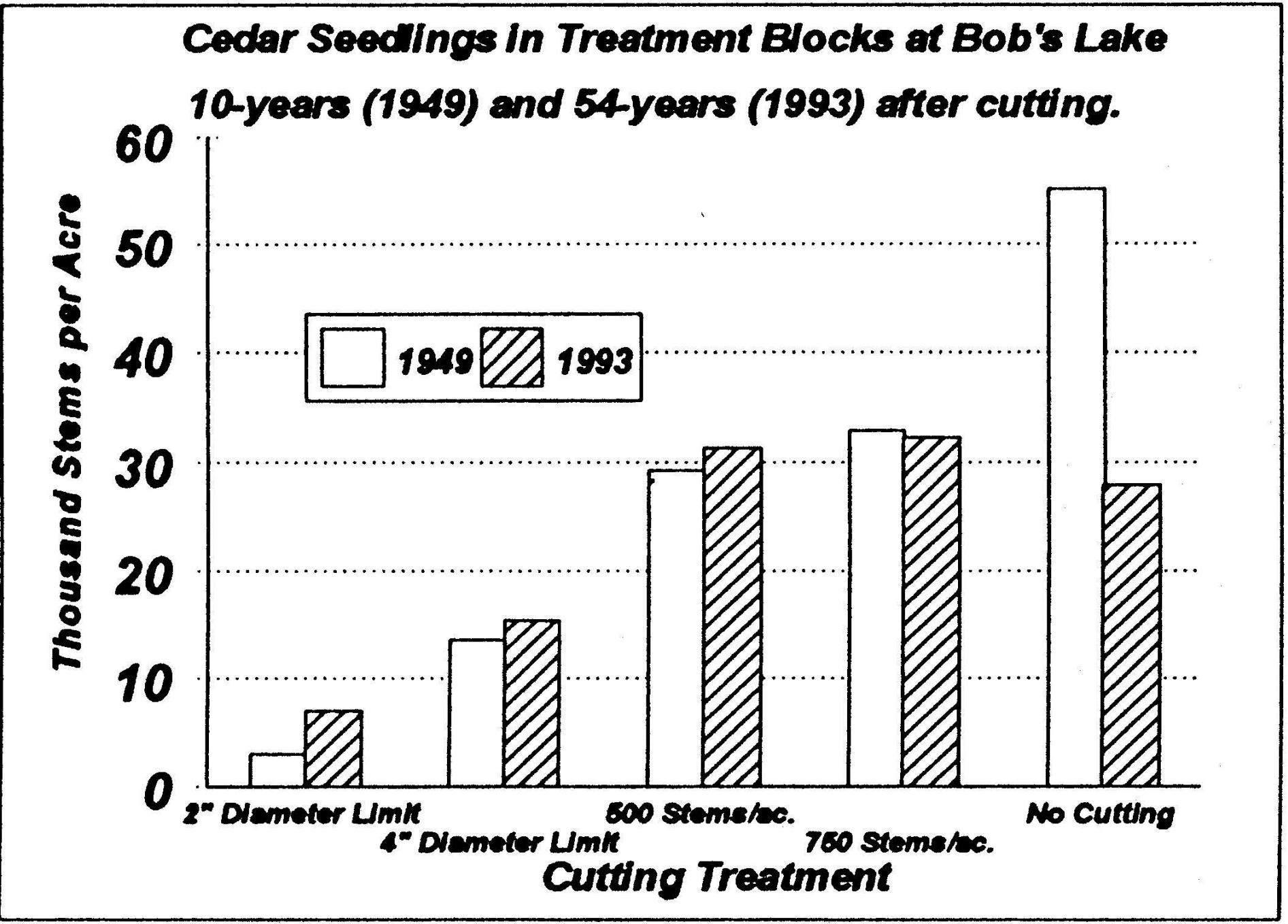
A SECOND LOOK AT BOB'S LAKE CEDAR REPRODUCTION STUDY

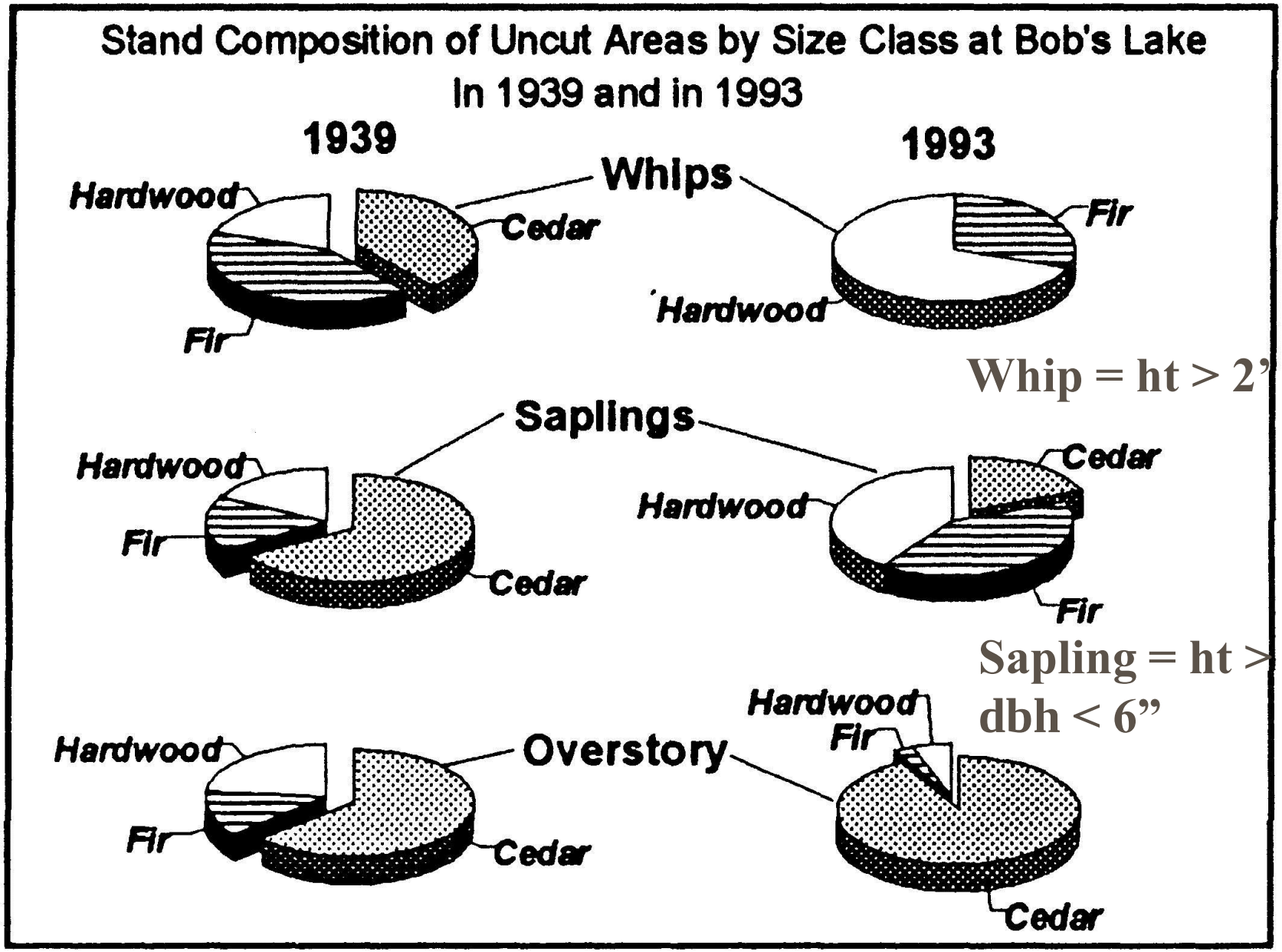
Rod Chimner- Michigan State University
Mike Zuidema- MDNR
Ray Miller- Michigan State University



Bob's Lake in **1939** (during cutting). Note the regrowth on the ridge to the north-west and the absence of regrowth on the ridge in the south-west corner of the photo. Treatment blocks are identified as follows: C=no cutting, 2=2" diameter limit, 4=4" diameter limit, 5=500 stems per acre, 7=750 stems per acre. Three treatment blocks in the north-east and south-east corners had not yet been cut when this photo was taken.

Data from Miller and Chimner 1995





Whip = ht > 2' & < 8'

Sapling = ht > 8' with a dbh < 6"

Overstory = dbh > 6"

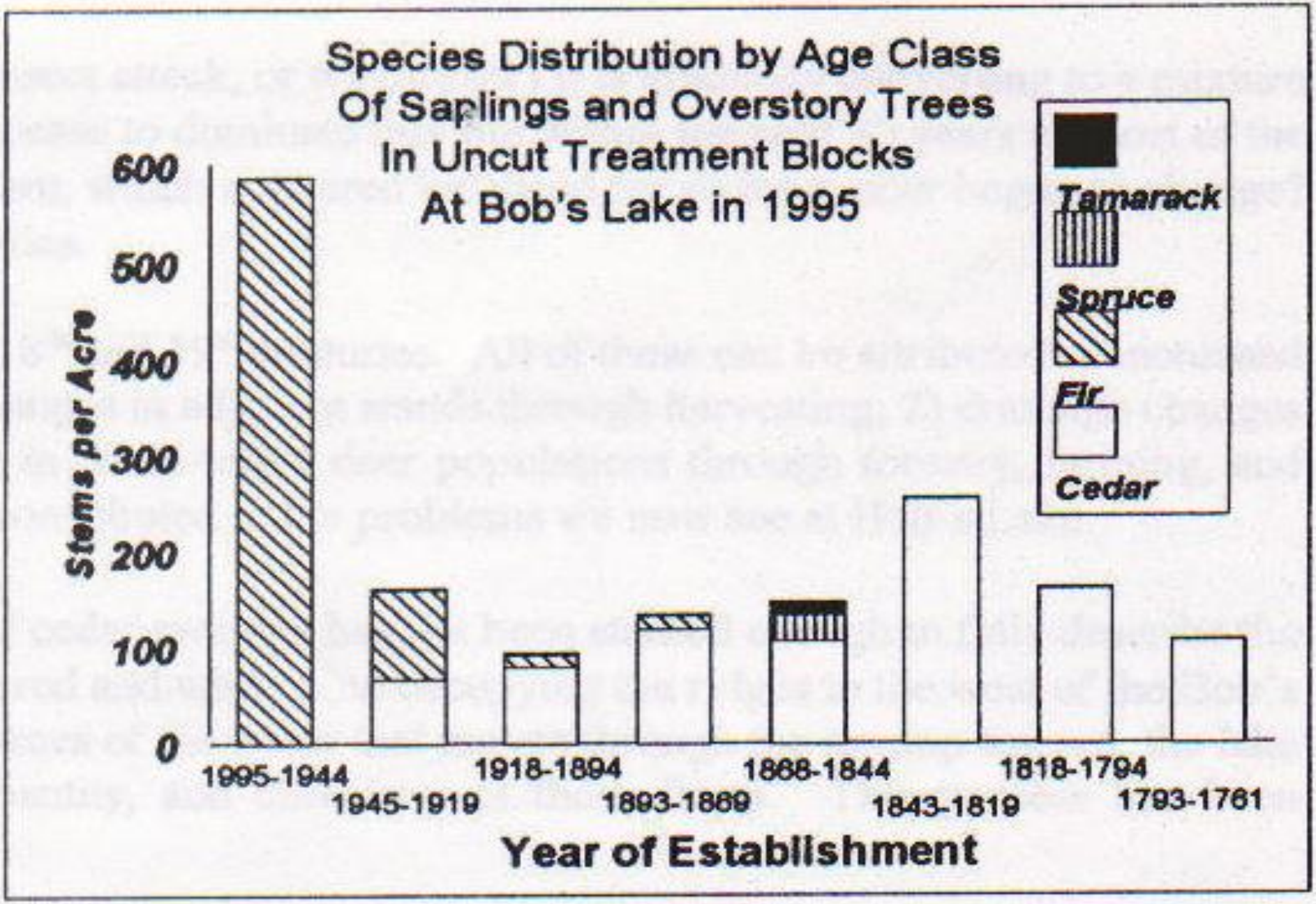

Species Distribution by Age Class
Of Saplings and Overstory Trees
In Uncut Treatment Blocks
At Bob's Lake in 1995
Tamarack
Spruce
Fir
Cedar
Stems per Acre
600
500
400
300
200
100
0
1995-1944
1945-1919
1918-1894
1893-1869
1868-1844
1843-1819
1818-1794
1793-1761
Year of Establishment

Figure 6

Table 2. Stand composition in the Bob's lake cutting at time of establishment and 1993 (In stems per acre).

Species	Stems 2-8 feet in height		Stems 6 inches dbh and over		Total stems over 2 feet in height	
	Time of establishment	1993[1]	Time of establishment	1993	Time of establishment	1993
N. White Cedar	189	0	158	275	1007	328
Black Spruce	2	7	58	20	109	36
Balsam Fir	200	520	33	4	400	679
Aspen	4	0	0	1	16	1
Red Maple	51	49	0	0	53	49
Tamarack	7	0	0	0	9	1
Alder	31	800[2]	0	0	138	1141
Other[3]	n/a	37	n/a	21	n/a	85
Total	484	1418	249	321	1732	2320

[1]Assumed 1 inch dbh to be equal to 2-8 feet in height for summer of 1993.
[2]Alder was not seperated into 1 inch dbh class, approximately equal to 800 alder/acre.
[3]Other species include:paper birch, black ash, aspen and dogwood (*Cornus* spp. Michx.).

Silvicultural Management Options

- Site Preparations: Recommended treatments include:
  - Burning (reduce sphagnum, blacken soil, bare soil, pH)
  - Mechanical scarification (grind and mix soil)
  - Micro site modification (bedding, furrowing and mounding)
  - pH and fertility adjustments
  - Light

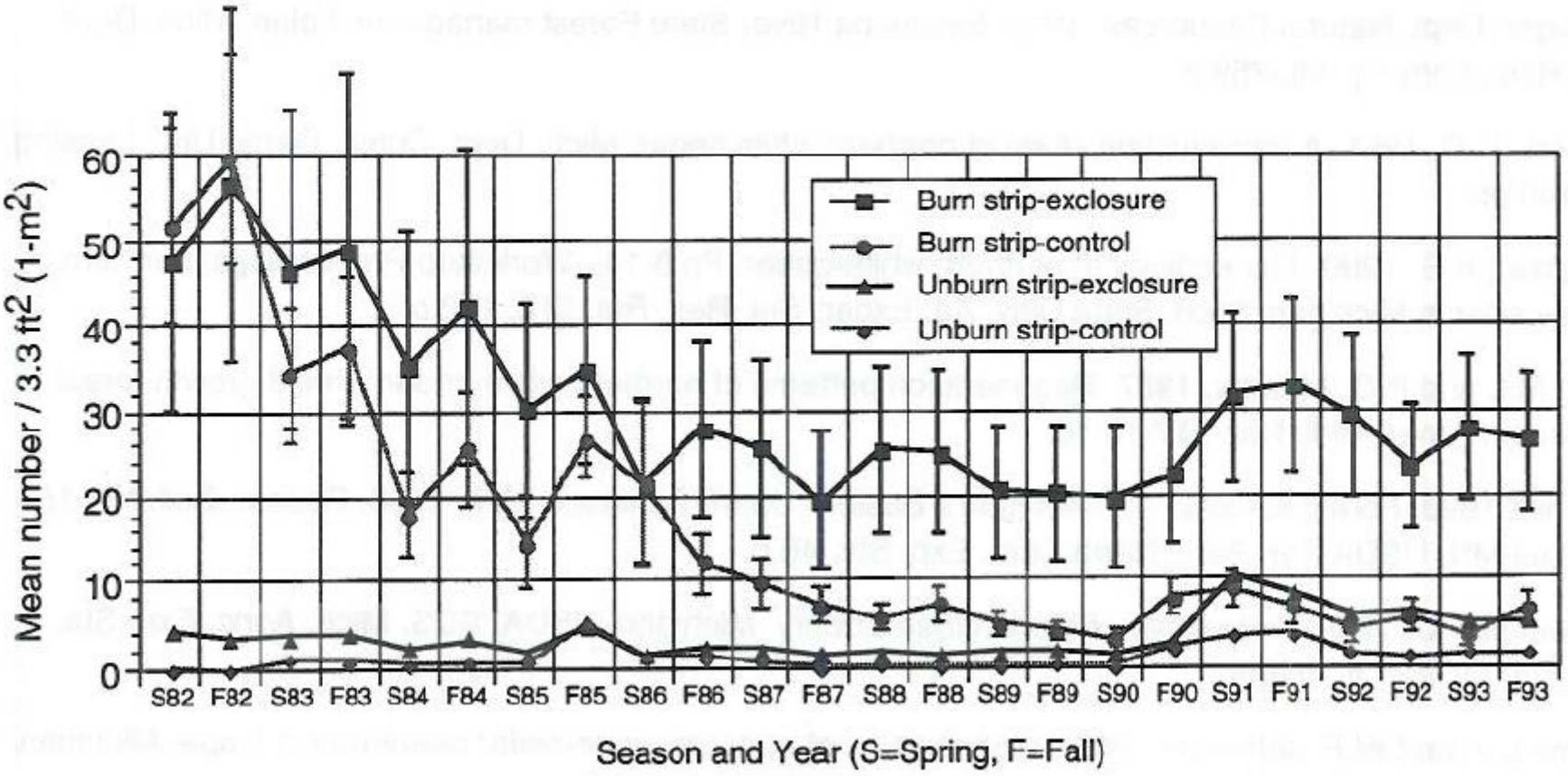
  Caveat: These methods have been poorly tested and outcomes are unknown.

Northern White Cedar Regeneration in Menominee County, Michigan

WILDLIFE DIVISION REPORT 3255

Robert V. Doepker, Michigan Department of Natural Resources, Norway, MI
Dean E. Beyer, Jr., Michigan Department of Natural Resources, Shingleton, MI
Larry J. Visser, Michigan Department of Natural Resources, Houghton Lake Heights, MI
Frank C. Short, Michigan Department of Natural Resources, Gladstone, MI
Frank M. Short, Rapid River, MI

Figure 2. Mean number (+/- 1 SE) of cedar seedlings counted per 3.3 ft^2 (1-m^2), in clear-cut strips with four different post sale treatments, EMU30, Menominee County, Michigan, 1982-1993.



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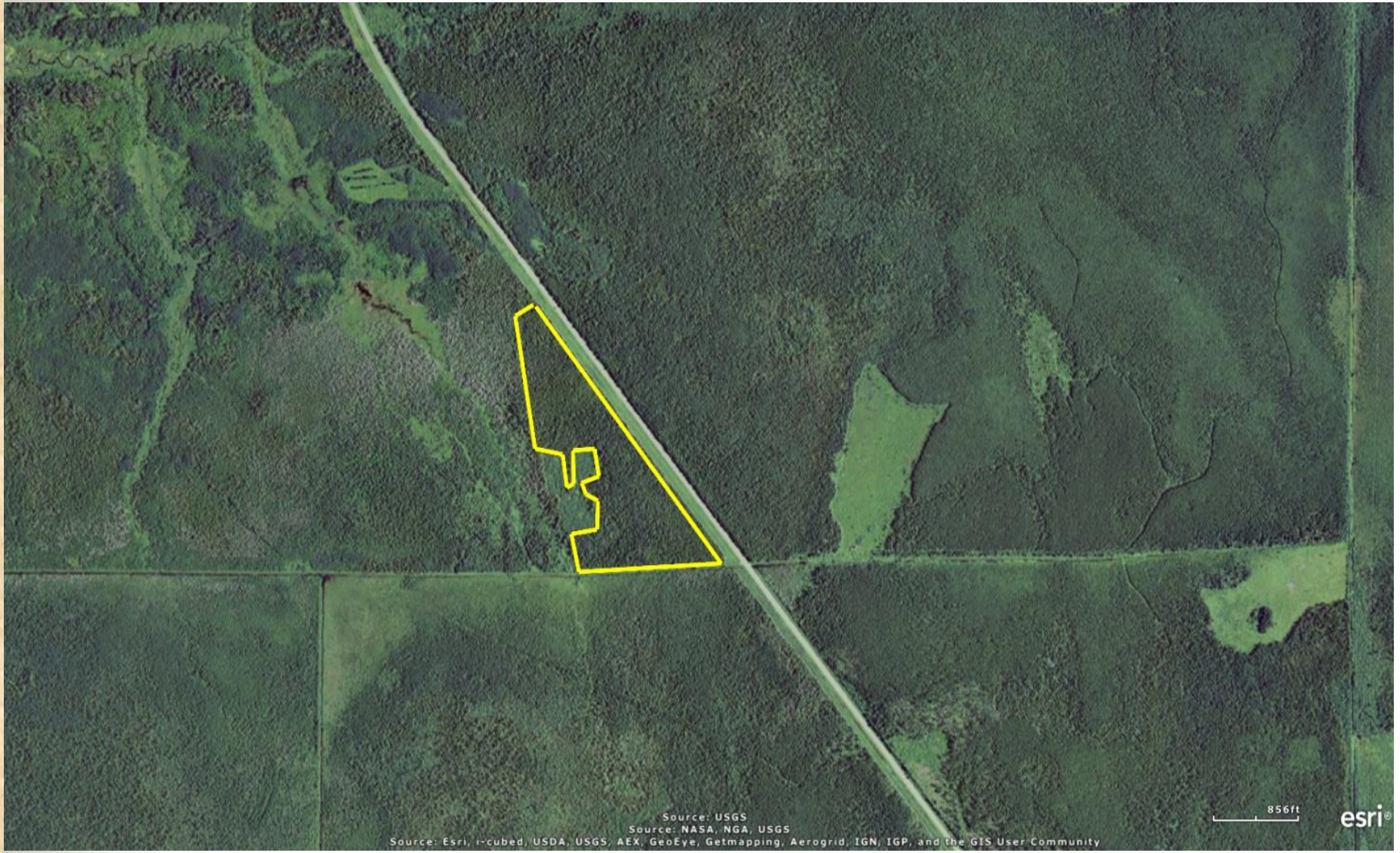
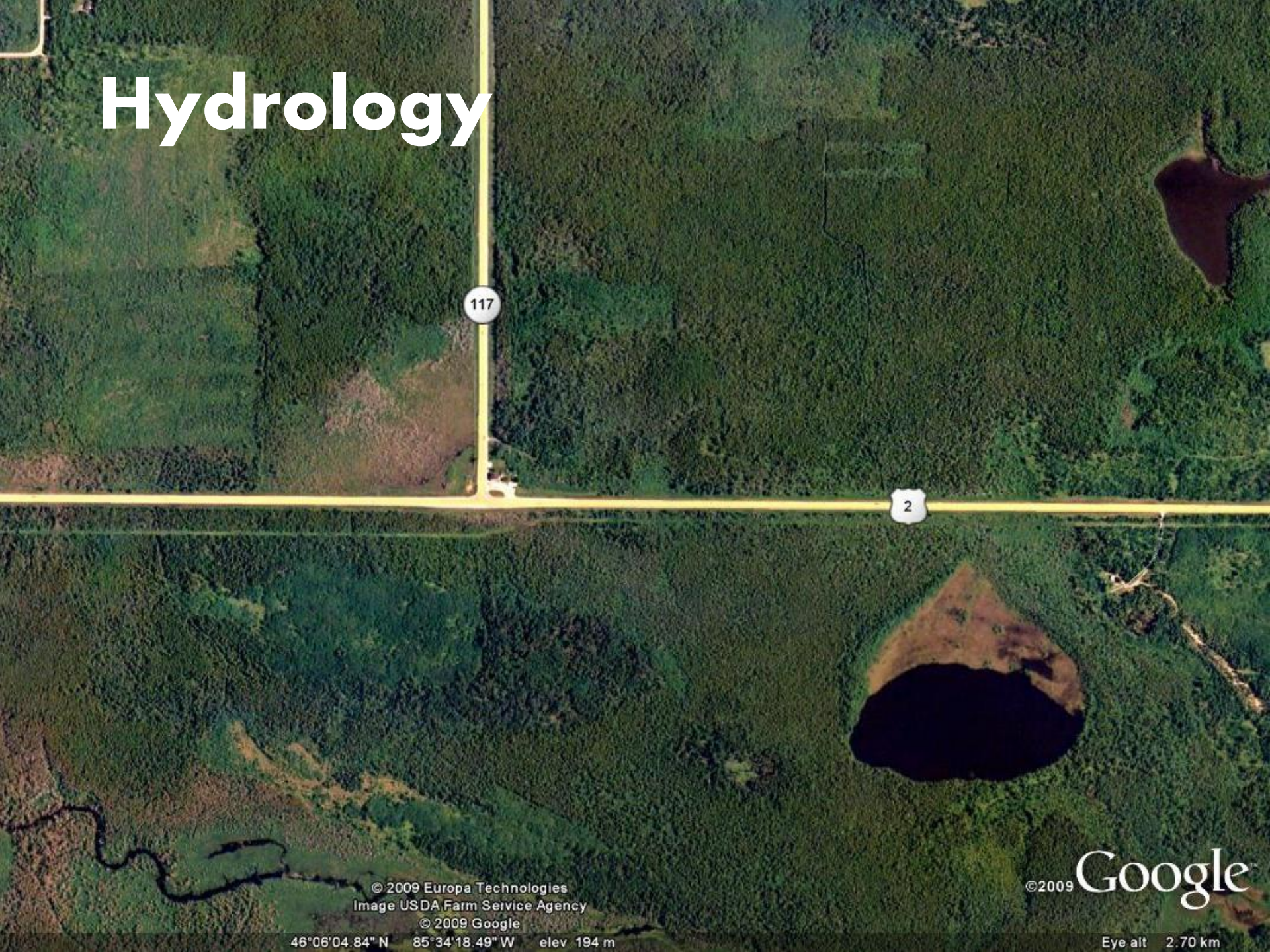
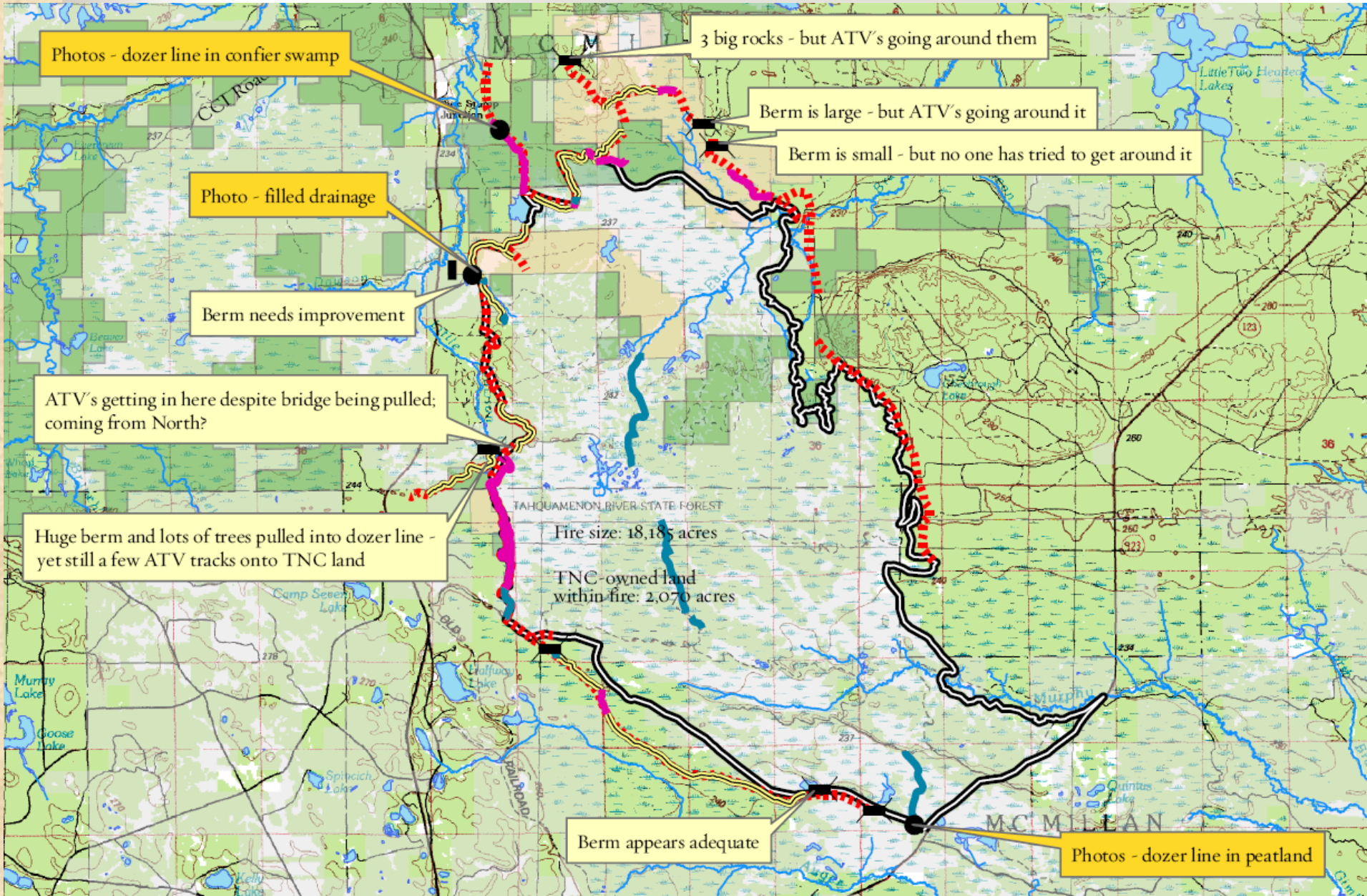
Beltrami County Sites-#276



Hydrology


117
2
© 2009 Europa Technologies
Image USDA Farm Service Agency
© 2009 Google
46°06'04.84" N 85°34'18.49" W elev 194 m
©2009 Google
Eye alt 2.70 km

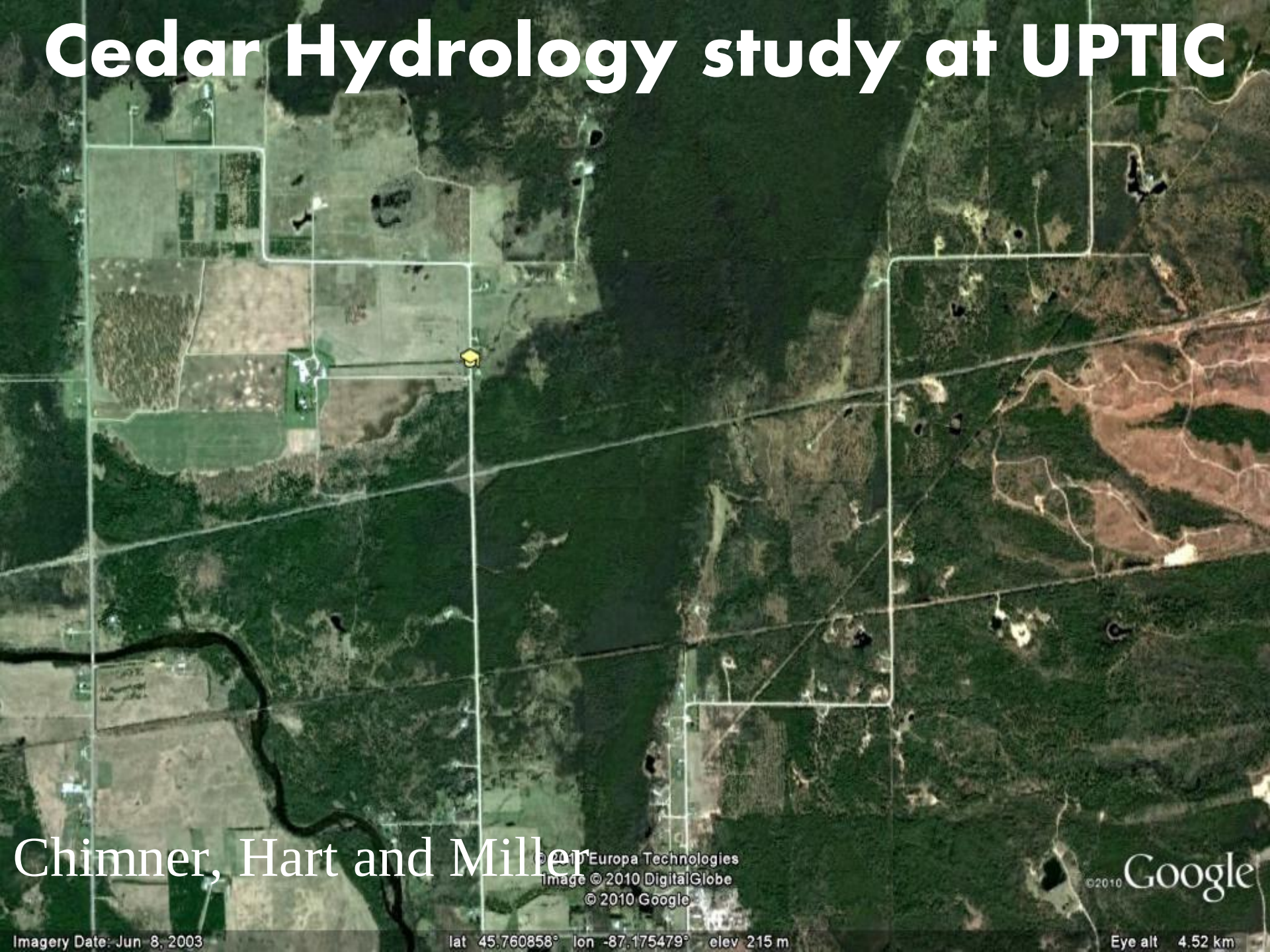
Sleeper Lake Fire-2007

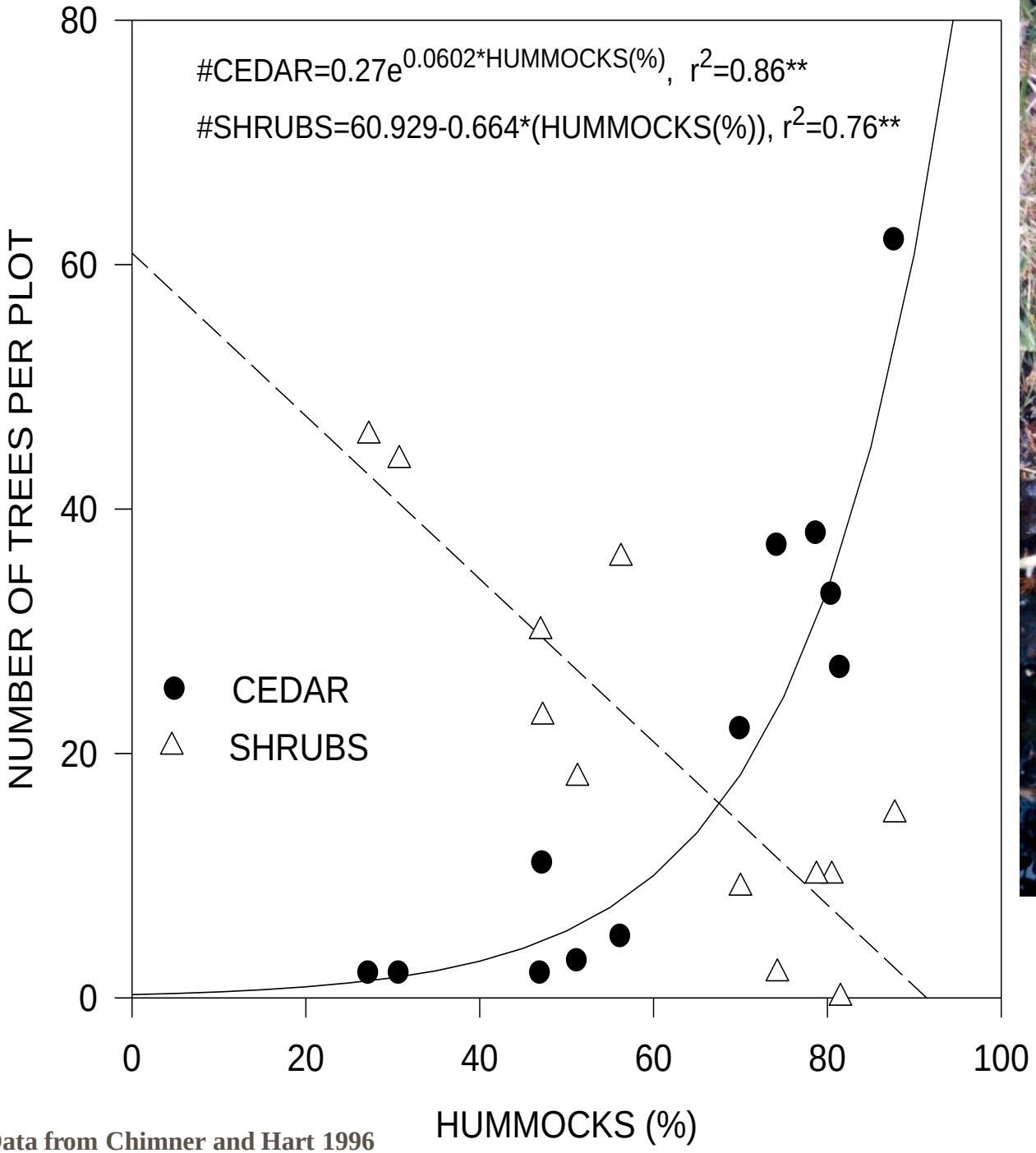



Light Conditions


STIHL

Cedar Hydrology study at UPTIC

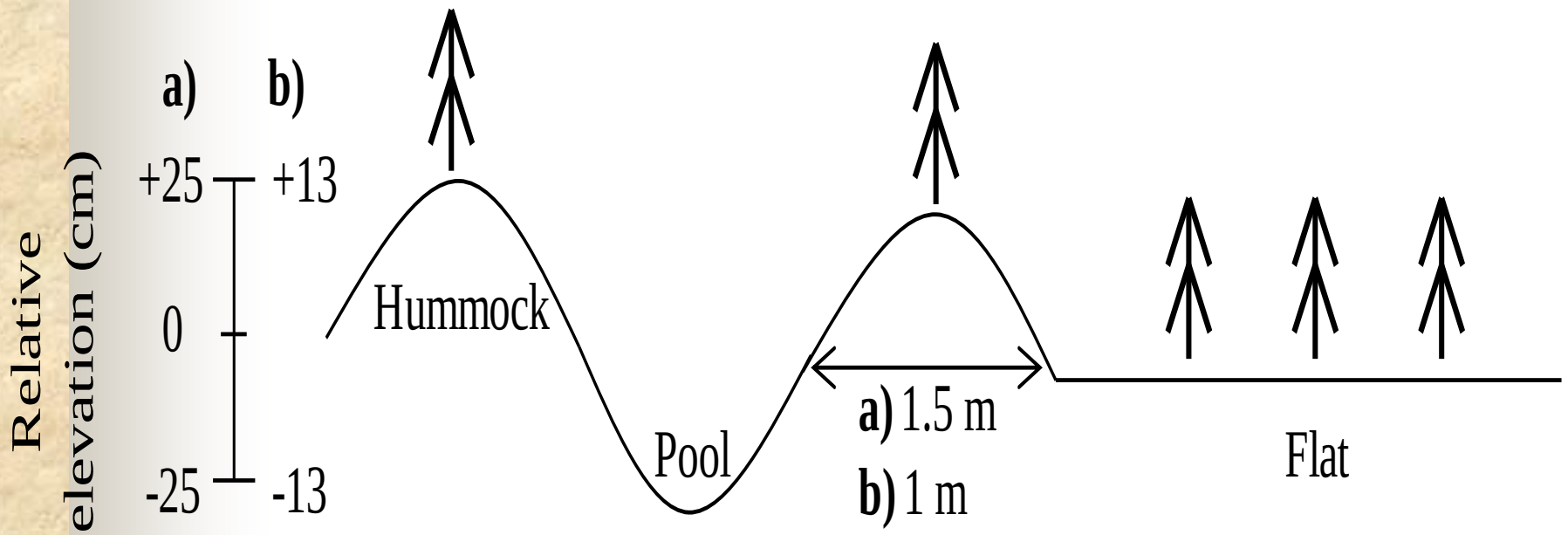


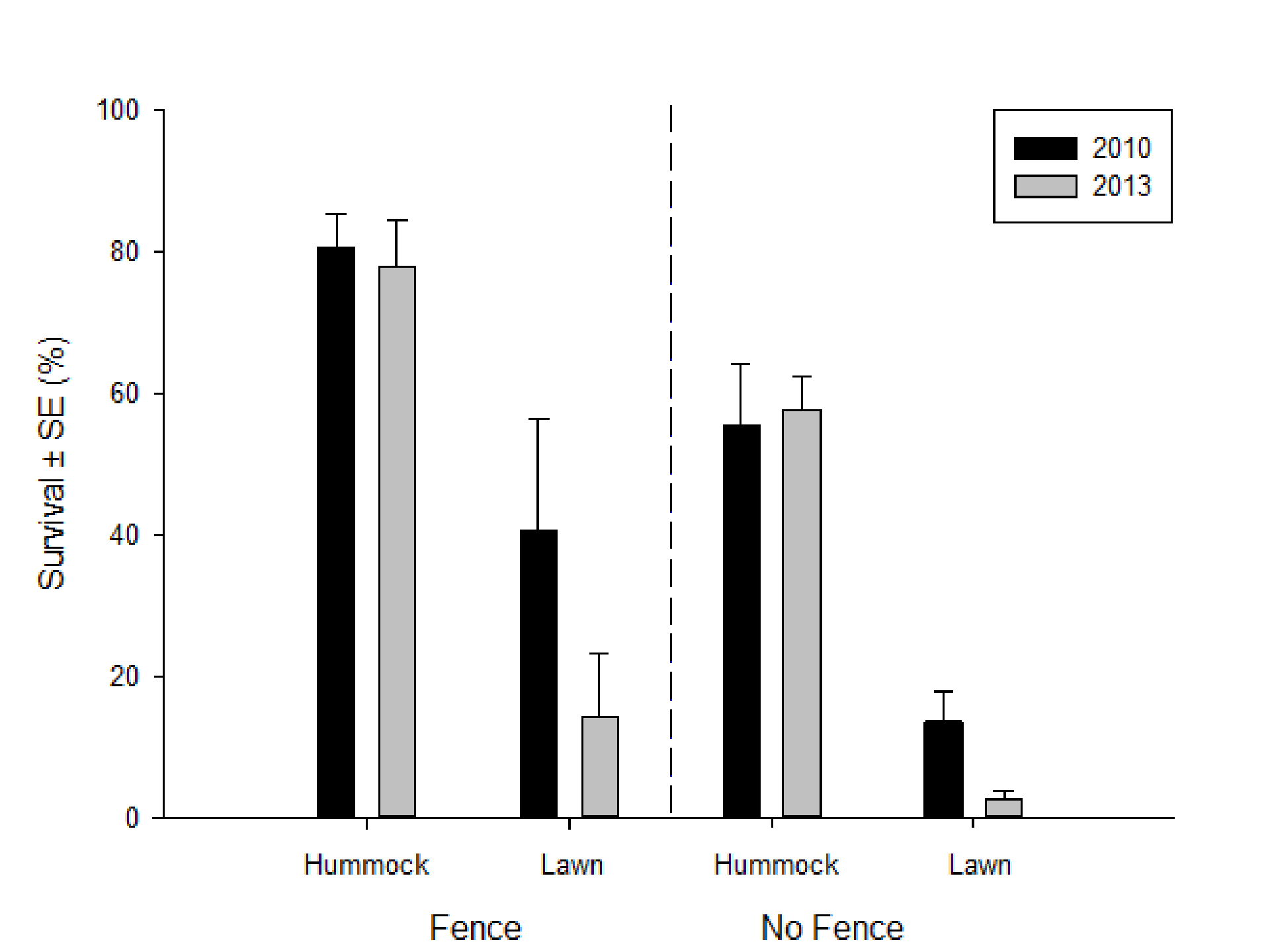


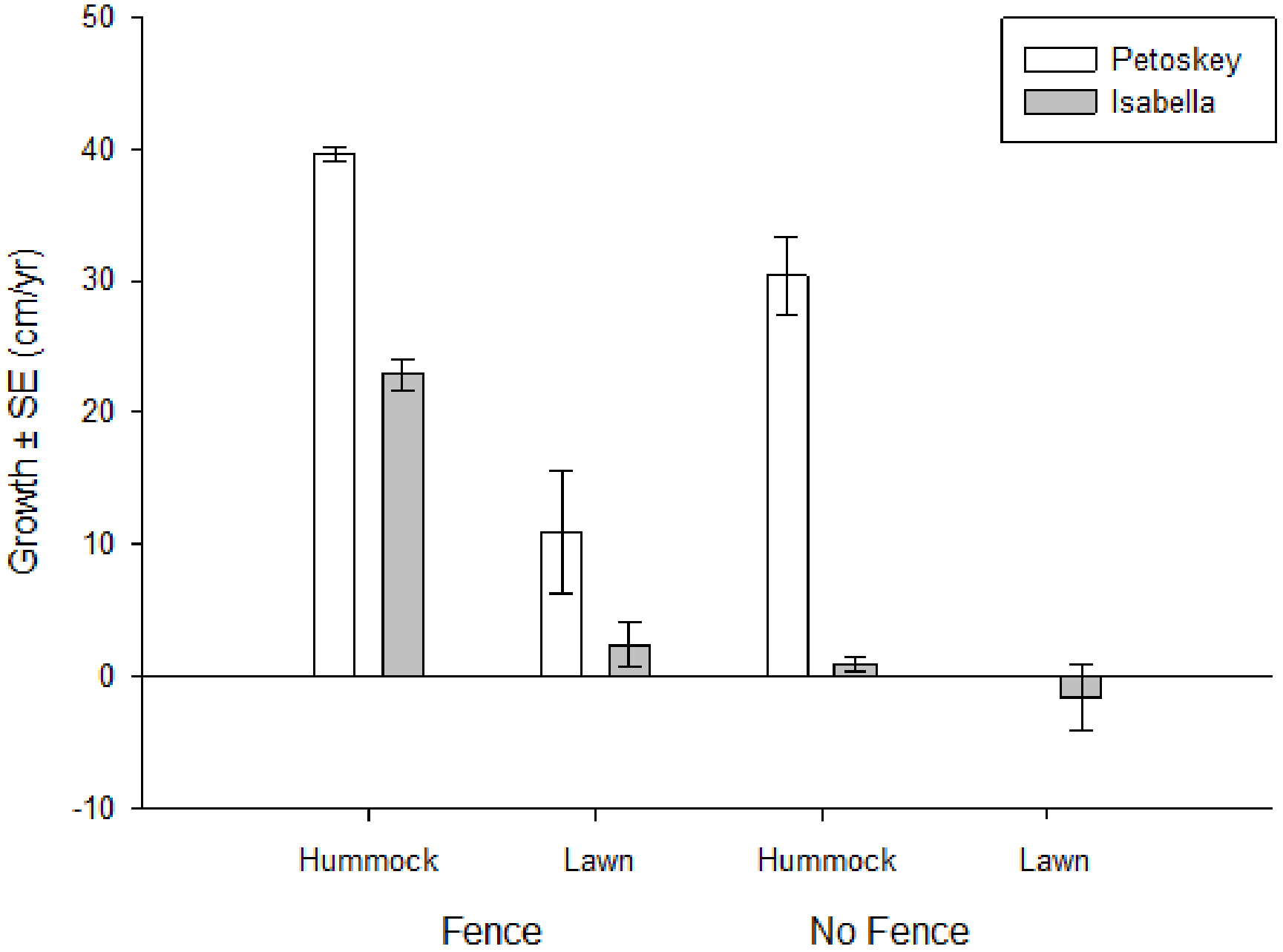
Data from Chimner and Hart 1996

MDOT Cedar Construction

Microtopography




100
80
60
40
20
0
Survival ± SE (%)
2010
2013
Hummock
Lawn
Hummock
Lawn
Fence
No Fence


50
40
30
20
10
0
-10
Growth ± SE (cm/yr)
Petoskey
Isabella
Hummock
Lawn
Hummock
Lawn
Fence
No Fence

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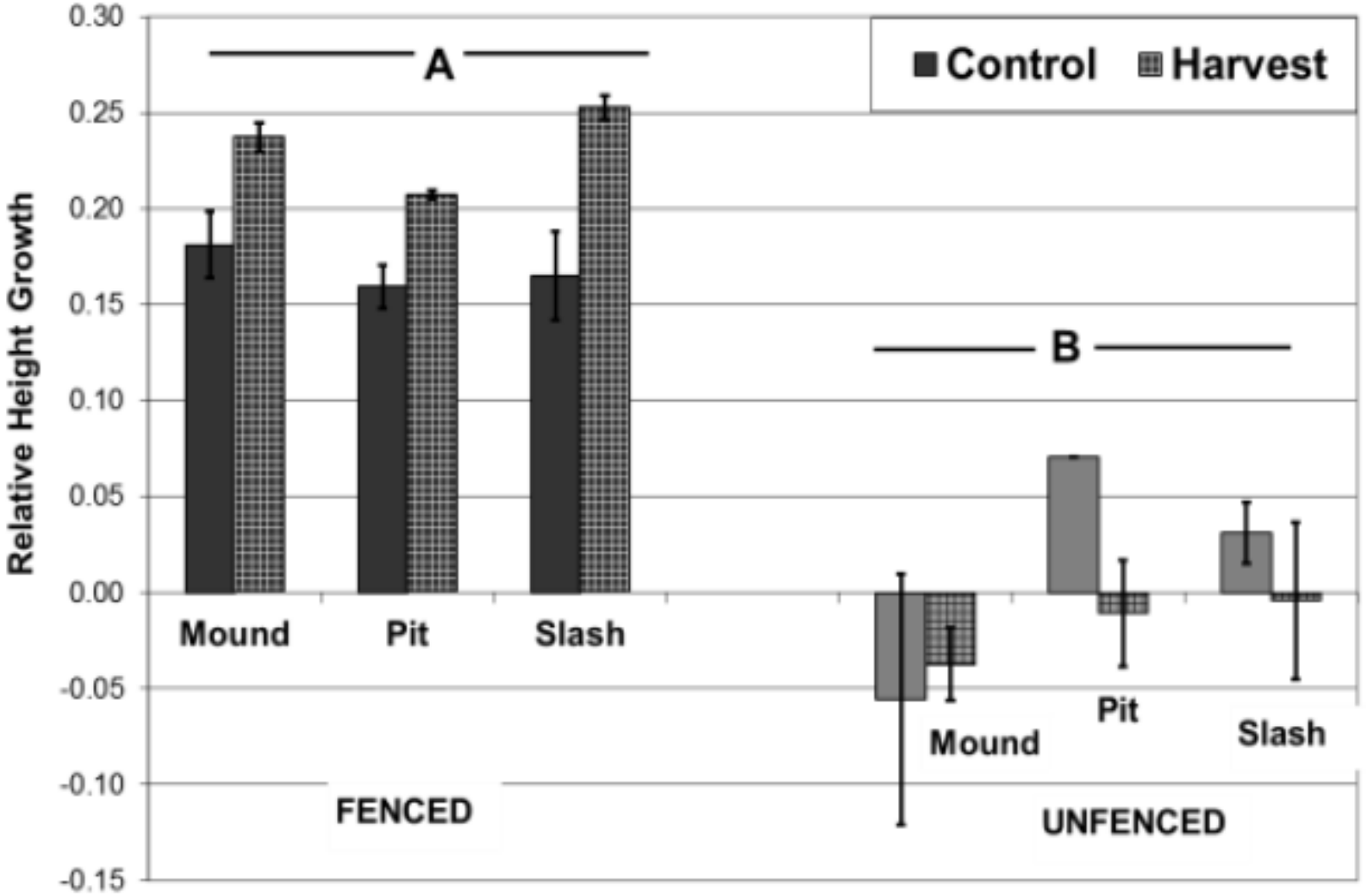
(a)



Haworth 2011

Management Options

- Wildlife Control: Recommended treatments include:
  - Exclosures ($$)
  - Lure animals away by feeding??
  - Reduce populations
  - Introduce predators
  - More snow??

2012 Silvicultural Guidelines

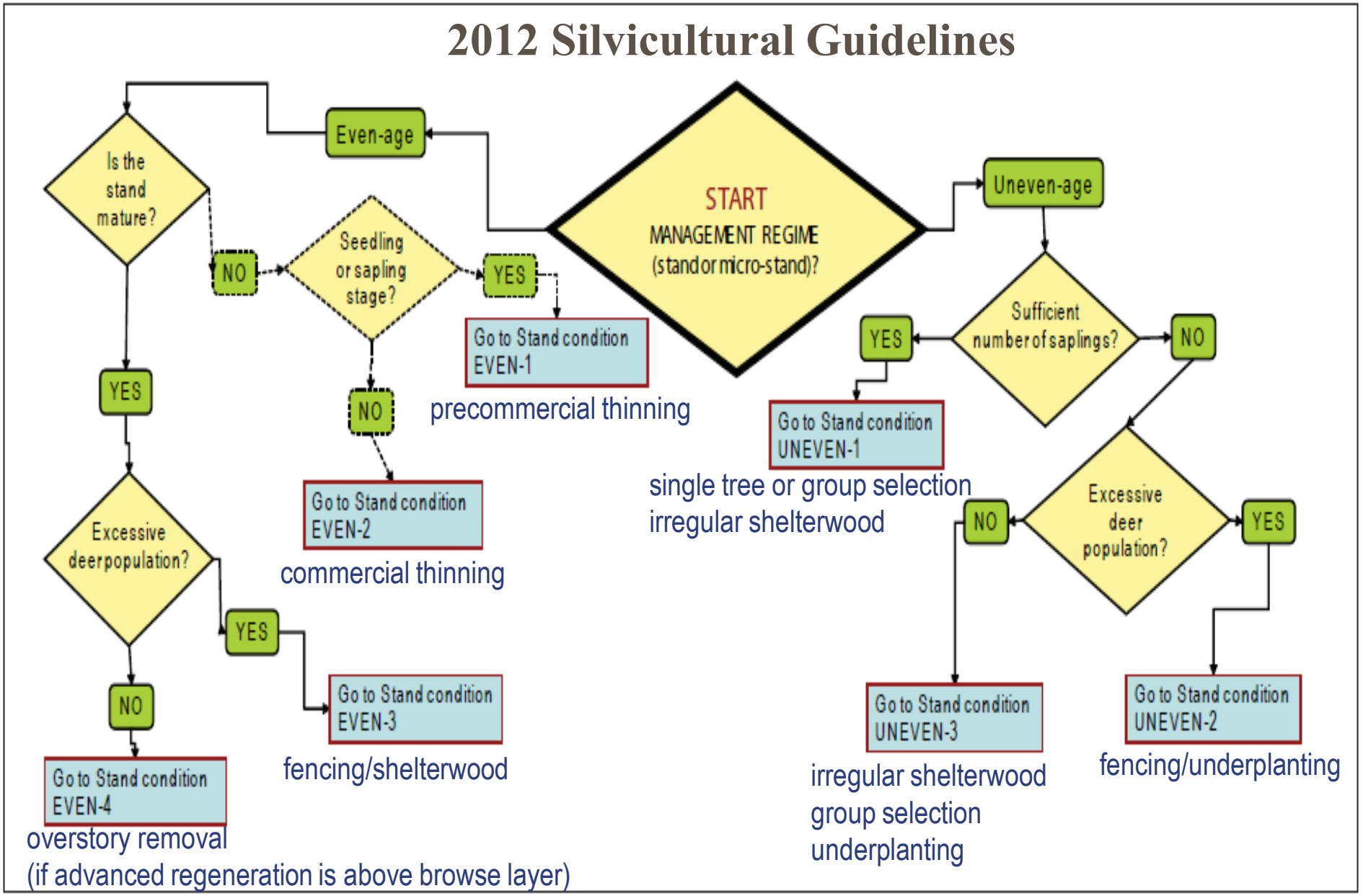


Figure 10.—Decision key for cedar management. Figure by Jean-Claude Ruel, Jean-Martin Lussier, and Guy Lessard for the first version, used with permission.

Things to remember…

- Cedar blows over easily
- Invasive species can invade when canopy is opened
- Hydrology matters- too dry or too wet
- Herbivory protection really matters