Old Growth Red Oak

Umlah Hill Drumlin

"Multiaged old growth red oak stand on the Chebucto Peninsula"

Nick Hill & David Patriquin,

for the MTRI Old Forest Conservation Science Conference, Debert, N.S. Oct 19-21, 2016

David Patriquin: Speaker, Friday 2:25-2:55 pm (Gunner Room).

David Patriquin retired as a Professor of Biology from Dalhousie University in 2008. Since then has been active in several natural history and environmental organizations with a focus on the Chebucto Peninsula.

Title: Multi-aged old growth red oak stand on the Chebucto Peninsula

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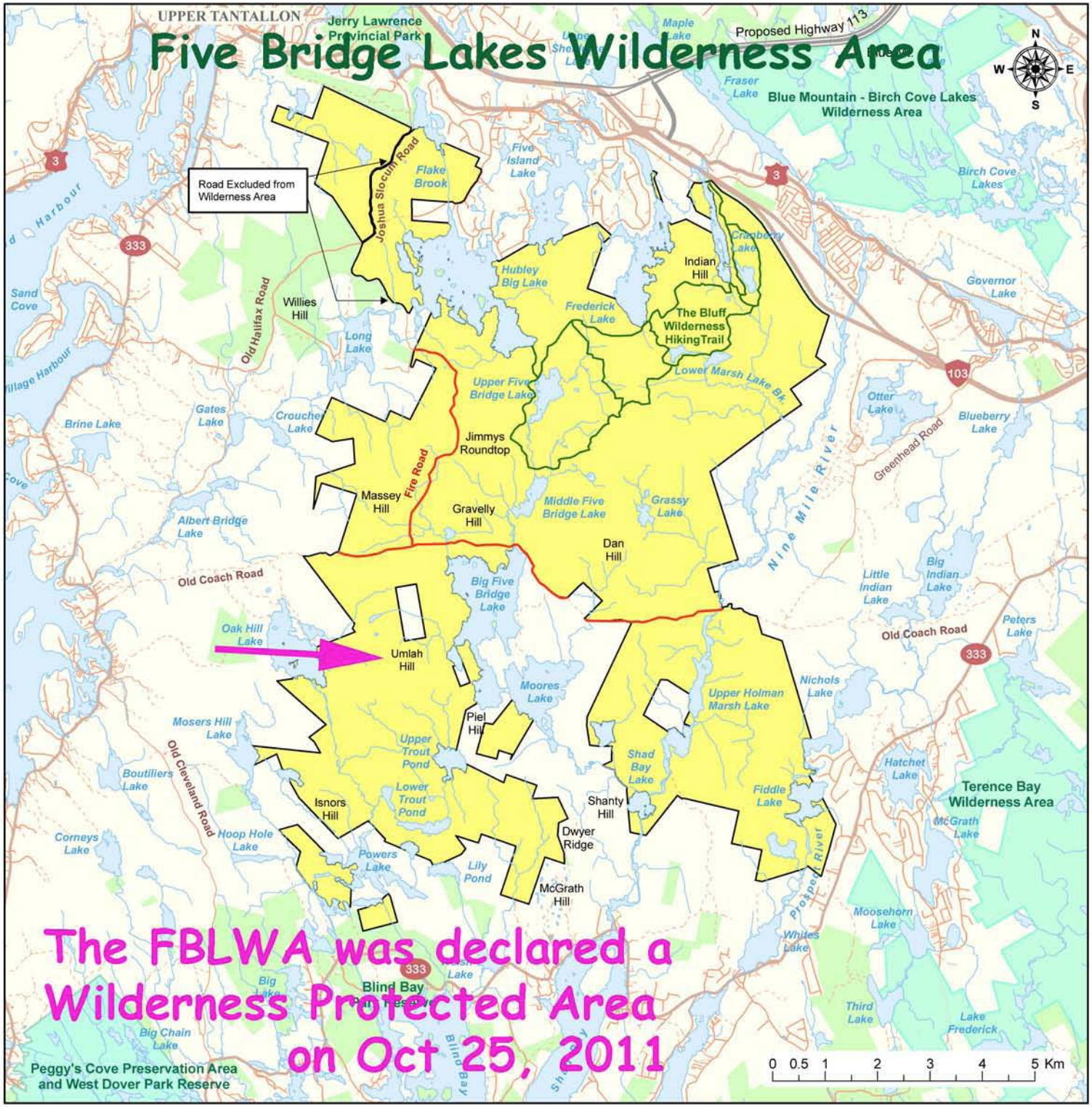
Abstract:

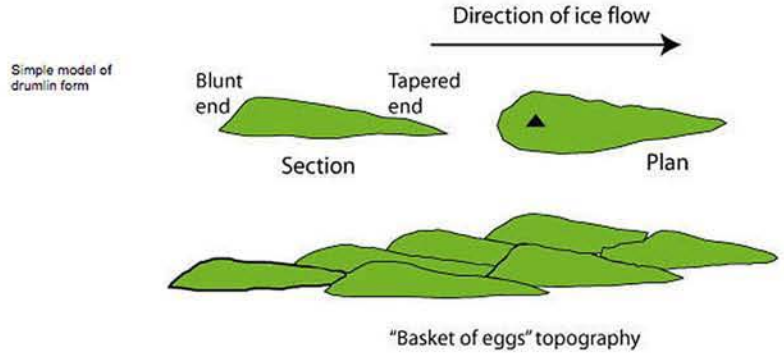
A Rapid Appraisal study was conducted July 21-22, 2009 to verify existence of and characterize an OG red oak stand on Umlah Hill southeast of Oak Hill Lake. It had been known years ago by Ralph Wheadon as a NSDNR employee and fire warden for the area. The site was visited again on Sep 3-4, 2011 to look for charcoal in soil profiles. The study was supported in part by Five Bridges Wilderness Heritage Trust.

The stand has features of a multi-aged, old growth oak forest with snags and fallen dead in a range of diameters and distinct moose maple and witch hazel subcanopies. The overstory is made up mostly of red oak, some yellow birch, occasional white birch; red maple was common, but tended to be in the subcanopy/overgrown by oak. The stand covers approximately 15 ha. Cores indicate the larger trees are over 100 years of age. We observed scat from mainland moose as well as evidence of the brown bear and many cavities in snags. Some adjacent areas support younger oak stands with some, but not all of these features.

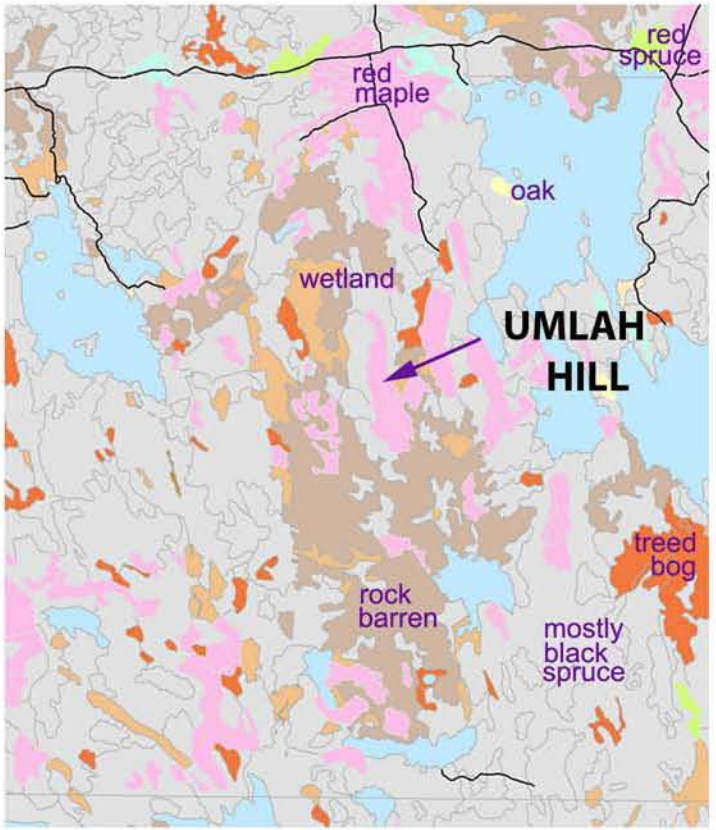
Soil profiles revealed charcoal layers in adjacent areas supporting younger oak stands, but not at Umlah Hill, which appears to have escaped area fires by being relatively isolated and surrounded by wetland. Wind induced tree top damage continuously causes decay in the tallest oaks and these produce single tree light gaps and valuable habitat for a suite of snag-dependent wildlife. This mature forest is thus composed not of trees of several centuries old, but of younger trees yet the forest has the same characteristics of typical OG. This type of old growth red oak forest is apparently now rare within the whole range of red oak in North America.

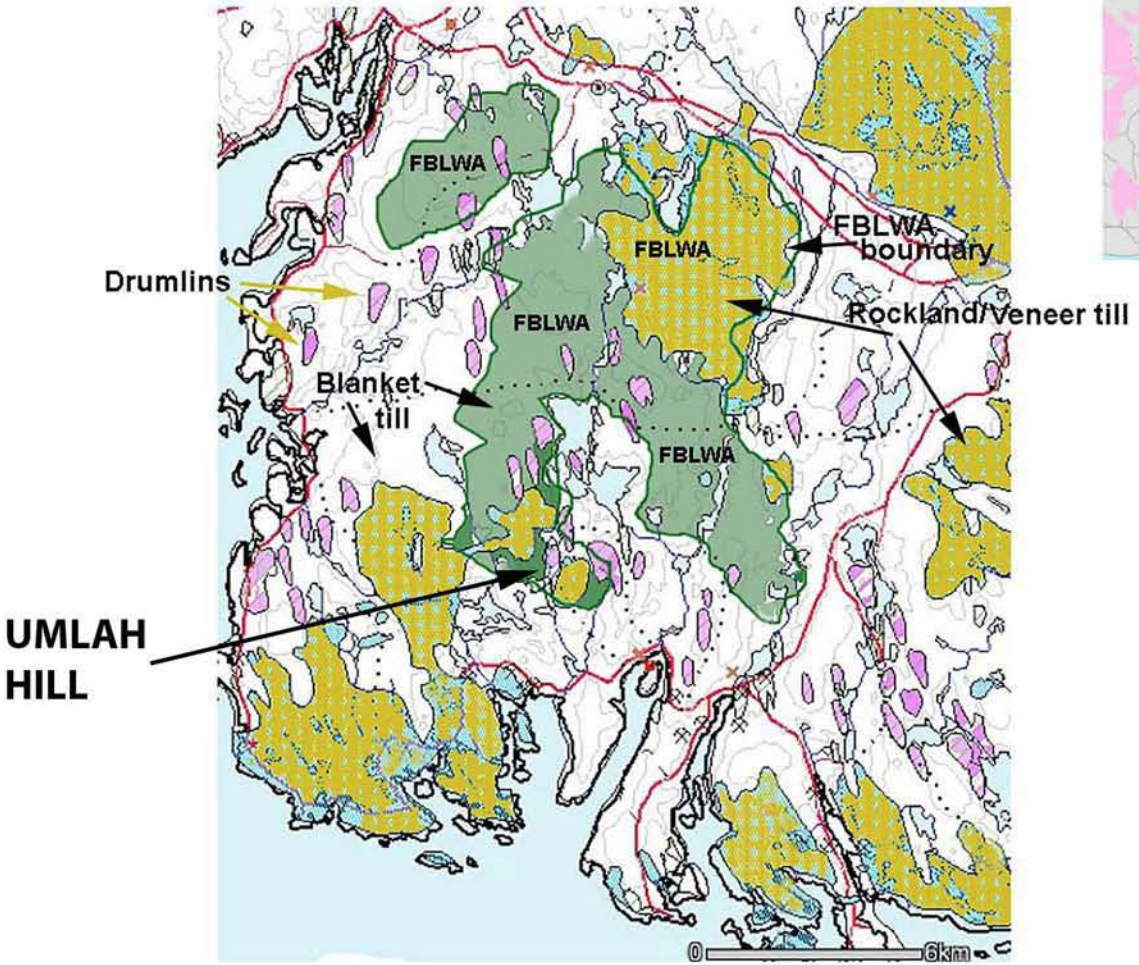

Five Bridge Lakes Wilderness Area
UPPER TANTALLON
Jerry Lawrence Provincial Park
Proposed Highway 113
Blue Mountain - Birch Cove Lakes Wilderness Area
Road Excluded from Wilderness Area
Joshua Slocum Road
Flake Brook
Five Island Lake
Maple Lake
Fraser Lake
Birch Cove Lakes
Cranberry Lake
Indian Hill
Hubley Big Lake
Frederick Lake
The Bluff Wilderness HikingTrail
Lower Marsh Lake Brk
Governor Lake
Willies Hill
Old Halifax Road
Long Lake
Upper Five Bridge Lake
Otter Lake
Blueberry Lake
Greenhead Road
Nine Mile River
Gates Lake
Crouchers Lake
Brine Lake
Jimmys Roundtop
Fire Road
Massey Hill
Gravelly Hill
Middle Five Bridge Lake
Grassy Lake
Albert Bridge Lake
Dan Hill
Old Coach Road
Big Five Bridge Lake
Little Indian Lake
Big Indian Lake
Peters Lake
Oak Hill Lake
Umlah Hill
Moores Lake
Upper Holman Marsh Lake
Nichols Lake
Mosers Hill Lake
Piel Hill
Old Cleveland Road
Upper Trout Pond
Shad Bay Lake
Hatchet Lake
Boutiliers Lake
Lower Trout Pond
Fiddle Lake
Terence Bay Wilderness Area
Isnors Hill
Shanty Hill
McGrath Lake
Corneys Lake
Hoop Hole Lake
Dwyer Ridge
Powers Lake
Lily Pond
Prospect River
McGrath Hill
Moosehorn Lake
Whites Lake
Blind Bay
Third Lake
Lake Frederick
Big Chain Lake
Peggy's Cove Preservation Area and West Dover Park Reserve
The FBLWA was declared a Wilderness Protected Area on Oct 25, 2011
0 0.5 1 2 3 4 5 Km
N
W
E
S

Drumlins on the Chebucto Peninsula



http://www.landforms.eu/Lothian/drumlin.htm



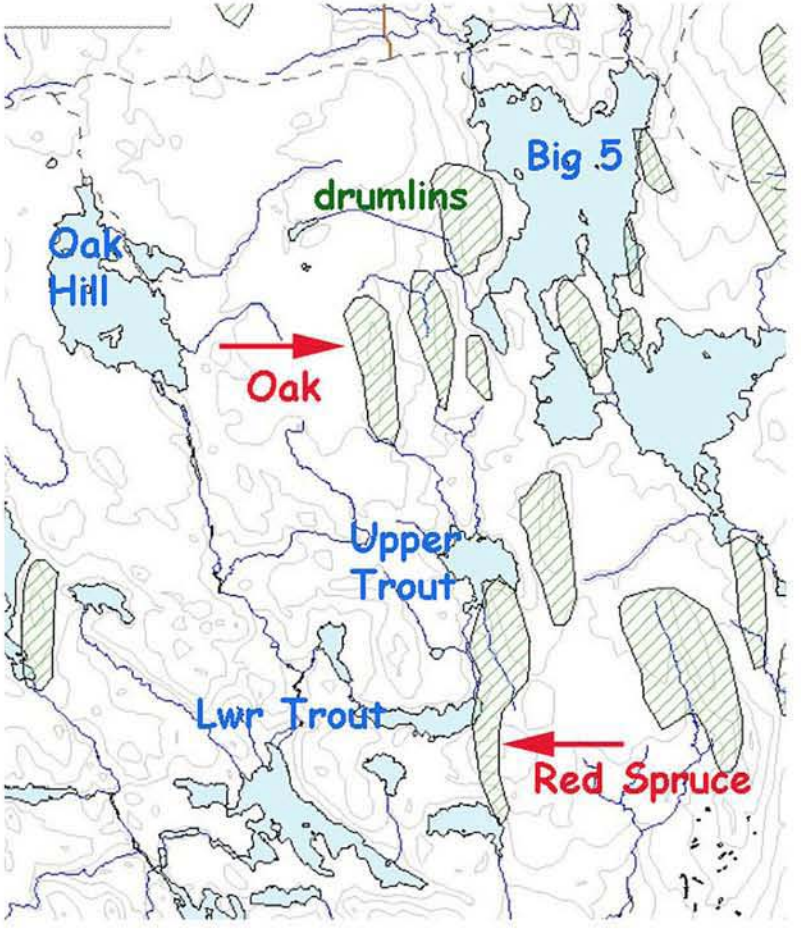


Investigating Old Growth 2009

Beth McGee/Five Bridges Trust

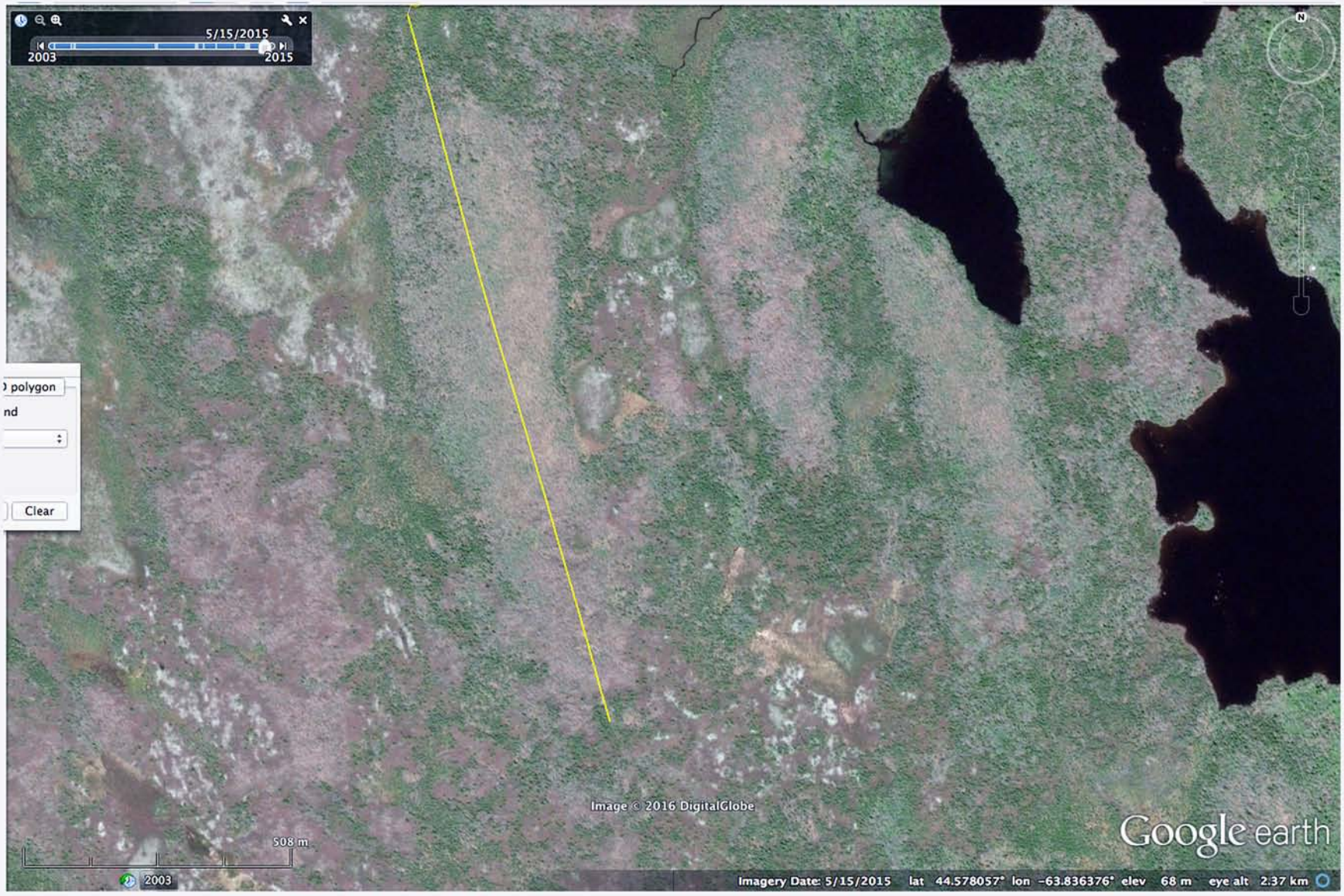
Chebucto Wilderness Coalition Steering Committee

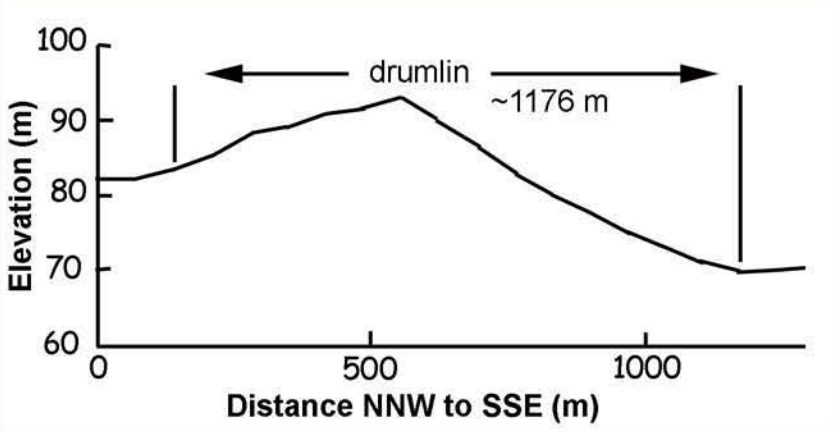
Nick Hill (Fern Hill Farm)
David Patriquin (WRWEO)



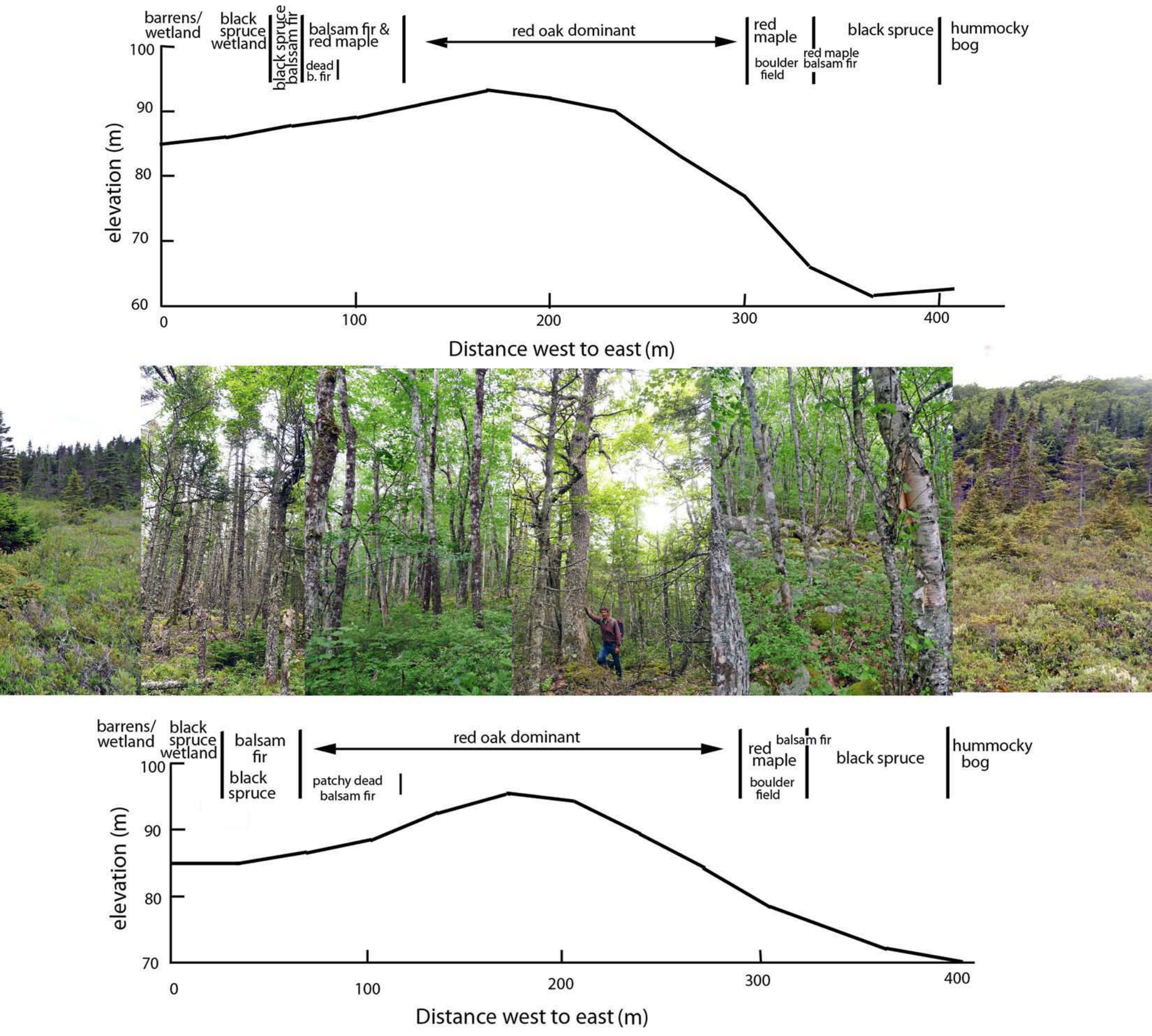
Ralph Wheadon x
Index Map 56


Vasile
Ivanov
Sep 4-5, 2011


5/15/2015
2003
2015
polygon
nd
Clear
Image © 2016 DigitalGlobe
508 m
2003
Google earth
Imagery Date: 5/15/2015 lat 44.578057° lon -63.836376° elev 68 m eye alt 2.37 km


drumlin
~1176 m
Elevation (m)
100
90
80
70
60
0
500
1000
Distance NNW to SSE (m)


6/10/2014
2009:
- TS 1,2: descriptive observations & photos, continuous
- Belt Transect: diameters of living trees and of snags and fallen dead by species in a belt 182 x 1.88 m
2011:
- soil profiles x 3
- seedling counts in 6 x 6.5 m area
TS 2
44 34.861 -63 50.457
TS 1
belt transect
44 34.750-063 50.308
Image © 2016 DigitalGlobe
239 m
2003
Imagery Date: 6/10/2014 lat 44.581017° lon -63.840950° elev 93 m eye alt 1.28 k


barrens/ wetland
black spruce wetland
black spruce
balsam fir
balsam fir & red maple
dead b. fir
red oak dominant
red maple
boulder field
red maple
balsam fir
black spruce
hummocky bog
100
90
80
70
60
elevation (m)
0
100
200
300
400
Distance west to east (m)
barrens/ wetland
black spruce wetland
balsam fir
black spruce
patchy dead balsam fir
red oak dominant
red maple
balsam fir
boulder field
black spruce
hummocky bog
100
90
80
70
elevation (m)
0
100
200
300
400
Distance west to east (m)

KEY FEATURES I

FOUR CANOPY LAYERS

1. **OVERSTORY** - mostly red oak
   - some yellow birch
   - red maple common but tended to be overgrown by oak
   - occ'l white birch
   - occ'l red spruce

2. **STRIPED MAPLE SUBCANOPY** at ~7-9 m

3. **WITCH-HAZEL SUBCANOPY** at ~ 3 – 4.5 m

4. **CONTINUOUS LOW BUSH GROUNDCOVER**
   Typically < 0.7 m; blueberry, huckleberry, New York fern, bracken fern, lambkill, sasaparilla, mayflower, Labrador tea (in pockets) and seedlings of red oak, red maple, striped maple, yellow birch, fir and occasional black spruce.

LIVING TREES (from belt transect)

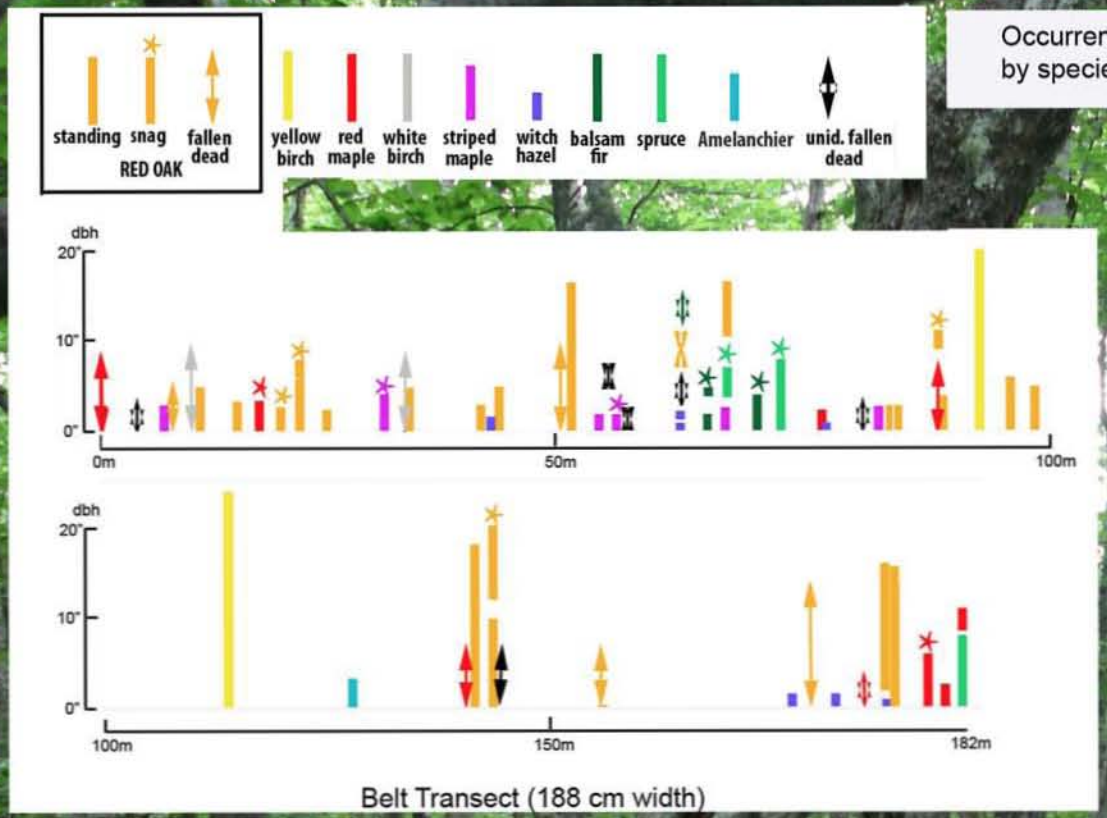
	#/ha	m2/ha	%area
red oak	497	19.7	54.3
red maple	117	1.0	2.9
yellow birch	58	13.8	38.1
striped maple	117	0.5	1.3
witch-hazel	205	0.2	0.4
Amelanchier	29	0.1	0.4
balsam fir	29	0.05	0.2
spruce	29	0.9	2.5

KEY FEATURES II

- **All species, except fir, are multi-aged.**
- **Balsam fir common** but reaches max 3-4 m height, then appears to die.
- **Many canopy gaps**
- **Snags** in a range of diameters common larger snags had many cavities.
- **Fallen dead trees** in range of diameters & various stages of decomposition
- **Trees generally widely spaced**.
  Likely good winter cover for moose.
  Moose scat was observed at several sites.

Tree core ages:

- **Red Oak 14 inches dbh, 55 years**
- **Red Oak 17.6 inches dbh, 110 years + (not to centre)**
- **Red Oak 22.9 inches- pitch problem (no age)**
- **Red Spruce 17 inches, 101 years**



Belt Transect (188 cm width)

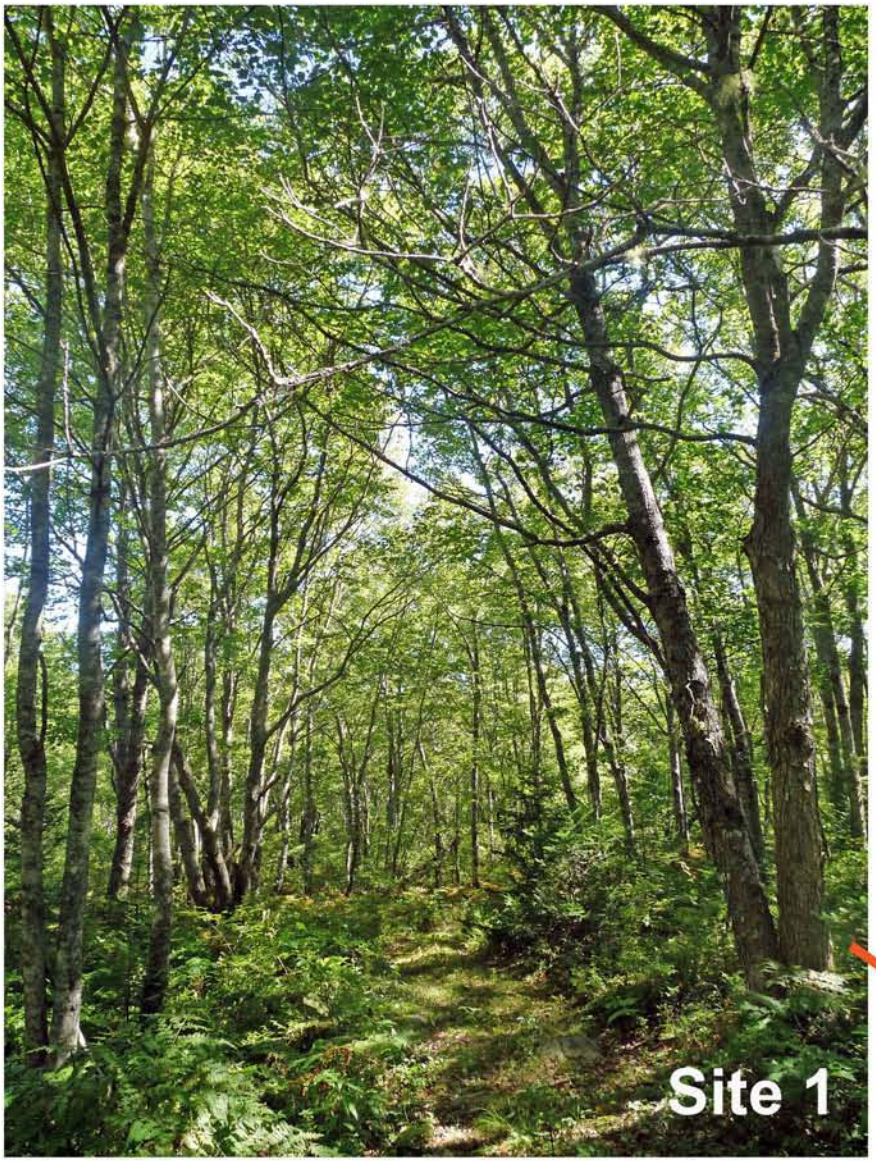
Occurrence of standing trees, snags and fallen dead on belt transect by species. Vertical axis is diameter at breast height (dbh)

Comparison of Umlah Hill (this study) with Grand Anse and North River OG stands (Stewart et al. 2003). Stats are for trees >10 cm diameter.
M = medium, H = high for shade tolerance.

ATTRIBUTE	UMLAH HILL	GRAND ANSE	NORTH RIVER
Community Type	Red Oak (M) Yellow Birch (M) Red Maple (M)	Sugar Maple (H) Yellow Birch (M) American beech (H)	Sugar Maple (H) Yellow Birch (M) American Beech (H)
Density, all, #/ha	672	1476	1072
>40 cm	175	106	79
>50 cm	146	48	39
>60 cm	58	16	14
Basal Area, all, m^2/ha	34.5	40.3	34.5
>40 cm	20.2	22.0	17.5
>50 cm	13.0	12.9	11.0
>60 cm	5.3	5.4	5.0
Snag Basal Area, m^2/ha	4.0	4.0	2.5
Fallen Dead, m^2/ha	12.0	-	-
Snag Volume, m^3/ha	-	25	58
Downed Volume, m3/ha	-	17	45
Ratio FD/Snags by basal area	**3.0**	**-**	**-**
Ratio Downed to Snag by volume	**-**	**2.3**	**2.6**
Ratio Dead to Live by basal area	**35%**		
Ratio Dead to Live by vol	**-**	**28%**	**23%**

"Fallen Dead" = "Downed"

Charcoal was observed in soil at base of red oak snag



Charcoal layer observed at 10 cm+ depth in red maple dominated woodland, many stump sprouts, ~ even aged

Soil profiles in Umlah Hill red oak stands

1

2

3

SEEDLING COUNTS Sept. 21, 2011
In 6 x 6.5 m area (gap)

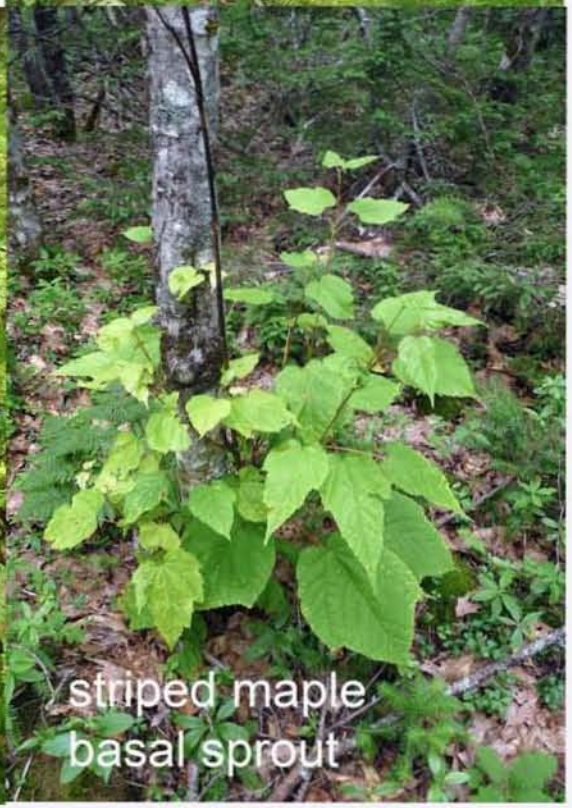
Species	No. seedlings	Heights
red oak	18	5-30 cm; median 8.5
red maple	17	tallest: 25 cm
yellow birch	2	6, 36 cm
striped maple	1	10 cm
witch hazel	14	1-5 cm

Red oak seedlings: 2-5 lvs/plant.
One red oak basal sprout: 42 cm height

Approx. 40 seedlings/juvenile **balsam fir**, to 1 m height

Ground cover

bracken fern
New York fern
cinnamon fern (1)
lowbush blueberry
lambkill
goldthread
wild sarsaparilla
bunchberry
cucumber root
wild lily-of-the-valley
starflower
hair-cap moss
leaves



FEC Vegetation & Soil Types

TH6

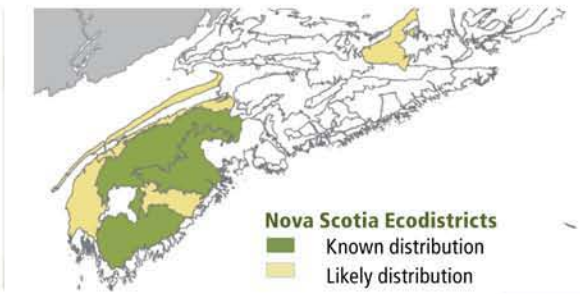
Red oak – Yellow birch / Striped maple

Quercus rubra – Betula alleghaniensis / Acer pensylvanicum

n=11

Concept: This mid to late successional Vegetation Type (VT) has an overstory dominated by red oak and yellow birch with lesser amounts of other species. Red oak's co-dominance with other hardwoods defines this VT. Due to the long-lived and shade-tolerant nature of dominant overstory trees, TH6 can develop old forest characteristics that are maintained by gap disturbance. However disturbance regimes associated with this VT are variable.

Successional Dynamics: TH6 is a mid to late successional hardwood VT that may have even-aged or uneven-aged structure, depending on disturbance history. The mechanism for maintenance of red oak in this VT is not fully understood, although low-intensity spring fires are thought to play a role. Increased presence of red maple and/or white birch generally indicates more intense past disturbances. Early successional stages can include IH4 (Trembling aspen / Wild raisin – Bunchberry) and IH6 (White birch – Red maple / Sarsaparilla – Bracken). On drier sites, TH6 may be the climax VT, while on more mesic sites TH6 may succeed to TH1 (Sugar maple / Hay-scented fern) or TH2 (Sugar maple / New York fern – Northern beech fern) in the absence of fire.



Site Characteristics

Slope Position:	Upper[5] Middle[3] Crest[1] Level[1]
Surface Stoniness:	(Non - Slightly)[4] (Moderately)[4] (Very - Excessively)[2]
Bedrock Outcrop:	(Non-rocky)[10]
Elevation Range:	50 - 201m
Slope Gradient:	Gentle[6] Steep[2] Level[1] Moderate[1]
Aspect:	North[3] East[3] South[3] None[1]
Exposure:	Moderate[5] Exposed[2] Mod. exposed[2] Mod. Sheltered[1]
Microtopography:	Moderately[3] Strongly[3] Level[2] Severely[1] Ultra[1]
Drainage:	Well[7] Moderately well[2] Rapid[1]

Soil Characteristics

Soil Type:	ST2[4] ST2-G[2] ST8[2] ST1[1] ST2-L[1]
Parent Material:	Glacial till[5] Colluvium[2] nd[3]
Rooting Depth (cm):	(<30)[1] (30-45)[5] (>45)[3] nd[1]
Duff Thickness (cm):	(0-5)[4] (6-10)[4] (11-20)[1] nd[1]

Distinguishing Features

Red oak and at least one northern hardwood species (yellow birch, sugar maple, beech) in the upper canopy of this hardwood forest is diagnostic for classification. TH6 forest is typical of western Nova Scotia and usually found on drier soils than the other TH forests.

Cancer root

ST2
Fresh – Medium to Coarse Textured

Description

ST2 is mainly associated with fresh, coarse-loamy soils dominated by sandy loam texture. Coarse fragment content is generally low to moderate in surface horizons, but levels can be higher in soils derived from granite, quartzite, or sandstone tills. Site drainage is usually well, but ranges between rapid and moderately well depending on slope position, slope percent, and subsoil permeability. ST2 profiles usually contain a well developed Ae horizon, but Ahe horizons can also be found, particularly in loamy soils (ST2-L). Cemented B horizons are also possible.

Ecological Features

ST2 is generally poor to medium in fertility, but is sometimes richer (especially ST2-L). Moisture may be somewhat limiting during the growing season (especially in coarser soils), but usually not severely so. ST2

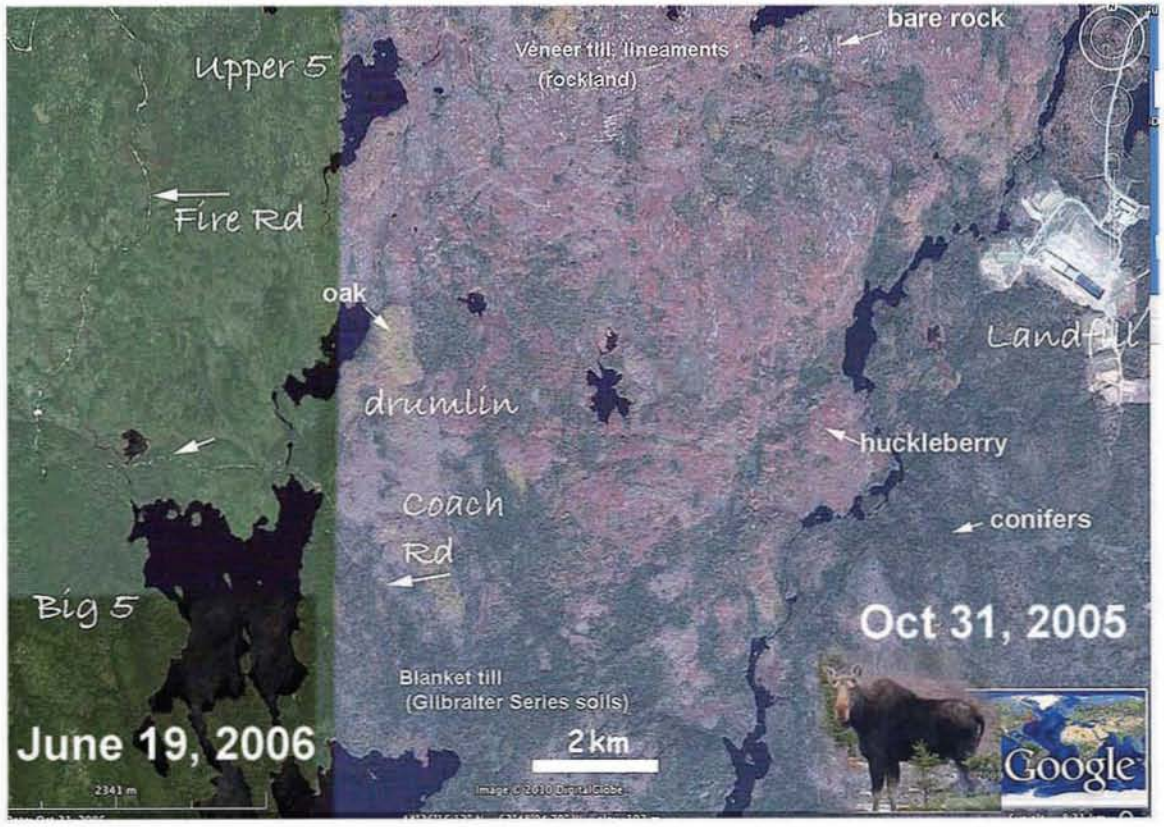
T2 dominated by sandy loam texture. Note he well developed, but broken, Ae horizon and ominant orange/brown colours below signifying ell aerated (good drainage) conditions.

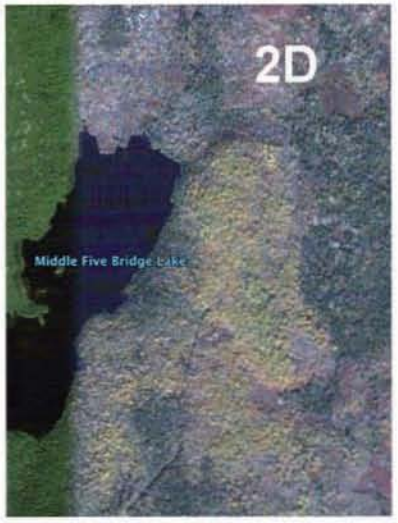
Assessment Tips

Watch for the presence of numerous, small coarse fragments when assessing soils derived from granitic glacial tills (e.g. Gibraltar and Wyvern series). These coarse fragments, which are usually large quartz grains left over from weathered rock, can cause ST2 to shift to ST1.

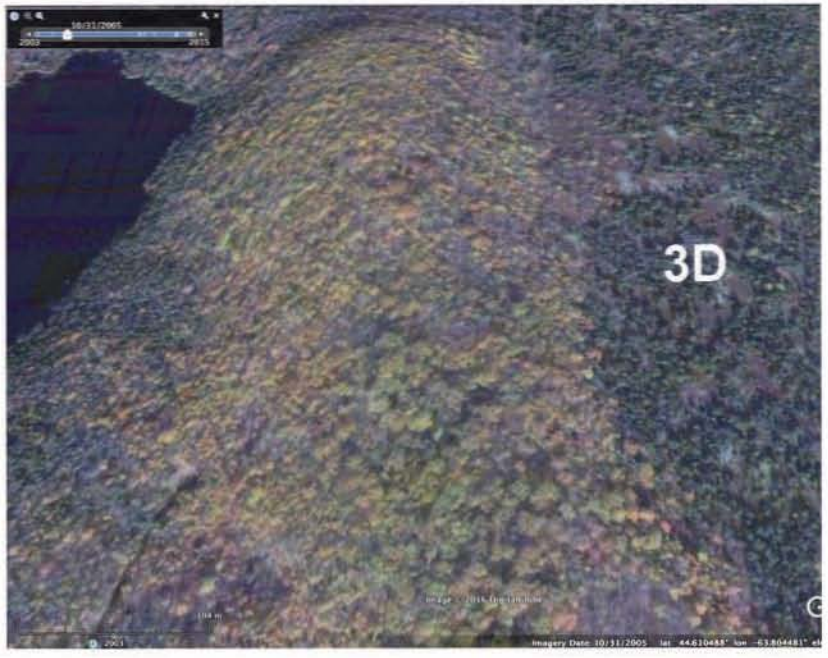

4/7/2009
Ruler
Line
Path
Polygon
Circle
3D path
3D polygon
Measure the distance or area of a geometric shape on the ground
Perimeter: 2,931.32 Meters
Area: 26.49 Hectares
Mouse Navigation
Save
Clear
Image © 2016 DigitalGlobe
Google earth
763 m
2003
Imagery Date: 9/17/2004 lat 44.582893° lon -63.831671° elev 55 m eye alt 3.54 km


Several drumlins in Umlah Hill area may support OG red oak stands
?
Lower Five Bridges Lake
UMLAH HILL
?
?
© 2016 Google
9/5/2015
Google Earth
404 m
2003
Imagery Date: 9/5/2015 lat 44.586316° lon -63.845904° elev 88 m eye alt 2.13 km



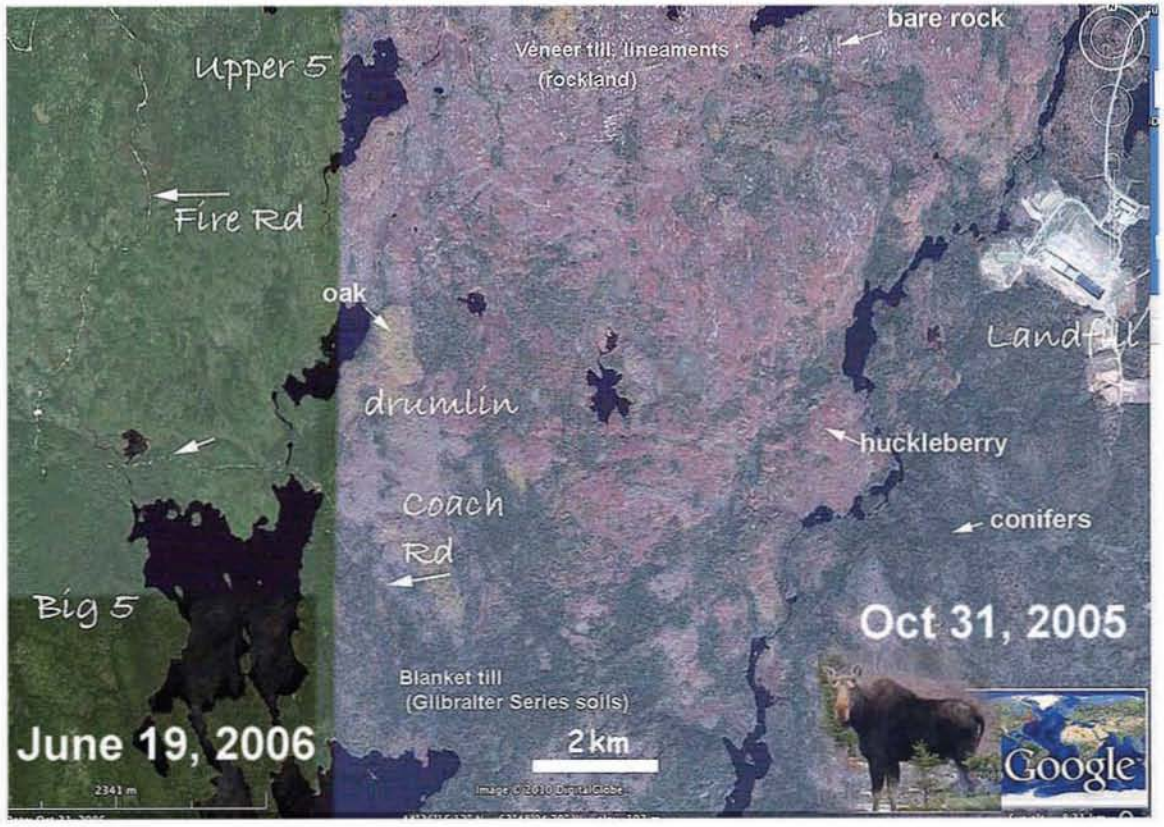


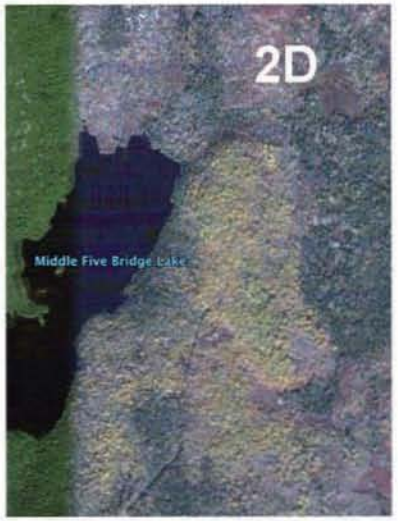
Drumlin by Middle Five Bridge Lake



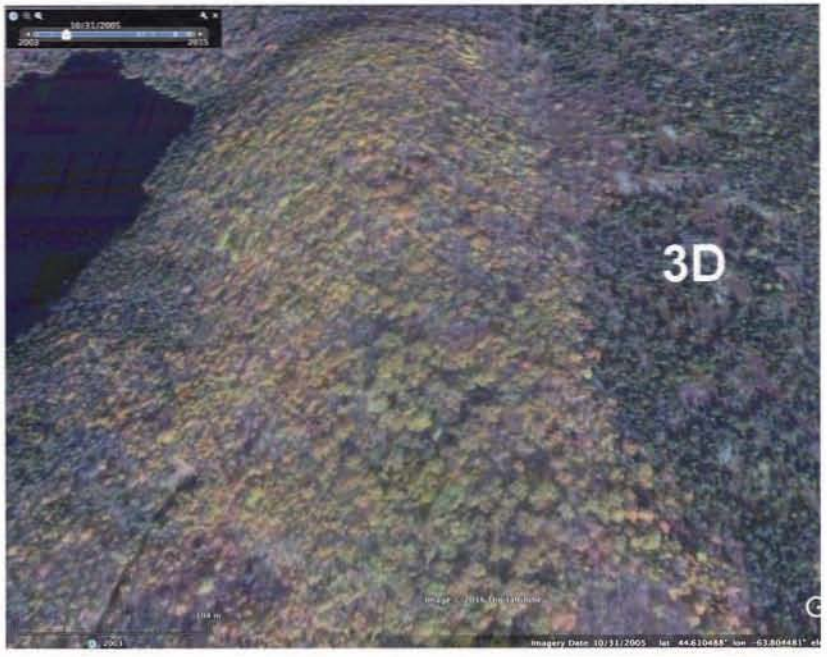
Google Earth Historical Imagery

- sections conducted late Oct/Nov are "colour-coded"





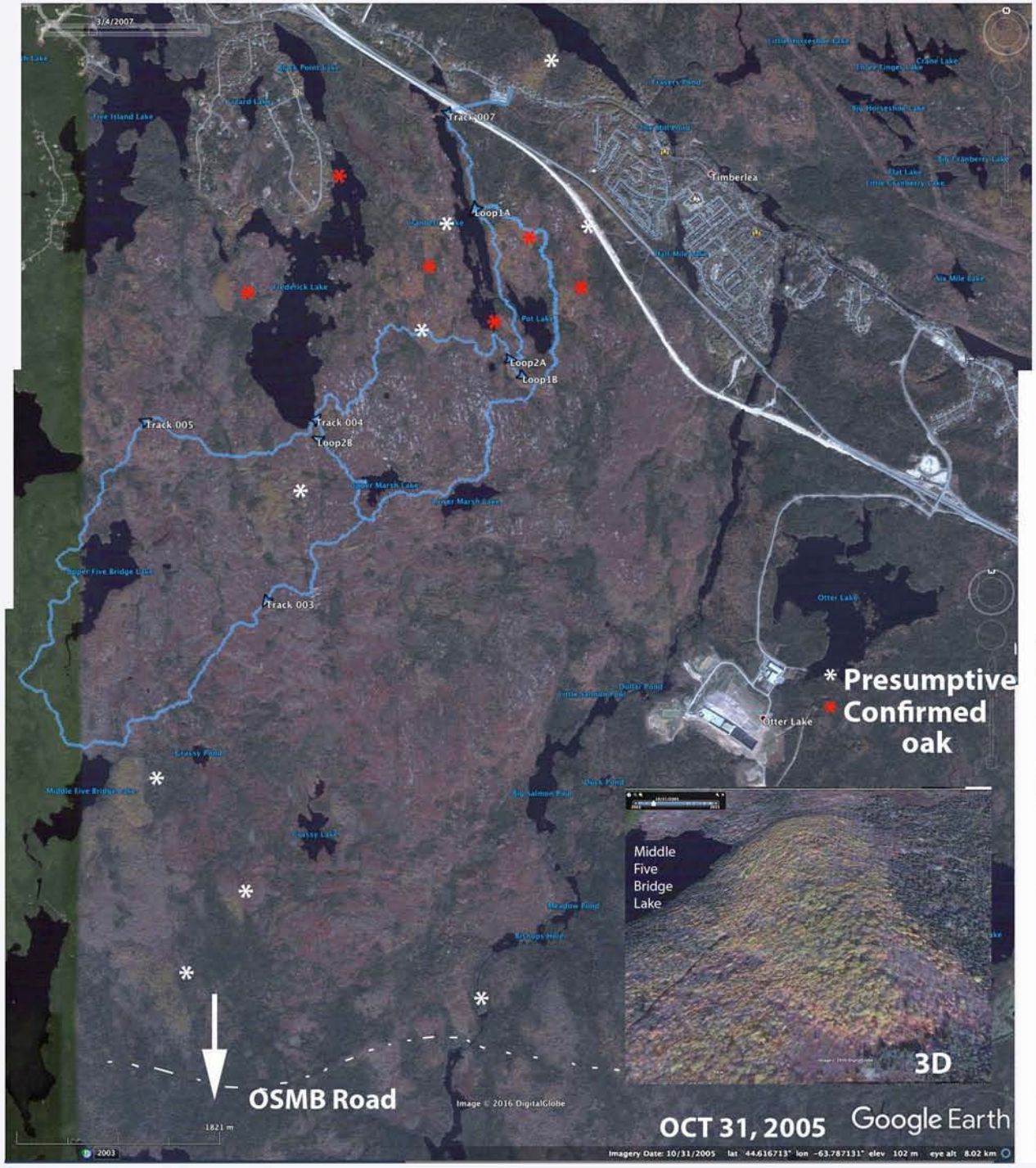
Drumlin by Middle Five Bridge Lake

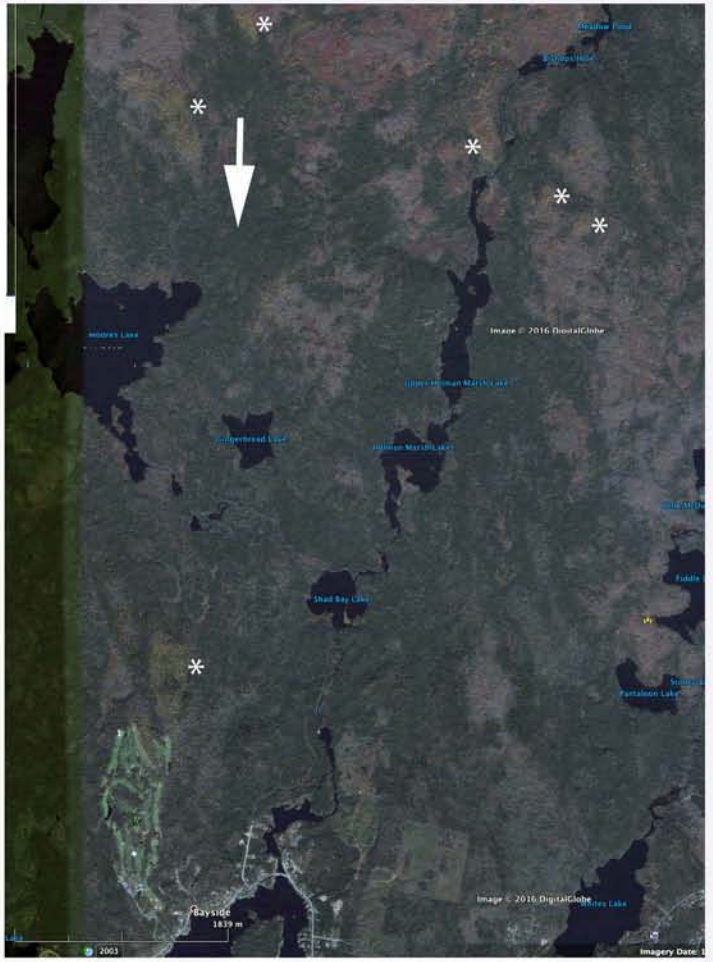


Google Earth Historical Imagery

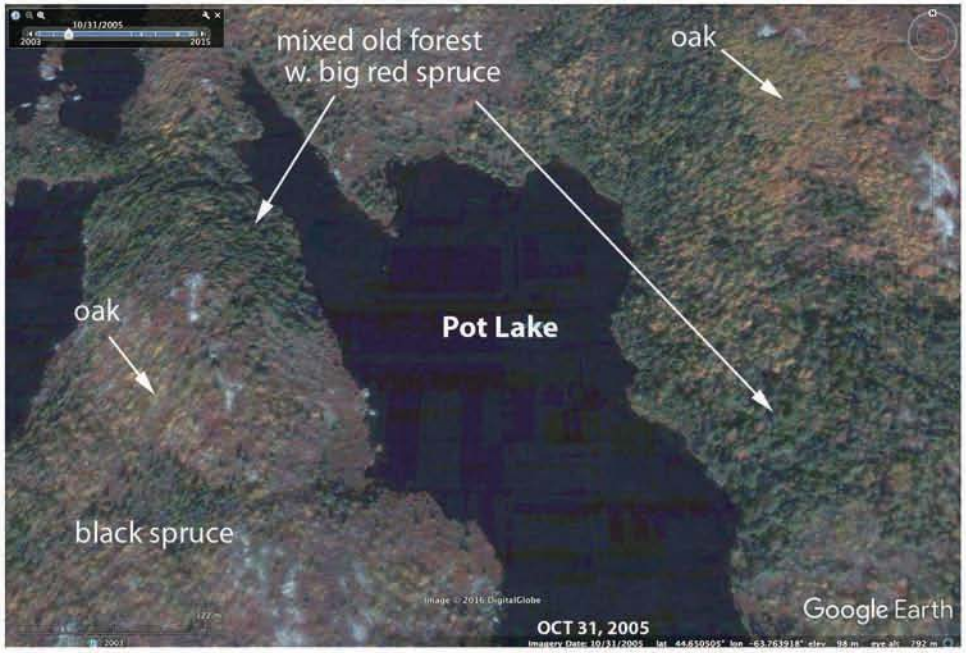
- sections conducted late Oct/Nov are "colour-coded"

Larger red oak stands in a section of the FBLWA, above (left) and below (right) the Old St, Margaret's Bay (Coach) Road

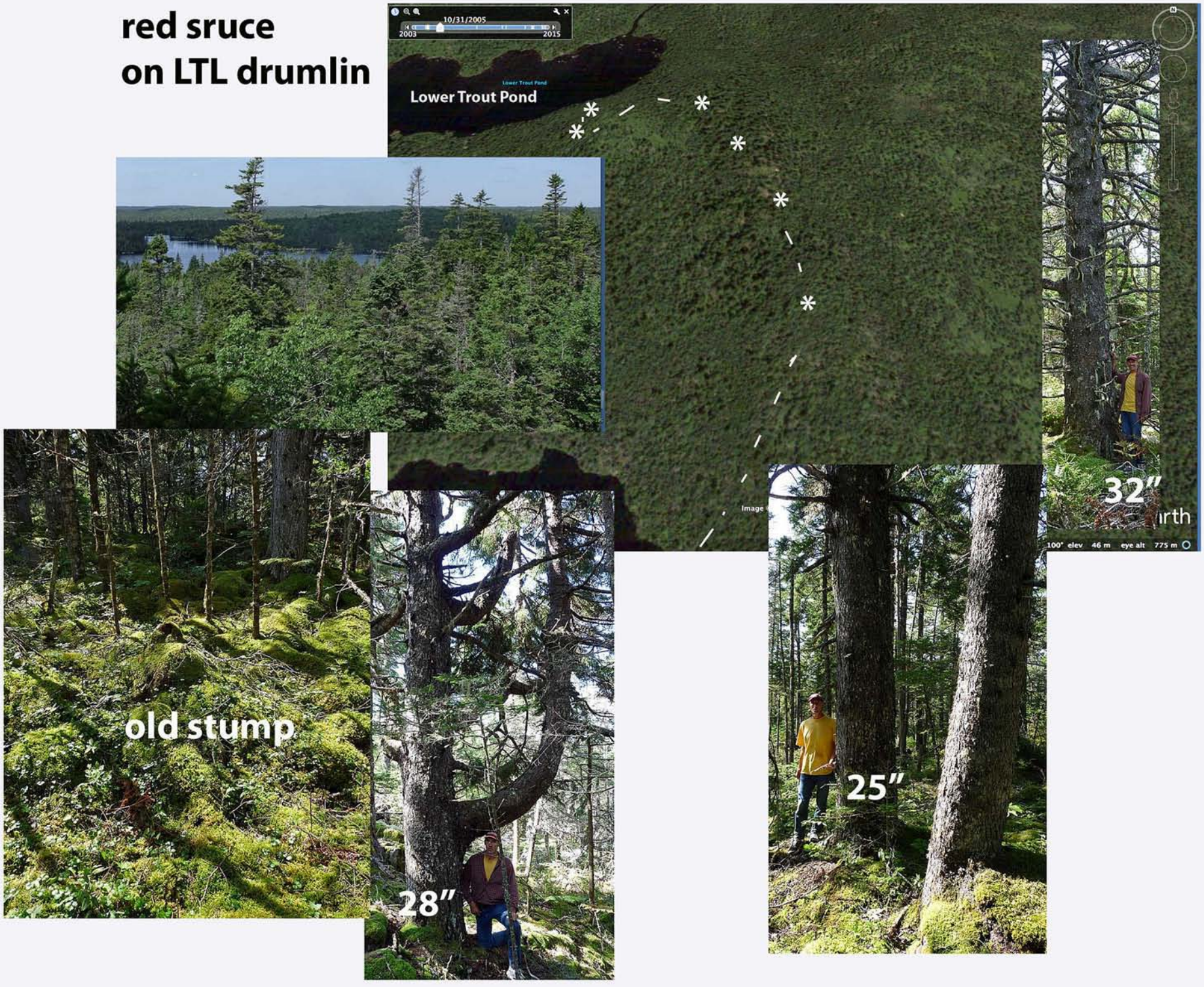




More sheltered, moist sites on hillsides support mixed Acadian forest, some with large dbh red spruce



red sruce
on LTL drumlin



OTHER OAK STANDS IN FBLWA

Area is well represented in hardwoods, many oak dom'd, typically close to hill tops but also on flatter land

Most stands afforded easier access for logging & lack natural fire barriers as found at Umlah Hill

Lacking in most oak stands compared to Umlah Hill:

- **uneven age distribution of trees**
- **large diameter, old (> 100 years) trees**
- **a complex of dead wood (including fallen and standing dead wood in all all stages of decay)**
- **a sub-canopy of the mesic, striped maple.**

INTERPRETATION/CONCLUSIONS

1. Umlah Hill is a rare example of a dynamic equilibrium state where red oaks dominate and are the gap makers that ensure continued oak regeneration.

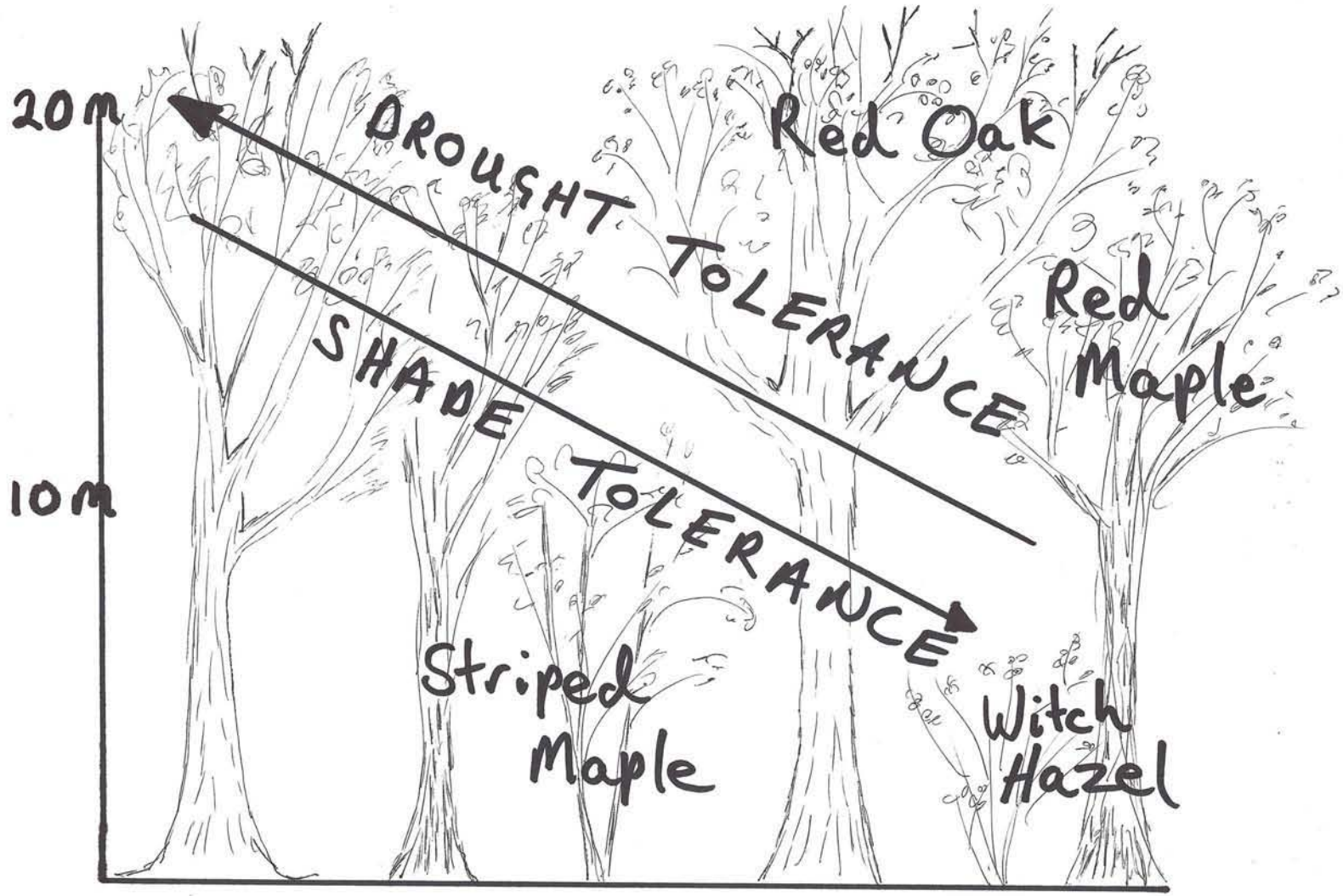
2. Wind tree top damage continuously causes decay in the tallest oaks and these produce single tree light gaps and valuable habitat for a suite of snag dependent wildlife (e.g. cavity nesters, woodpeckers, flying squirrel, owls).

3. This process ensures a steady supply of dead wood and continuous regeneration of seedlings of the intermediate shade tolerant red oaks and yellow birch.

4. This mature forest is thus composed not of trees of several centuries old but of younger trees yet the forest has the same characteristics outlined for typical old growths (downed logs, standing snags, uneven-aged tree distribution, small blowdown gaps.

5.The mature forest at Umlah Hill **has local importance for wildlife.**

6. The Red Oak canopy protects a Red Maple subcanopy and lower down, a shrub layer of Striped Maple and Witch Hazel.



7. Not surprisingly, Yellow Birch is numerically much less abundant than oak and red maple as it has low drought tolerance and is highly dependent on gap formation and decayed coarse woody debris as a substrate for seedlings. However the few trees that propser make up a significant component of the total basal area.

Mature red oak forests like the Umlah Hill site are apparently rare in northeastern NA

Frelich, L.E. & Reich, P. 2002. **Dynamics of old-growth oak forests in the eastern United States**. In: McShea, W.J. & W.M. Healy. (eds.) *Oak Forest Ecosystems: Ecology and Management for Wildlife*. Baltimore: Johns Hopkins Unniversity Press.

The processes we infer for the Umlah Hill red oak stand match the processes Frelich, L.E. & Reich describe for the creation of old, multi-aged stands of oak:

"Old multi-aged stands are those with a history of numerous partial disturbances, usually surface fires and windstorms, that kill small proportions of the canopy over two or more centuries. Oak stands in this category may be very old-up to several centuries - with respect to time since last canopy-killing disturbance, but they have sustained disturbances severe enough to prevent invasion and replacement by shade-tolerant species but not so severe as to kill most of the adult oaks. This type of oak forest is most likely to occur on dry-mesic sites where invasion by shade-tolerant hardwoods is not vigorous.

Other protected old growth oak stands in Nova Scotia

Great Barren and Quinan Lakes Nature Reserve (Tusket River Watershed)

"Ridges within the nature reserve support outstanding examples of mature, Red Oak-dominated forest. The Red Oak is mixed with varying amounts of Yellow Birch, White Pine, Red Maple, Witchhazel, Striped Maple, and Balsam Fir."

McFarlane's Wood

..”a small remnant of once widespread rich hardwoods in Cape Breton, that involved the shade tolerant sugar maple. .It is located on a ridge in Mull River, in the Skye River Hills and Valleys natural landscape.”

Indian Man Lake Nature Reserve

“…designated in 1990 to protect a mature red oak forest near Lower Caledonia, Guysborough County. This forest type is rare in eastern Nova Scotia.”
(It is an Oak-Pine assemblage; there is no pine at Umlah Hill)

→ **Others?**