Exploring the Pre-Settlement Forests of Chautauqua County

Stephen J. Tulowiecki, Ph.D.

University at Buffalo
The State University of New York

State University of New York College at Geneseo

About me…

Biogeographer

"Life" "Earth" "Writing"

Geographic Information Scientist

Collecting, analyzing, managing, and viewing geographic data

MAP OF

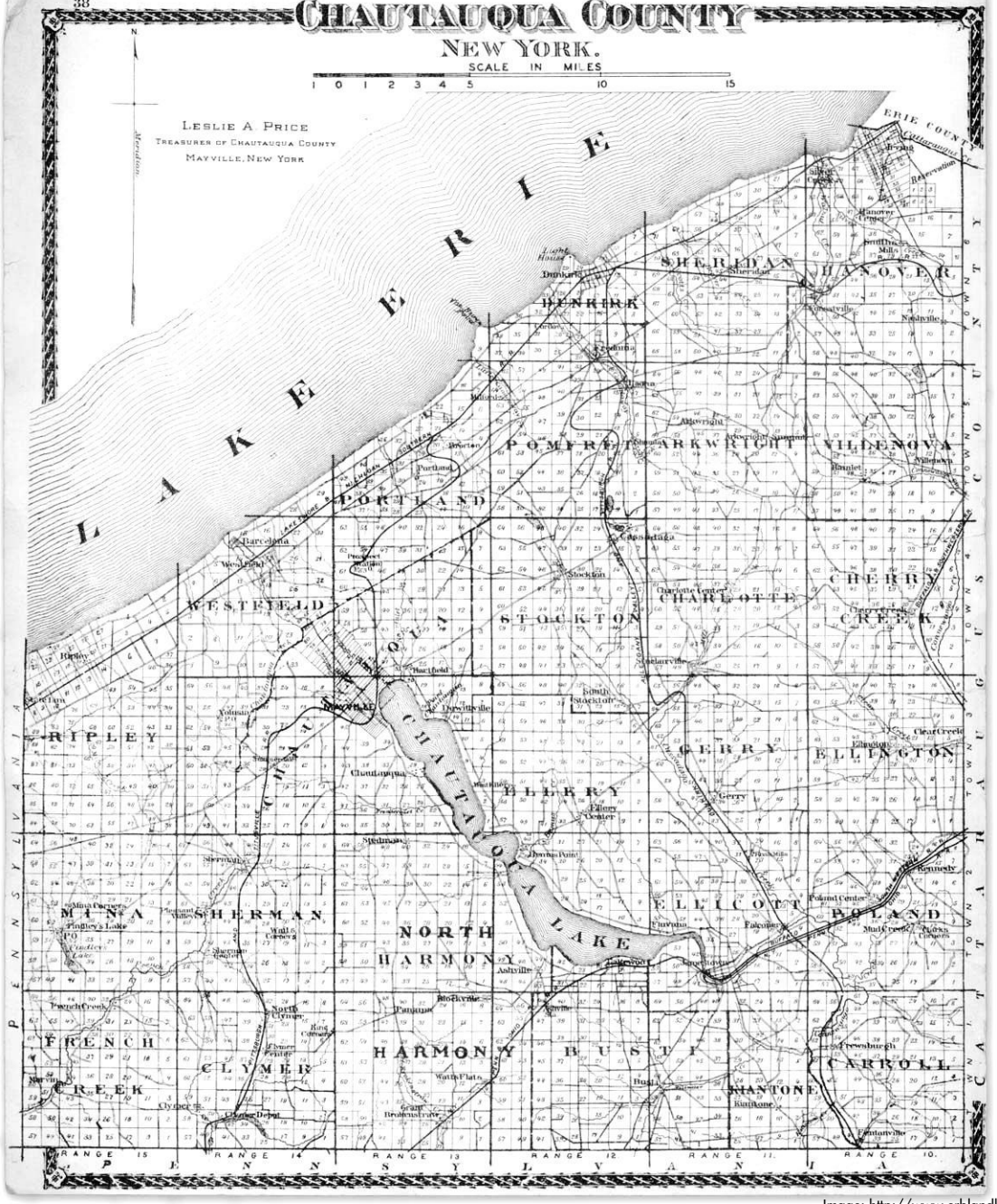
CHAUTAUQUA COUNTY

NEW YORK.

SCALE IN MILES

1 0 1 2 3 4 5 10 15

LESLIE A. PRICE
TREASURER OF CHAUTAUQUA COUNTY
MAYVILLE, NEW YORK



What were forested landscapes like, just prior to European-American settlement in Eastern North America?

Studying past forests is important.

"Ecological baseline"

Climate change and shifting ranges

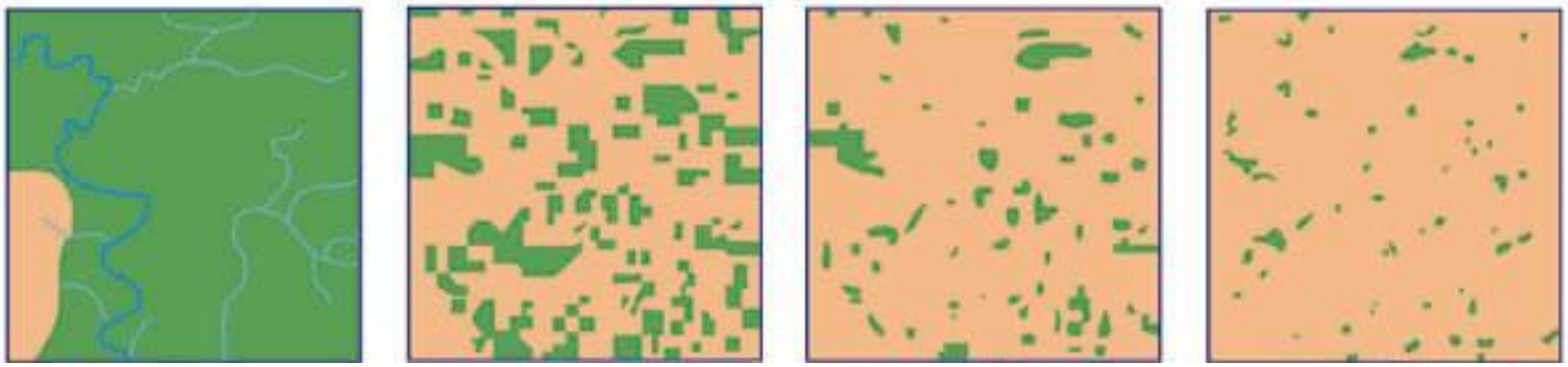
Conservation of rare species

Restoration of ecosystems

etc.

Cadiz Township, Wisconsin

1831 1882 1902 1950



Curtis, J.T. 1956. The modification of mid-latitude grasslands and forests by man. In W.L. Thomas Jr., ed. Man's Role in Changing the Face of the Earth. Chicago: University of Chicago Press.

Image: http://www.mhhe.com/biosci/genbio/olc_linkedcontent/j_enhancement/raven_27-4.html

Where does one find data regarding forests of the 17th and 18th centuries?

Physical evidence:
lake sediments, tree rings, etc.

“Unconventional data sources”: historical maps, photos, pioneer accounts, herbarium records, **land surveys**

(Vellend et al. 2013)

Traveler narratives - e.g. David Thomas, 1816

A few miles from Walnut Creek, I observed the trees, whose names follow, growing together, and which I notice as a very singular occurrence in our forests:

Juglans nigra	black walnut
Juglans cinerea	butternut
Juglans squamosa	shell bark
Quercus rubra	red oak
Quercus alba	white oak
Pinus canadensis	hemlock
Pinus strobus	white pine
Castanea vesca	chestnut
Fagus ferruginea	beech
Liriodendrum tulipifera	whitewood or poplar
Carpinus americana?	iron wood
Prunus virginiana	wild cherry
Acer saccharinum	sugar maple
Acer rubrum	soft maple
Betula nigra	birch
Sambucus pubescens	Canadian elder
Ulmus americana	elm
Magnolia acuminata	cucumber tree
Fraxinus alba	white ash

Original Land Survey Records

- Records of the first land surveys in North America
- Marked the first township and lot boundaries
- Recorded vegetation data
  - "**Witness-trees**": trees blazed at survey corners
  - "**Line-descriptions**": descriptions of tree species observed along survey lines

SURVEYORS

Image: http://dohertysmith.com.au/wp-content/uploads/2013/06/historyofsurveying2.jpg

T. 3 R. 13.

L. 3.

L. 4. & L. 9.

N.1.q.		Butternut	
		W. ash Sugr.	
		Maple good	
		for Meadow	
Sw.	47.00		47.00
		Birch &	
N.1.q	55.00	B. ash	5500
		Soft maple	
		Bass & Elm	
		Hickory Chestnut	
		W. & B. oak	
	60.00		60.00

North

Sugar Maple Post

N. 26. W. 21. Maple 12.

N. 13. E. 18. Maple 8.

Beech Post

N. 58. W. 30 Beech 10.

S. 51. W. 30. Beech 8.

Survey line between lots 3 and 9
Township 3, Range 12
Chautauqua County, New York
November 1804

Original land survey records are important and advantageous.

They provide an ecological “snapshot” just before European-American settlement.

They are spatially exhaustive.

They were created with a relatively standard “sampling design.”

How are land survey records mapped?

T. 3 R. 13.

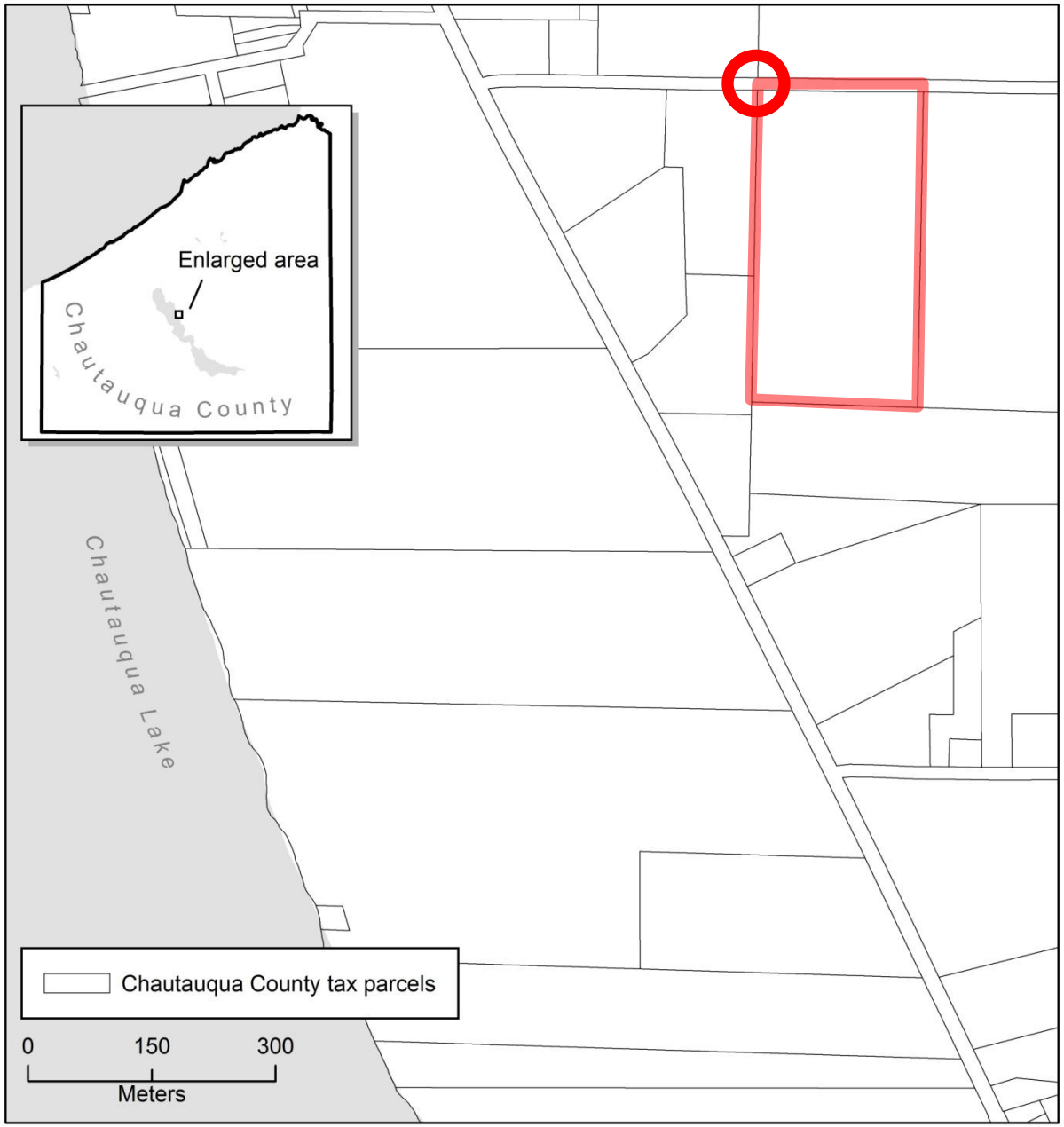
L. 3.

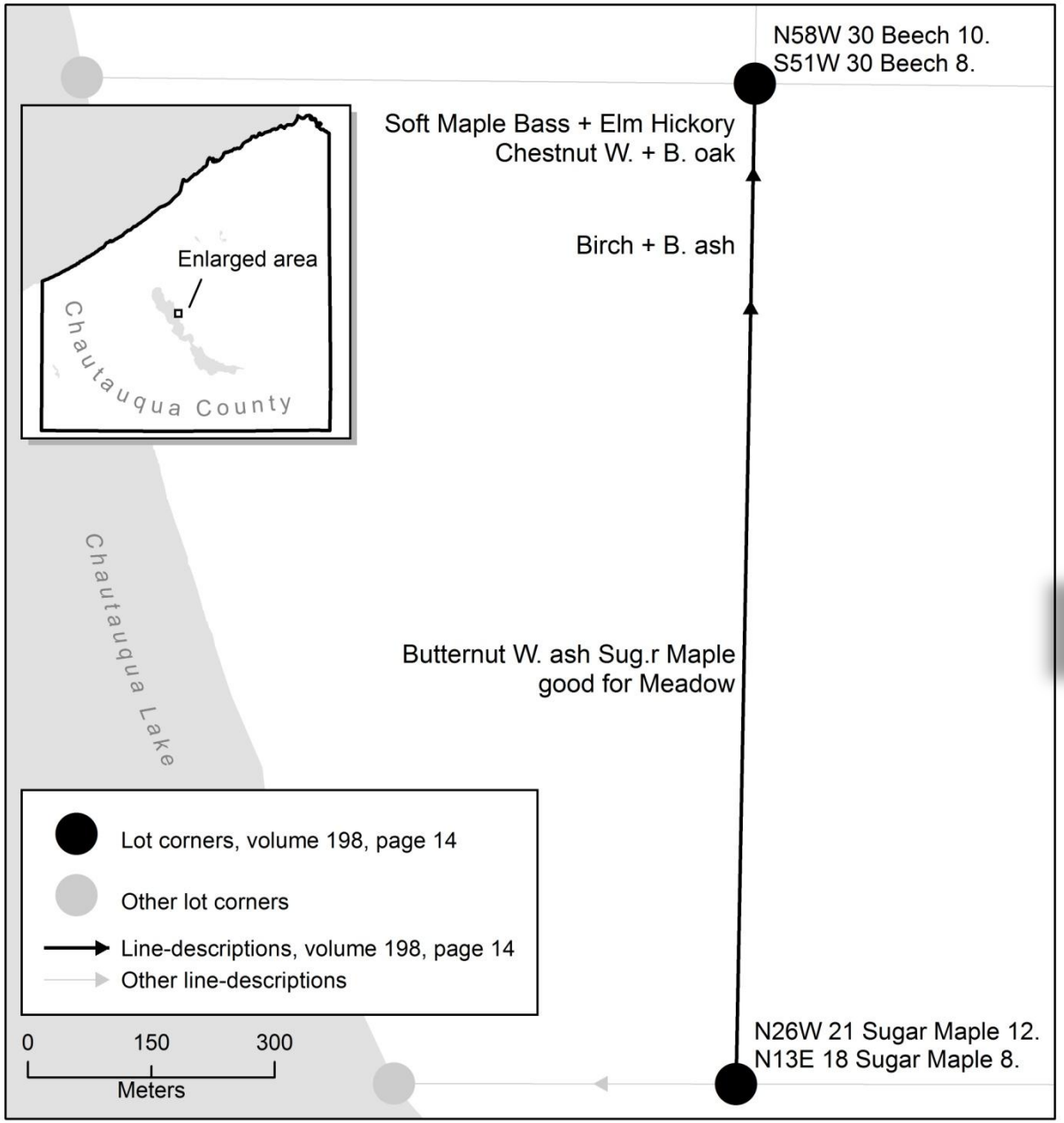
L. 4. & L. 9.

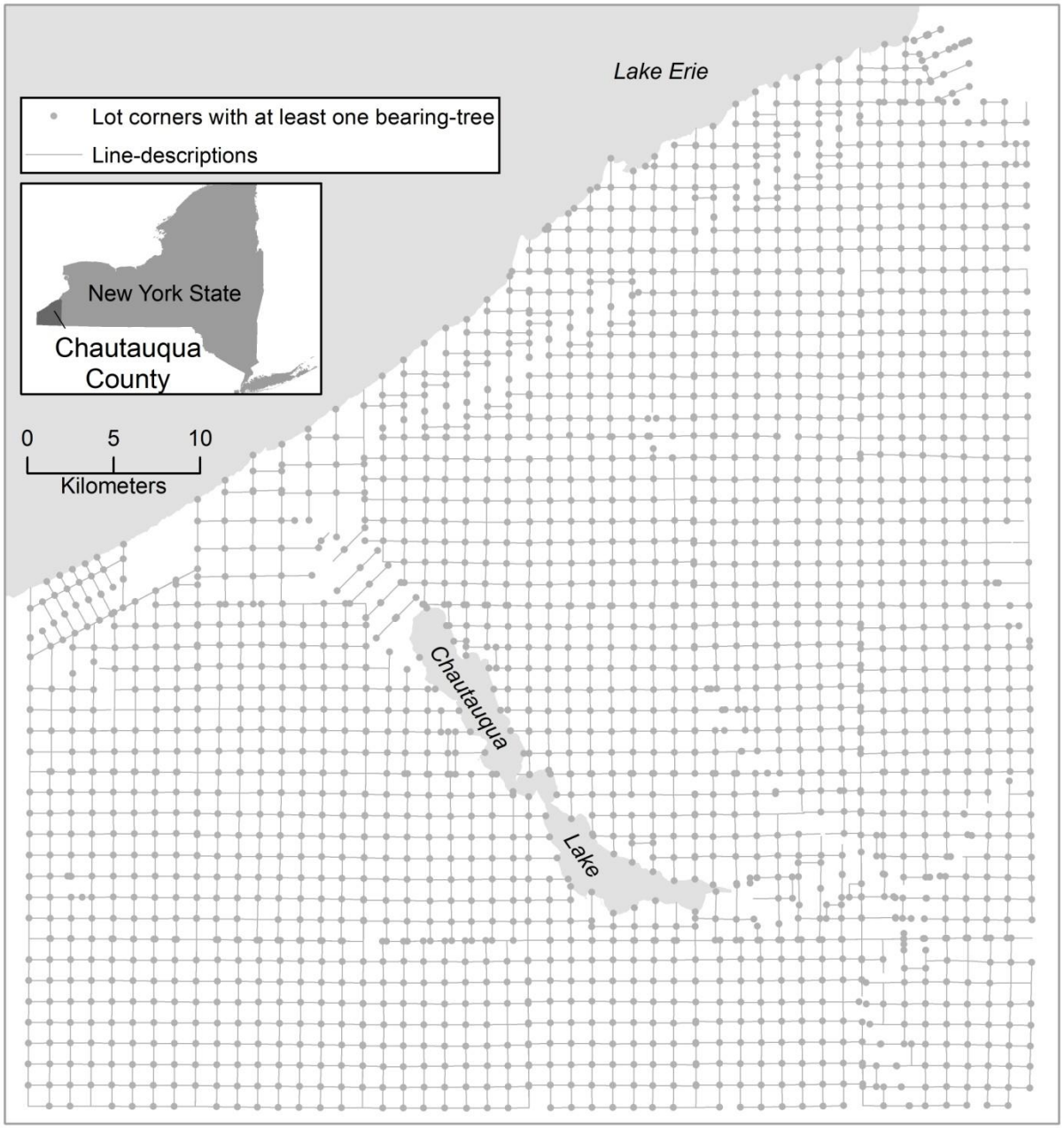
N.1.q.		Butternut	Sugar Maple Post
		W. ash Sugr.	N. 26. W. 21. Maple 12.
		Maple good	N. 13. E. 18. Maple 8.
		for Meadow	
Sw.	47.00		47.00
		Birch &	
N.1.q	55.00	B. ash	5500
		Soft maple	
		Bass & Elm	
		Hickory & Chestnut	
		W. & B. oak	
	60.00		60.00 Beech Post
			N. 58. W. 30 Beech 10.
			S. 51. W. 30. Beech 8.

North

Survey line between lots 3 and 9
Township 3, Range 12
Chautauqua County, New York
November 1804


Enlarged area
Chautauqua County
Chautauqua Lake
Chautauqua County tax parcels
0
150
300
Meters


N58W 30 Beech 10.
S51W 30 Beech 8.
Soft Maple Bass + Elm Hickory
Chestnut W. + B. oak
Birch + B. ash
Enlarged area
Chautauqua County
Chautauqua Lake
Butternut W. ash Sug.r Maple
good for Meadow
Lot corners, volume 198, page 14
Other lot corners
Line-descriptions, volume 198, page 14
Other line-descriptions
0
150
300
Meters
N26W 21 Sugar Maple 12.
N13E 18 Sugar Maple 8.


Lake Erie
Lot corners with at least one bearing-tree
Line-descriptions
New York State
Chautauqua County
0
5
10
Kilometers
Chautauqua
Lake

references to American chestnut (*Castanea dentata*)

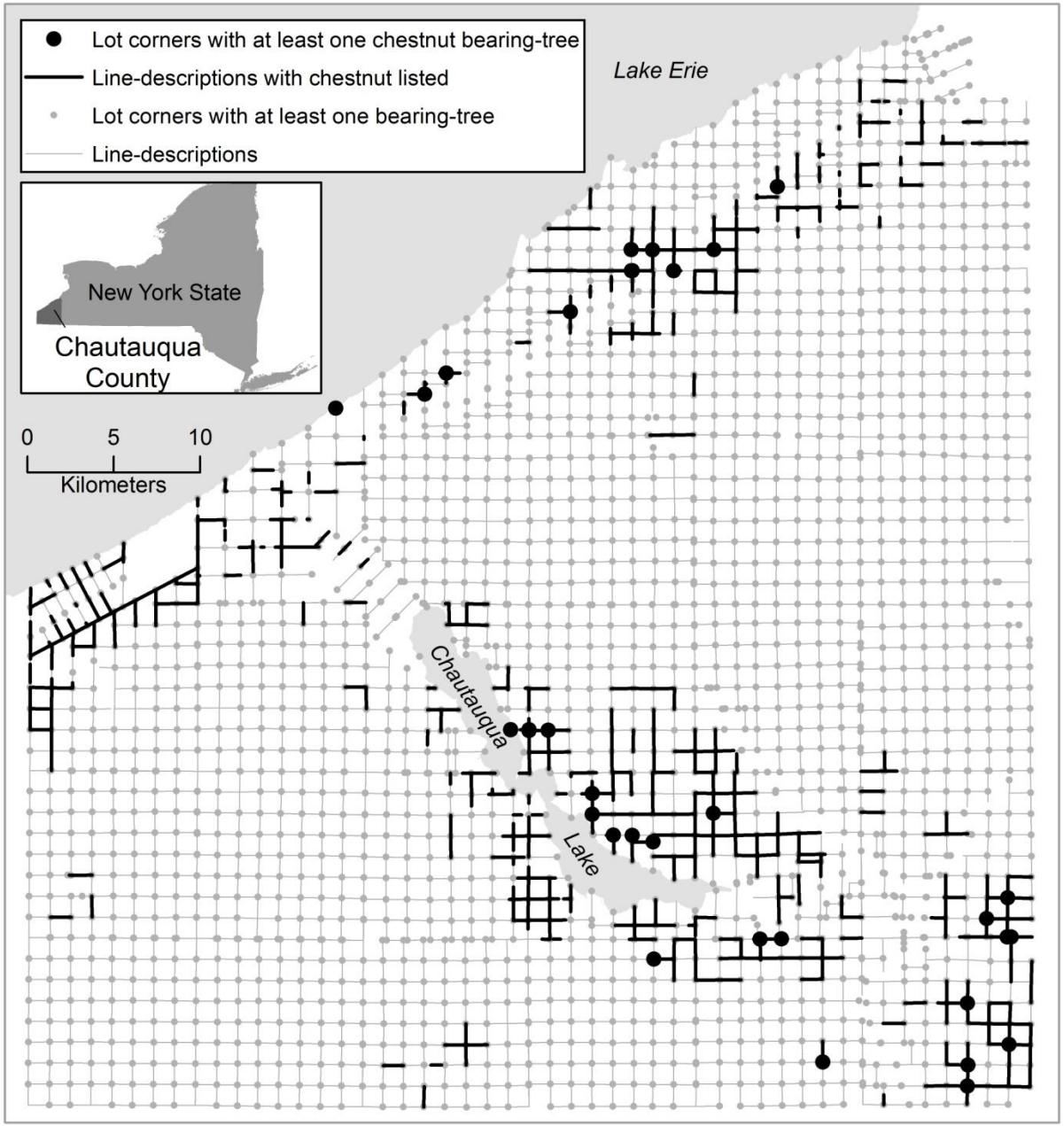
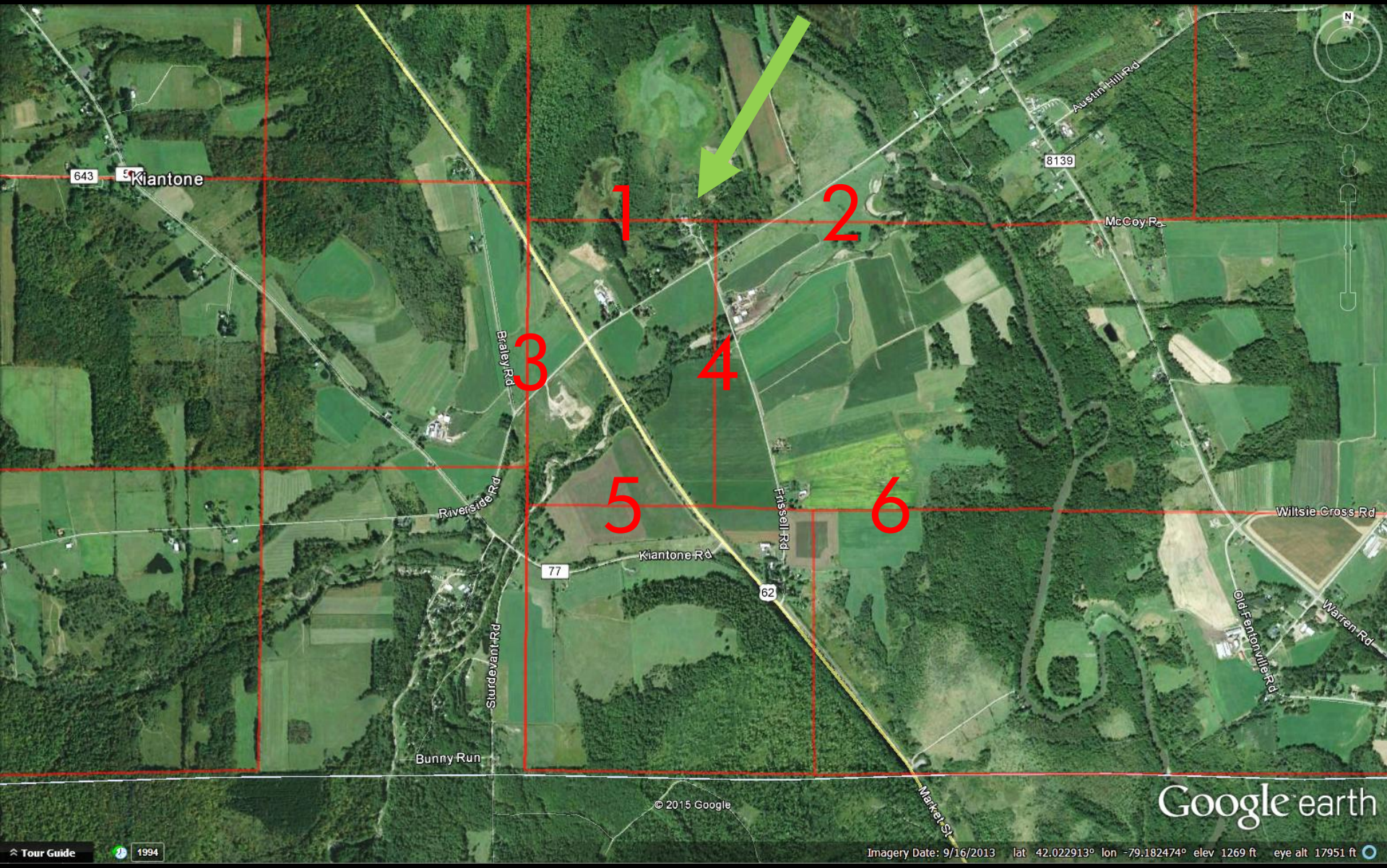


Image: http://www.charliechestnut.org/Phase1/Scrapbook/GrowingUp09LeavesD.html

We are here.

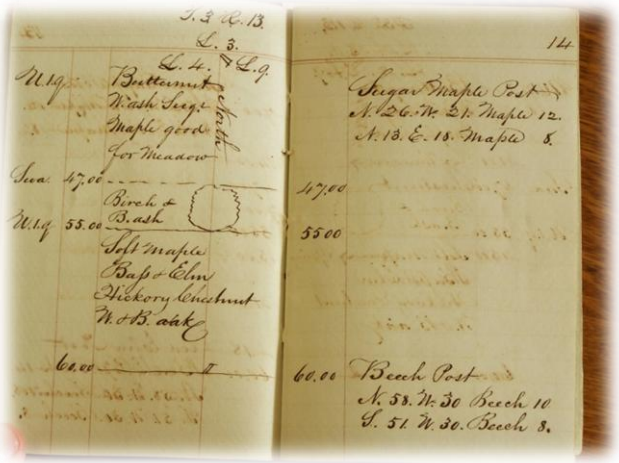

1
2
3
4
5
6
Kiantone
643
Austin Hill Rd
8139
McCoy Rd
Braley Rd
Riverside Rd
Frissell Rd
Wiltsie Cross Rd
Kiantone Rd
77
62
Sturdevant Rd
Old Fentonville Rd
Warren Rd
Bunny Run
Market St
© 2015 Google
Google earth
Tour Guide
1994
Imagery Date: 9/16/2013 lat 42.022913° lon -79.182474° elev 1269 ft eye alt 17951 ft

Original land survey records = a wealth of data

Chautauqua County, by the numbers…

3,917

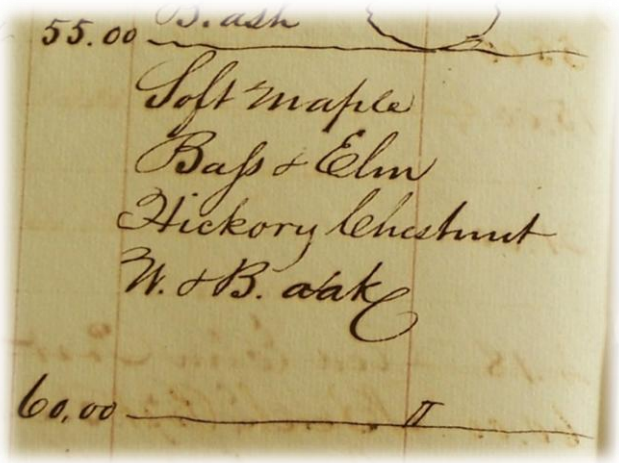
pages of field notes



= 1 page

5,871

line-descriptions



= 1 line-description

19,538

mentions of tree species in line-descriptions

= 7 mentions

6,521

witness-trees

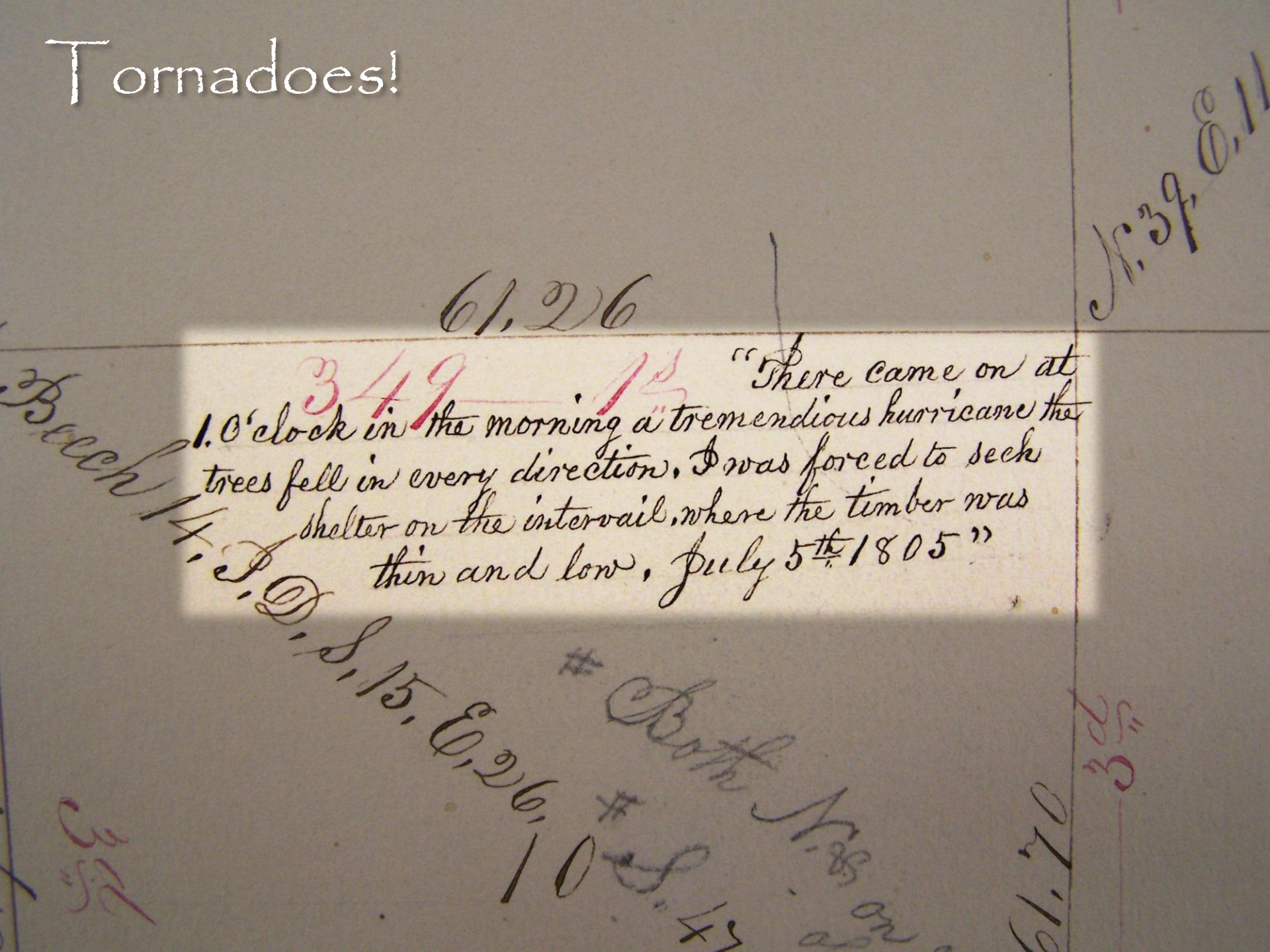
= 2 witness-trees

39

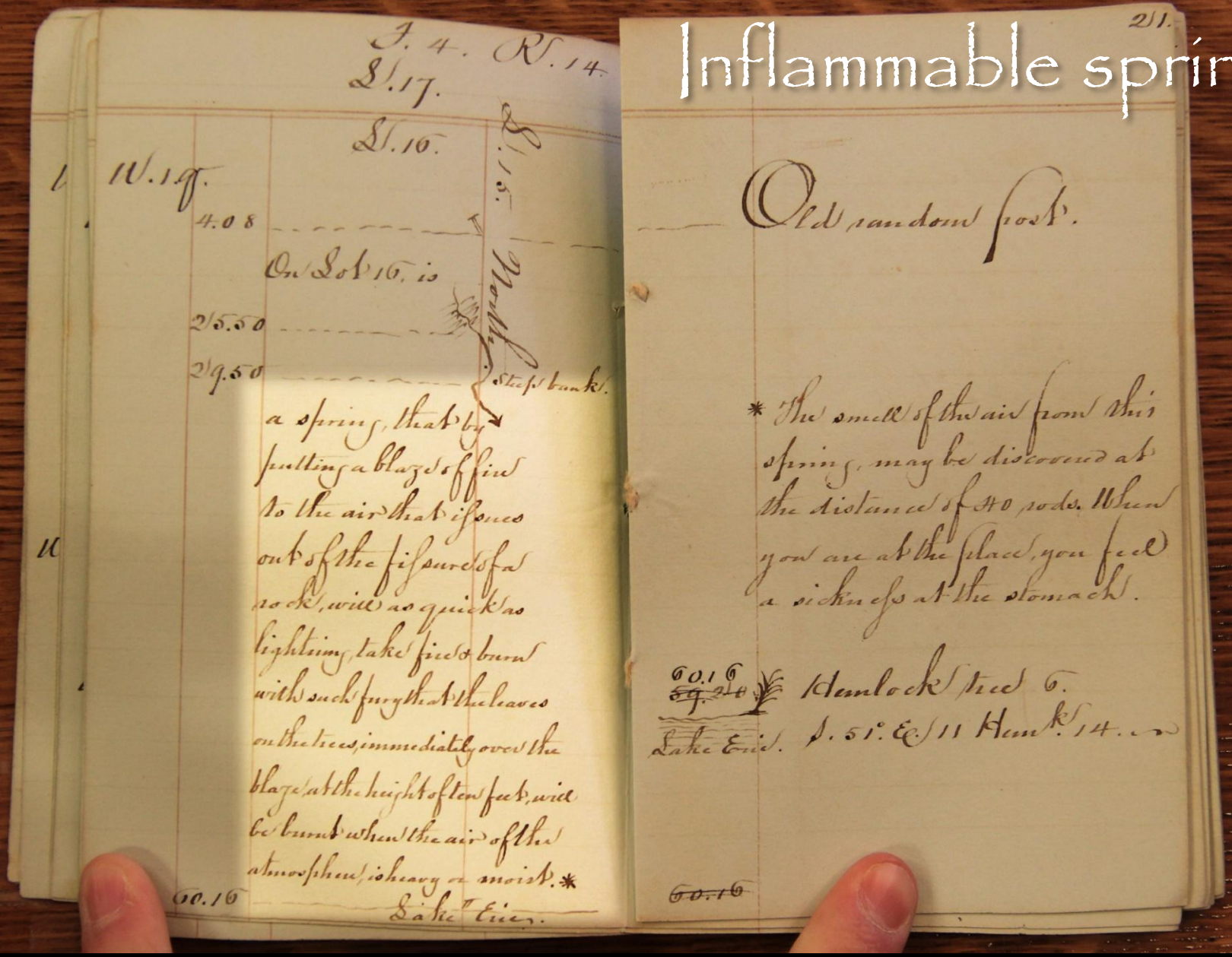
unique tree species mentioned

Oddities

Tornadoes!


61, 26
"There came on at
1. O'clock in the morning a tremendious hurricane the
trees fell in every direction. I was forced to seek
shelter on the intervail, where the timber was
thin and low, July 5th 1805"
Beech 14. P. S. 15, E. 26.
10 S.
N. 39. E. 11

Inflammable springs!



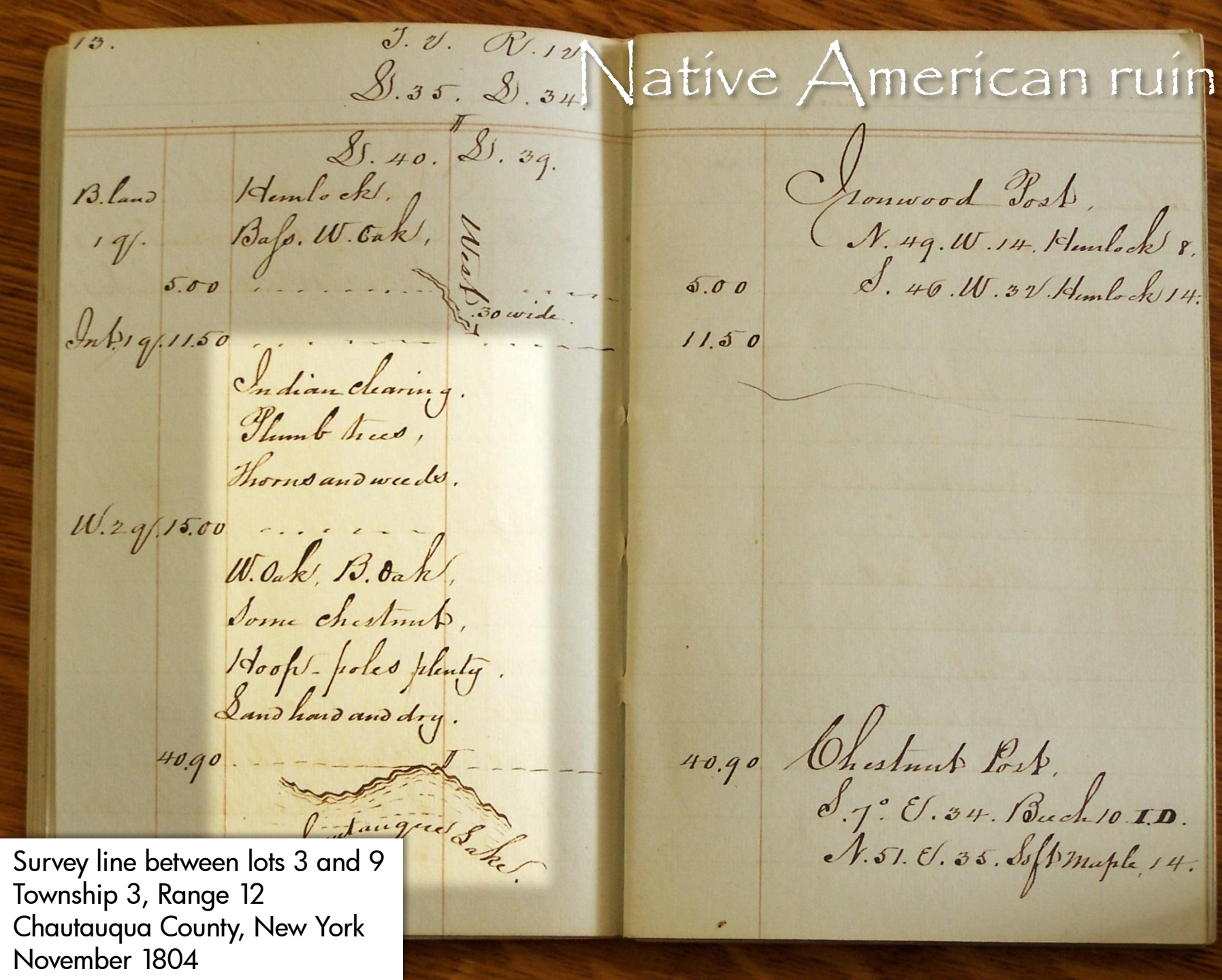
T. 4. R. 14.
S. 17.
S. 16.
W. 1/4.
4.08
On Lot 16. is
25.50
29.50
Steep bank.
a spring, that by putting a blaze of fire to the air that issues out of the fissures of a rock, will as quick as lightning take fire & burn with such fury that the leaves on the trees, immediately over the blaze, at the height of ten feet, will be burnt when the air of the atmosphere is heavy or moist.*
60.16
Lake Erie.

Old random post.

* The smell of the air from this spring, may be discovered at the distance of 40 rods. When you are at the place, you feel a sickness at the stomach.

60.16 Hemlock tree 6.
Lake Erie. S. 51. E. 11 Hemk. 14.
60.16

Native American ruins!



Survey line between lots 3 and 9
Township 3, Range 12
Chautauqua County, New York
November 1804

Once the species records are mapped, how are they used?

Quantify forest composition and structure

Map tree distributions

Map forest communities

Study forest disturbances (windthrow, fire)

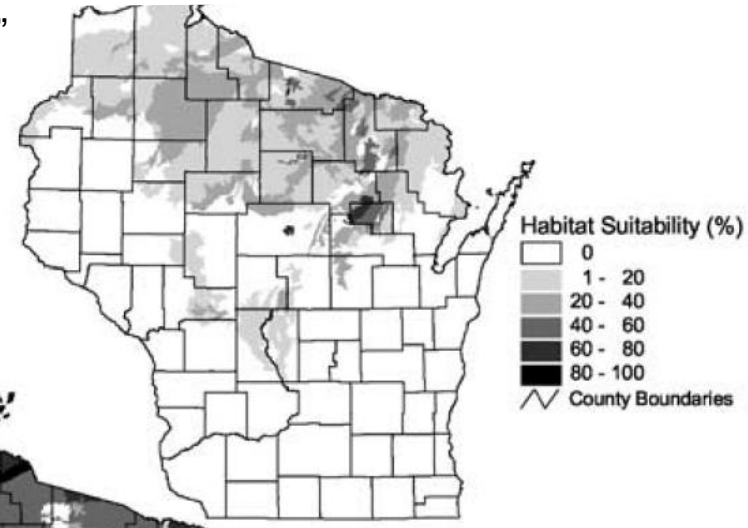
Map animal habitats

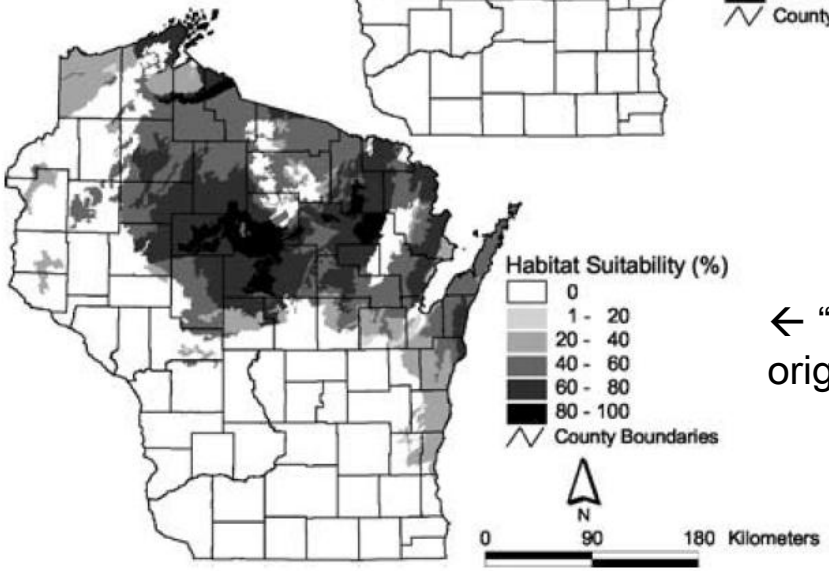
Quantify forest change

Understand Native American impacts

Black-throated green warbler: breeding habitat change in Wisconsin from 1850 to 2000

"Modeled" current range →





← "Modeled" original range

Schulte, L.A., Pidgeon, A.M., and Mladenoff. 2005. One hundred fifty years of change in forest bird breeding habitat: estimates of species distributions. *Conservation Biology* 19 (6): 1944-1956.

What were Chautauqua County forests like?

"The pioneers of Chautauqua County found it an unbroken wilderness… Chautauqua county then was densely covered with a majestic forest of the largest growth which cast its dark shadows everywhere over hills and valleys and along the streams and borders of the lakes."

Andrew Young, 1875

#1 Old forests with low sunlight.

The most mentioned trees.

Rank	Common name	Taxon
1	Beech	*Fagus grandifolia*
2	Sugar maple	*Acer saccharum*
3	Basswood	*Tilia americana*
4	Hemlock	*Tsuga canadensis*
5	Elm	*Ulmus americana*
6	White ash	*Fraxinus americana*
7	Cucumber magnolia	*Magnolia acuminata*
8	Chestnut	*Castanea dentata*
9	White pine	*Pinus strobus*
10	Black ash	*Fraxinus nigra*
11	Black oak	*Quercus velutina*
12	White oak	*Quercus alba*
13	Butternut	*Juglans cinerea*
14	Hickory	*Carya* spp.
15	Whitewood	*Liriodendron tulipifera*
16	Yellow birch	*Betula alleghaniensis*
17	Black cherry	*Prunus serotina*
18	Alder	*Alnus incana*
19	Red maple	*Acer rubrum*
20	Sycamore	*Platanus occidentalis*

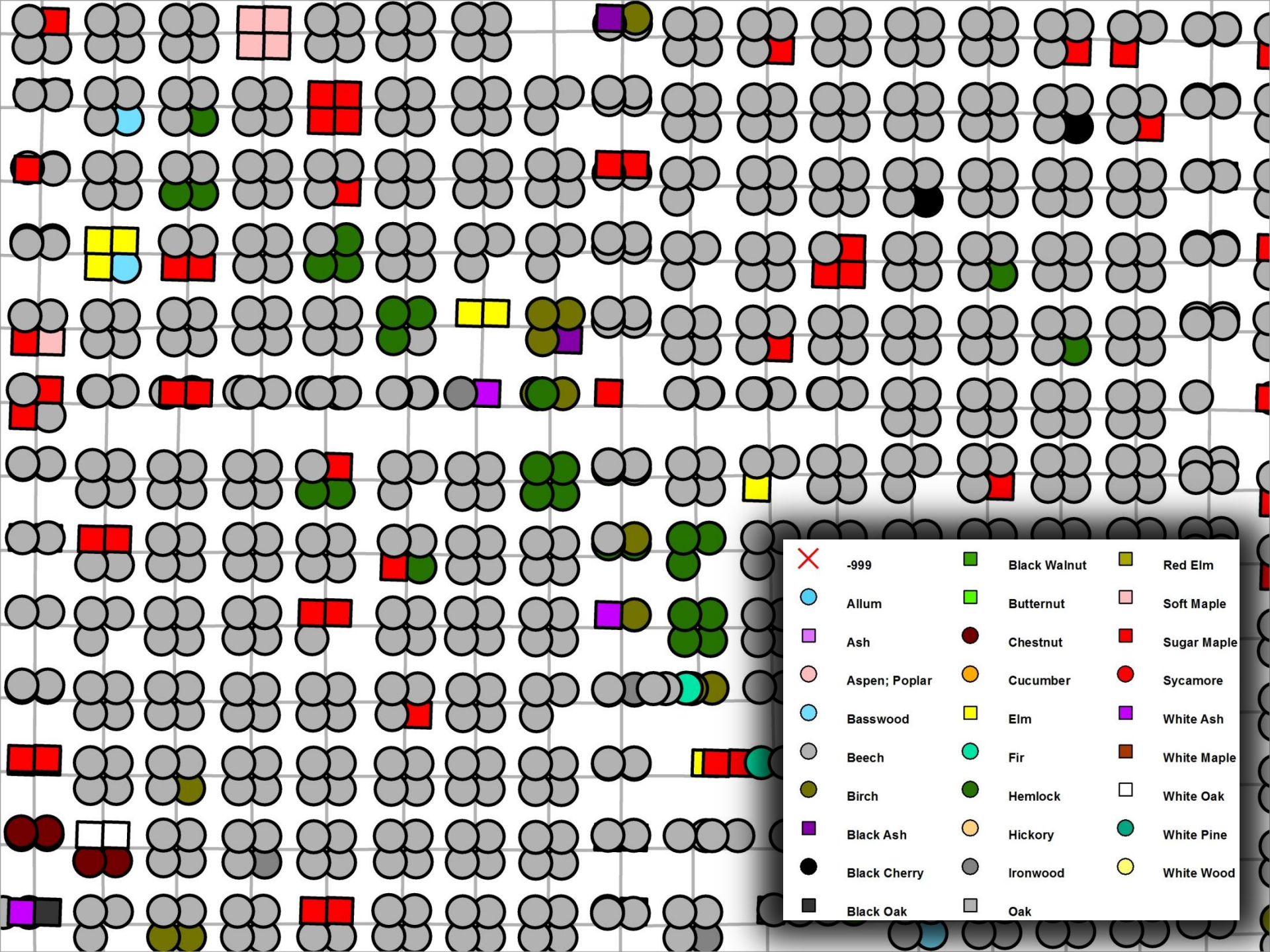
Longer-lived

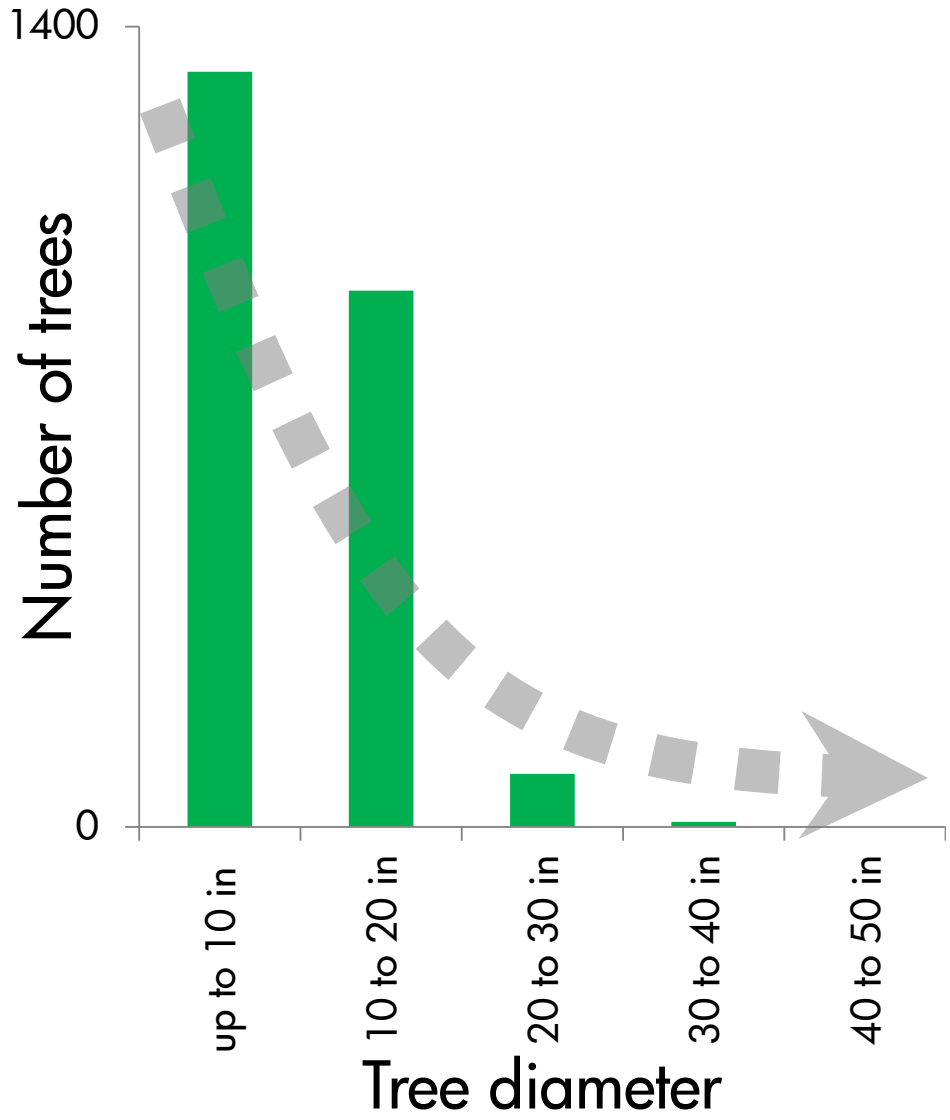
Shorter-lived

Tree species	Shade tolerance
Hemlock	4.8
Sugar maple	4.8
Beech	4.8
Basswood	4.0
…	
Red oak	2.8
White ash	2.5
Black cherry	2.5
Poplar	1.2

0 (no tolerance) to
5 (maximal tolerance)

Niinemets, U. and Valladares, F. 2006. Tolerance to shade, drought, and waterlogging of temperate Northern Hemisphere trees and shrubs. *Ecological Monographs* 76 (4): 521-547.

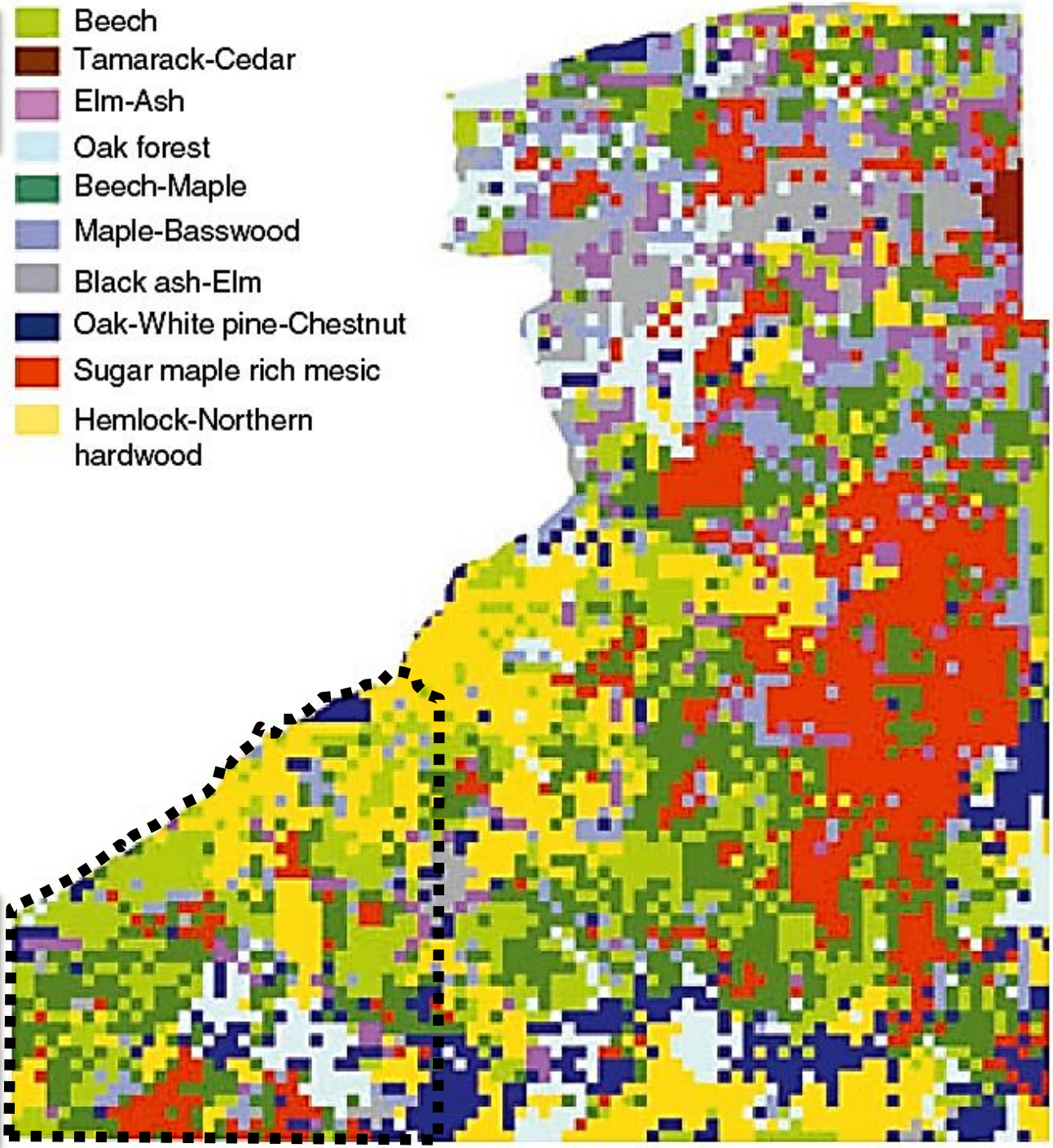

-999
Allum
Ash
Aspen; Poplar
Basswood
Beech
Birch
Black Ash
Black Cherry
Black Oak
Black Walnut
Butternut
Chestnut
Cucumber
Elm
Fir
Hemlock
Hickory
Ironwood
Oak
Red Elm
Soft Maple
Sugar Maple
Sycamore
White Ash
White Maple
White Oak
White Pine
White Wood


1400
0
Number of trees
up to 10 in
10 to 20 in
20 to 30 in
30 to 40 in
40 to 50 in
Tree diameter


http://www.ancientforest.org/ontarios-old-growth-forests-a-guidebook/orw_3155/

#2 Influenced by environmental conditions.

Forest communities, ca. 1790



Wang, Y.-C. 2006. Spatial patterns and vegetation-site relationships of the presettlement forests in western New York. *Journal of Biogeography* 34 (3): 500-513.

Swamp	Mesic	Dry-mesic	Sub-xeric	Xeric

Swamp	Mesic	Dry-mesic	Sub-xeric	Xeric

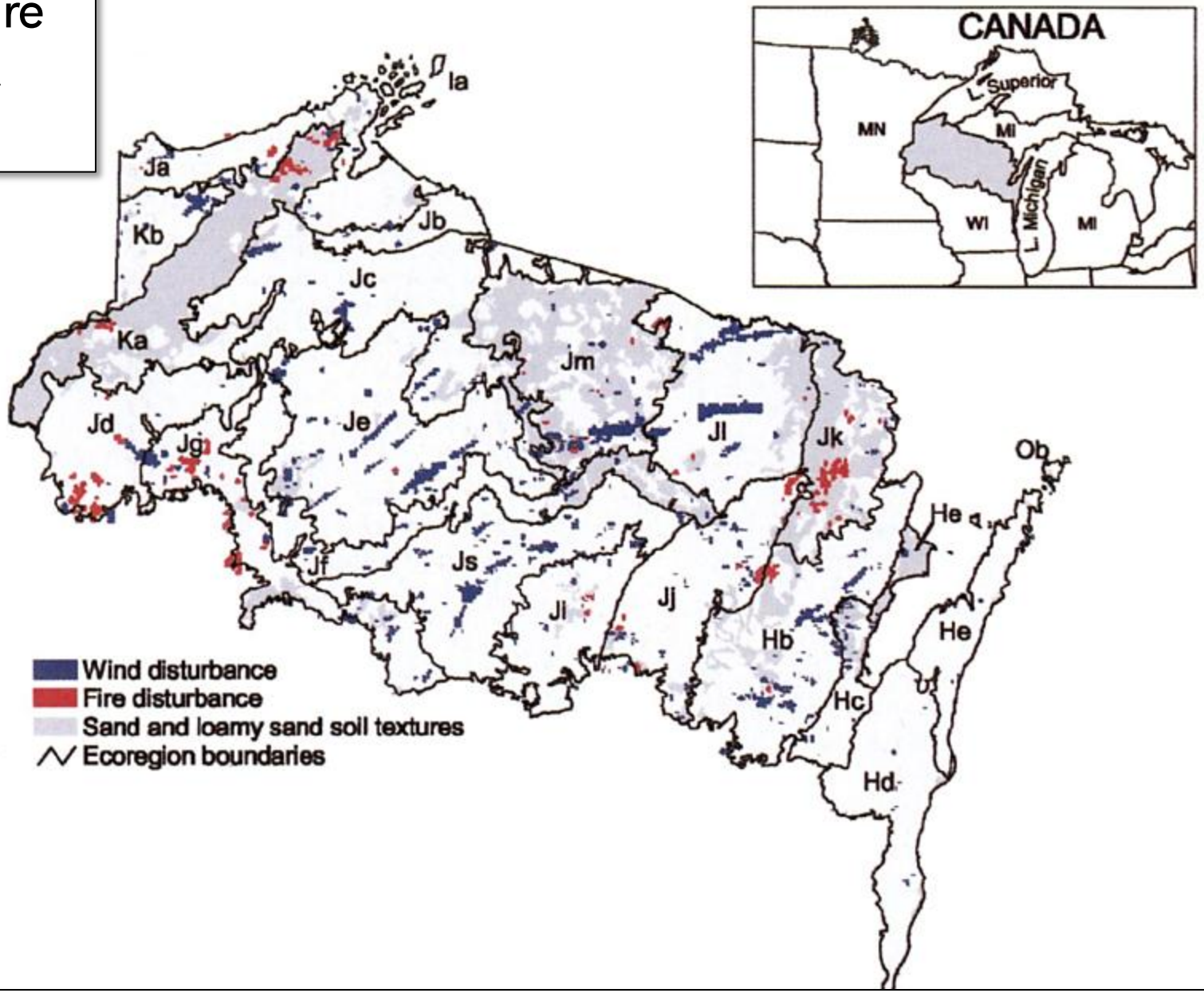
Swamp	Mesic	Dry-mesic	Sub-xeric	Xeric

Swamp	Mesic	Dry-mesic	Sub-xeric	Xeric

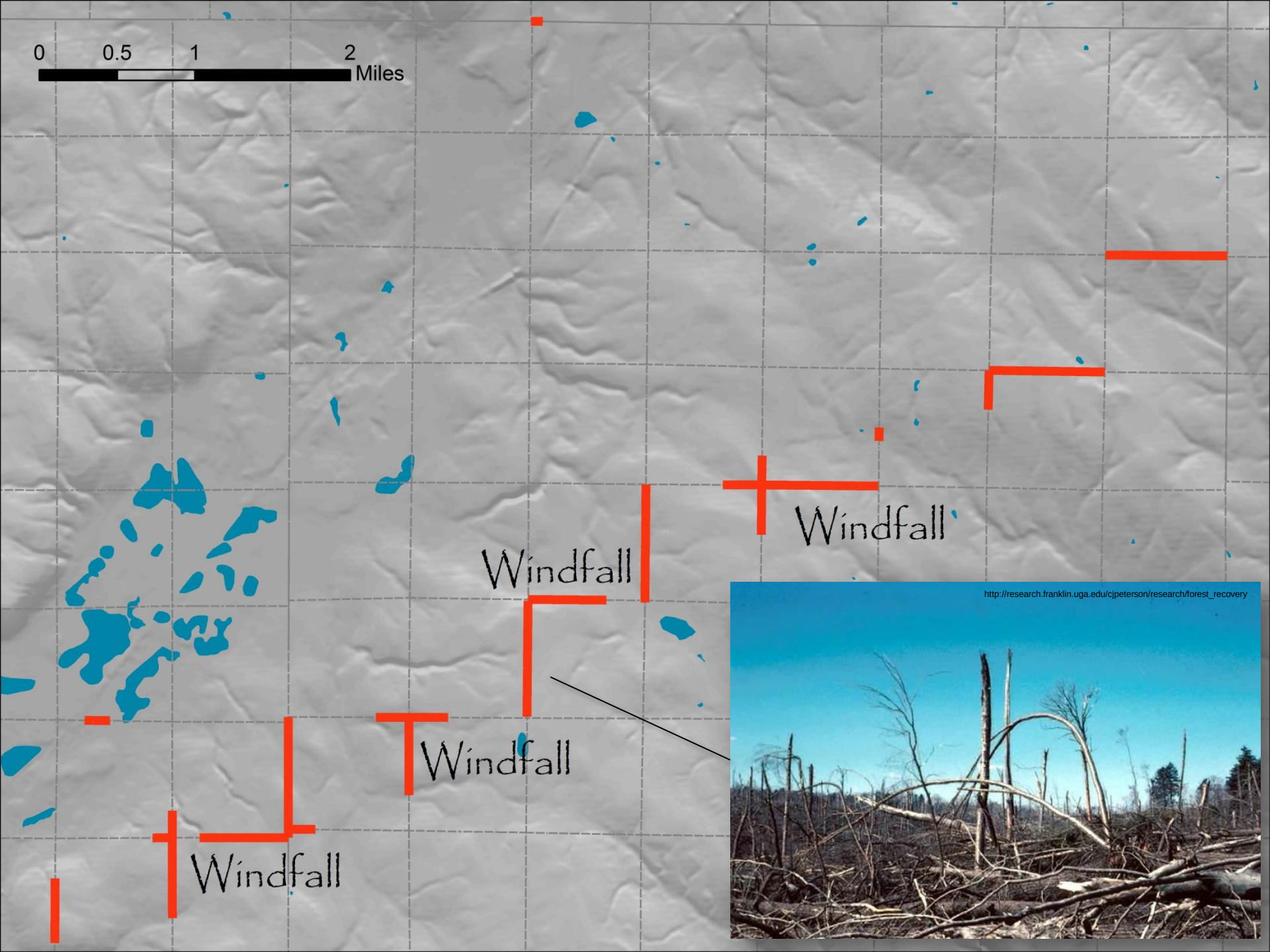
Swamp	Mesic	Dry-mesic	Sub-xeric	Xeric

#3 Impacted by windthrow.

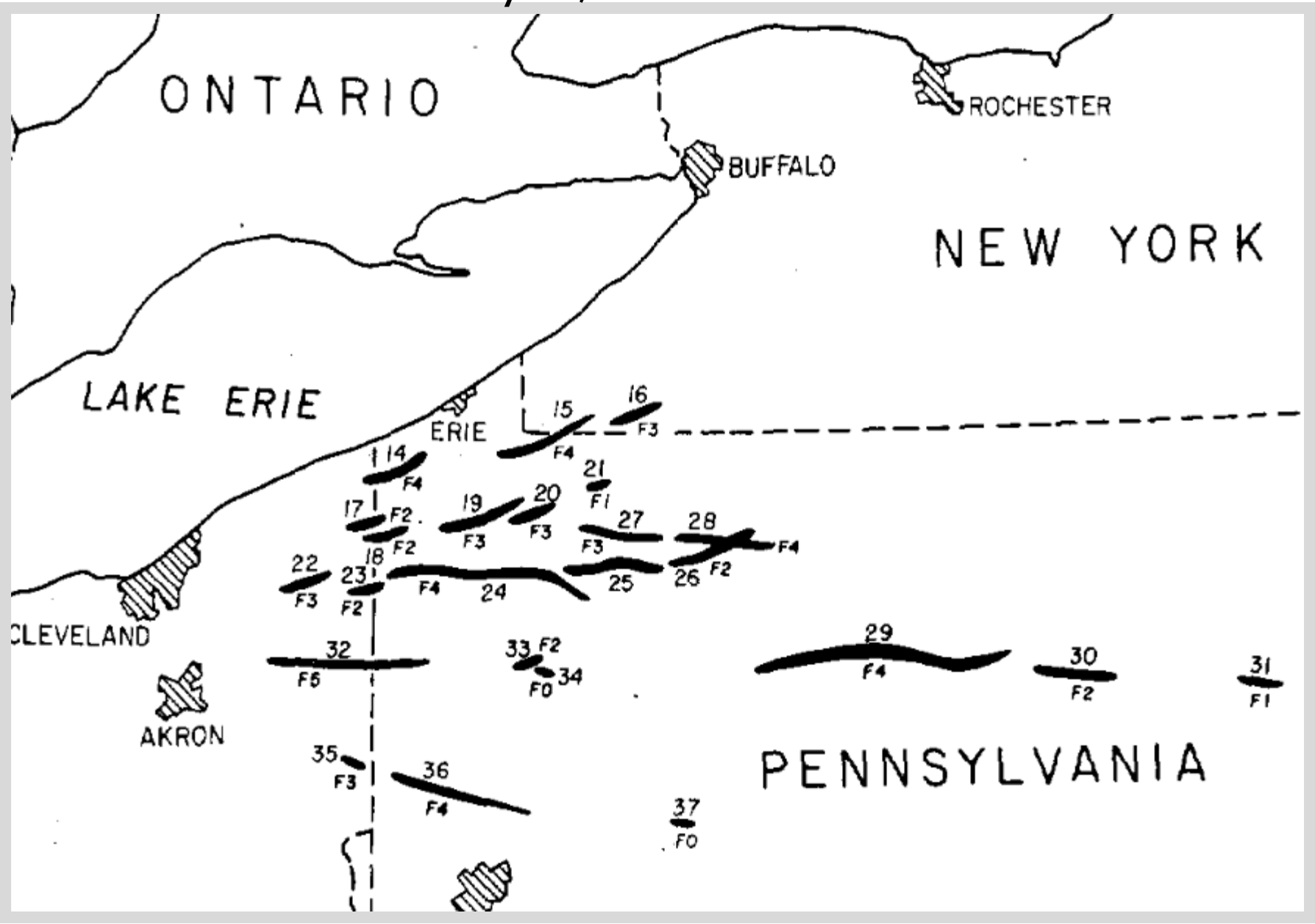
Wind and fire disturbance, ca. 1850



Schulte, L.A. and Mladenoff, D.J. 2005. Severe wind and fire regimes in northern forests: historical variability at the regional scale. *Ecology* 86: 431-445.


0
0.5
1
2
Miles
Windfall
Windfall
Windfall
Windfall
http://research.franklin.uga.edu/cjpeterson/research/forest_recovery

Tornado Outbreak of May 31, 1985



http://www.erh.noaa.gov/cle/office/localinterest/1985Tornado/storm_data.pdf

#4 Altered by Native American land use.

Clearing for village construction

Clearing for horticulture

Burning to
clear land,
improve hunting,
ease travel, and
promote mast-bearing trees

Images: http://en.wikipedia.org/wiki/Oak_savanna

Land-use practices may have promoted shade-intolerant, fire-tolerant, mast-bearing species.

(such as oak, chestnut, and hickory)

Images: http://www.123rf.com/stock-photo/white_oak_acorn_cap.html http://www.grit.com/community/american-chestnut-zmgz13mazgou.aspx http://www.123rf.com/search.php?word=hickory+nut&imgtype=0&t_word=&t_lang=en

Land-use practices may have also reduced shade-tolerant, fire-sensitive species.

(such as beech and sugar maple)

Ecological Monographs, 00(0), 0000, pp. 000–000

Native American impact on past forest composition inferred from species distribution models, Chautauqua County, New York

Stephen J. Tulowiecki[1] and Chris P. S. Larsen

Department of Geography, University at Buffalo, Wilkeson Quadrangle, Buffalo, New York 14261 USA

Abstract. Little consensus surrounds the extent of Native American impacts upon tree species composition in Eastern North America, prior to European-American settlement (presettlement). Native American land-use practices (e.g., forest clearance and burning) likely altered forest composition, but the spatial extent of these alterations remains vaguely quantified. Previous research has attempted to quantify the spatial extent of clearance practices, but little research has addressed the more subtle alterations to tree species composition resulting from Native American land use. Research has also inadequately distinguished between environmental and anthropogenic controls upon tree species composition, leaving open the possibility that, instead of modifying forest composition, Native American societies instead settled where favored tree species were already present. This study employed species distribution models (SDMs) trained from tree species data within presettlement land survey records (PLSRs), in order to understand Native American impacts upon presettlement tree species composition in Chautauqua County, New York. Using historical and archaeological data, this study developed "Native American variables" (NAVs), which represented human accessibility to features of Iroquoian settlement. This study then modeled the distribution of tree species in relation to both environmental variables and NAVs. Notable results indicate that NAVs significantly improved the predictive performance of SDMs for mast-bearing taxa, such as oak (*Quercus* spp.), chestnut (*Castanea dentata* (Marsh.) Borkh.), and hickory (*Carya* spp.). Under a simulated absence of Iroquoian settlement, the amount of "suitable" area in Chautauqua County decreased by 2 to 23 percentage points for five mast-bearing taxa, depending upon species and modeling procedure. Results imply that Iroquoian alterations to tree species composition covered a larger spatial extent, in comparison to previous estimates of the spatial extent of clearance practices in Iroquoian regions. Yet, the majority of forest compositional modifications occurred within 10 to 15 km of village sites. This study offers a novel methodology for quantifying Native American impacts upon past tree species composition, and suggests that Iroquoian land-use practices of [illegible]-shaped forest compositional patterns at local extents in one region of

Image: http://archaeology.org/news/3338-150603-trees-edible-nuts

ARCHAEOLOGY

A publication of the Archaeological Institute of America

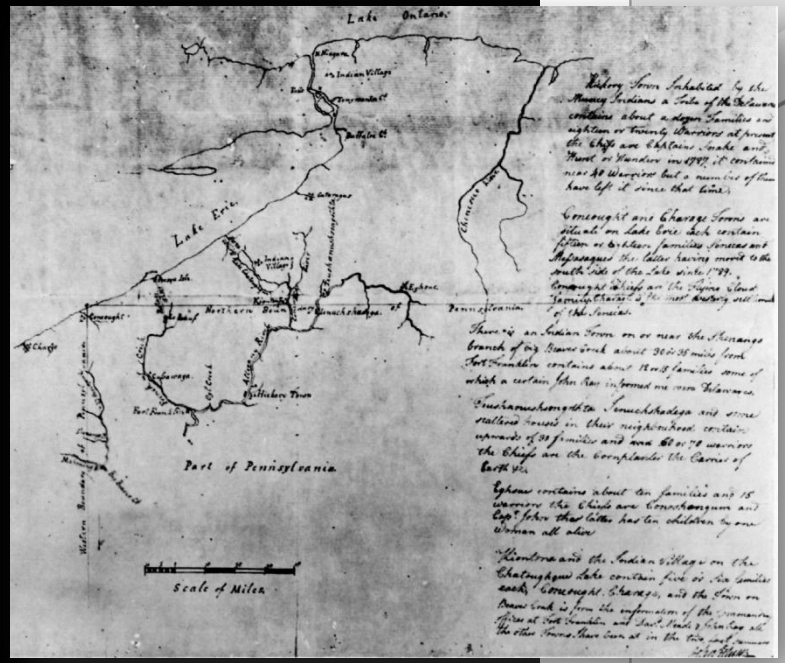
New York's 19th-Century Forests Reflected Human Habitation

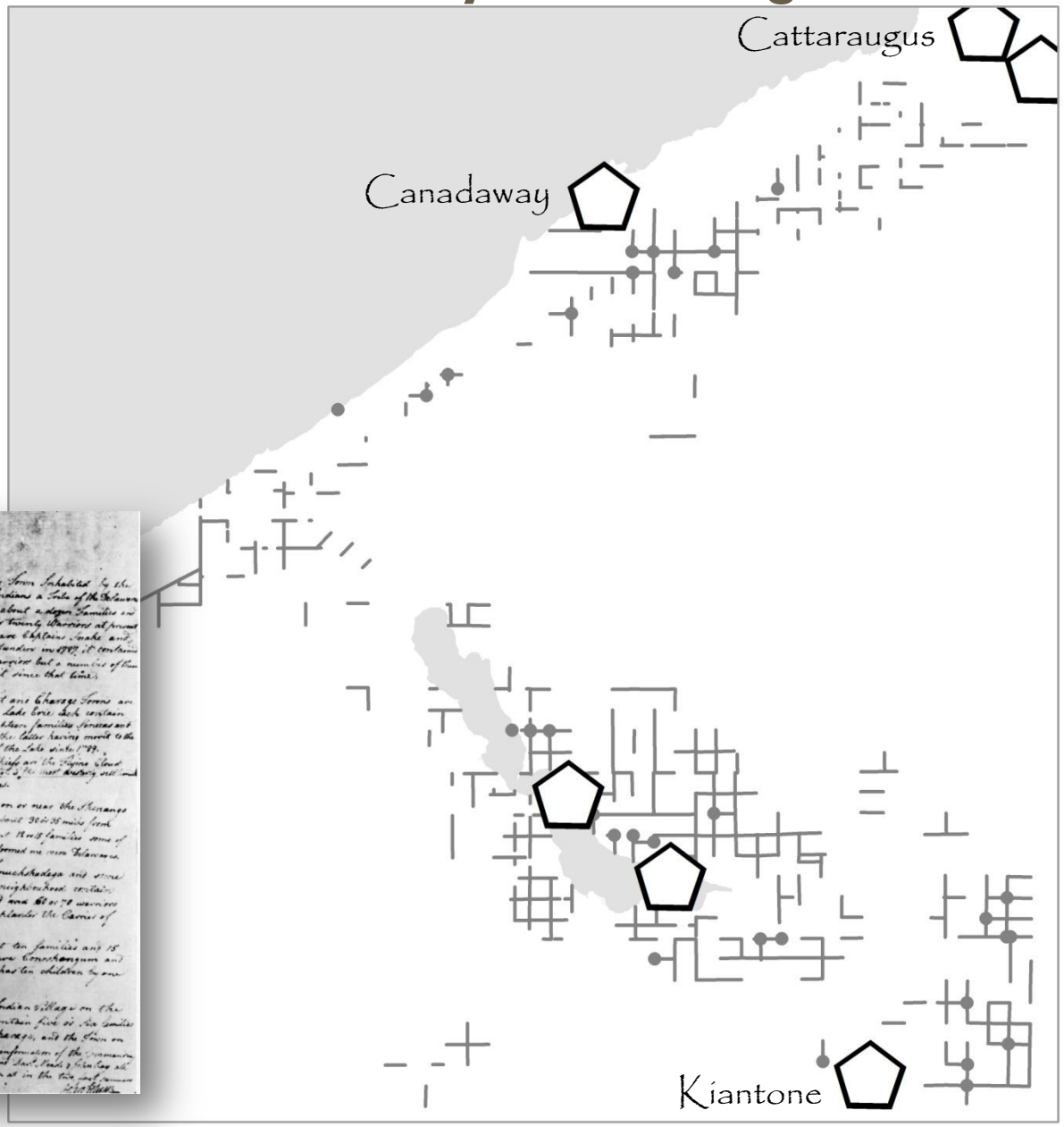
Wednesday, June 03, 2015

(Steve Tulowiecki)

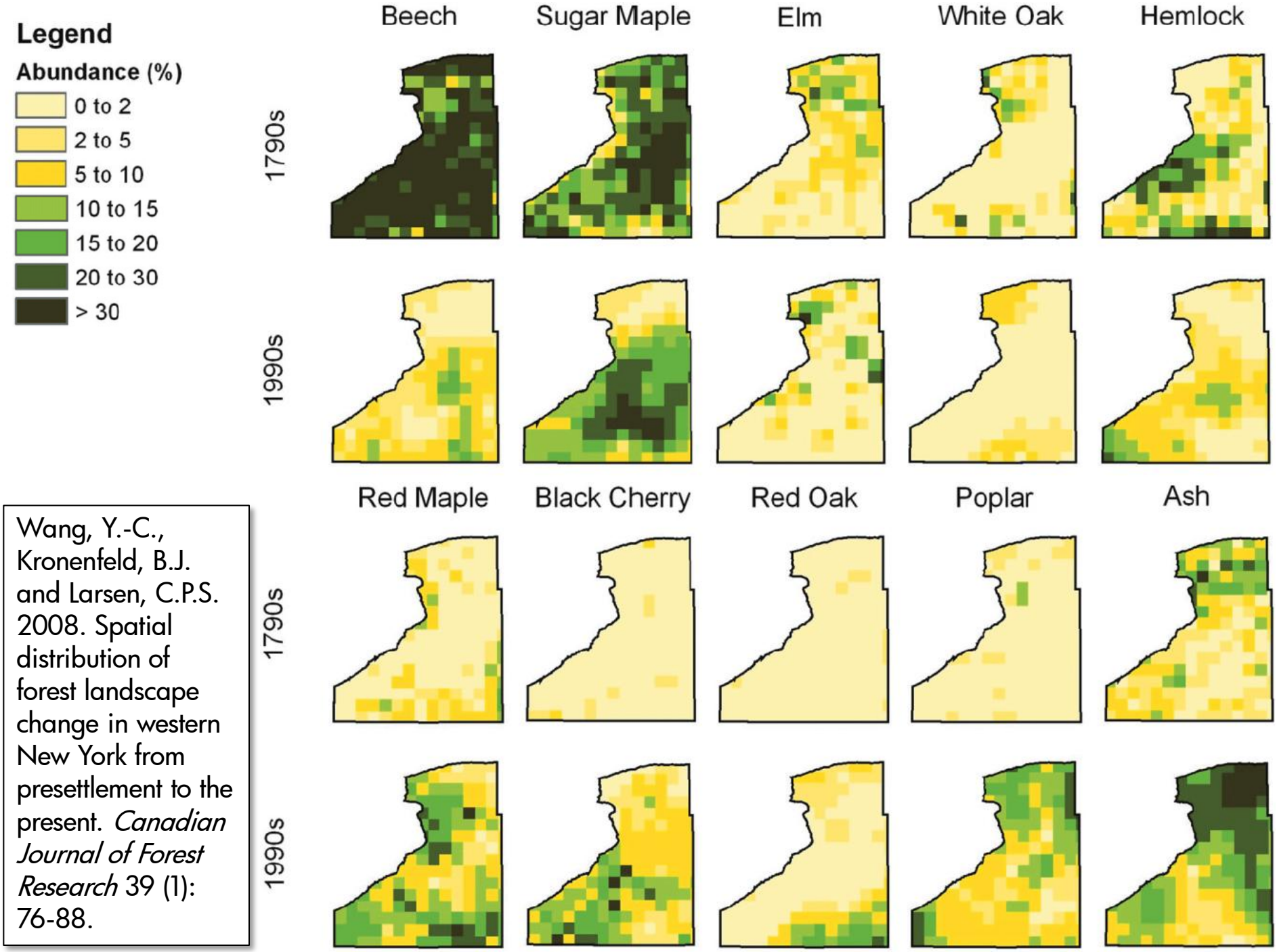
BUFFALO, NEW YORK—New research suggests that a higher than expected number of fire-tolerant, large-nut-bearing trees such as hickory, chestnut, and oak were present near the sites of Native American villages in Western New York in the early nineteenth century. In contrast, beech and sugar maples, which burn readily in forest fires, appeared in smaller numbers than expected. Steve Tulowiecki, who conducted the study while a student at the University at Buffalo with Chris Larsen, used data on trees that was collected in a survey of Chautauqua County between 1799 and 1814, and mapped it along with temperature,

18th century Seneca villages

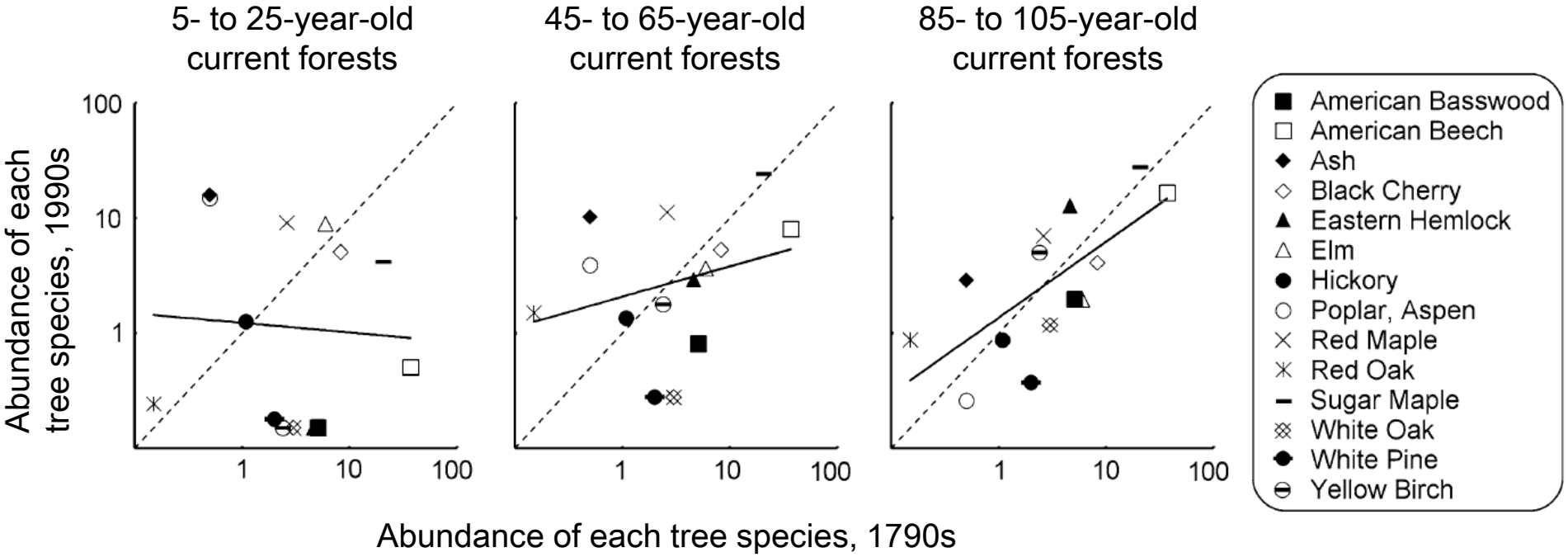




#5 Different from today.



Wang, Y.-C., Kronenfeld, B.J. and Larsen, C.P.S. 2008. Spatial distribution of forest landscape change in western New York from presettlement to the present. *Canadian Journal of Forest Research* 39 (1): 76-88.



Wang, Y.-C., Larsen, C.P.S. and Kronenfeld, B.J. 2010. Effects of clearance and fragmentation on forest compositional change and recovery after 200 years in western New York. *Plant Ecology* 208: 245-258.

"The pioneers of Chautauqua County found it an unbroken wilderness… Chautauqua county then was densely covered with a majestic forest of the largest growth which cast its dark shadows everywhere over hills and valleys and along the streams and borders of the lakes."

Andrew Young, 1875

The pioneers of Chautauqua County found mostly old forests with low sunlight – but it was *not* unbroken. Beech-maple forests were most abundant, and other forest types grew in swamps and upon drier sites. Younger forests grew in areas of recent windthrow. Further breaking the pattern were areas where the Seneca modified forest composition to favor oak, hickory, and chestnut, within about 6 miles of Seneca villages.

In comparison to today's forests, original Chautauqua County forests were made up of trees of varied sizes, and tree species that were shade-tolerant.