Exploring the Pre-Settlement Forests of Chautauqua County

Stephen J. Tulowiecki, Ph.D.
About me...
Biogeographer

“Life”  “Earth”  “Writing”
Geographic Information Scientist

Collecting, analyzing, managing, and viewing geographic data
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.
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:

<table>
<thead>
<tr>
<th>Tree Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juglans nigra</td>
<td>black walnut</td>
</tr>
<tr>
<td>Juglans cinerea</td>
<td>butternut</td>
</tr>
<tr>
<td>Juglans squamosa</td>
<td>shell bark</td>
</tr>
<tr>
<td>Quercus rubra</td>
<td>red oak</td>
</tr>
<tr>
<td>Quercus alba</td>
<td>white oak</td>
</tr>
<tr>
<td>Pinus canadensis</td>
<td>hemlock</td>
</tr>
<tr>
<td>Pinus strobus</td>
<td>white pine</td>
</tr>
<tr>
<td>Castanea vesca</td>
<td>chestnut</td>
</tr>
<tr>
<td>Fagus ferruginea</td>
<td>beech</td>
</tr>
<tr>
<td>Liriodendrum tulipifera</td>
<td>whitewood or poplar</td>
</tr>
<tr>
<td>Carpinus americana?</td>
<td>iron wood</td>
</tr>
<tr>
<td>Prunus virginiana</td>
<td>wild cherry</td>
</tr>
<tr>
<td>Acer saccharinum</td>
<td>sugar maple</td>
</tr>
<tr>
<td>Acer rubrum</td>
<td>soft maple</td>
</tr>
<tr>
<td>Betula nigra</td>
<td>birch</td>
</tr>
<tr>
<td>Sambucus pubescens</td>
<td>Canadian elder</td>
</tr>
<tr>
<td>Ulmus americana</td>
<td>elm</td>
</tr>
<tr>
<td>Magnolia acuminata</td>
<td>cucumber tree</td>
</tr>
<tr>
<td>Fraxinus alba</td>
<td>white ash</td>
</tr>
</tbody>
</table>
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
Survey line between lots 3 and 9
Township 3, Range 12
Chautauqua County, New York
November 1804

Sugar Maple Post

Beech Post

W. I q. 55.00
Soft maple
Bass & Elm
Hickory Chestnut
W. & B. oak

W. I q. 55.00
Soft maple
Bass & Elm
Hickory Chestnut
W. & B. oak

60.00
60.00

47.00

55.00

Birch & Bash

Seal.
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?
N58W 30 Beech 10.
S51W 30 Beech 8.

Soft Maple Bass + Elm Hickory
Chestnut W. + B. oak

Birch + B. ash

Butternut W. ash Sug.r Maple
good for Meadow

N26W 21 Sugar Maple 12.
N13E 18 Sugar Maple 8.

Lot corners, volume 198, page 14
Other lot corners
Line-descriptions, volume 198, page 14
Other line-descriptions
references to American chestnut (Castanea dentata)

- Lot corners with at least one chestnut bearing-tree
- Line-descriptions with chestnut listed
- Lot corners with at least one bearing-tree
- Line-descriptions

Image: http://www.charliechestnut.org/Phase1/Scrapbook/GrowingUp09LeavesD.html
We are here.
Original land survey records = a wealth of data
Chautauqua County, by the numbers...
3,917 pages of field notes
5,871
line-descriptions

= 1 line-description
19,538
mentions of tree species in line-descriptions

= 7 mentions
6,521 witness-trees

(Sugar Maple Post)

= 2 witness-trees
39 unique tree species mentioned
Oddities
There came on at 1 O'clock in the morning a tremendous hurricane, the trees fell in every direction. I was forced to seek shelter on the interval, where the timber was thin and low. July 5th, 1805.
Inflammable springs!

Old rambont food.

* The smell of the air from this spring, may be discerned at the distance of 300 paces. Should you be at the place, you feel a sickness at the stomach.

Lake Eerie.

Lake Erie.

Hamlock Field.

June 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?
Map forest communities

Quantify forest composition and structure

Map tree distributions

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 ←

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.

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

<table>
<thead>
<tr>
<th>Tree species</th>
<th>Shade tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemlock</td>
<td>4.8</td>
</tr>
<tr>
<td>Sugar maple</td>
<td>4.8</td>
</tr>
<tr>
<td>Beech</td>
<td>4.8</td>
</tr>
<tr>
<td>Basswood</td>
<td>4.0</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>Red oak</td>
<td>2.8</td>
</tr>
<tr>
<td>White ash</td>
<td>2.5</td>
</tr>
<tr>
<td>Black cherry</td>
<td>2.5</td>
</tr>
<tr>
<td>Poplar</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Shade tolerance ranges from 0 (no tolerance) to 5 (maximal tolerance).

Number of trees

Tree diameter

0

up to 10 in

10 to 20 in

20 to 30 in

30 to 40 in

40 to 50 in

http://www.ancientforest.org/ontarios-old-growthforests-guidebook/crw_3155/
#2 Influenced by environmental conditions.
#3 Impacted by windthrow.
Tornado Outbreak of May 31, 1985
#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.
Land-use practices may have promoted shade-intolerant, fire-tolerant, mast-bearing species.

(such as oak, chestnut, and hickory)
Land-use practices may have also reduced shade-tolerant, fire-sensitive species.

(such as beech and sugar maple)
Native American impact on past forest composition inferred from species distribution models, Chautauqua County, New York

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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 tree species and forest compositional patterns at local extents in one region of...
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

Kiantone

Canadaway

Cattaraugus
#5 Different from today.
Abundance of each tree species, 1790s

5- to 25-year-old current forests

45- to 65-year-old current forests

85- to 105-year-old current forests

“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.