

# OLD-GROWTH FORESTS IN NEW YORK'S FOREST PRESERVE, AN EXTENSIVE REMNANT ECOSYSTEM

2025 CERM

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Department of  
Environmental  
Conservation

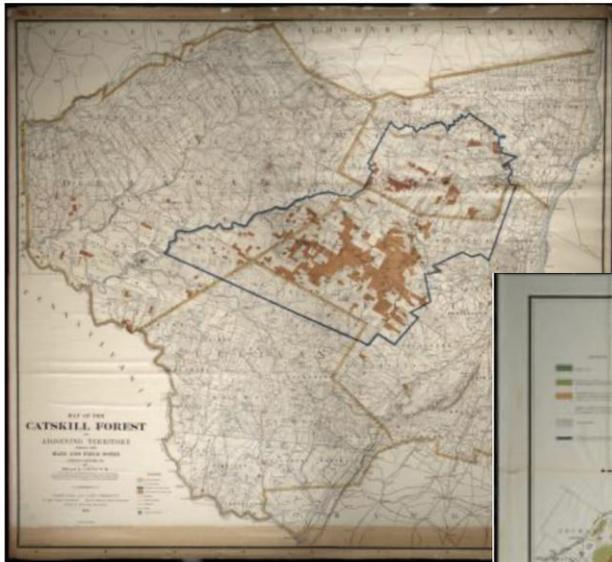


New York  
Natural Heritage  
Program



# One Forest Preserve – Two Parks: Adirondack and Catskills Parks

New York Forest Commission addressed need for forest preservation



1911 map of Catskills showing "blue line"



1891 map of proposed Adirondack "blue line"

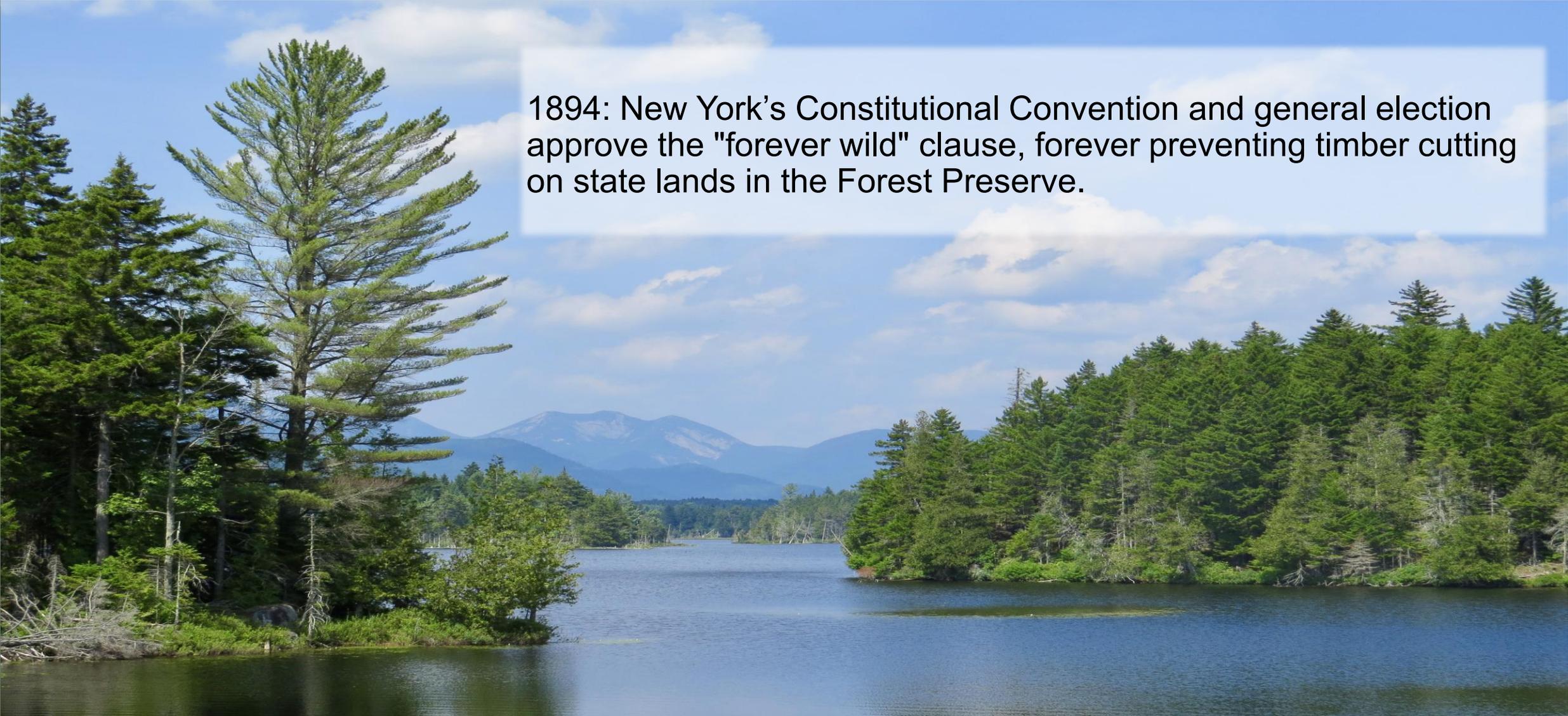
In 1884, the NY Legislature appointed a Forest Commission to investigate the need for forest preservation.

The Forest Commission outlined in **blue ink** on a map the proposed boundaries for the Adirondack and Catskill Parks.

Today, the **"blue line"** means the **boundaries of the Adirondack and Catskill Parks**.

## 1894: New York State Constitutional Protection Adirondack and Catskill Parks To Be Kept *FOREVER WILD*

1894: New York's Constitutional Convention and general election approve the "forever wild" clause, forever preventing timber cutting on state lands in the Forest Preserve.



## 2023 – 2027: Old-Growth Forest Study in NY's Forest Preserve



Study initiated and funded by  
NYSDEC:

Map, Model, Identify Characteristics,  
and Estimate Carbon

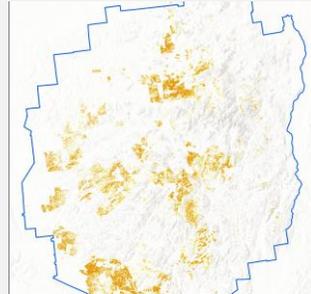
Based on previous studies, New  
York State has an estimated 275,000  
to 860,000 acres of old growth  
forest, most of it found in the Forest  
Preserve.

# Research Overview



## Part 1:

*Characteristics of Old-Growth  
Forests within New York's Forest  
Preserve*



## Part 2:

*Application of Machine Learning  
Methods to Predict Old-Growth  
Forest Extent*

## Part 1:

# *Characteristics of Old-Growth Forests within New York's Forest Preserve*

# Methodology

## Site Locations

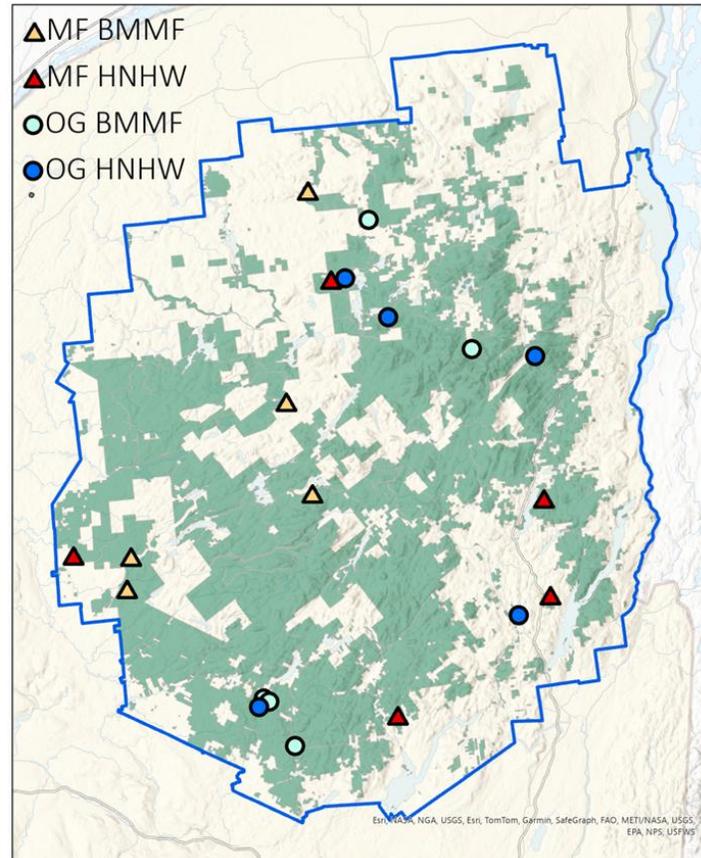
### Adirondack Park

→ May – August 2023 and 2024

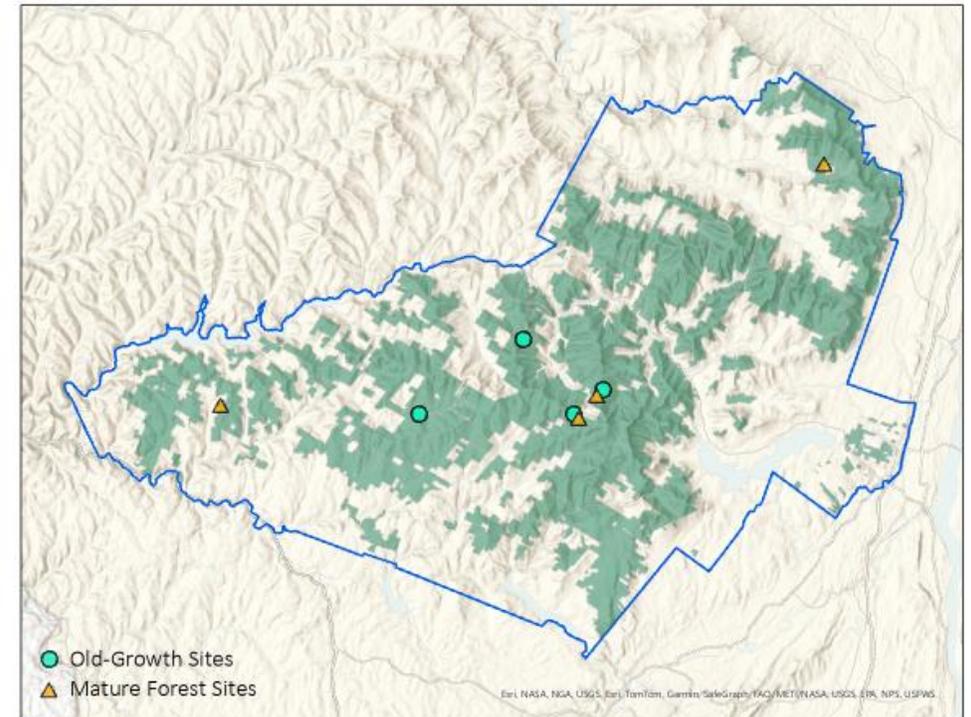
→ 28 sites total surveyed

→ Sites classified by:

- Stand type – old-growth forest (OG) or mature forest (MF)
- Location: Catskill Park (CAT) or Adirondack Park (ADK)
- Forest community type: Beech-Maple Mesic Forest (BMMF) or Hemlock-Northern Hardwood Forest (HNHW) (Edinger et al. 2014)



### Catskill Park



# Methodology

## Site Classification

### Old-Growth Forest Sites



→ Previously identified as old-growth forest by regional researchers:

Michael Kudish (CAT), Neil Pederson and Harvard Forest (ADK and CAT), Charles Cogbill (ADK), New York Natural Heritage Program (ADK)

### Mature Forest Sites



→ Record of wide-scale logging or disturbance (Adirondack Park Agency)

→ Supplemented with date of acquisition into the NYSFP (Colin Beier & CAFRI)

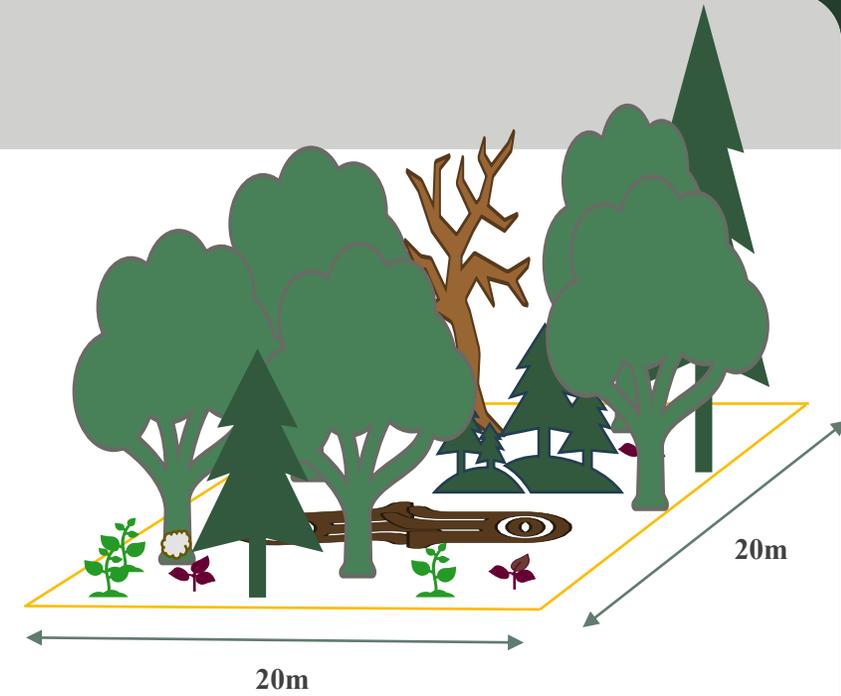
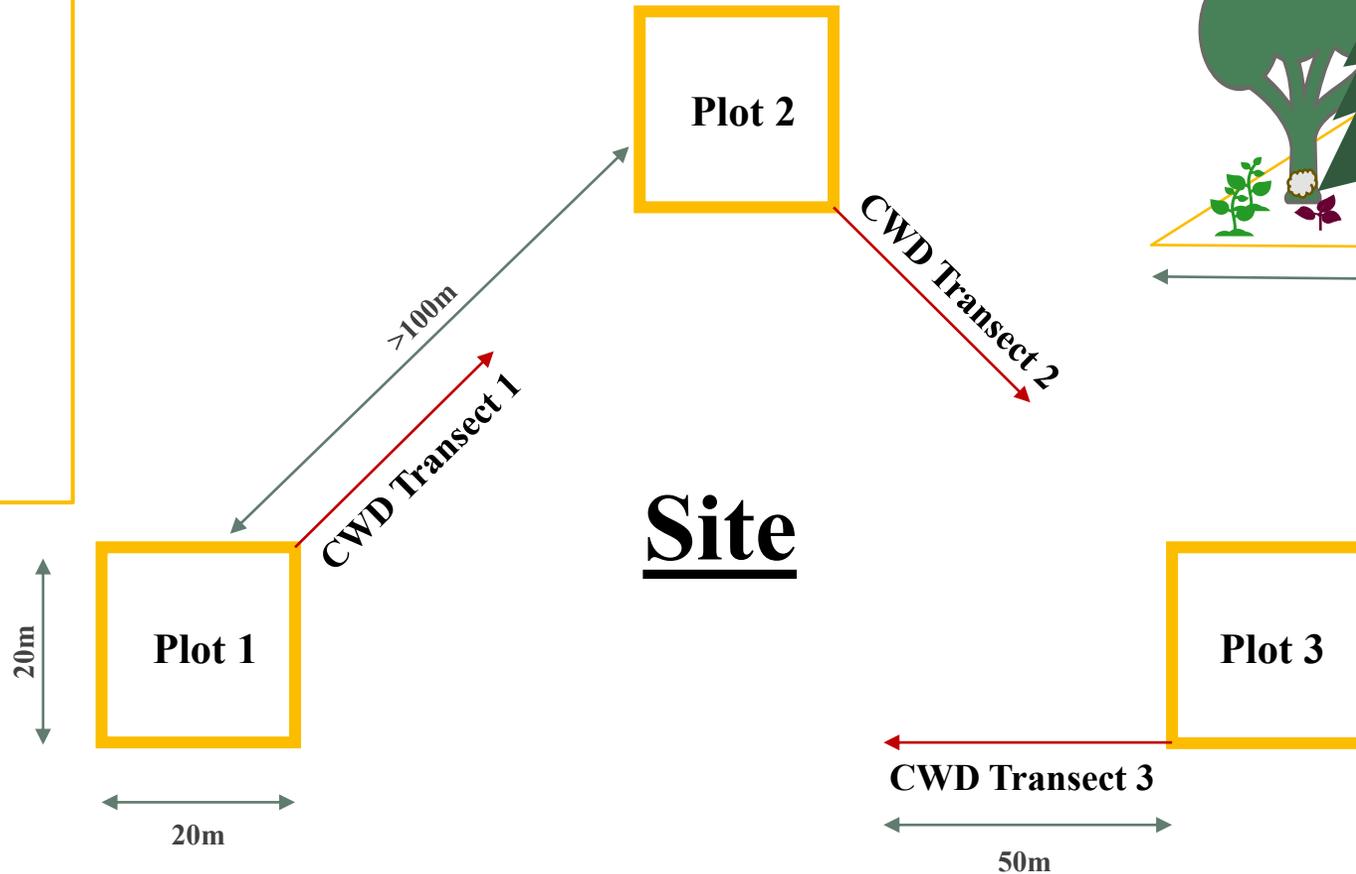
→ Michael Kudish (CAT)

# Methodology

Sampling Design by Site

Documented in each plot:

- All vegetation, by strata
- Epiphytes
- Tree diameters
- Coarse woody debris transect (Brown, 1971)
- Increment core



# Results

## Structure

### Beech-Maple Mesic Forest

Location	Type	#	Basal area (m <sup>2</sup> /ha)	Density (trees/ha)	CWD volume (m <sup>3</sup> /ha)	Snag Basal Area (m <sup>2</sup> /ha)	Snag volume (m <sup>3</sup> /ha)
Adirondack Park	Old-Growth	5	40.4 ± 7.2	500 ± 67.7	94.6 ± 49.6	6.2 ± 4.2	44.1 ± 26.5
	Mature	5	31.6 ± 4.6	653.3 ± 165.5	39.3 ± 17.6	3.1 ± 2.5	19.6 ± 15.1
Catskill Park	Old-Growth	4	37.2 ± 3.0	502.1 ± 77.7	63.6 ± 24.2	4.1 ± 1.2	21.1 ± 5.9
	Mature	4	37.2 ± 8.0	531.3 ± 101.2	36.4 ± 17.1	2.2 ± 0.5	13.2 ± 8.4

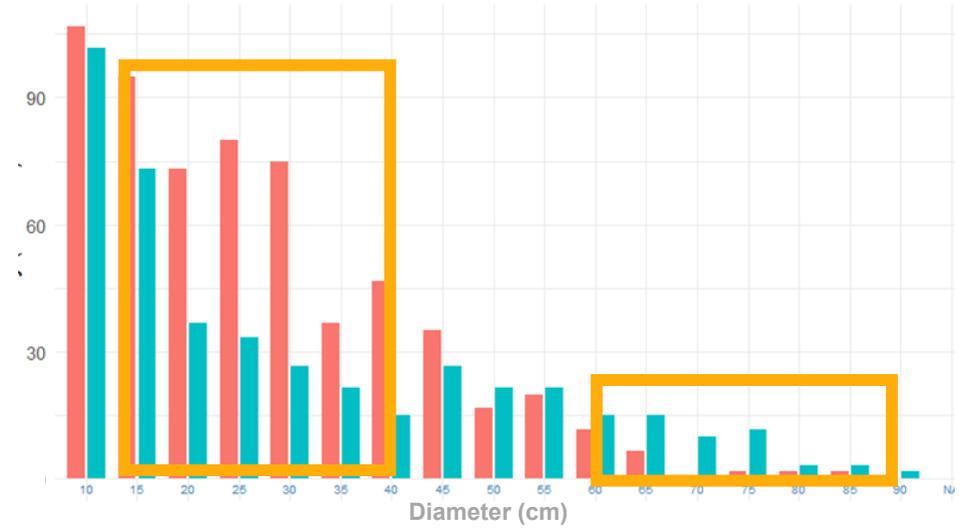
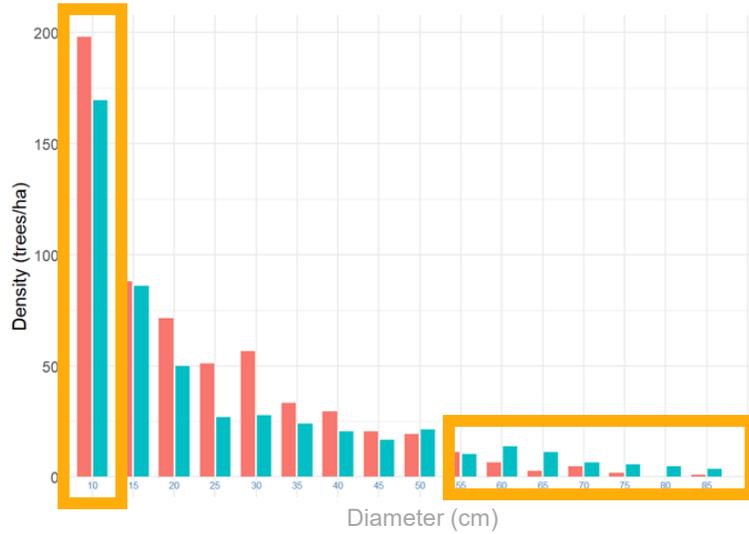
		Basal area (m <sup>2</sup> /ha)	Density (trees/ha)	CWD volume (m <sup>3</sup> /ha)	Snag Basal Area	Snag volume (m <sup>3</sup> /ha)
<i>P-value</i>	Stand Type	0.15	0.09 ●	0.01 ★	0.06 ●	0.05 ★
	Location	0.72	0.23	0.27	0.25	0.09 ●
	Stand Type x Location	0.2		0.36	0.65	0.32

### Hemlock-Northern Hardwood Forest

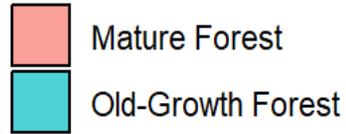
Location	Type	#	Basal area (m <sup>2</sup> /ha)	Density (trees/ha)	CWD volume (m <sup>3</sup> /ha)	Snag Basal Area (m <sup>2</sup> /ha)	Snag volume (m <sup>3</sup> /ha)
Adirondack Park	Old-Growth	5	46.8 ± 13.8	441.7 ± 75.7	133.4 ± 31.1	4.2 ± 3.1	19.2 ± 18.4
	Mature Forest	5	45.4 ± 7.2	611.7 ± 175.2	42.9 ± 21.2	2.7 ± 0.98	18.9 ± 10.1
<i>P-value</i>		Stand Type	0.85	0.09 ●	0.001 ★	0.51	0.98

# Results

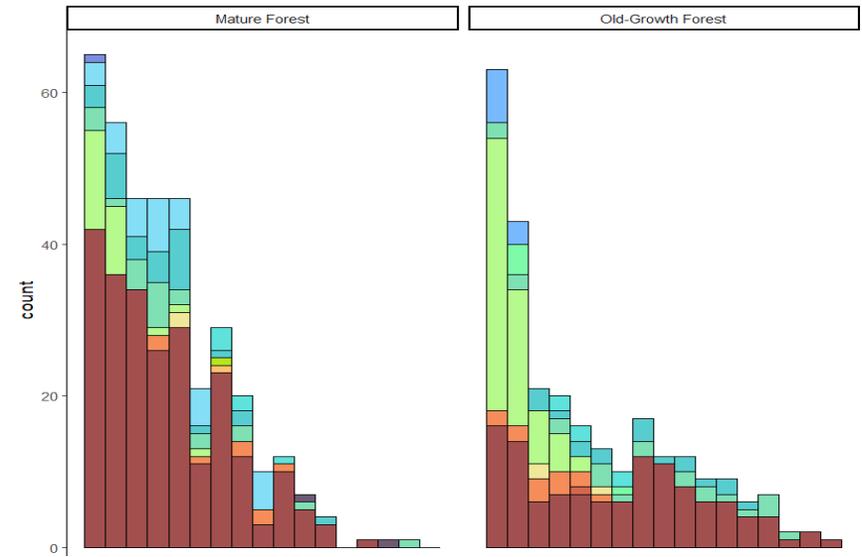
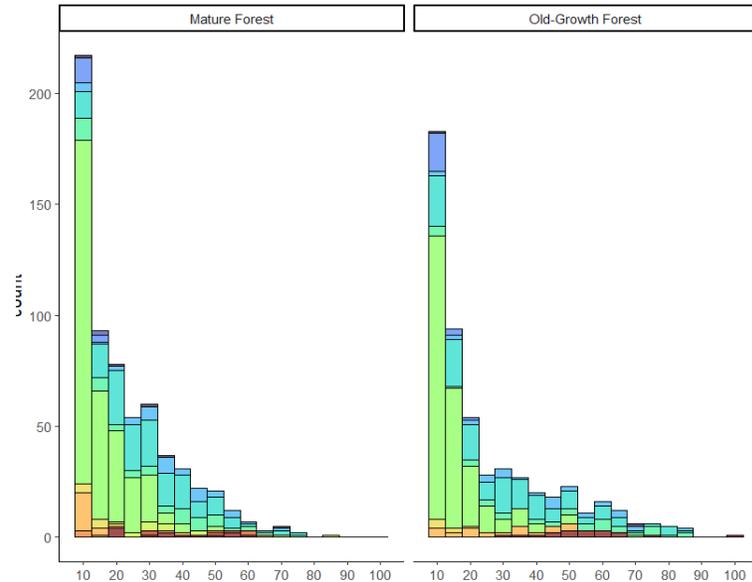
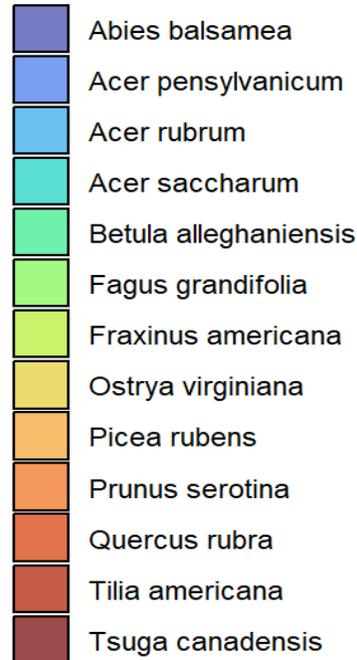
## Tree Diameter Distributions



### Stand Type



### Tree Species

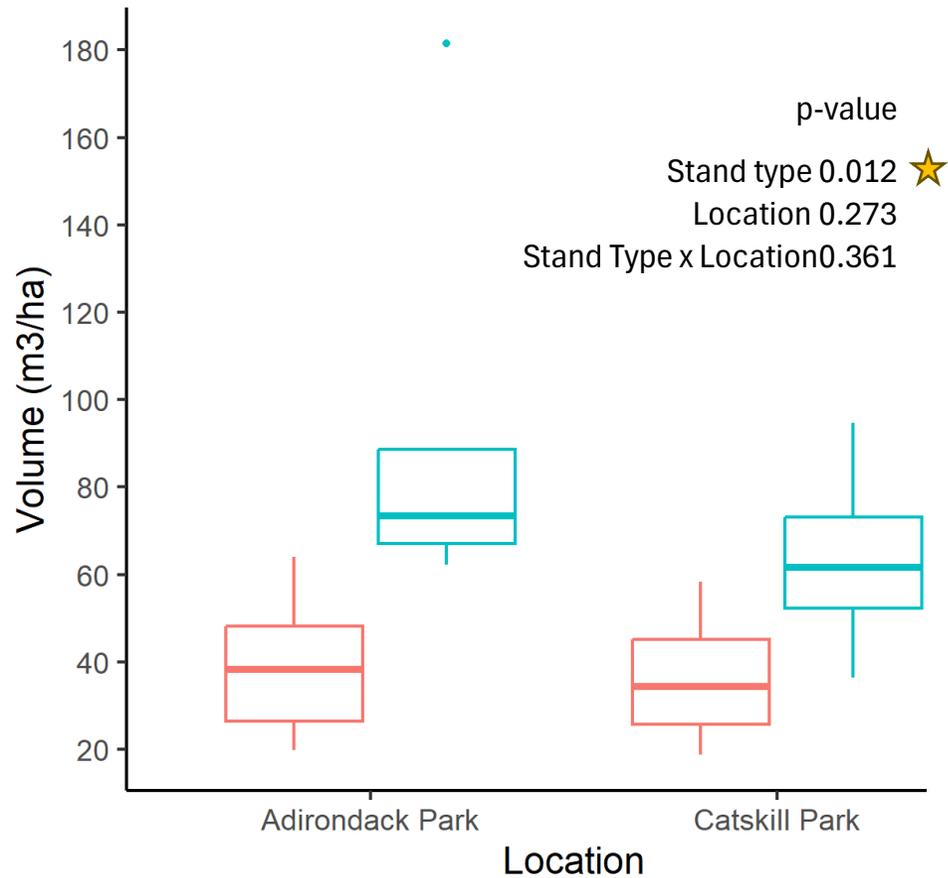


**Beech-Maple Mesic Forest**

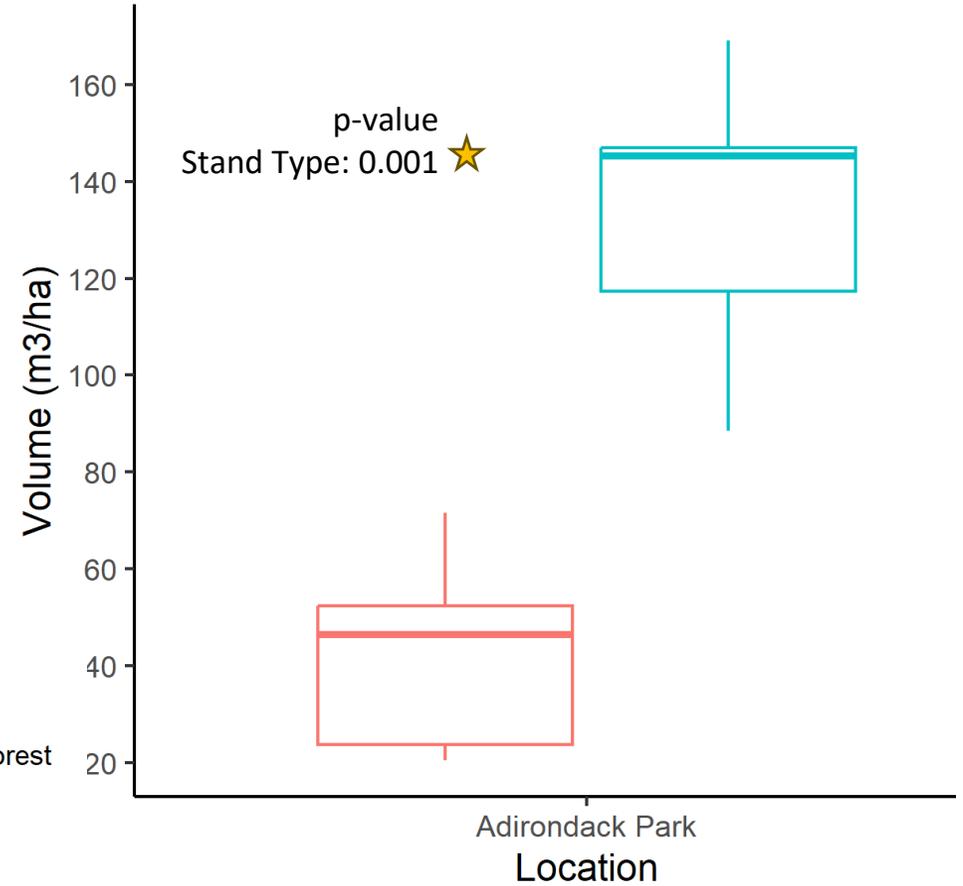
**Hemlock-Northern Hardwood Forest**

# Results

## Coarse Woody Debris



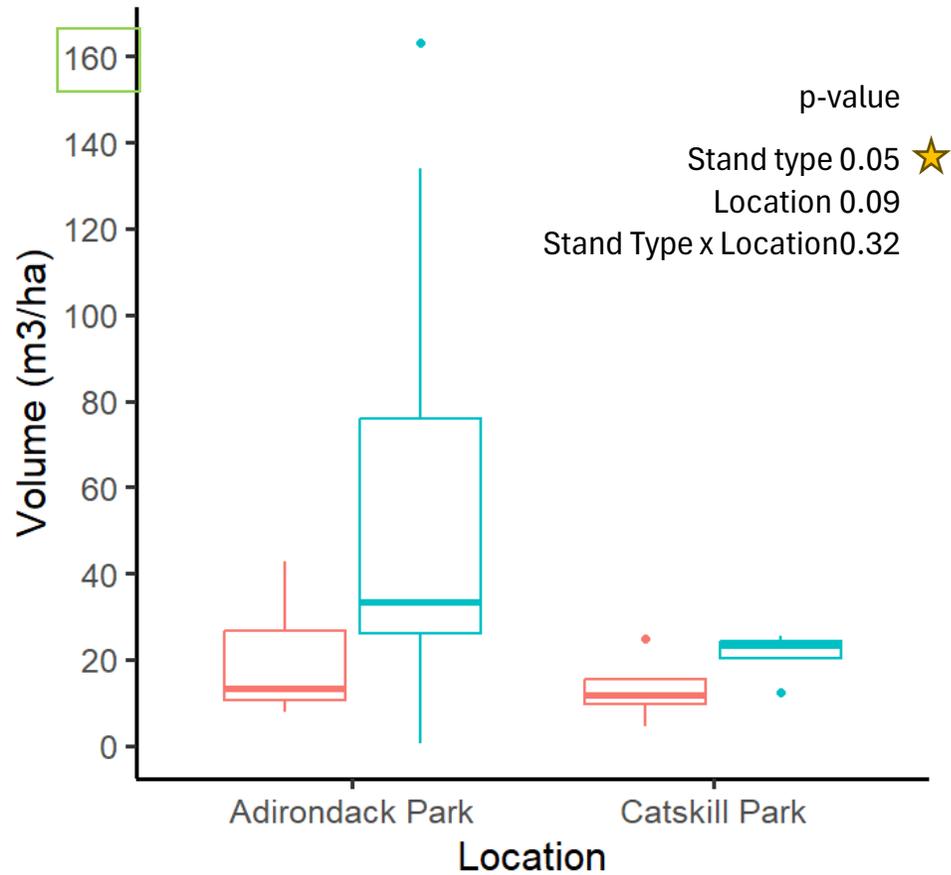
**Beech-Maple Mesic Forest**



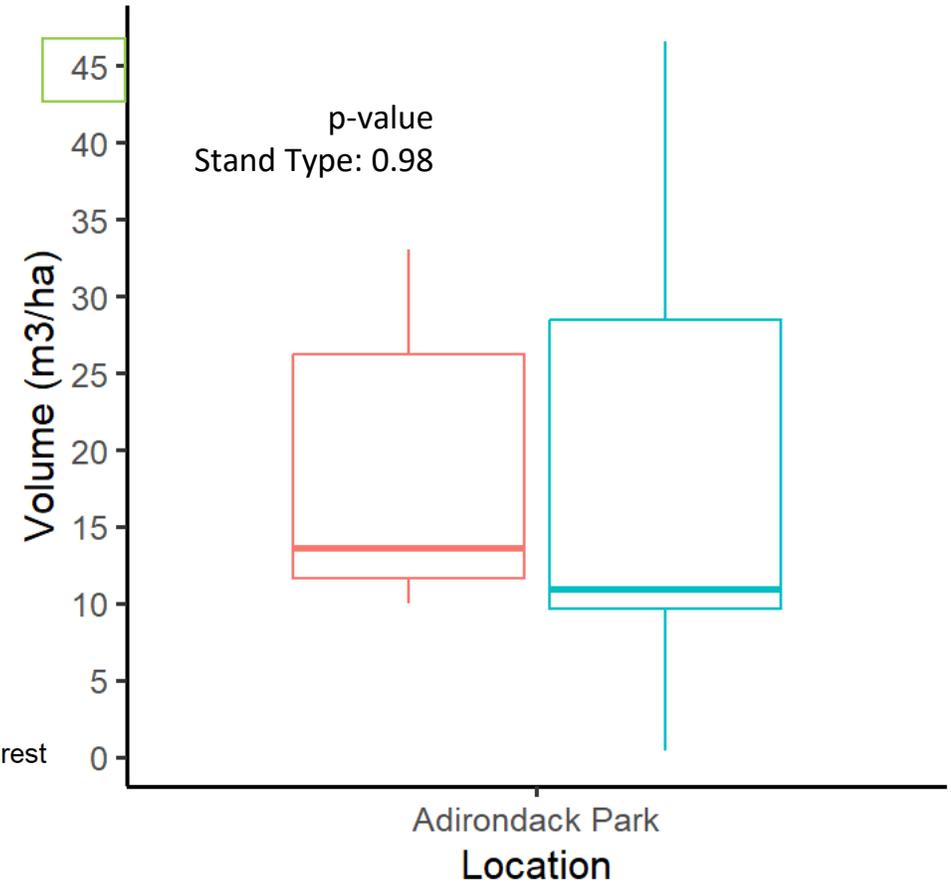
**Hemlock-Northern Hardwood Forest**

# Results

## Snags



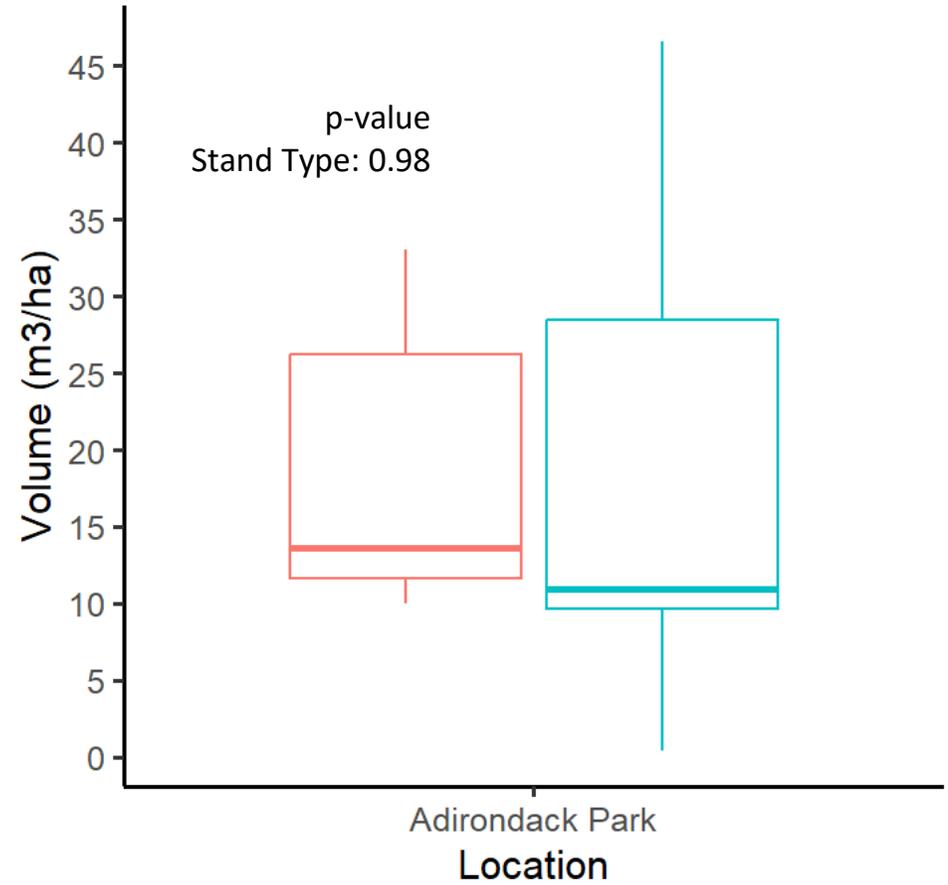
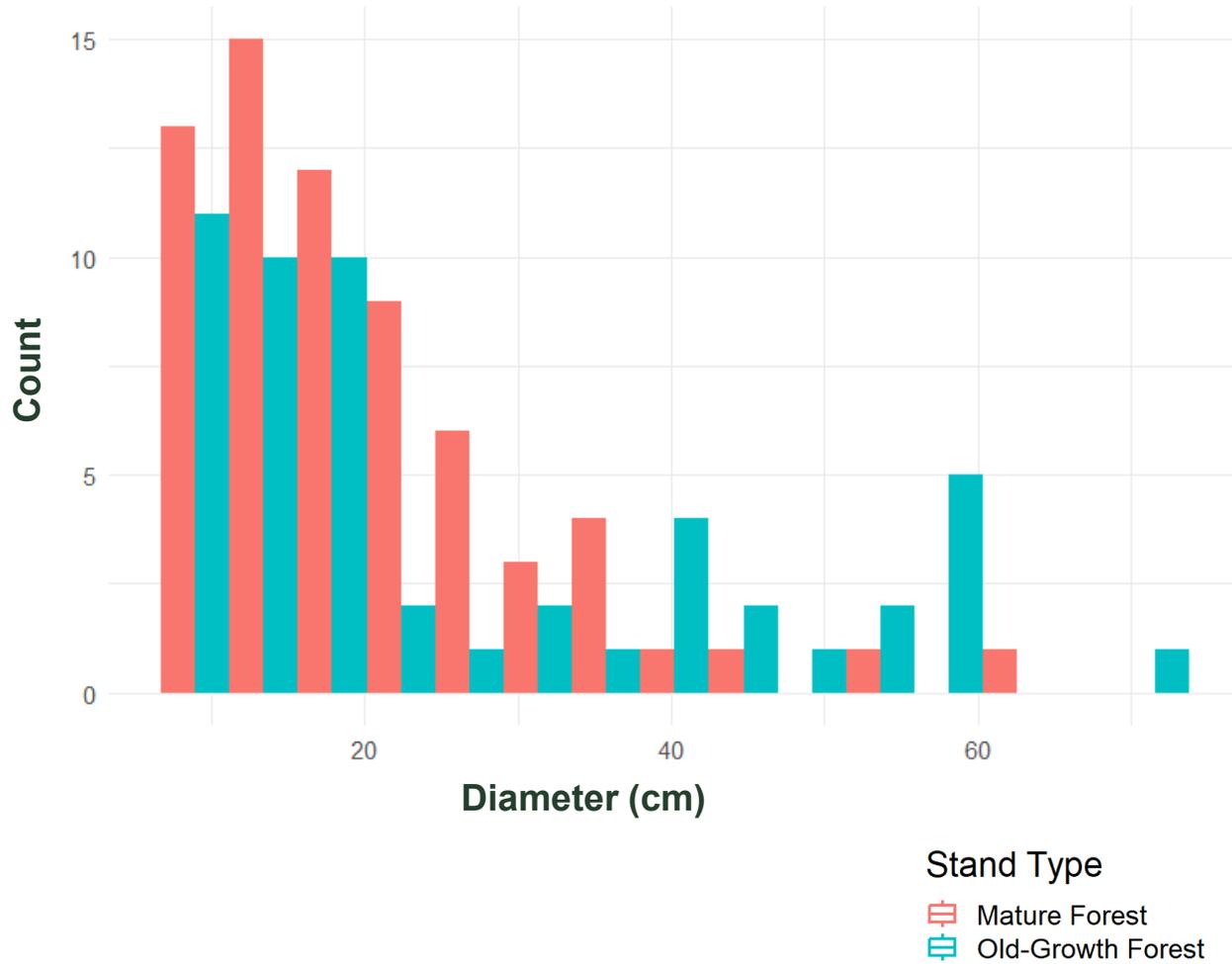
**Beech-Maple Mesic Forest**



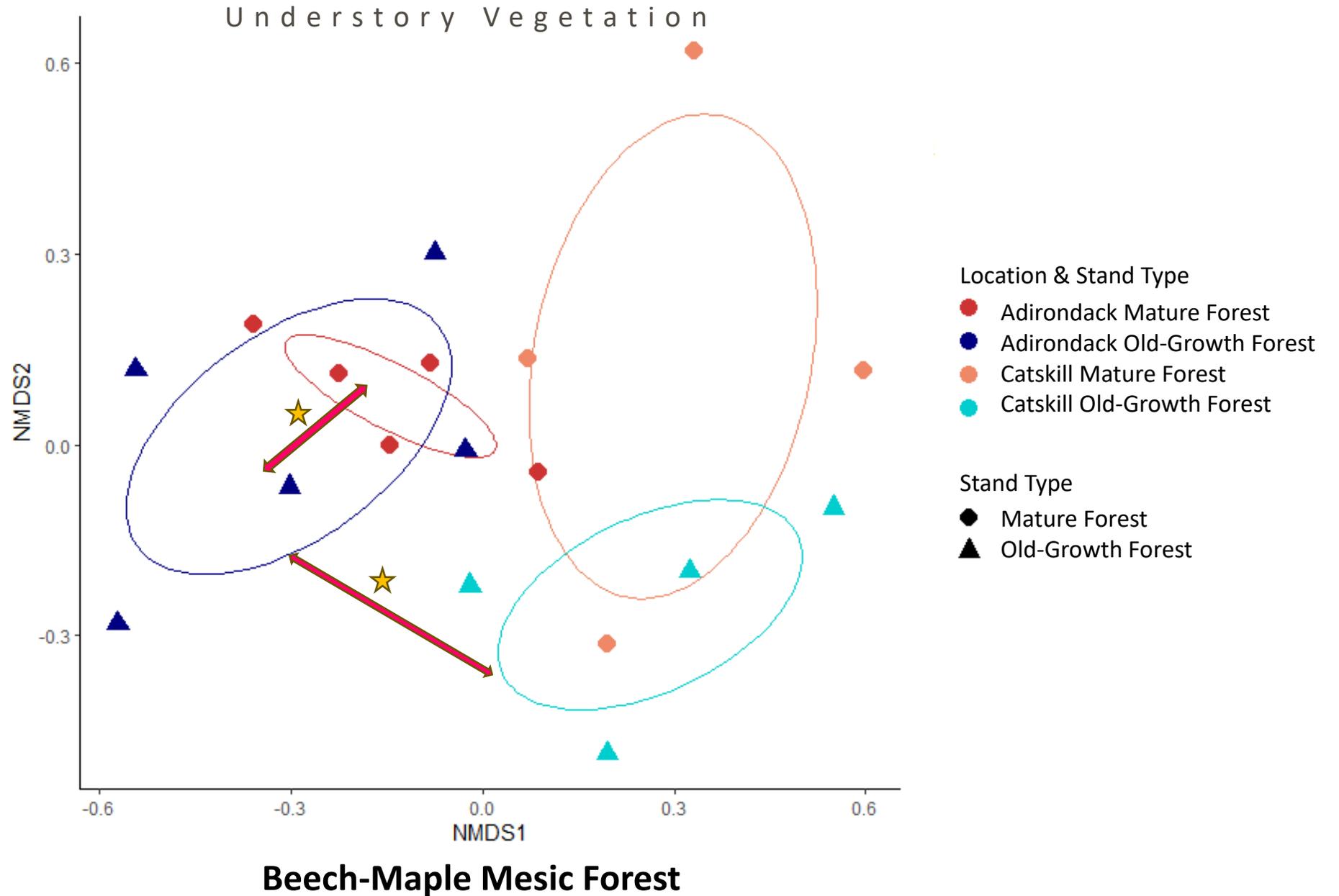
**Hemlock-Northern Hardwood Forest**

# Results

## Snag Diameters

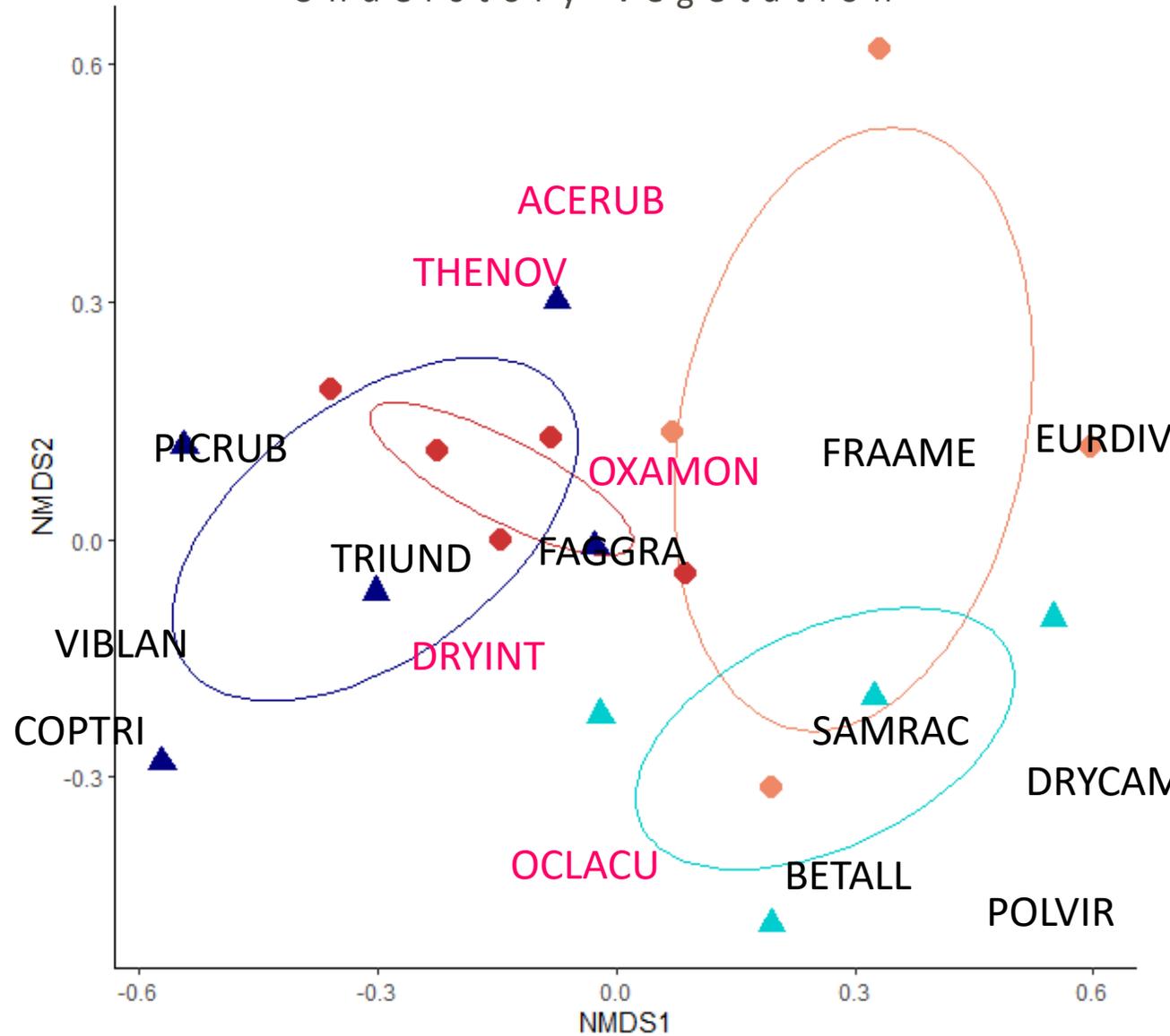


# Results



# Results

Understory Vegetation



## Indicator Species

### Old-Growth Forest:

*Dryopteris intermedia*  
*Oclemena acuminata*  
*Oxalis montana*

### Mature Forest:

*Acer rubrum*  
(seedlings)  
*Thelypteris novaboracensis*

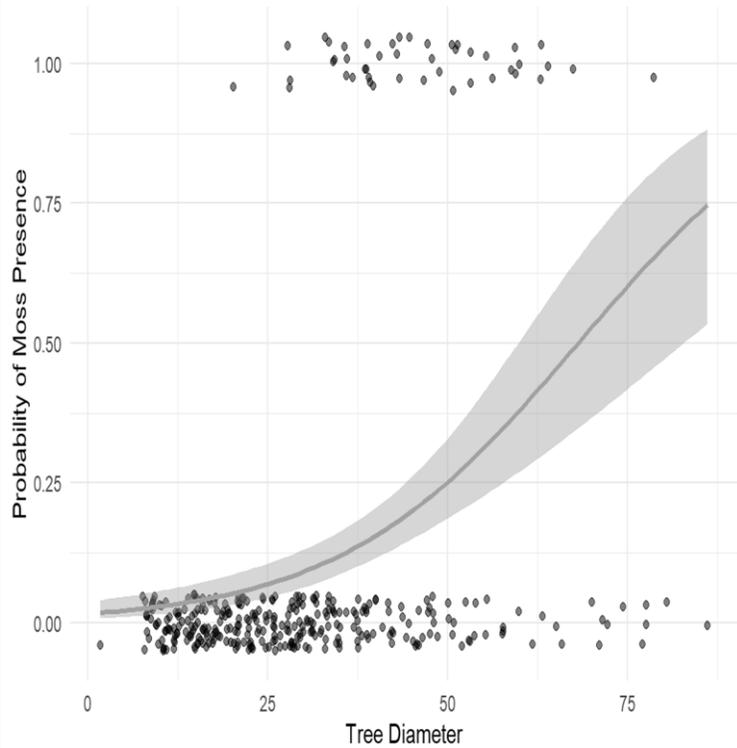
Beech-Maple Mesic Forest

# Results

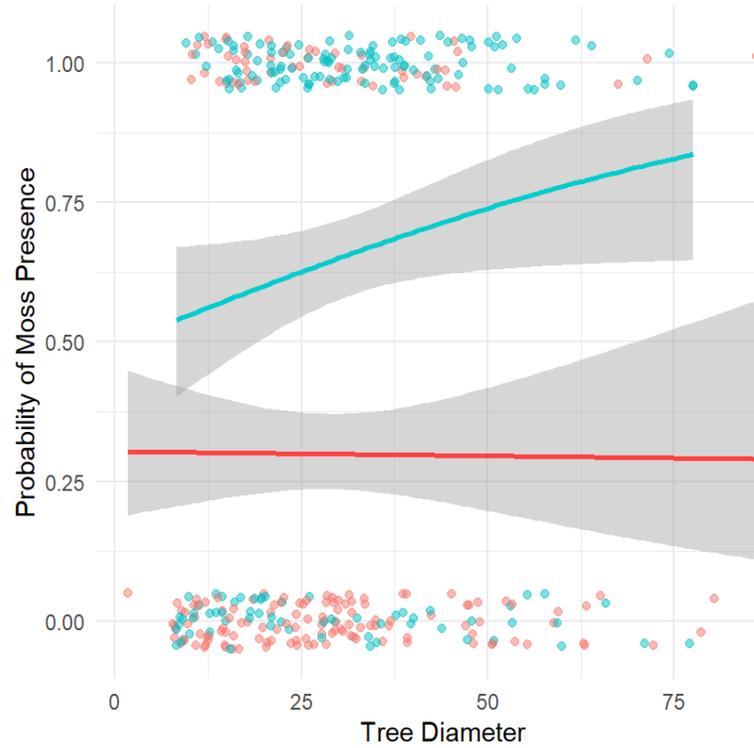
## Epiphytes



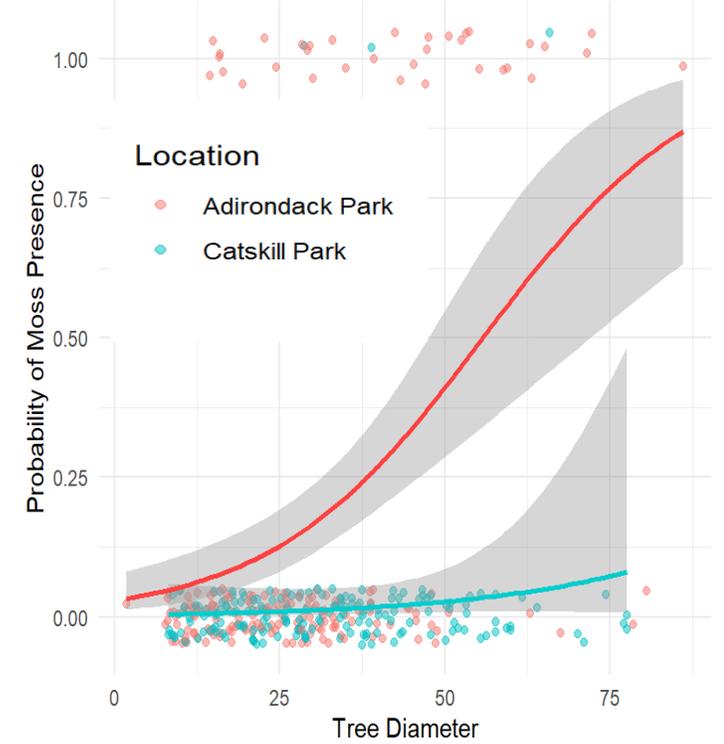
*Plagiomnium ciliare*



*Dicranum viride*



*Neckera pennata*



Most species had a significant relationship with diameter

Some species were found more often in Catskills (*D. viride*), others more often in Adirondacks (*N. pennata*)

# Conclusion

## Old-Growth Forest Characteristics

- Compositional differences in understory and epiphyte species between old-growth and mature forests
  - Structural differences between old-growth and mature forests such as large tree density, coarse woody debris volumes, snag volume in New York's Forest Preserve
  - Location effect: differences between old-growth forest in the Catskills and Adirondacks
- How can these characteristics be used as potential indicators of old growth?

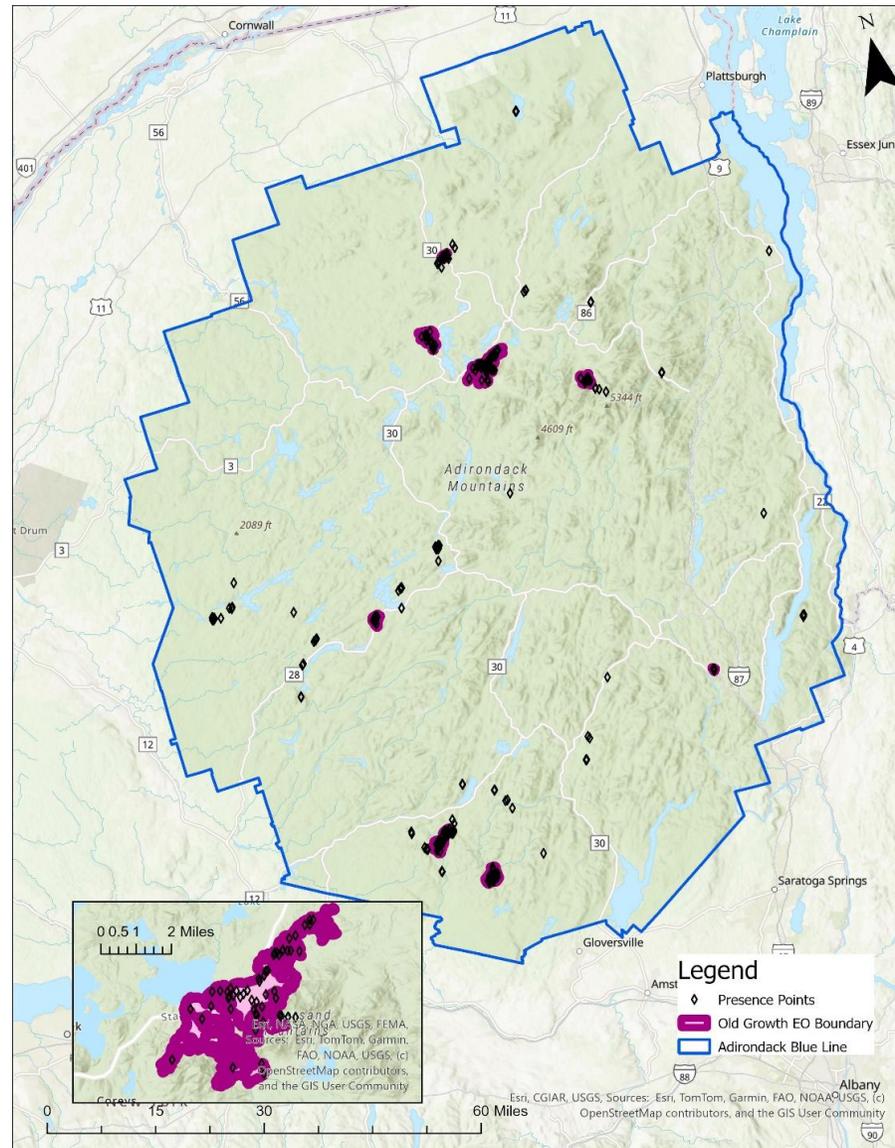
## Part 2:

*Application of machine learning methods to  
predict old-growth forest*

# Methodology

Model built using  
Random Forest, a  
machine learning  
algorithm

Trained using presence  
points, background  
points, and  
environmental variables



Environmental Variables  
Historically Influenced

*Railroads*

*Rivers*

*Time Since Acquisition*

Landform Features

*Narrow Valley*

*Upper Slope*

*Lower Slope*

*Wide Valley*

*Slope*

*Elevation*

Forest structure

*Aboveground Biomass (AGB)*

*Canopy Rugosity*

*Average Canopy Height*

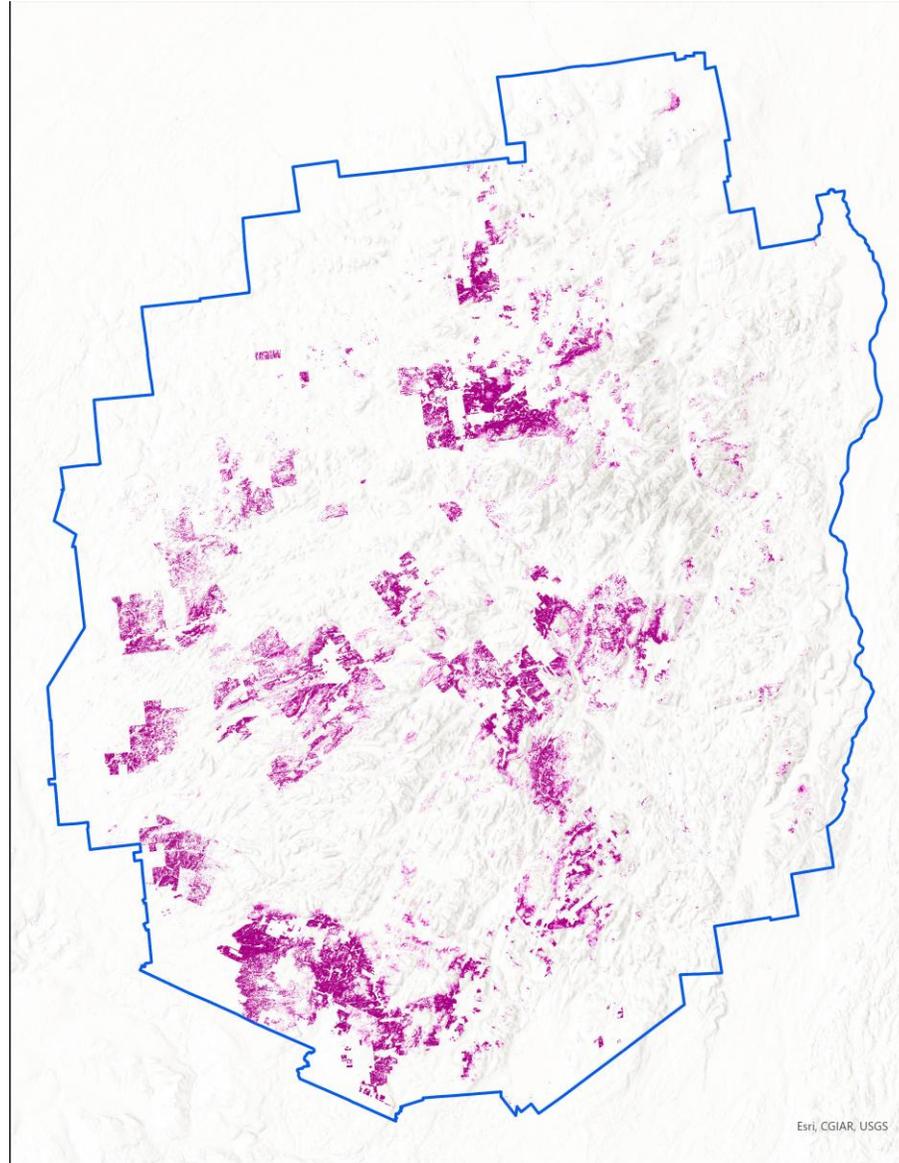
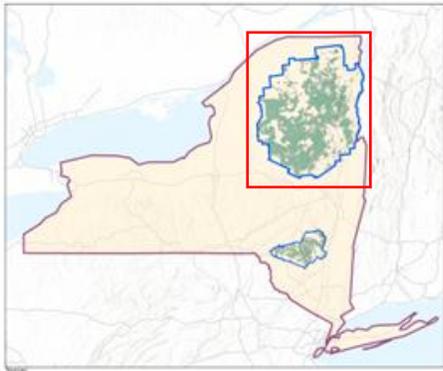
*Maximum Canopy Height*

*Bare ground Roughness*

Satellite

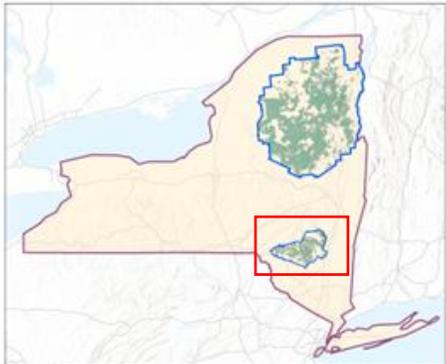
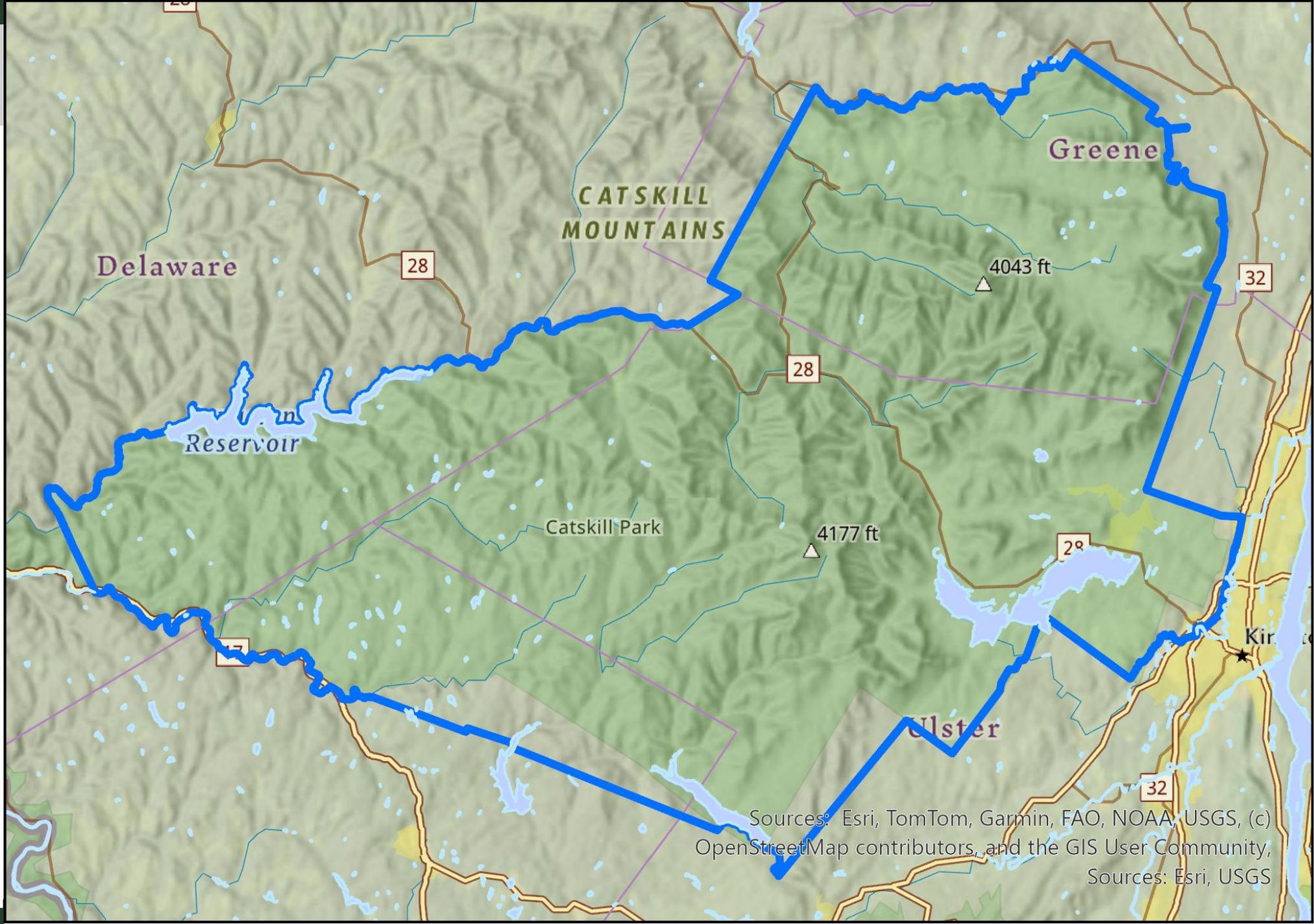
*NDVI*

# Results



Medium Probability of Old-Growth Forest Presence

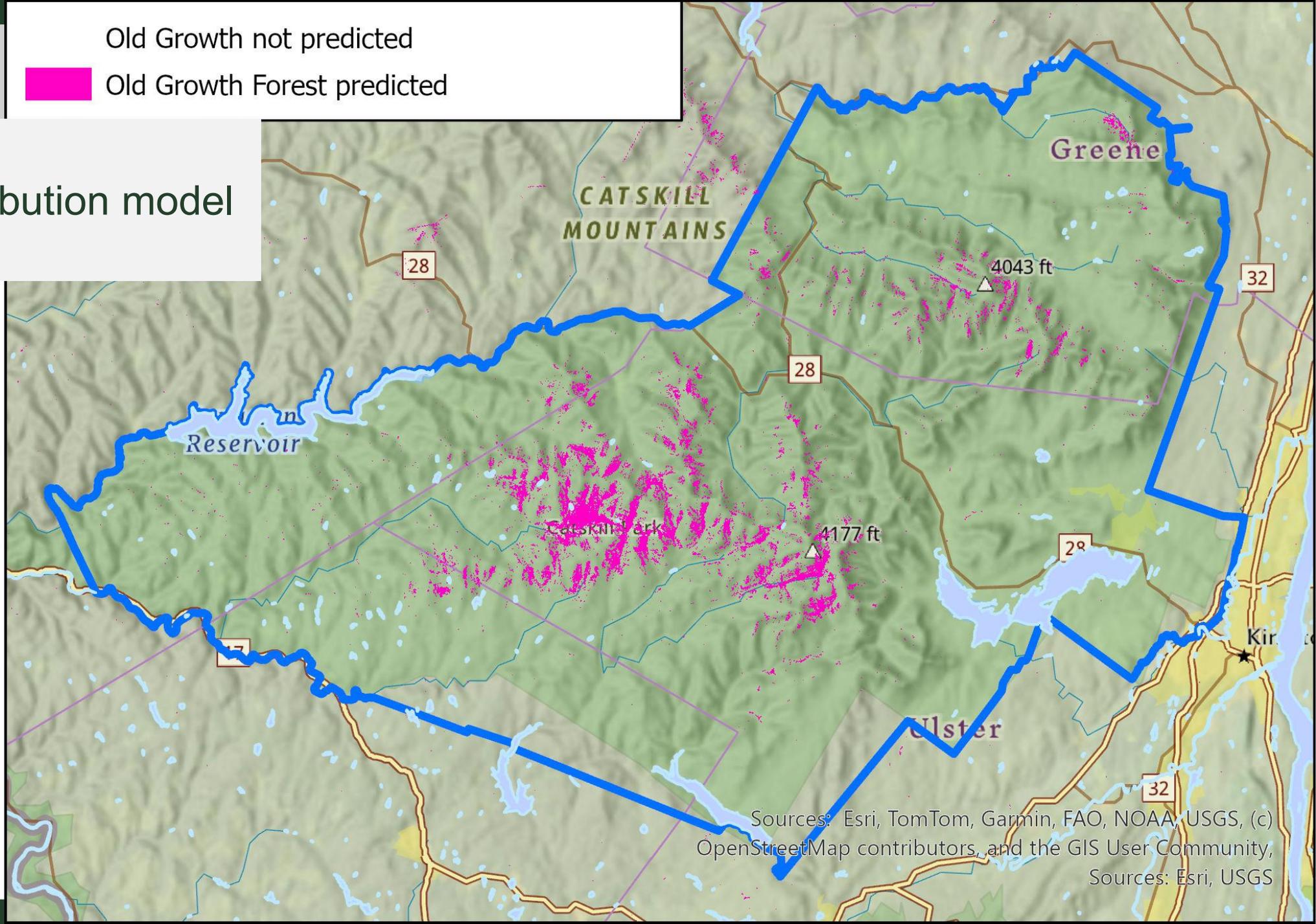
High Probability of Old-Growth Forest Presence



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Sources: Esri, USGS

Version 1 of an old-growth distribution model for the Catskills

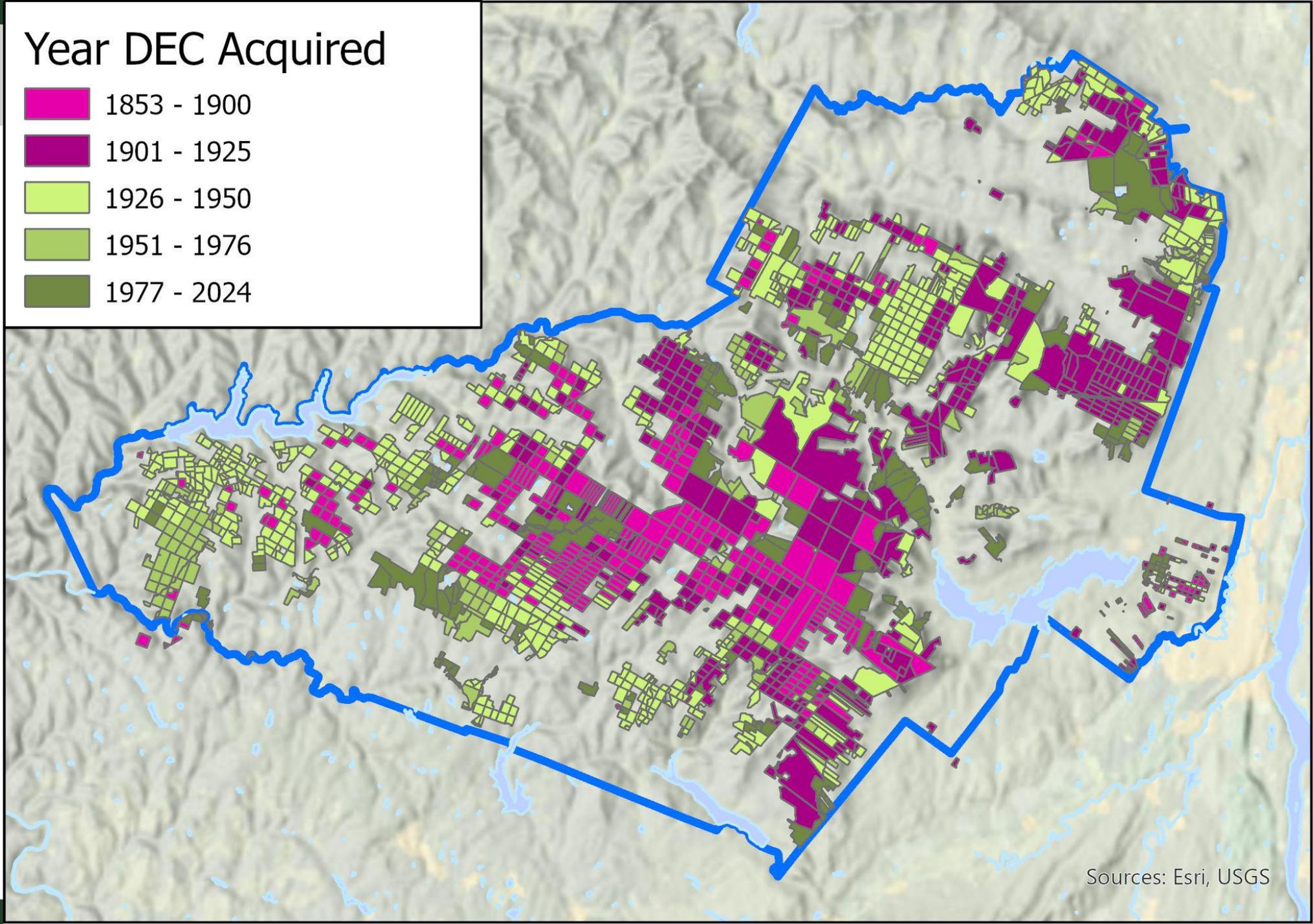
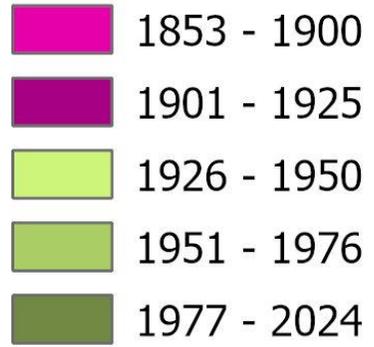
- Old Growth not predicted
- Old Growth Forest predicted



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Sources: Esri, USGS

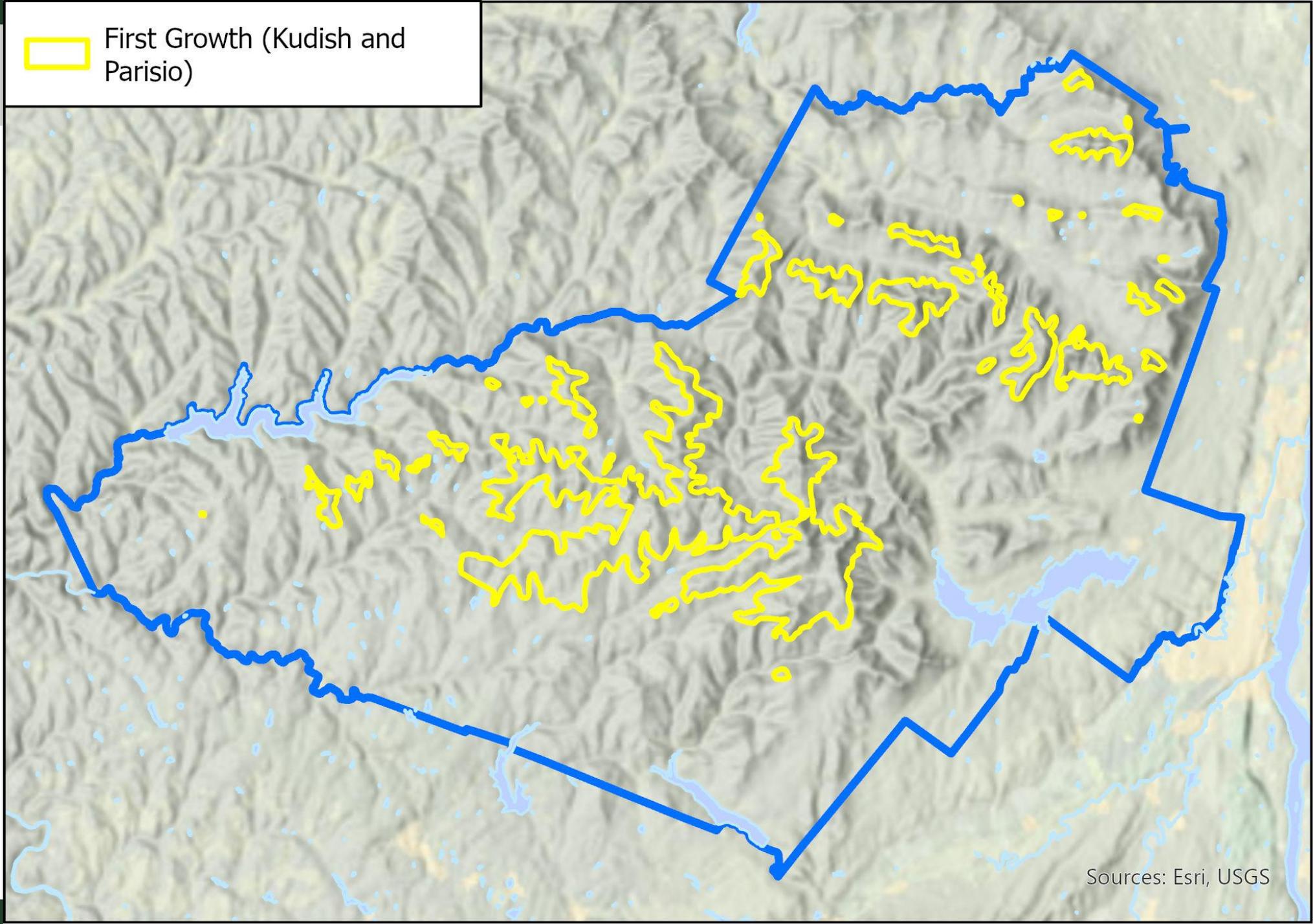
Work completed by  
intern Mary Morris,  
summer 2025

## Year DEC Acquired



And *early*  
First-Growth  
estimate by Kudish  
and Parisio

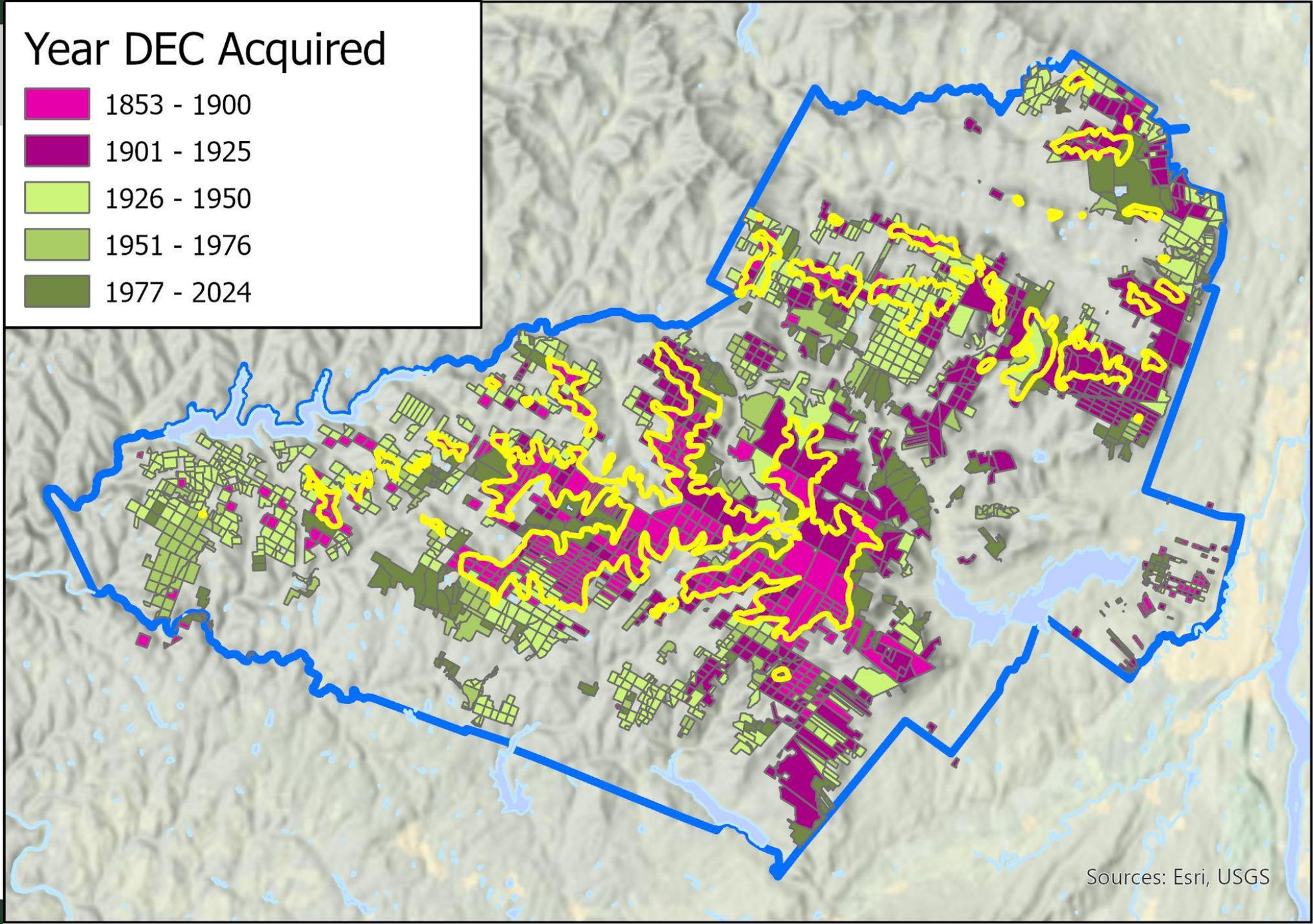
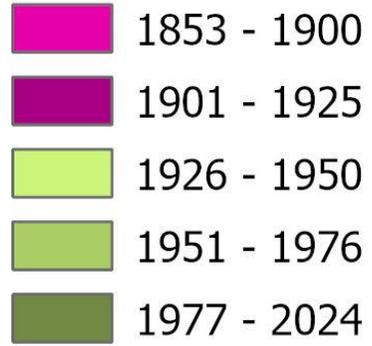
 First Growth (Kudish and Parisio)



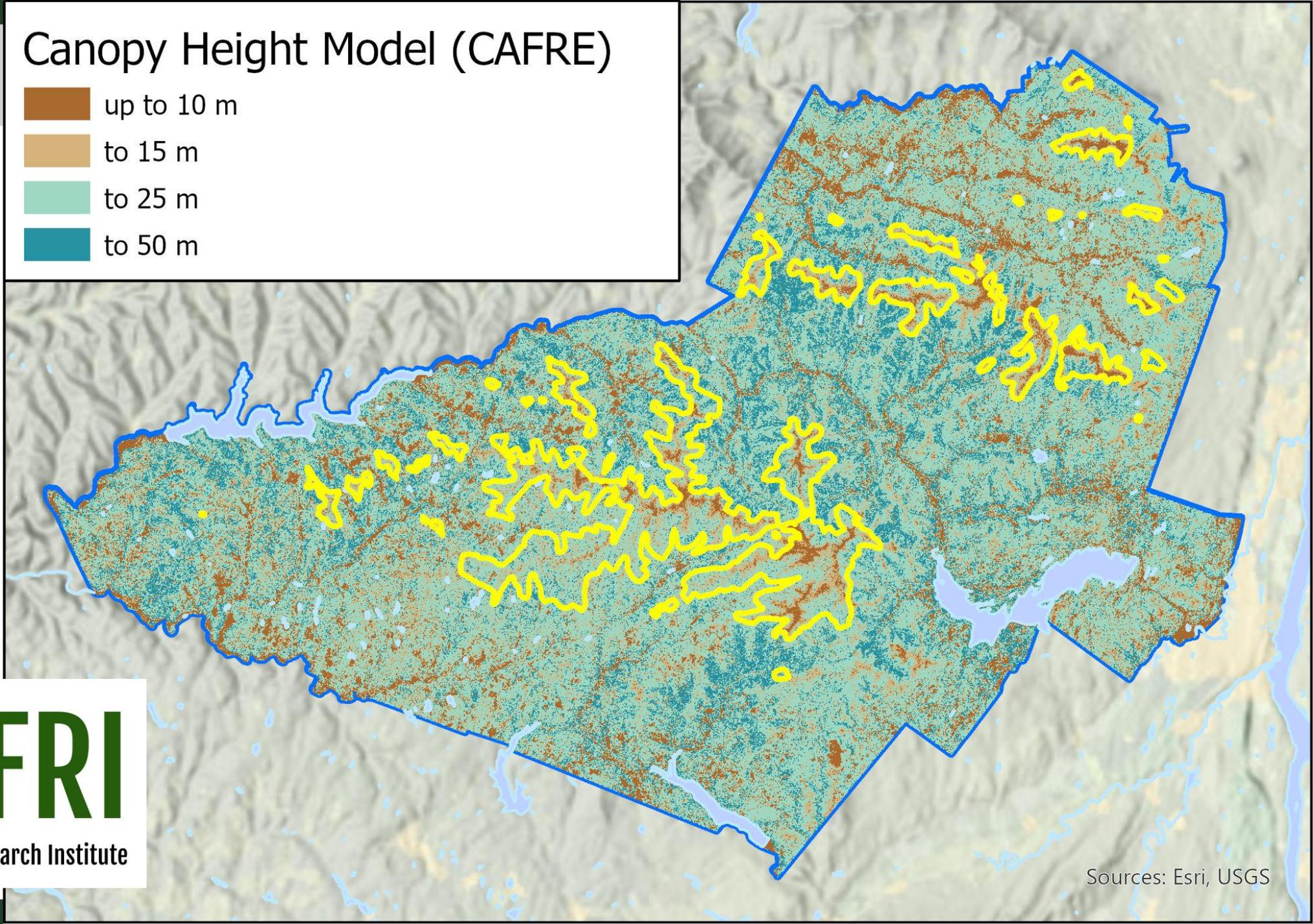
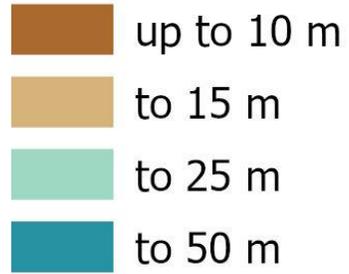
Sources: Esri, USGS

Alignment of first-growth model with parcel acquisition year.

## Year DEC Acquired



# Canopy Height Model (CAFRE)



Climate & Applied Forest Research Institute

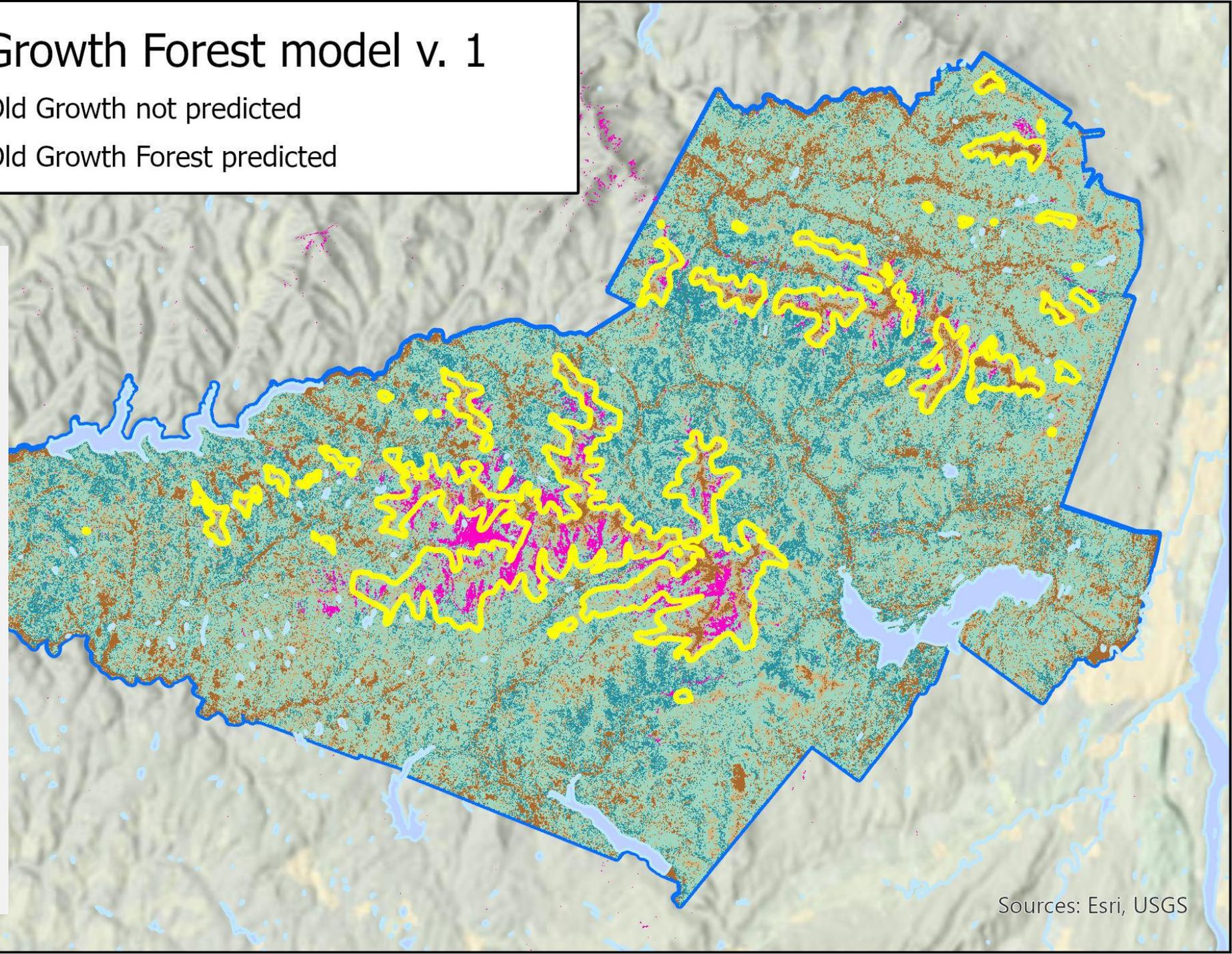
Sources: Esri, USGS

# Old Growth Forest model v. 1

Old Growth not predicted



Old Growth Forest predicted



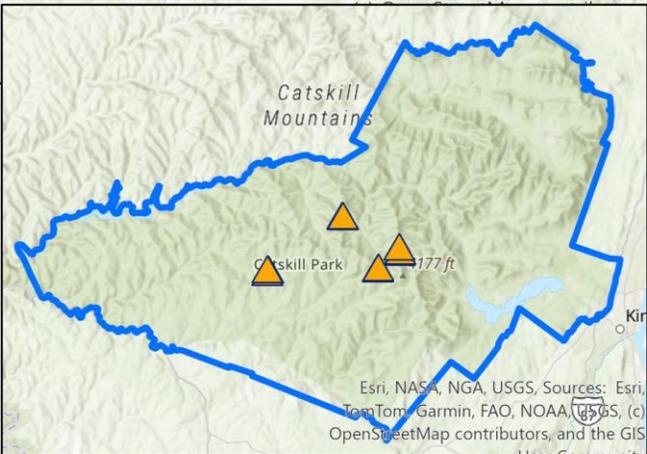
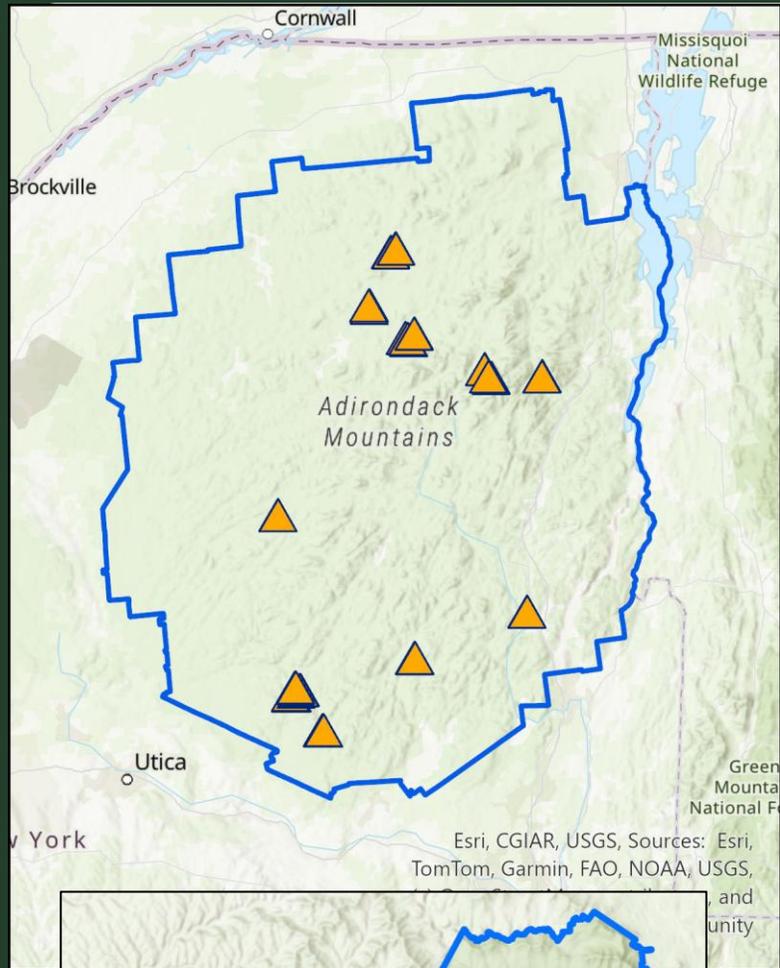
V. 1 included:

- elevation
- slope
- LF: valley
- LF: upper slope
- LF: peak
- LF: lower slope
- basal area model
- aspect
- aboveground biomass model

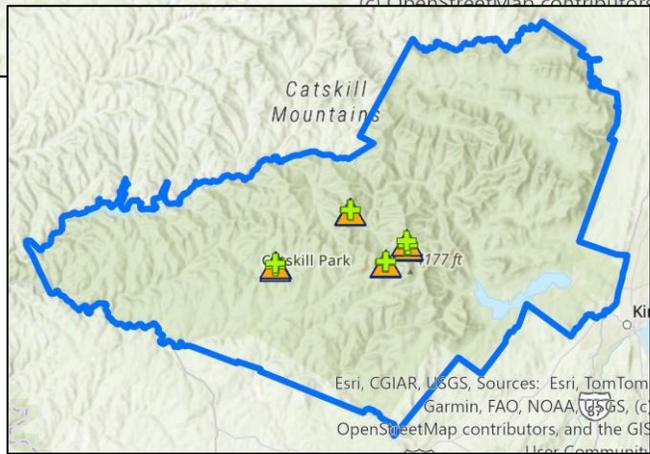
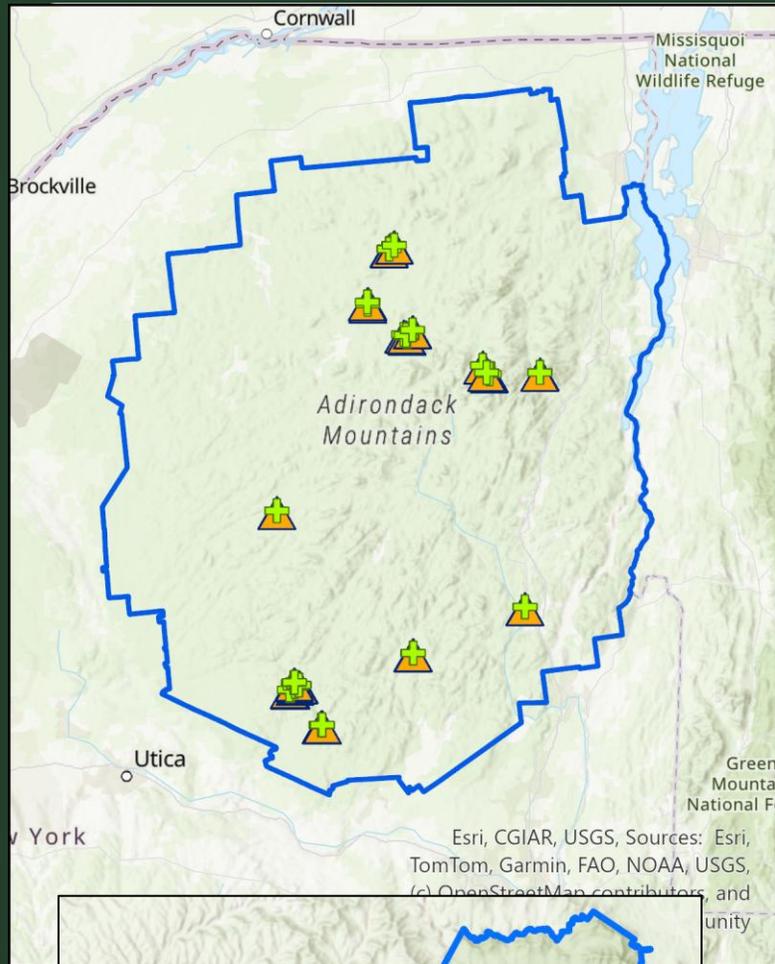
Improved version will include:

- acquisition date
- canopy roughness
- ground roughness

# Next Steps



Align above-ground data with ...



photos: S. Hart



...below-ground data  
by co-locating soil samples

## Looking Forward:

Continue collaborations between:

- DEC
- NYNHP
- ESF students and faculty
- USGS

Continue to better understand

- characteristics
- carbon storage
- extent of old-growth forests

Gain a better understanding of other expressions of old-growth:

- Higher elevation forests (Mountain Fir Forests)?
- Wetlands and conifer flats?
- Blowdowns?

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Tim Howard: [tghoward@esf.edu](mailto:tghoward@esf.edu)



**Department of  
Environmental  
Conservation**



New York  
Natural Heritage  
Program

