The Role of Natural Heritage Programs in Conservation of Old Forest in the Northeast

Liz Thompson- Moderator

Northeast Natural Heritage Programs:

Justin Schlawin -- *Maine*

Jaci Braund -- *Pennsylvania*

Max Henschell -- *New York*

Bob Zaino -- *Vermont*

Bill Nichols -- *New Hampshire*

Gero Island, ME

Describe your program and its role in the heritage network in advancing conservation of significant ecosystems?

Nature’s Network data -> decisions

Field Data

Collect

Collect biodiversity data

Assembled Data

Curate

Assemble and standardize data

Information

Calculate

Assess status and trends to identify high priority places

Knowledge

Communicate

Deliver biodiversity knowledge products

Decisions

Conserve

Guide conservation strategies in a changing world

Collaborate – Convene experts to support our mission

Code – Develop technology solutions to support the data-to-decisions lifecycle

NatureServe

MNAP supports conservation action!

MNAP Conservation Services

- Conservation and Development **Planning** through environmental review
- Provide **Technical Assistance** for forest management to minimize impacts to significant features
- Provide preacquisition review services for **land conservation and restoration** projects, in partnership with major conservation funders in Maine
- Provide Scientific Review and Evaluation of Potential **Ecological Reserves**
- Terrestrial **Invasive Plant** inventory and management

maine DEPARTMENT OF Agriculture Conservation & Forestry

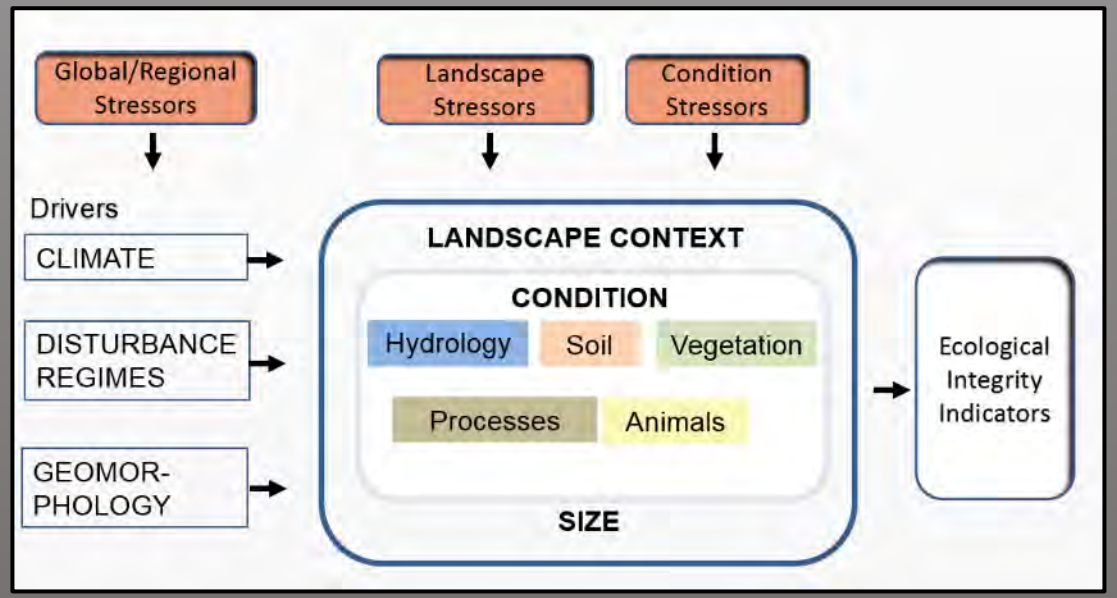
One example of advancing conservation of significant ecosystems…

NH NHB is working with NatureServe and a handful of other NHPs to develop Ecological Integrity Assessment (EIA) protocols for upland ecological systems.

EIAs defined as:

"an assessment of the degree to which, under current conditions, the structure, composition, processes, and connectivity of an ecosystem corresponds to reference conditions, and are within the bounds of natural or historical disturbance regimes"

Conceptual Ecological Model for Assessing Ecological Integrity (Faber-Langendoen et al. 2016)



Upland Ecological Integrity Assessment

Draft version for upland ecological systems soon to be rolled out for review.

Primary Rank Factor	Major Ecological Factor	Metric Name
LANDSCAPE CONTEXT	LANDSCAPE	LAN2 Land Use Index
		LAN3 Core Area
		LAN4 Core Centroid to Edge
	EDGE	EDG1 Perimeter with Natural Edge
		EDG2 Width of Natural Edge
CONDITION	VEGETATION	VEG1 Native Plant Species Cover
		VEG2 Invasive Nonnative Plant Species Cover
		VEG3 Native Plant Species Composition
		VEG4 Vegetation Structure
		VEG5 Woody Regeneration
		VEG6 Coarse Woody Debris, Snags, and Litter
	SOIL	SOI1 Soil/Substrate Condition
SIZE	SIZE	SIZ1 Comparative Size

DEPARTMENT OF NATURAL AND CULTURAL RESOURCES
NEW HAMPSHIRE
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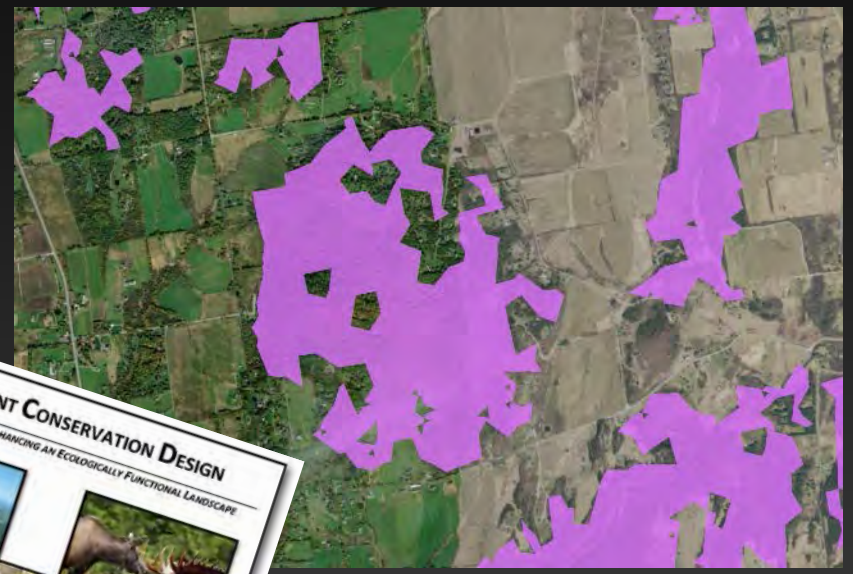
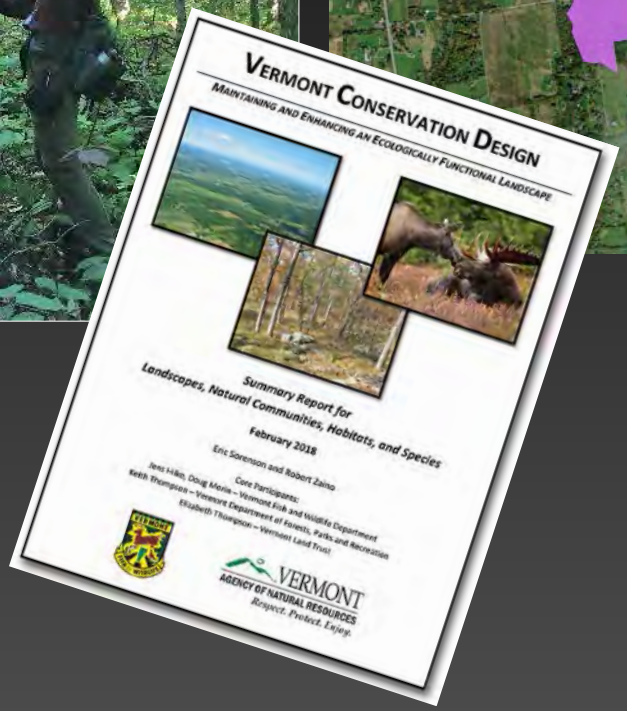
The mission of the Vermont Fish & Wildlife Department is the conservation of our fish, wildlife, plants and their habitats for the people of Vermont

- Classify, map, and track high-quality natural communities
- Map and track larger ecological units: habitat blocks (forest blocks)
- Conservation science and planning
- Technical assistance, outreach, and education





Vermont
Natural Heritage Inventory

Pennsylvania Natural Heritage Program

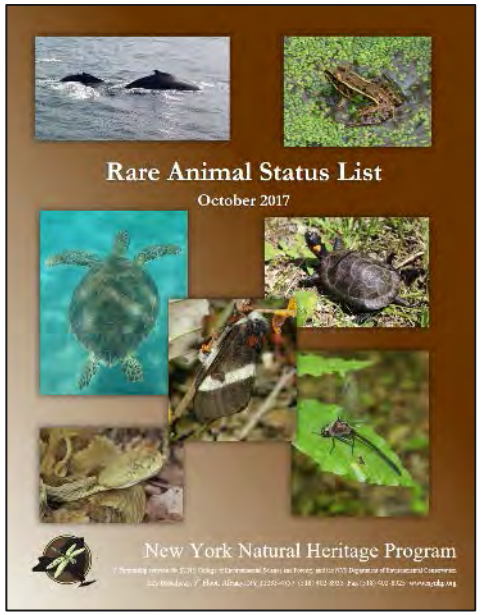
Session 2: Describe your program and its role in the heritage network in advancing conservation of significant ecosystems?

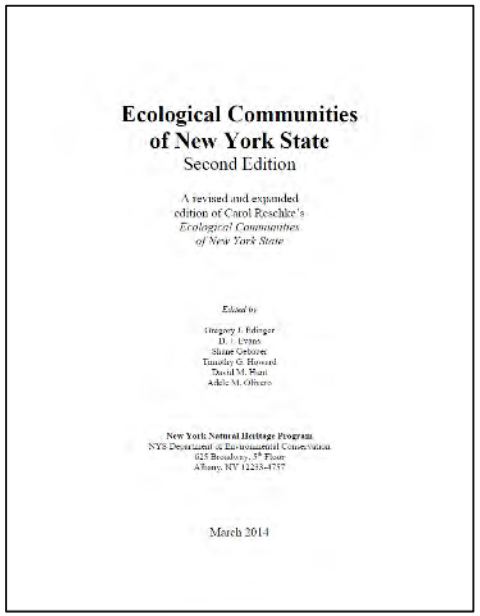
- Crosswalking our types with the NVC
  - Line up with rest of heritage network
  - Still gives unique types for PA but allows for a line of similarity
- Surveying, mapping, delineating significant ecosystems
  - Site rank (A-D)
  - Feeds into overall state rank (S1-S5) to determine rarity
- Advancing conservation of significant ecosystems:
  - Analyzing geospatial distribution of different types – *how many occurrences?*
  - Determining ranking specifications – *what is the minimum mapping size for an A occurrence?*
  - Running types through Rank Calculator to provide an unbiased State Rank (heritage network standard)
- PNHP working on overarching goals when it comes to significant ecosystems
  - Many questions remain
  - Tracking a large patch matrix forming community
    - Does that include a small patch of old growth within a younger stand?
  - Is old growth a measure of quality rather than a type?
  - Is size more important than old status?

New York Natural Heritage Program

"Facilitating conservation of New York State's biodiversity"

- Program of the State University of New York College Environmental Science and Forestry (SUNY-ESF)
- Funded primarily by the NYS Department of Environmental Conservation and its partners
- Maintain records on significant examples of natural communities, rare plants, animals, exotic species throughout the State
  - No direct stewardship or management





What are some tools that your program uses to identify or model locations of mature or old forest?

Approaches to Finding Old Forests

Settlement pattern

Area settled later; less suited to pasturing or agriculture

Long term public ownership

Forested lands protected for a long time by an agency or land trust

Logging desirability

Relatively remote / difficult to access (steep slopes, higher elevation)

70-year-old snapshot

1953 B&W aerial photo stereo pairs (3D) - Heterogeneous canopy texture

Landscape position

Areas more protected by position on the landscape from major wind events

Human land use

Areas free of stone walls, cellar holes, gravel pits, roads as viewed on LIDAR

Modern comparison

View with more recent aerial photographs

Field verification

Field investigation / documentation

Documented historical research

Maps, historical accounts, surveys

Old forest confirmation

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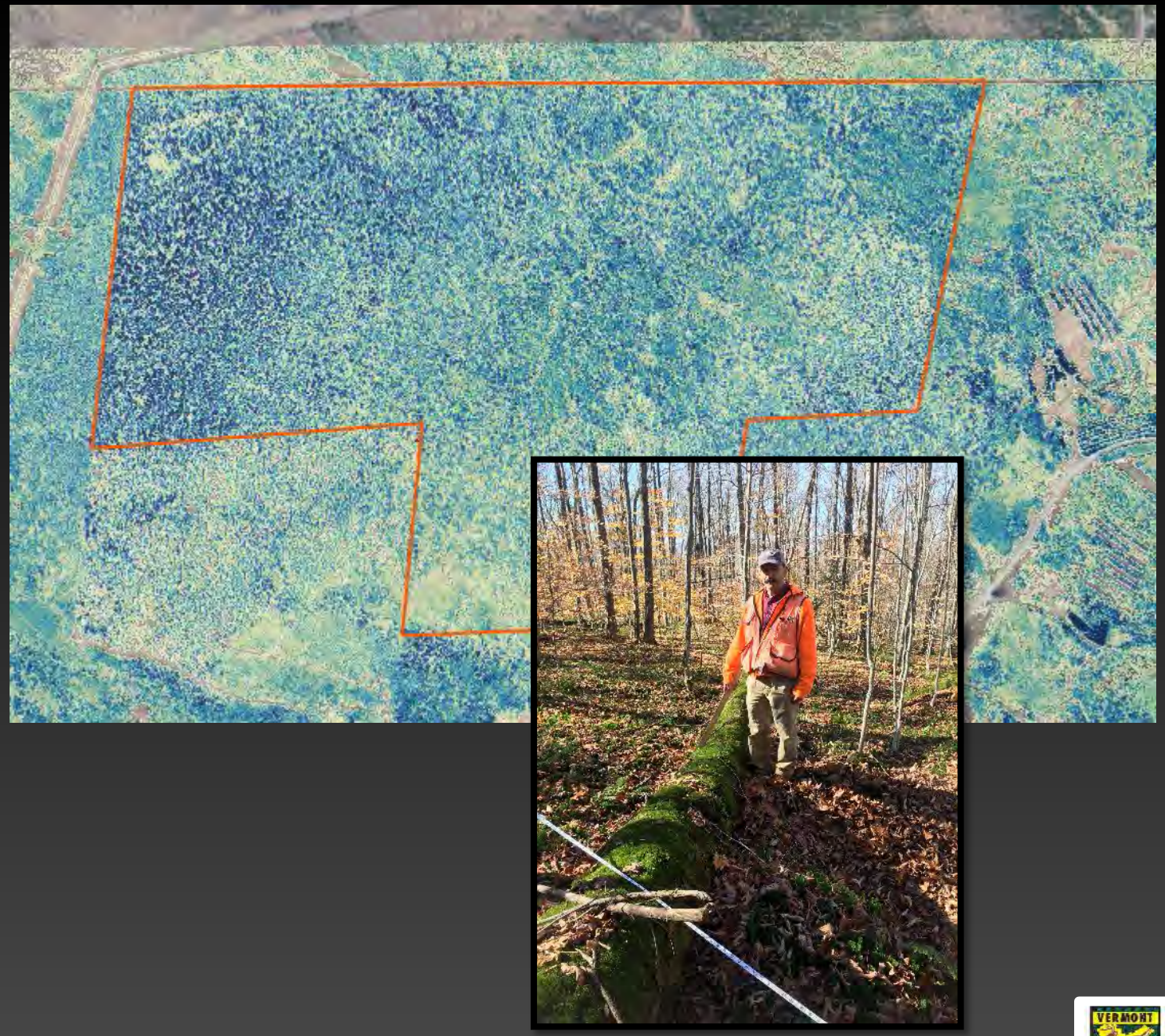
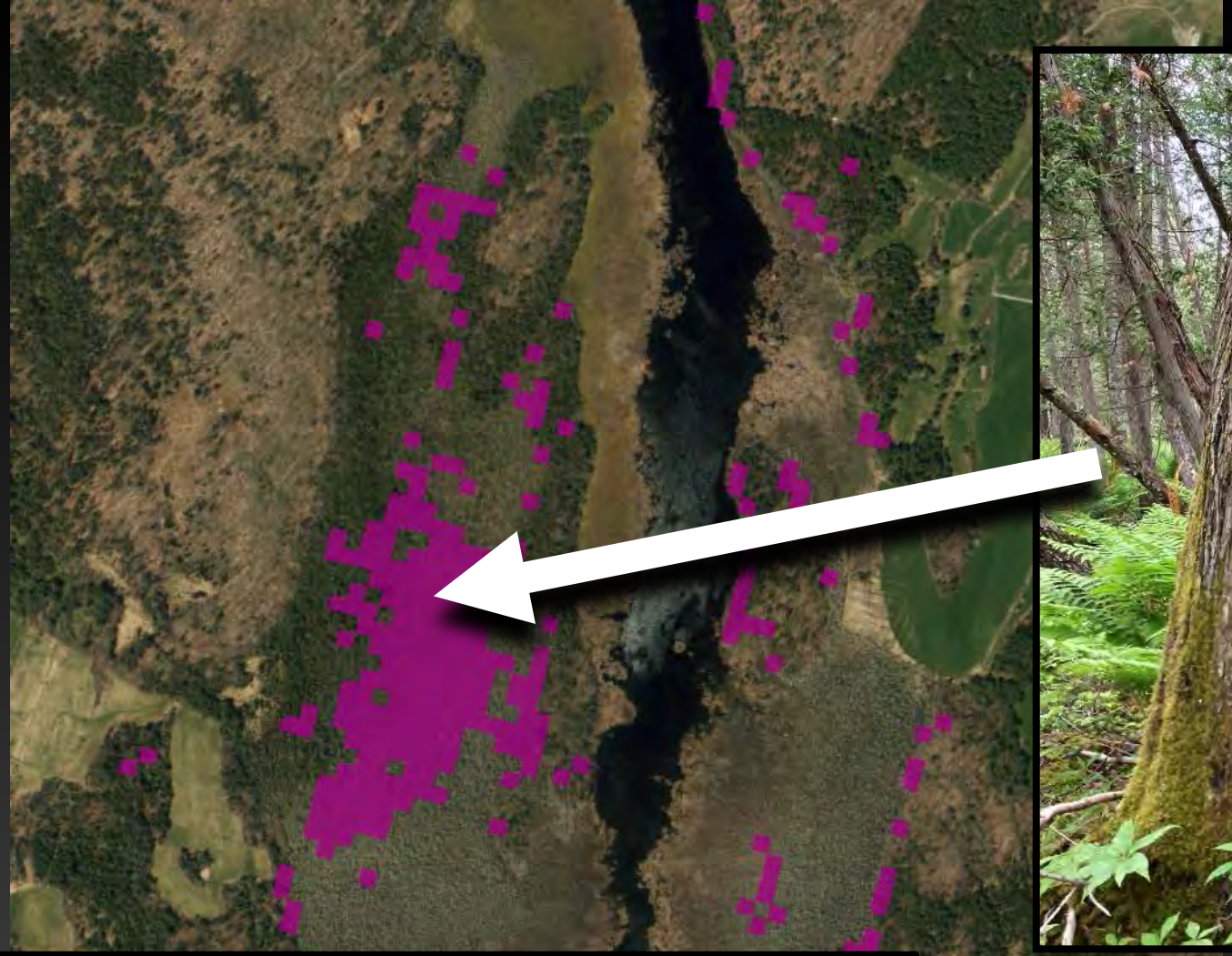
Inventory of old forests in Vermont

- Following up on anecdotal leads in the Natural Heritage Database – "*Mature forest, maybe old growth.*"
- Improving mapping and documentation of known old forest sites
- Lidar canopy height (normalized digital surface model)



Vermont
Natural Heritage Inventory



- NDVI (normalized difference vegetation index)
- LANDFIRE canopy bulk density (2016)
- LANDFIRE canopy base height (2016)
- % canopy cover from NLCD (2016)
- Forest height from GEDI, NASA's LiDAR satellite (2019)

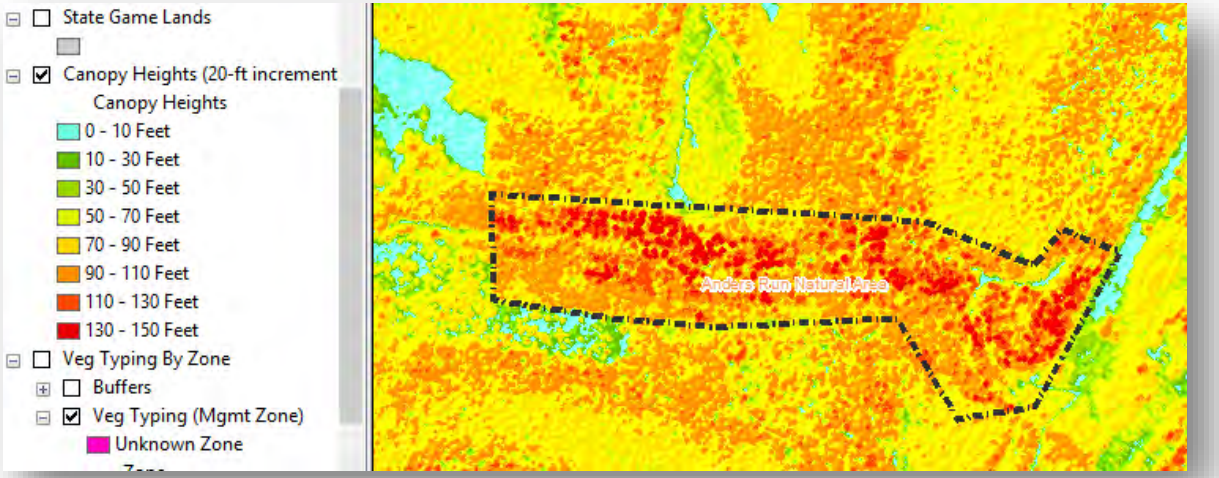
Wildlands NETWORK

Vermont
Natural Heritage Inventory

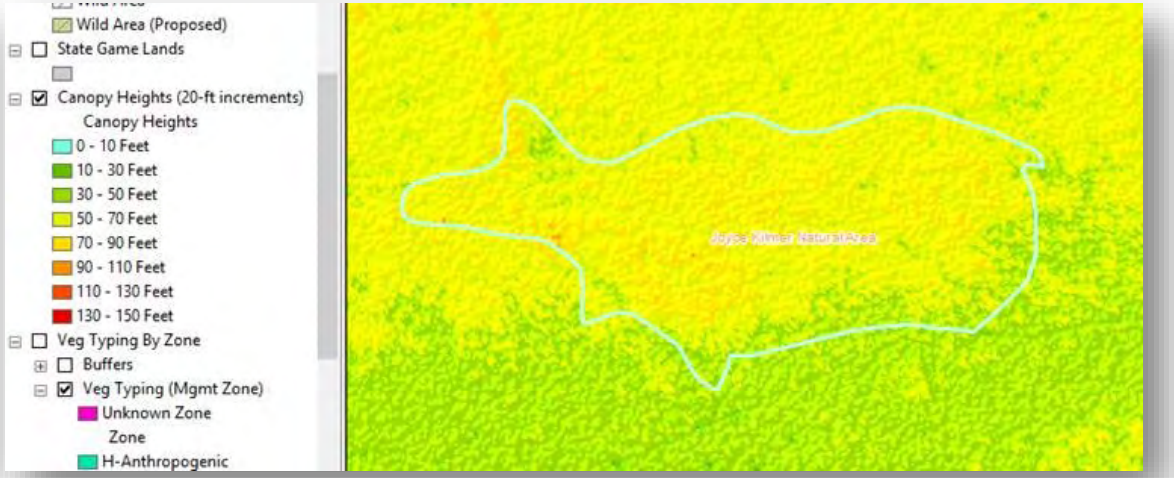
Pennsylvania Natural Heritage Program

Session 2: What are some tools that your program uses to identify or model locations of mature or old forest?

- Unaware of any modeling effort in PA
- Canopy height LiDAR
  - Completed for State Forest – limited in use
  - Tall trees not always indicative of old forest



Works well for Anders Run Natural Area



Not so well for Joyce Kilmer Natural Area

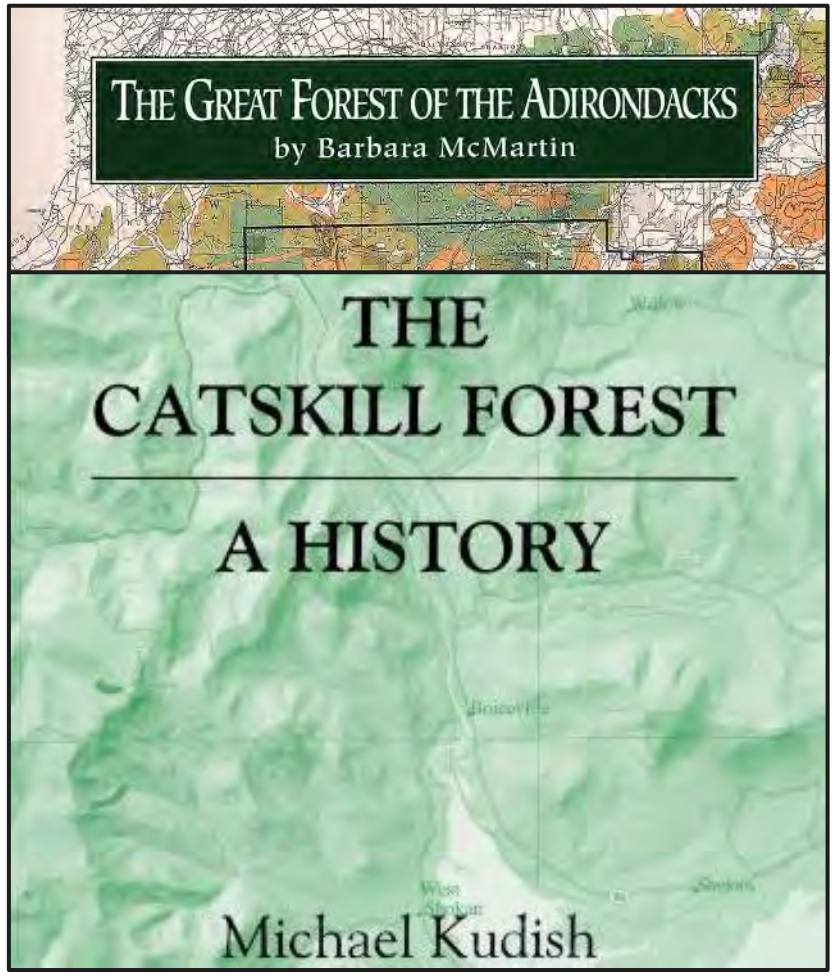
Pennsylvania Natural Heritage Program

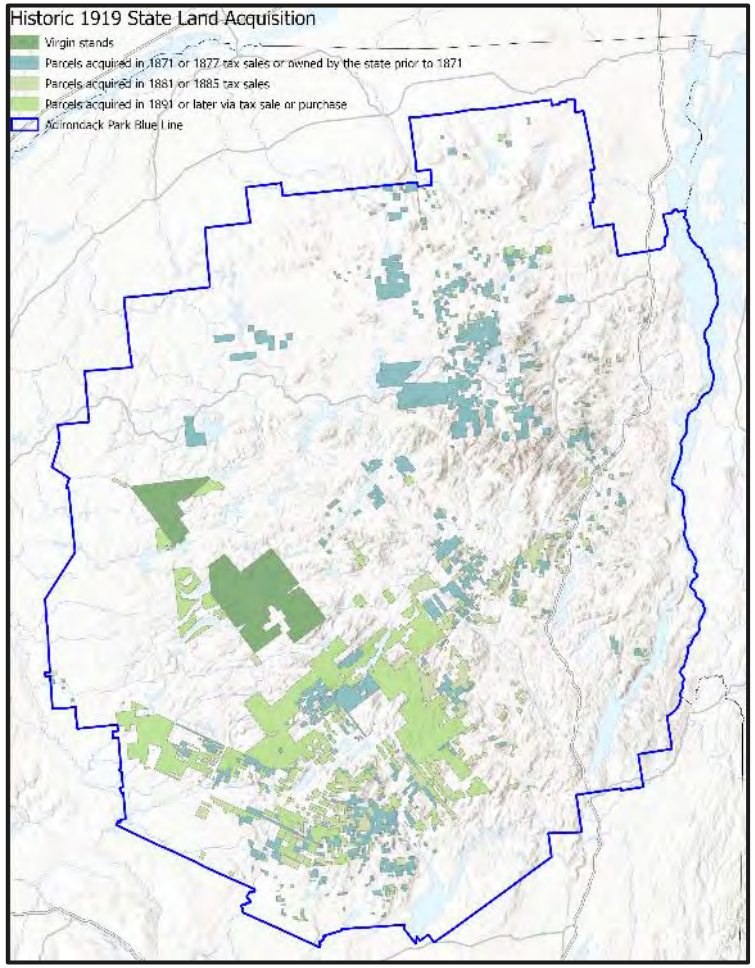
Session 2: What are some tools that your program uses to identify or model locations of mature or old forest?

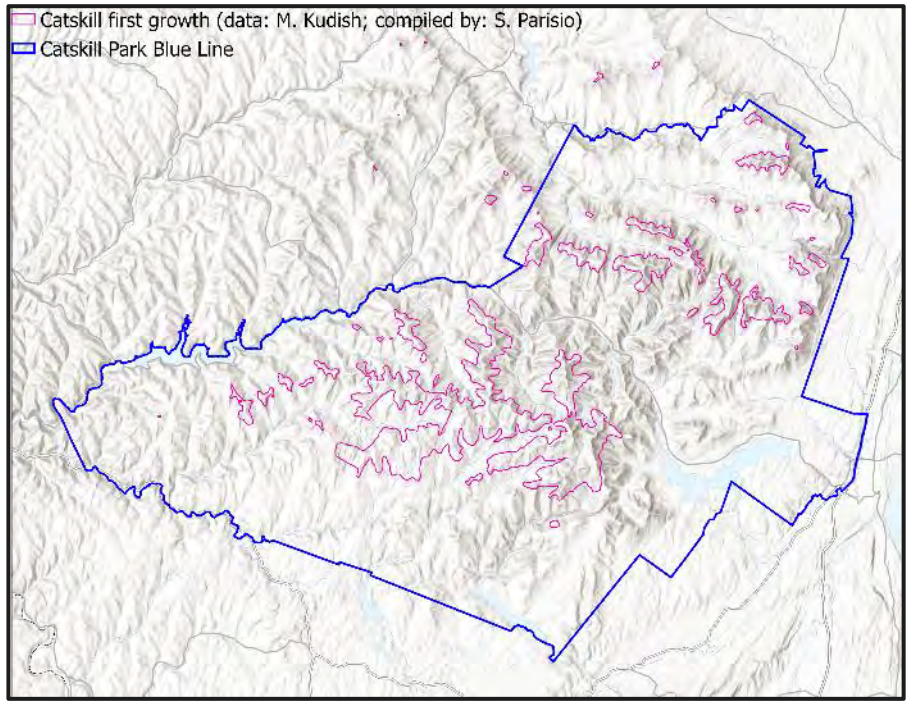
- State Forest old growth heat map
  - Working on updating the proposed old growth layer to be more applicable and less haphazard
  - Criteria:
    - Inaccessible areas (steep topography, limited zones)
    - Old trees (based on stand age – sometimes not very accurate)
    - Adjacent to known old growth (Natural Areas)
    - Tall trees (canopy LiDAR)
    - CWM and pit/mound topo LiDAR (need to determine a threshold)
    - Nearby old growth EO – norther flying squirrel, green salamander, Swainson's thrush, etc.
- Updated PEMA aerial (2022?)

Updated PEMA aerial for Hearts Content Recreation Area, Allegheny National Forest

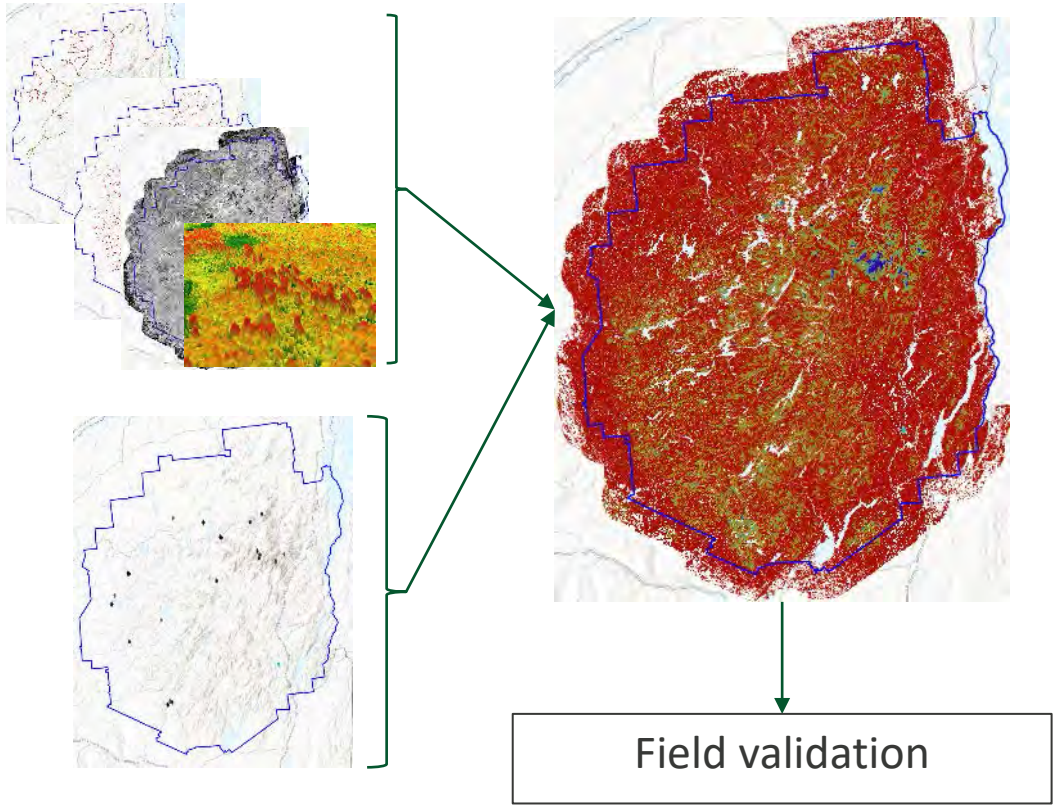
What are some tools that your program uses to identify or model locations of mature or old forest?







Tools identify or model old-growth forests



- Relevé plot (vegetation)
- 12 epiphytes
- Tree diameter
- Tree age
- Coarse woody debris

Stand age model (draft)

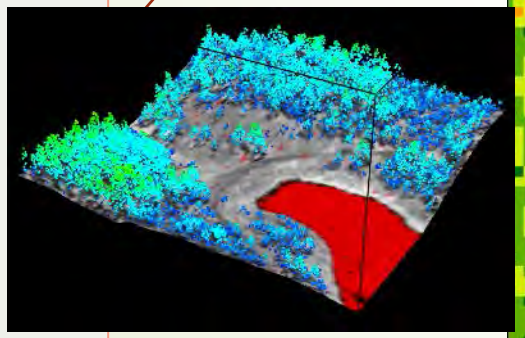
Field Data

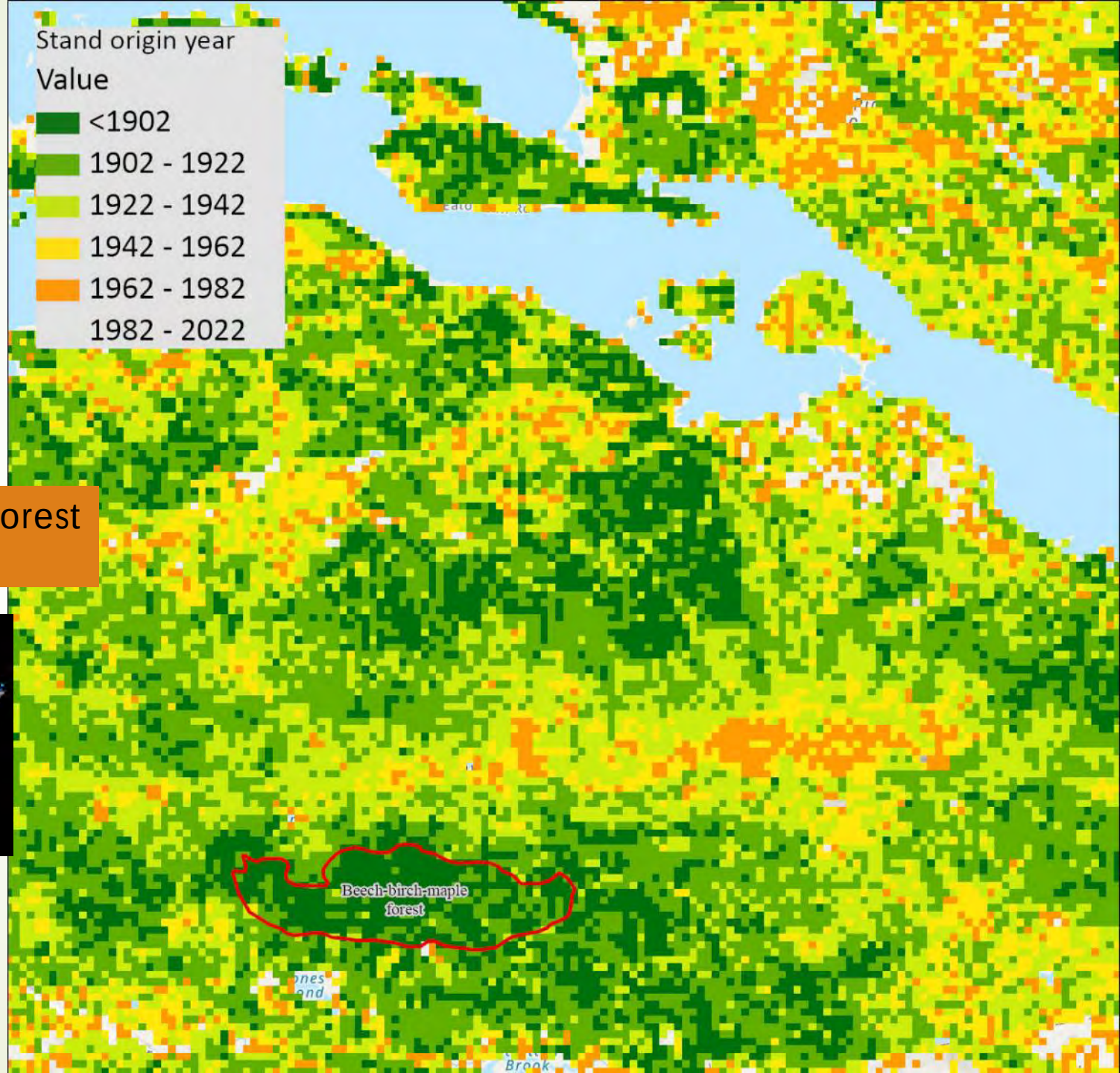
- Tree core data from MNAP

Predictor variables

- Canopy height model (LiDAR, NAIP)
- Elevation
- Landcover
- Spectral data?
- Other?

Random Forest Classier





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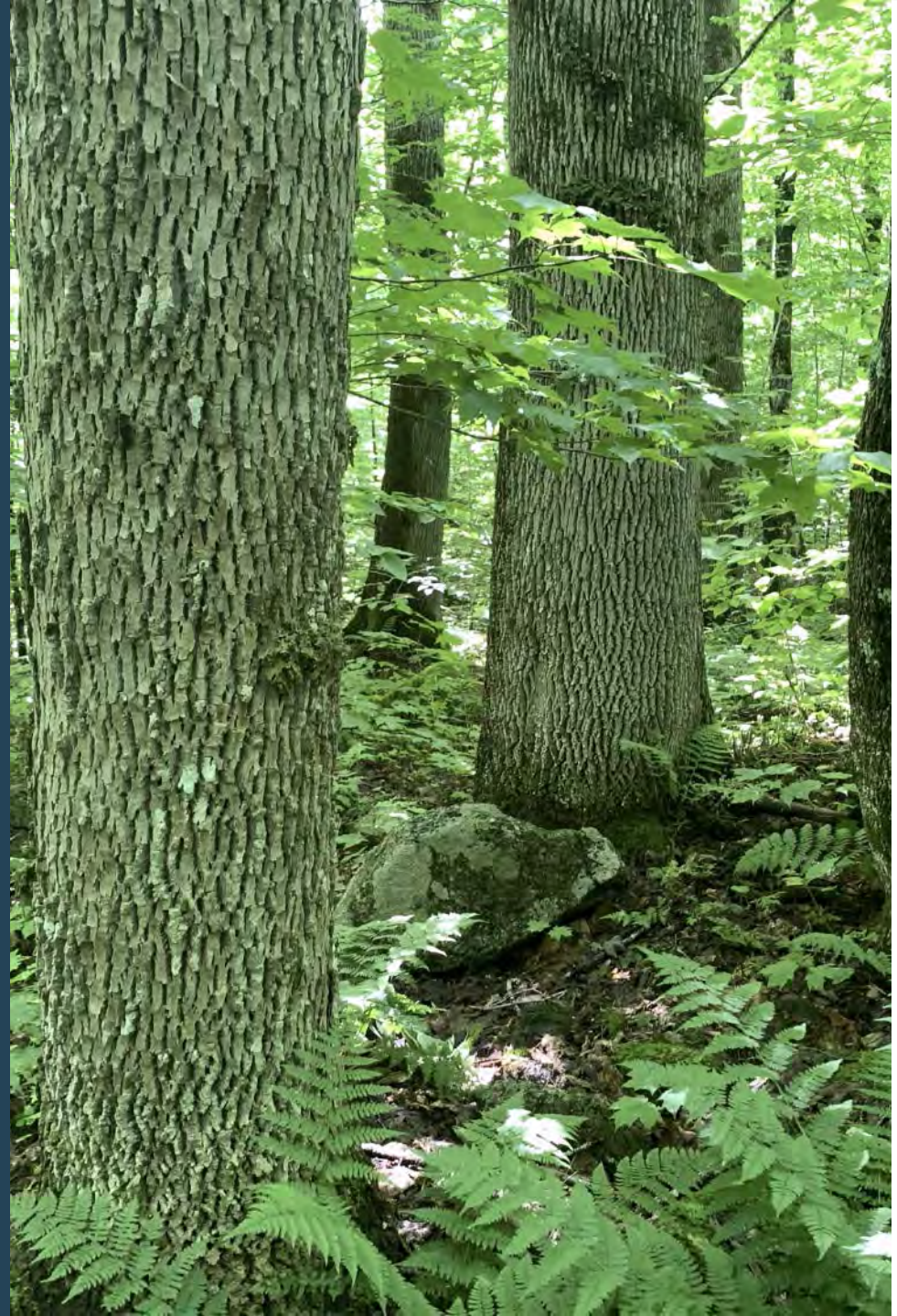
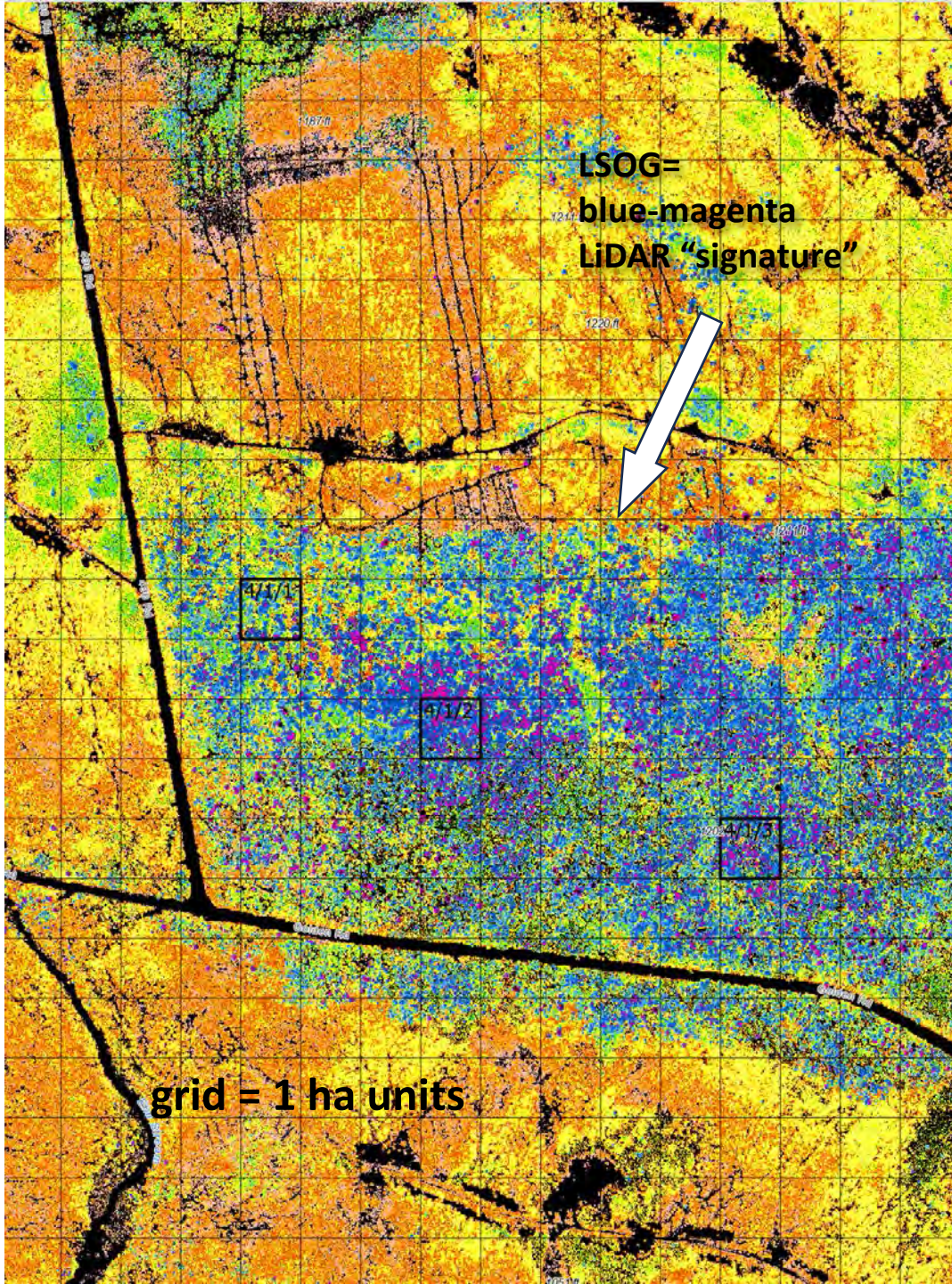
Using LiDAR to Locate, Map, And Conserve LSOG Forest

Field work at 102 sites in 2023 showed that LiDAR was 98% accurate in finding late-successional (100-200 yr old) forest in the “operational” zone of Maine’s working forest.

When calibrated to known sites, LiDAR can distinguish LS from OG based on canopy surface structure.

CONTACT: John Hagan
Jhagan@ourclimatecommon.org

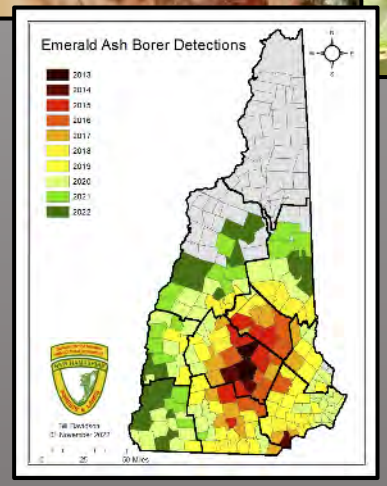




What impacts from invasive species, climate stressors, recreation and other stressors are you observing in your state?

Spongy moth defoliation, Oxford County, ME

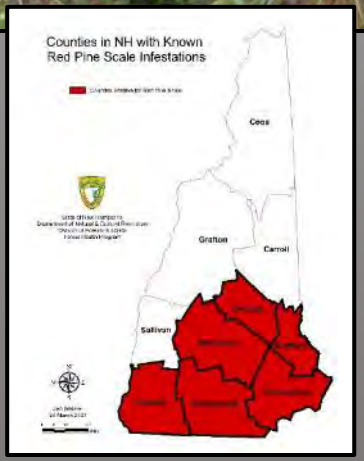
Invasive Insects and Diseases in NH Affecting Forests



Emeral Ash Borer

Beech Bark Disease

Red Pine Scale



Beech Leaf Disease

DEPARTMENT OF NATURAL AND CULTURAL RESOURCES
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Invasive Plant Species

USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

An Assessment of Invasive Plant Species in Northern U.S. Forests

Northern Research Station | Research Note NRS-311 | April 2023

This publication is part of a series that provides an overview of the presence of invasive plant species monitored on an extensive systematic network of plots measured by the Forest Inventory and Analysis (FIA) program of the USDA Forest Service, Northern Research Station (NRS). Previous research notes in this series have featured one of the invasive plants monitored on forested plots by NRS FIA in the 24 states of the midwestern and northeastern United States. This report shifts to an overview of all the monitored invasive plants and suggests that most of these plants have spread within the region.

Introduction

Invasive plants species (IPS)[1] have been monitored on select Phase 2 (P2) FIA plots since 2005 in the Midwest and since 2007 in the northeastern part of the NRS region. In 2005 and 2006, IPS data were collected year-round on 100 percent of the plots. Starting in 2007, the sampling intensity changed to collecting IPS data on 20 percent of plots with the monitoring window running from May through September. Since 2012, IPS data are collected on the Phase 2 Plus (P2+) sample. These plots are a 12.5 percent subsample of the Phase 2 plots, measured from May through September, and only occur on forest land.[2]

In this report, the 2014 and 2019 inventory data are presented to examine how IPS have changed over time. NRS FIA crews monitored 6,361 forested plots for invasive plants during the 2014 inventory and 4,244 in the 2019 inventory. Along with the standard forest variables collected during P2 measurement (e.g., tree diameter, height), these plots have various other attributes collected including the occurrence and coverage of IPS, vegetation structure, and down woody debris.

In past research notes, all species level nonnative bush honeysuckle data were lumped with the genus level observations. For this report, these data are not combined. This results in reporting on 43 species plus one undifferentiated genus (nonnative bush honeysuckle[3]), the 44 monitored IPS.

orested plots had one or more of s present in 2014. This number in 2019.

Native eastern white pine (*Pinus strobus*) mixed in among nonna Scotch pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*). US Forest Service photo by Cassandra M. Kurtz.

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Invasive Plant Science and Management

www.cambridge.org/inp

Identifying high-impact invasive plants likely to shift into northern New England with climate change

William Coville[1], Bridget J. Griffin[1] and Bethany A. Bradley[2]

[1]Research Assistant, Department of Environmental Conservation, University of Massachusetts, Amherst, MA, USA and [2]Professor, Department of Environmental Conservation, University of Massachusetts, Amherst, MA, USA

Research Article

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Author for correspondence:
Bethany A. Bradley, Department of Environmental Conservation, University of Massachusetts, Amherst, MA 01003.
(Email: bbradley@eco.umass.edu)

Abstract

Invasive plants are expanding their ranges due to climate change, creating new challenges for invasive species management. Early detection and rapid response could address some nascent invasions, but limited resources make it impossible to monitor for every range-shifting species. Here, we aimed to create a more focused watch list by evaluating the impacts of 87 plant species projected to shift into northern New England (the states of Maine, New Hampshire, and/or Vermont). We used the Environmental Impact Classification for Alien Taxa (EICAT) protocol to evaluate all ecological impacts reported in the scientific literature, scoring ecological impacts from 1 (minimal concern) to 4 (major) depending on the level of reported impact. For each species, we also recorded any reported impacts on socioeconomic systems (agriculture, human health, or economics) as "present." We found 24 range-shifting species with impacts on ecological communities, of which 22 have reported impacts in ecosystems common to northern New England. Almost all of these species also had impacts on socioeconomic systems and were available for purchase at ornamental plant retailers or online. Thus, these species can be considered high risk to northern New England with climate change based on their large negative impacts and potential to arrive quickly with deliberate human introduction. Our study demonstrates the use of impact assessments for creating targeted priority lists for invasive species monitoring and management.

Invasive Range Expanders Listing Tool

Terrestrial invasive plants are expected to shift their ranges in response to changing climate. This tool provides lists of terrestrial invasive plants expected to expand their ranges into the chosen county or state with climate change by 2040-2060. Climate change expansions are based on 13 future climate models and users must select the level of consensus (1-13 models) required to add a species to the state or county list. In addition, users can filter the list to species currently observed within a chosen geographic proximity to the focal county or state. Lists for range expansion with climate change include species that have not been observed within the focal state or county, do not have current suitable climate there, but are predicted to have suitable climate by 2040-2060 according to the selected number of climate models.The lists generated are for informational purposes and contain only species that are already present in the contiguous United States.

Select State: New Hampshire

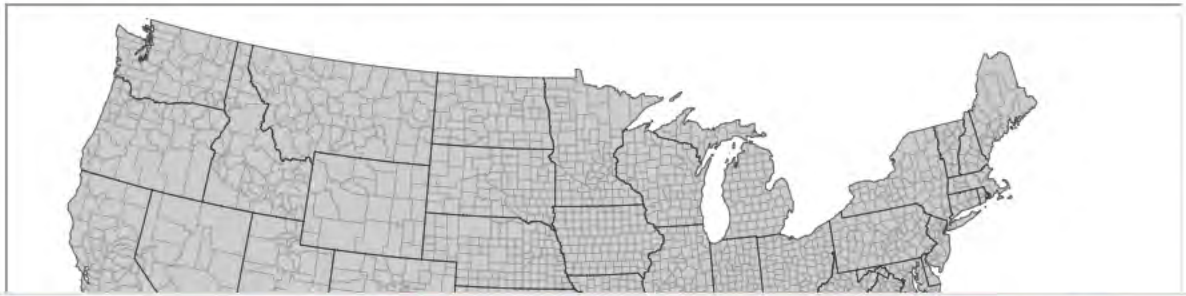
Select County: All Counties

Choose Number of Models: 13

Refine List by: Species observed within the country

Range Expansion Definition: Range expansion with climate change

REGIONS WHERE THE SPECIES HAS BEEN FOUND



LIST OF SPECIES WITHIN CURRENT CLIMATE

Download

Search:

Scientific Name	Common Name	Map
Achyranthes japonica	Japanese chaff flower	
Bromus catharticus	rescuegrass	

New Hampshire Comprehensive Invasive Plant List

NH Department of Agriculture, Markets & Food (NHDAMF)

NH Department of Environmental Services (NHDES)

January 2023

SCIENTIFIC NAME[1]	SYNONYMS	COMMON NAME	TERESTRIAL NHDAMF JURISDICTION		AQUATIC NHDES JURISDICTION		EARLY DETECTION RAPID RESPONSE SPECIES[6] (EDRR)
The following is a comprehensive list of invasive (Prohibited – P) and potentially invasive (Watch – W) plant species that the State of New Hampshire's Invasive Species Committee (ISC) has compiled to help promote education and awareness of these species. This includes plants **Prohibited (P)** and regulated by the NH Department of Agriculture, Markets & Food (NHDAMF) and the NH Department of Environmental Services (NHDES). Those listed as **Watch (W)** are not regulated, however, they exhibit some invasive characteristics that over time could allow them to spread rapidly and become invasive. Lastly, **Early Detection Rapid Response (EDRR)** species have exhibited invasive tendencies in the region and are likely to soon arrive or already occur in NH but not fully established. Where found, they are rapid response targets for eradication before they become more widely established. See more information on Prohibited, Watch, and Early Detection Rapid Response species below the table.			PROHIBITED[2] (P)	WATCH[3] (W)	PROHIBITED[4] (P)	WATCH[5] (W)	
Abutilon theophrasti Medik.		Velvetleaf Indian-mallow		W			
Acer ginnala Maxim.		Amur maple		W			
Acer platanoides L.	*Acer platanoides* var. *schwedleri* Nichols.	Norway maple	P				
Achyranthes japonica (Mig.) Nakai	*Achyranthes japonica* (Mig.) Nakai var. *hachijoensis* Honda	Japanese chaff flower		W			EDRR
Aegopodium podagraria L.	*Aegopodium podagraria* var. *variegata* Bailey	Bishop's goutweed		W			
Agrostemma githago L. var. *githago*	*Lychnis githago* (L.) Scop.	Common corncockle		W			
Ailanthus altissima (P. Mill.) Swingle	*Ailanthus glandulosa* Desv.	Tree of heaven	P				EDRR
Aira caryophyllea L. var. *caryophyllea*	*Aspris caryophyllea* (L.) Nash	Common silver-hairgrass		W			
Aldrovanda vesiculosa L.		Waterwheel plant				W	EDRR
Alliaria petiolata (Bieb.) Cavara & Grande	*Alliaria alliaria* (L.) Britt.; *Alliaria officinalis* Andrz. *ex* Bieb.; *Erysimum alliaria* L.; *Sisymbrium alliaria* (L.) Scop.	Garlic mustard	P				
le L.		Crow garlic		W			
sa (L.) Gaertn.	*Alnus alnus* (L.) Britt.; *Betula alnus* L. var. *glutinosa* L.	European black alder	P				EDRR
ticosa L.	*Amorpha fruticosa* var. *angustifolia* Pursh; *Amorpha fruticosa* var. *oblongifolia* Palmer; *Amorpha fruticosa* var. *tennesseensis* (Shuttlw. *ex* Kunze) Palmer	False indigo-bush		W			
glandulosa (Wallich) *brevipedunculata* *miy.*	*Ampelopsis brevipedunculata* (Maxim.) Trauty.; *Ampelopsis heterophylla* (Thunb.) Sieb. & Zucc. var. *amurensis* Planch.; *Ampelopsis heterophylla* (Thunb.) Sieb. & Zucc. var. *brevipedunculata* C.L. Li; *Cissus brevipedunculata* Maxim.; *Vitis brevipedunculata* (Maxim.) Dippel.	Amur peppervine		W			EDRR

Two high-quality old forest natural communities found during review of proposed mountain bike trails.

Vermont
Natural Heritage Inventory

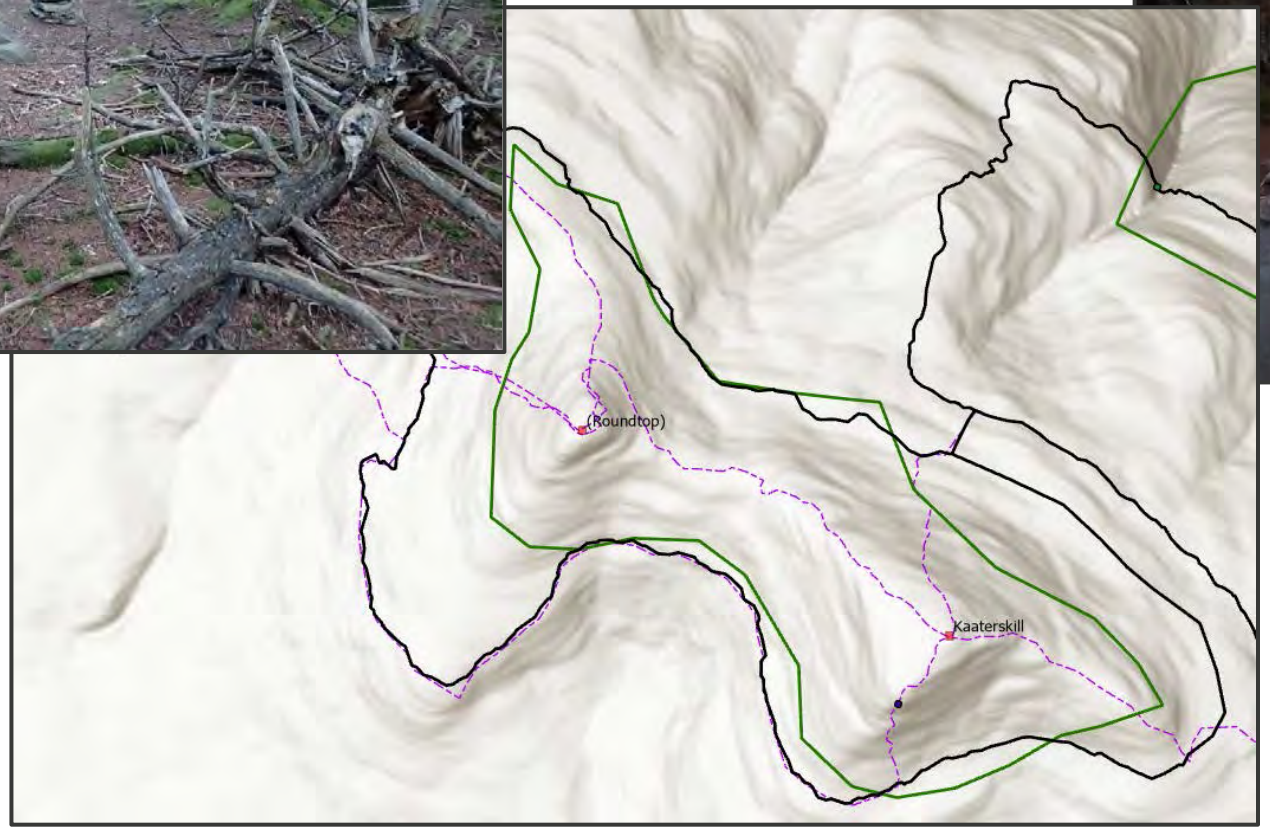
Pennsylvania Natural Heritage Program

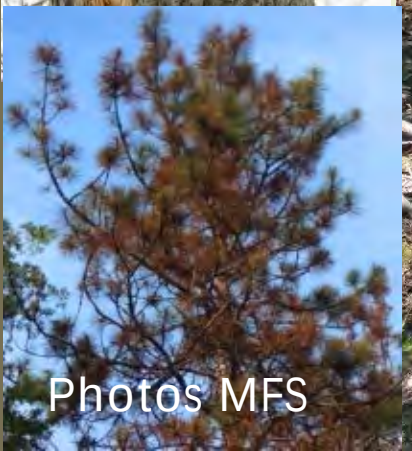
Session 2: What impacts from invasive plants, climate stressors, recreation and other stressors are you observing in your state?

Invasive plants  Hiking trails

- Invasive plants primarily an issue in the popular old forest Natural Areas – places with trails
  - Ricketts Glen Falls Trail may be the most popular trail in PA and it is an old growth forest
  - Otherwise old forests in PA tend to have very few invasive plants
- Main stressors:
  - Pests such as HWA, beech bark/leaf disease, etc.
  - Deer eating tree seedlings – an outstanding issue across most old forests in PA
    - What will this forest turn into when the hemlocks die?
- Climate stressors – all of the above plus extreme weather
  - Reviewing tree models for future climate scenarios
  - Which of our late successional tree species will do worse with extreme rain or drought?
  - Primary OG type is Hemlock (white pine) – Northern Hardwood Forest
    - most trees in this type are not expected to not fair well

Recreational effects on old-growth





Photos MFS

Hemlock Wooly Adelgid
Camden Hills, ME

Spruce bark beetle
(native)
Mt Abraham, ME

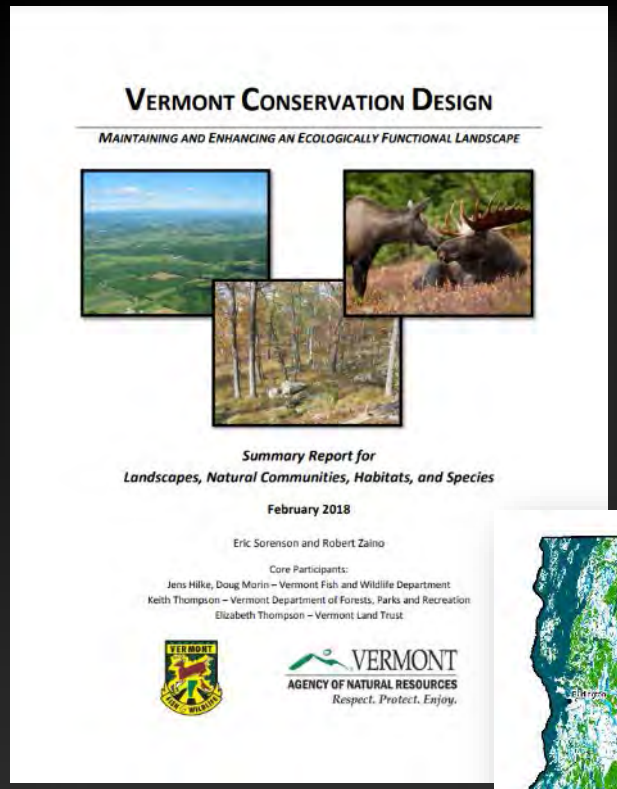
How is your program influencing conservation and management of old forest?

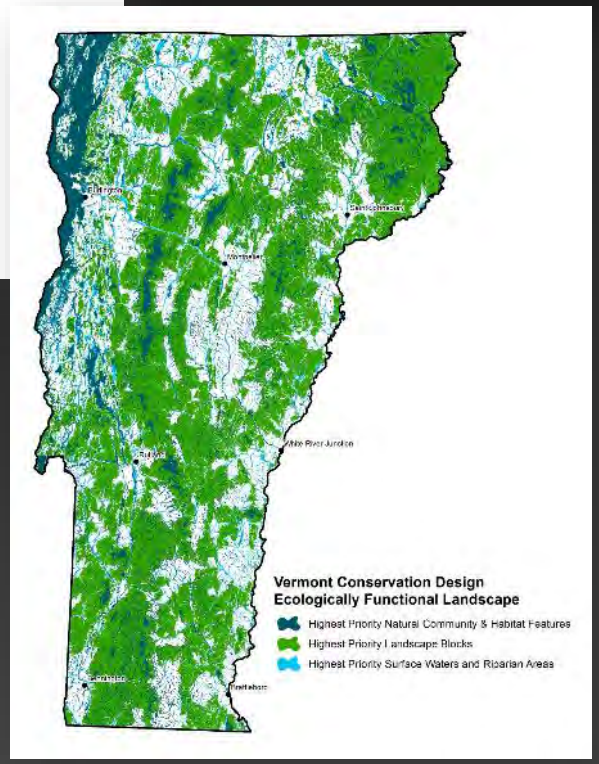
NH NHB collects old forest data that informs conservation prioritization associated with…

- EPA projects
- State lands for DNCR
- Forest Service projects on the WMNF
- Town lands
- Conservation organizations (TNC, land trusts)
- Private lands

Vermont Conservation Design Old Forest Target

- 9.1% of Vermont's forest
- (15% of matrix forest in highest priority forest blocks)
- 419,000 acres
- Distributed in each biophysical region
- Professional judgement: an amount that will reintroduce the ecological functions of old forests



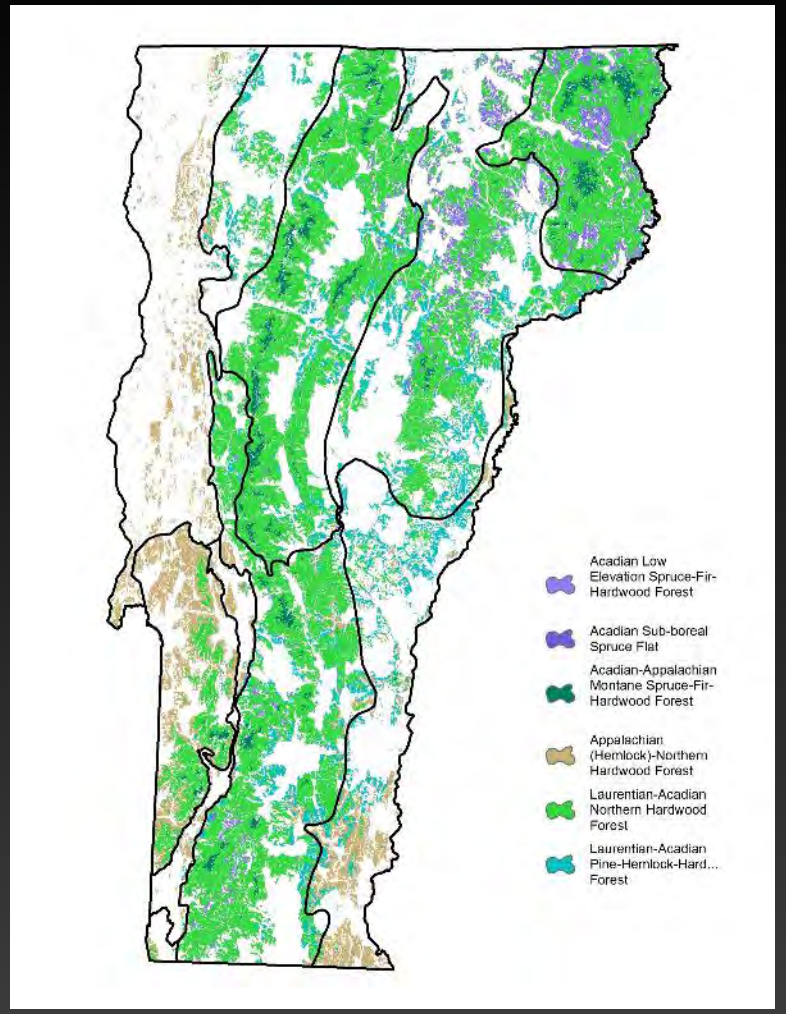


Vermont
Natural Heritage Inventory

Table 1: Acres of Future Old Forest Lands (lands identified by VFWD as likely to develop into old forests over time) by biophysical region and modeled natural community type, and their contributions to the Vermont Conservation Design old forest targets. Modeled natural community types may not accurately reflect natural communities on the ground but provide a rough estimate of representation.

Biophysical Region -> / Matrix Forest Natural Community Type	Northeastern Highlands	Taconic Mountains	Champlain Valley	Champlain Hills	Vermont Valley	Northern Green Mountains	Northern Vermont Piedmont	Southern Vermont Piedmont	Southern Green Mountains
Montane Spruce-Fir Forest/ Montane Yellow Birch-Red Spruce Forest	596	1,139	*n/a*	*n/a*	*n/a*	28,228	1,161	74	12,964
Red Spruce-Northern Hardwood Forest	1,256	0	*n/a*	0	0	80	396	0	3,403
Lowland Spruce-Fir Forest	236	0	*n/a*	*n/a*	*n/a*	23	124	0	636
Hemlock-Northern Hardwood Forest/ Red Oak-Northern Hardwood Forest	0	4,070	2,990	0	113	122	245	1,934	3,593
Northern Hardwood Forest	9,482	4,003	0	0	82	46,634	2,136	462	92,431
CURRENT TOTAL	**11,570**	**9,211**	**2,990**	**0**	**195**	**75,087**	**4,062**	**2,470**	**113,027**
Old Forest Target for Biophysical Region	*59,000*	*33,000*	*15,000*	*13,000*	*4,000*	*95,000*	*78,000*	*31,000*	*91,000*
Percent of Old Forest Target Achieved by Future Old Forest Lands	**20%**	**28%**	**20%**	**0%**	**5%**	**79%**	**5%**	**8%**	**124%***

**natural community distribution targets not met*



- **213,000 acres expected to become old forest**
- **Need an additional 206,000 acres for the target**

Vermont
Natural Heritage Inventory

30 x 30 conservation legislation includes maintaining and restoring old forests

No. 59
2023

Page 1 of 12

No. 59. An act relating to community resilience and biodiversity protection.

(H.126)

(c) Reaching 30 percent by 2030 and 50 percent by 2050 shall include a mix of ecological reserve areas, biodiversity conservation areas, and natural resource management areas. In order to support an ecologically functional and connected landscape with sustainable production of natural resources and recreational opportunities, the approximate percentages of each type of conservation category shall be guided by the principles of conservation science and the conservation targets within Vermont Conservation Design, prioritizing ecological reserve areas to protect highest priority natural communities and maintain or restore old forests.

New current use program category allows some landowners the ability to restore old forest conditions

Vermont
Natural Heritage Inventory

Pennsylvania Natural Heritage Program

Session 2: How is your program influencing conservation and management of old forest?

- Funding for my project from PA DCNR
  - Great interest and support from this state agency
  - Project outcome: Updated BMP's for managing old growth and aging forests
    - At least 25% in "proposed old growth"
  - Potentially quite high influence
- Collaborating with other agencies - PA Game Commission
  - Already managing for late-successional forests
  - PNHP may be more influential in the old forest associated EO's
    - Habitat requirements, populations, etc.
- Old Growth Rapid Assessment
  - Intending to distribute widely for PA natural resource professionals
    - State employees or private
  - Provide a metric or benchmark for management or decision making
  - Ideally will influence landowners to preserve aging forests – increase old forest across the state
  - Identifying areas within protected lands – influence management goals and objectives

Pennsylvania Natural Heritage Program

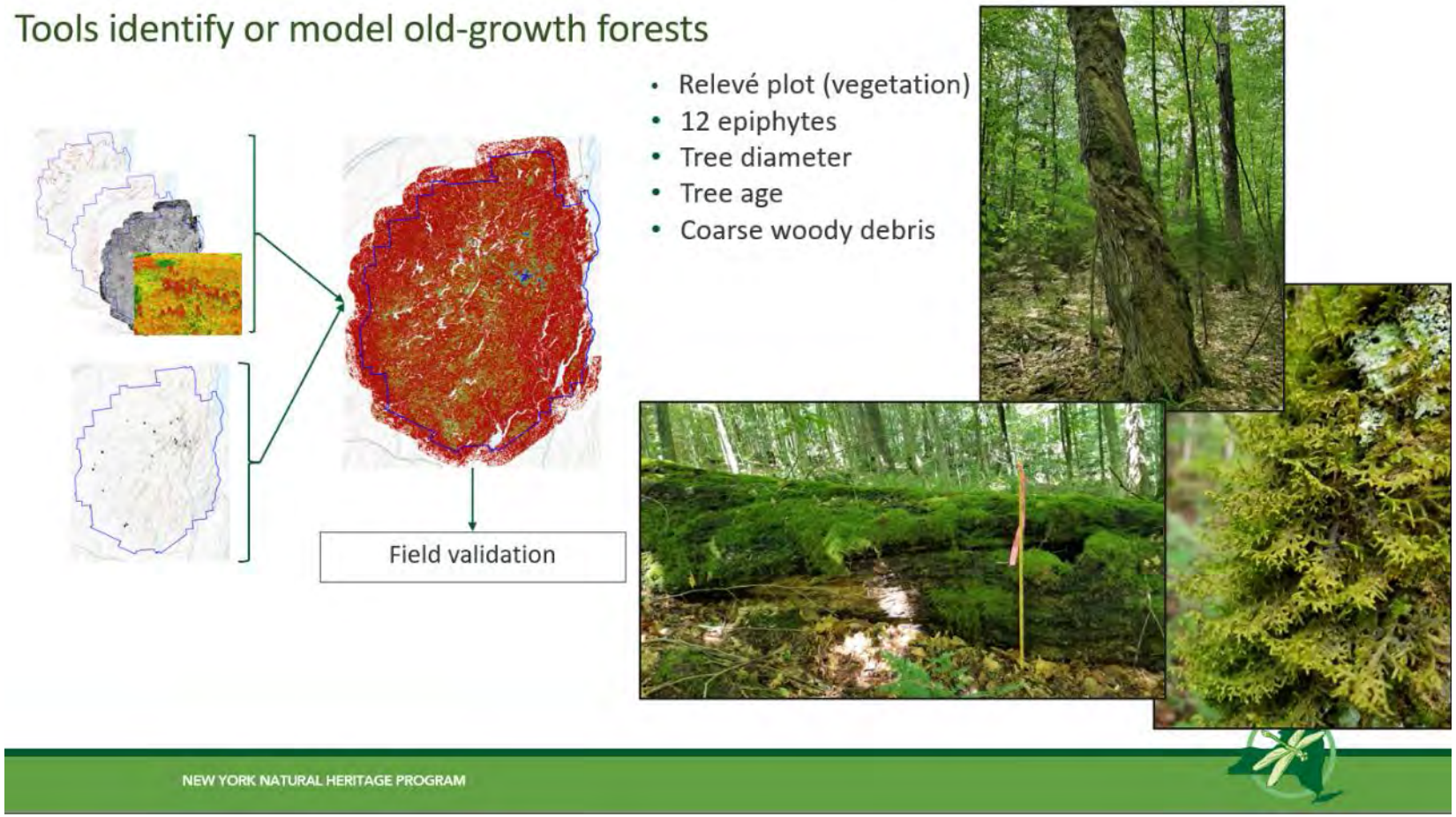
Session 2: How is your program influencing conservation and management of old forest?

- Public policy
  - Identify areas of healthy OG for carbon purposes
  - Model future carbon potential to influence land protection/management
    - Overlap with old forest management tactics
  - What types of management actions can increase the resiliency of old forests?
    - Deer mgmt., invasive species

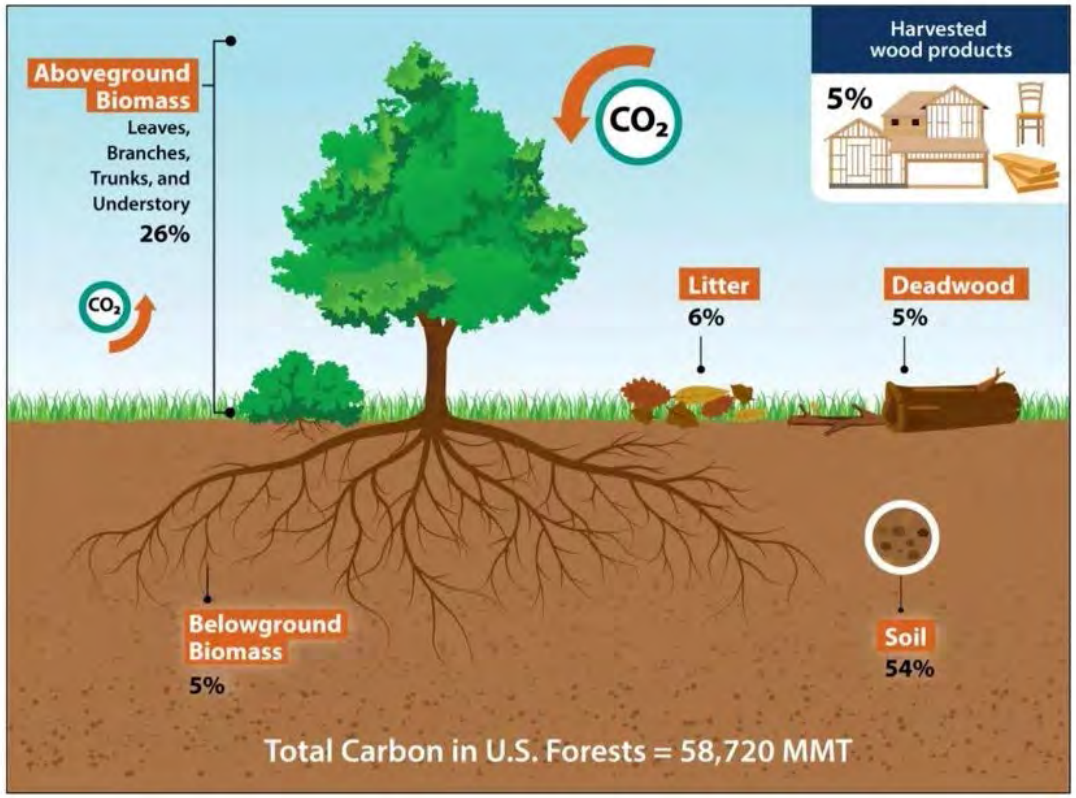
Management and conservation of old-growth

Where is the old-growth

- Mostly Forest Preserve
  - Adirondack Park
  - Catskill Park
- Modeling
- Field surveys
- Old-growth index



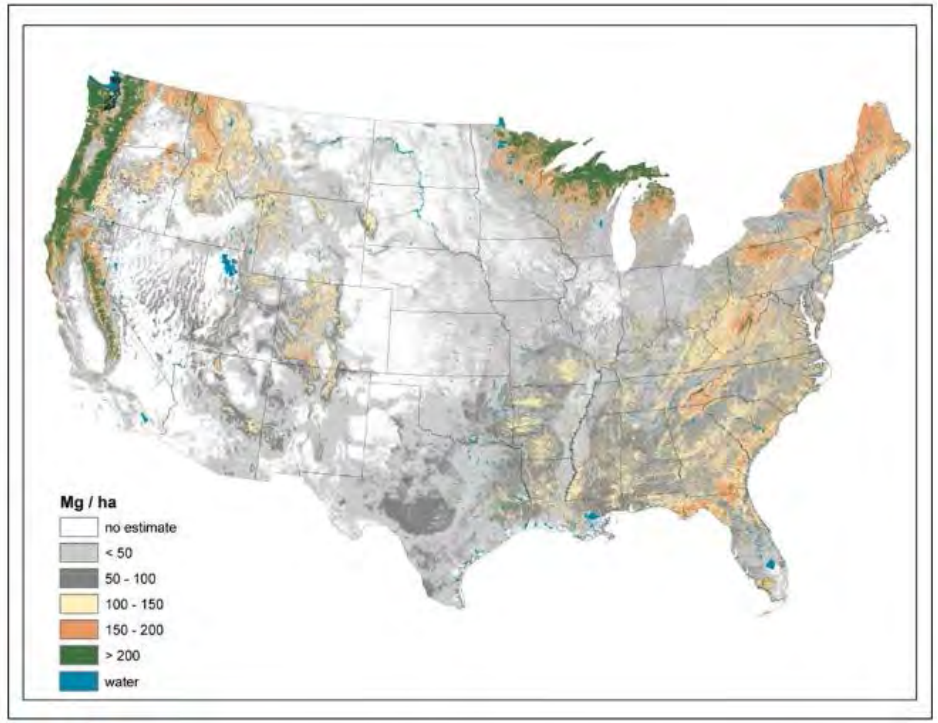
Management and conservation of old-growth



Source: Land Use, and Land-Use Change, and Forestry" in US National Greenhouse Gas Inventory, EPA 430-R-20_002, April 13, 2020

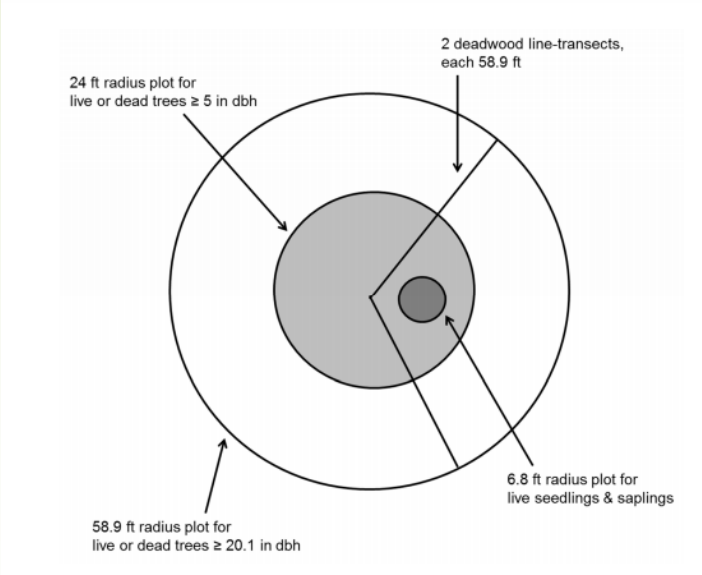
Carbon storage and sequestration

- NYS net zero carbon emissions by 2050
- 5 C-sinks
  - Above-ground
  - Below-ground
  - Dead wood
  - Litter/duff
  - Soils



Source: B. Wilson et al., "Imputing Forest Carbon Stock Estimates from Inventory Plots to a Nationally Continuous Coverage," *Carbon Balance and Management*, vol. 8, no. 1 (2013).

Monitoring and Management



- Tracking changes over time through continuous forest inventory in Ecological Reserves
- Harvest prescriptions to mimic old forest conditions on state lands
- Working with MFS to targeting release biocontrols to important sites

maine DEPARTMENT OF Agriculture Conservation & Forestry

Working forest land

- Core feature recommendations
- Buffer recommendations
- About 10 million acres enrolled in 3rd party certification

FSC FORESTS FOR ALL FOREVER™

SUSTAINABLE FORESTRY INITIATIVE

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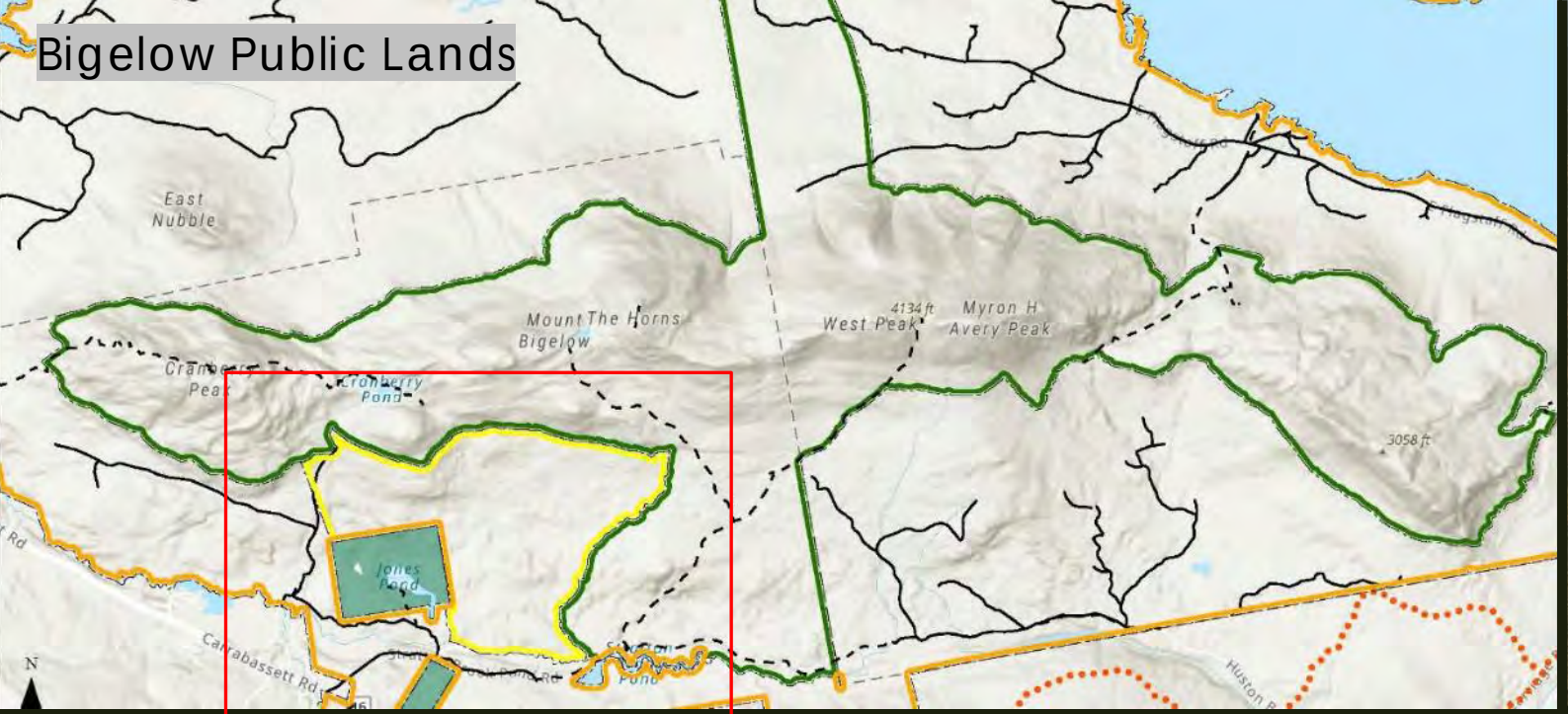
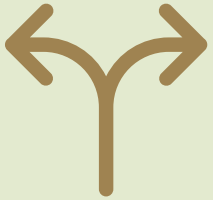


Conservation

-Ecological Reserves
-Pre-acquisition reviews
-Fieldwork supporting major funding proposals

Take home messages

Natural Heritage data on old forests is important for promoting conservation of important ecosystems



For the purposes of land management, Natural Heritage Programs are often the ones who make the decision about whether a site qualifies as ‘old growth’ or not

Natural heritage programs are utilizing emerging technology to map and survey significant areas of old forest.