Upland Ecological Integrity Assessment of the Northern Hardwood - Conifer Forest Ecological System at Mt. Sunapee

Upland Ecological Integrity Assessment Method

What is an Ecological Integrity Assessment (EIA)?

An assessment of the structure, composition, processes, and connectivity of an ecosystem

How these characteristics:

- Correspond to reference conditions
- Are within the bounds of natural disturbance regimes

Applications for Land Management

- Monitoring ecosystem condition to inform management actions
- Prioritizing sites for conservation or restoration
- Individual metric scores inform management needs, goals, success
- Comparison to reference conditions
- Understanding major stressors that need to be addressed to improve ecosystem function

Rapid Upland EIA Metrics

What is Assessed?

Primary Rank Factor	Major Ecological Factor	Metric Name
LANDSCAPE CONTEXT	LANDSCAPE	uLAN1 Land Use Index
		uLAN2 Landscape Core Area
		uLAN3 Landscape Core Depth of Interior
	EDGE	uEDG1 Width of Natural Edge
CONDITION	VEGETATION	uVEG1 Native Plant Species Cover
		uVEG2 Invasive Nonnative Plant Species Cover
		uVEG3 Native Plant Species Composition
		uVEG4 Vegetation Structure
		uVEG5 Woody Regeneration
		uVEG6 Coarse Woody Debris, Snags, and Litter
	SOIL	uSOI1 Soil/Substrate Condition
SIZE	SIZE	uSIZ1 Comparative Size

Establishing Ratings for EIA

- Distinguish expected or acceptable conditions from undesired ones that warrant further evaluation or management action
- Simple A – D categorical structure
- Sites are assigned to reference condition categories:
  - A = Very high ecological integrity, unimpacted
  - B = Minimally impacted
  - C or D = Low ecological integrity, moderately to severely impacted

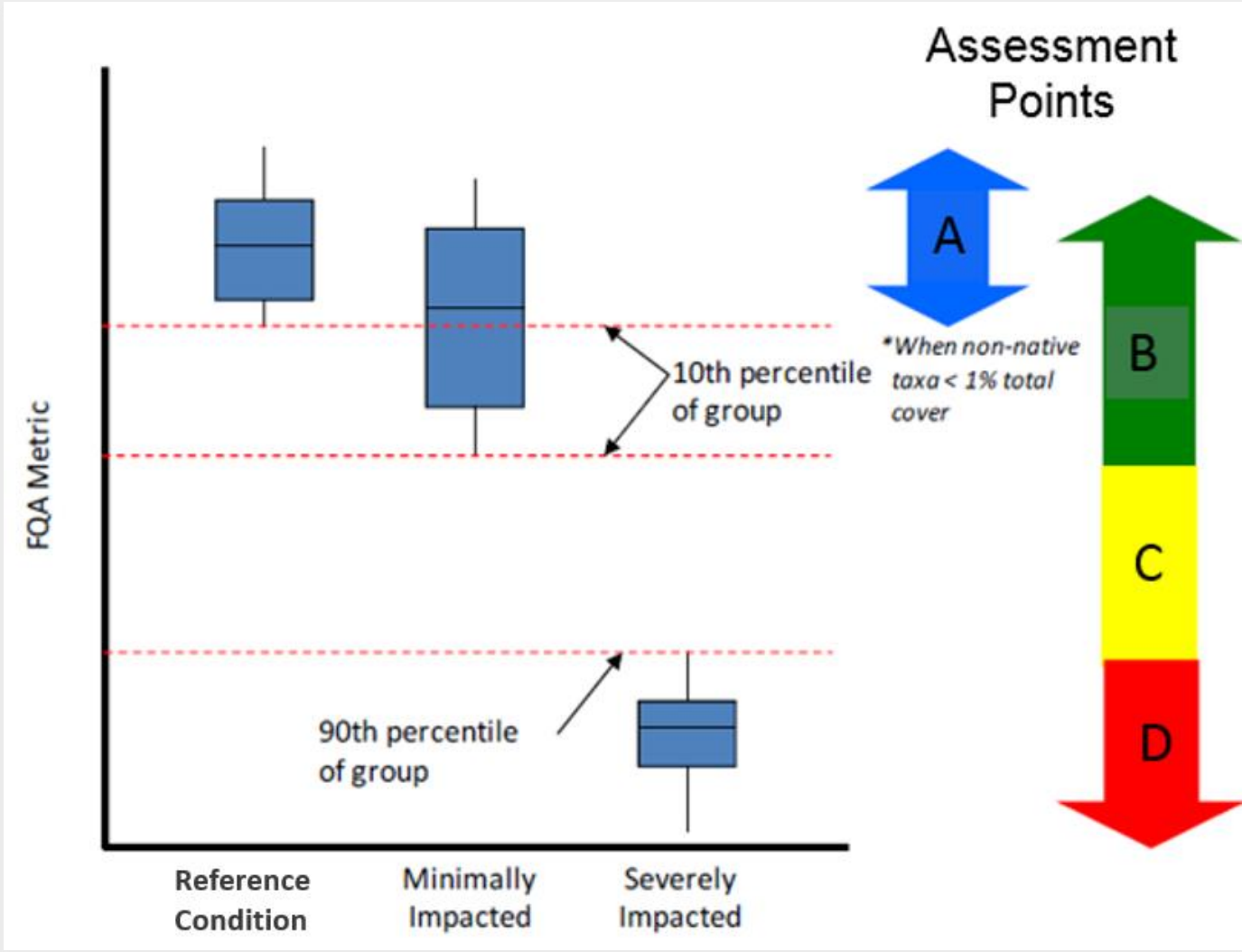


Figure adapted from Bourdaghs (2012).

Upland EIA Methodology

3 Step Approach

PRE-FIELD ASSESSMENT

Remote sensing (GIS)

- Landscape
- Edge
- Size
- Stressor Checklist

FIELD ASSESSMENT

Observations

- Condition
- Adjust Pre-field metrics
- Adjust Stressor Checklist

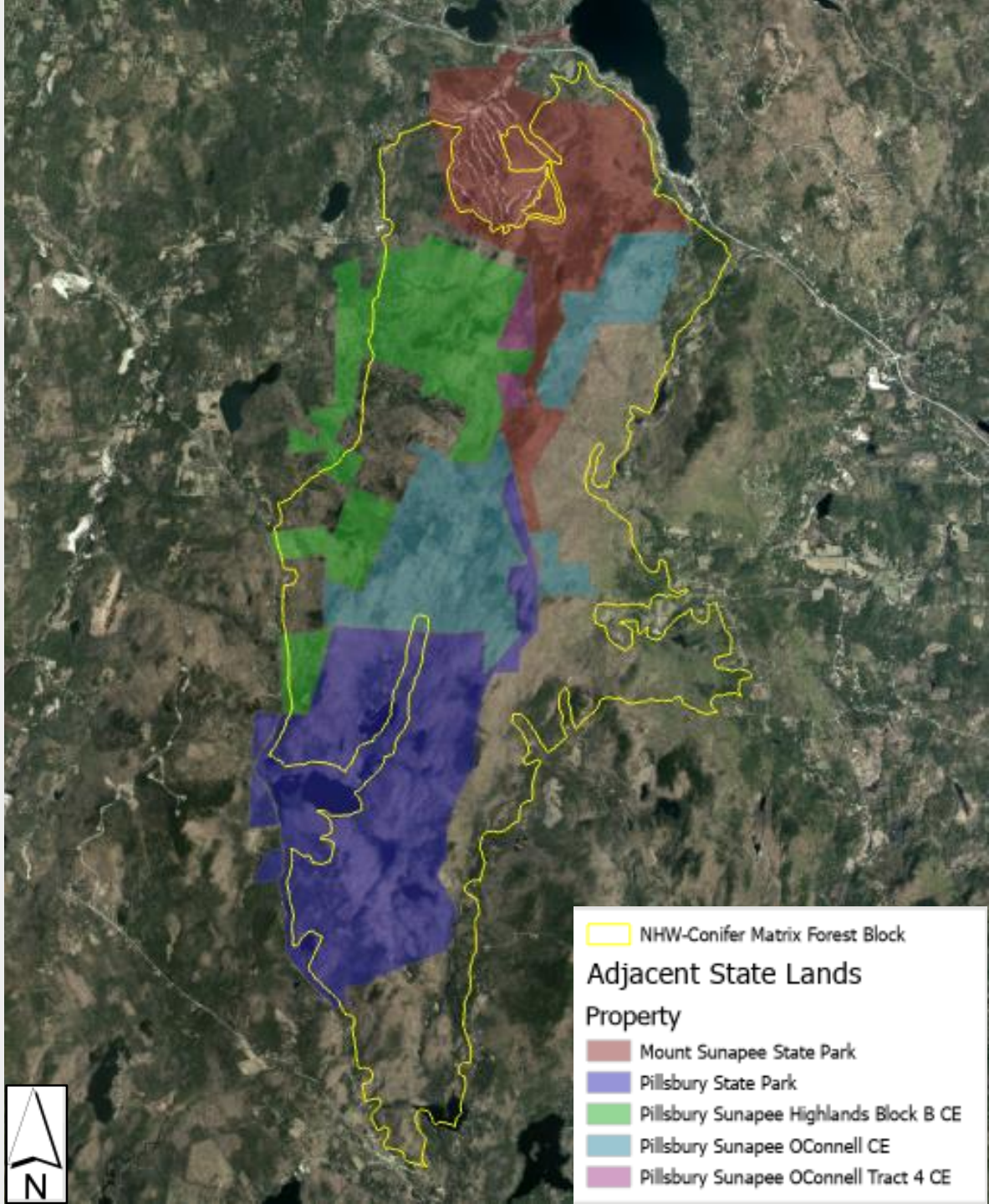
POST-FIELD ASSESSMENT

- QA/QC
- Data Processing
- Generate Results

Regional Context

- Within ~17K ac northern hardwood - conifer forest block
- One of the largest contiguous, unfragmented forest blocks in southwestern NH
- Matrix spatial pattern: extensive, contiguous cover across landscape

- State Lands
  - Pillsbury State Park to the south
  - Connected via the Pillsbury-Sunapee Corridor and conservation easements



Mt. Sunapee History

1906–1910 — Extensive logging on north face; remanent original forest remained in small areas

1911 — SPNHF purchased 656 ac of Mt. Sunapee to protect its “primeval forests” from logging

1934 — SPNHF owned 1,185 ac of cut & old forest

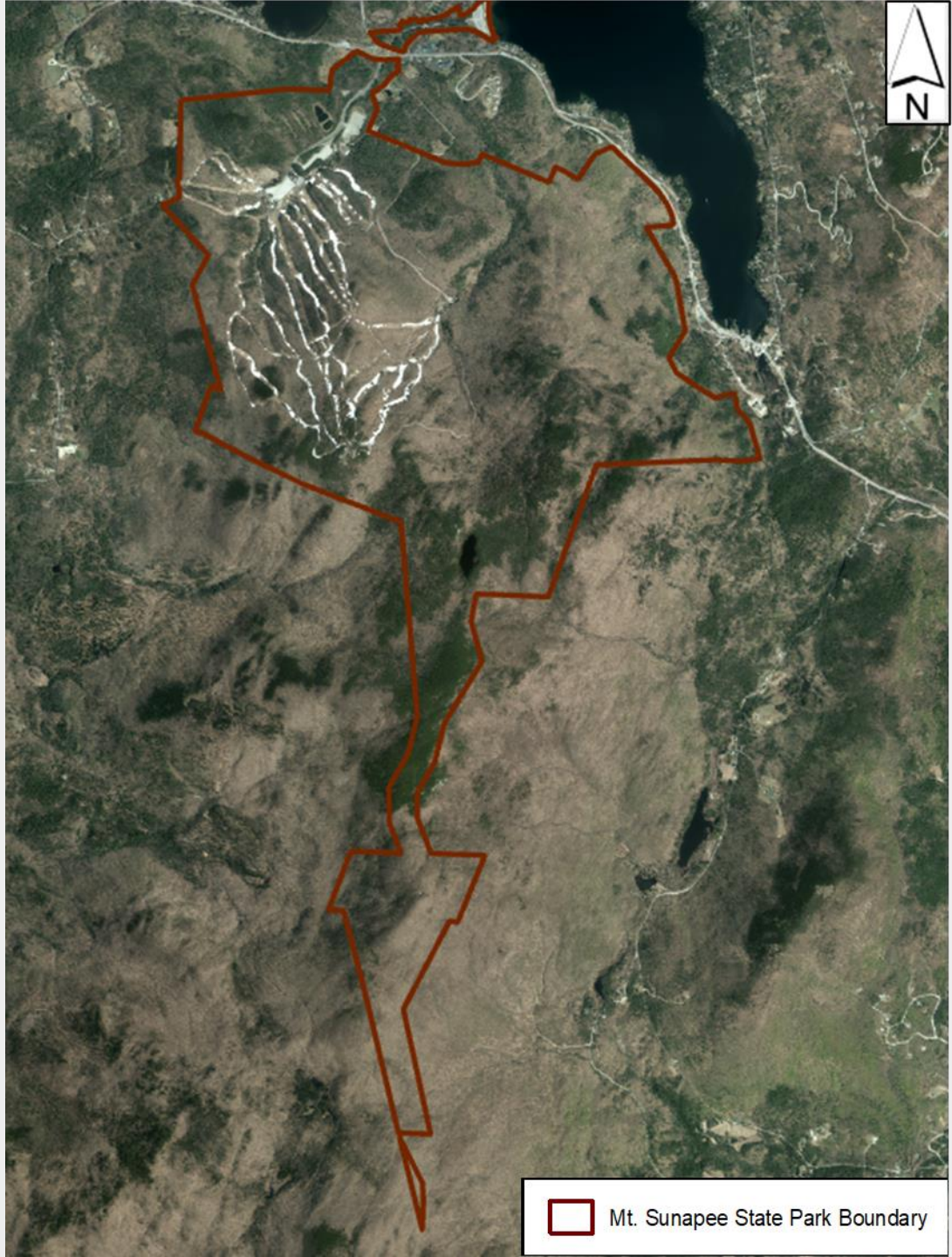
1938 — Hurricane significantly impacted ridgeline and summit

1948 — State took ownership; opened Mt. Sunapee State Park

1997 — Chris Kane rediscovered forgotten old growth

1998 — Moderate-heavy damage from major ice storm

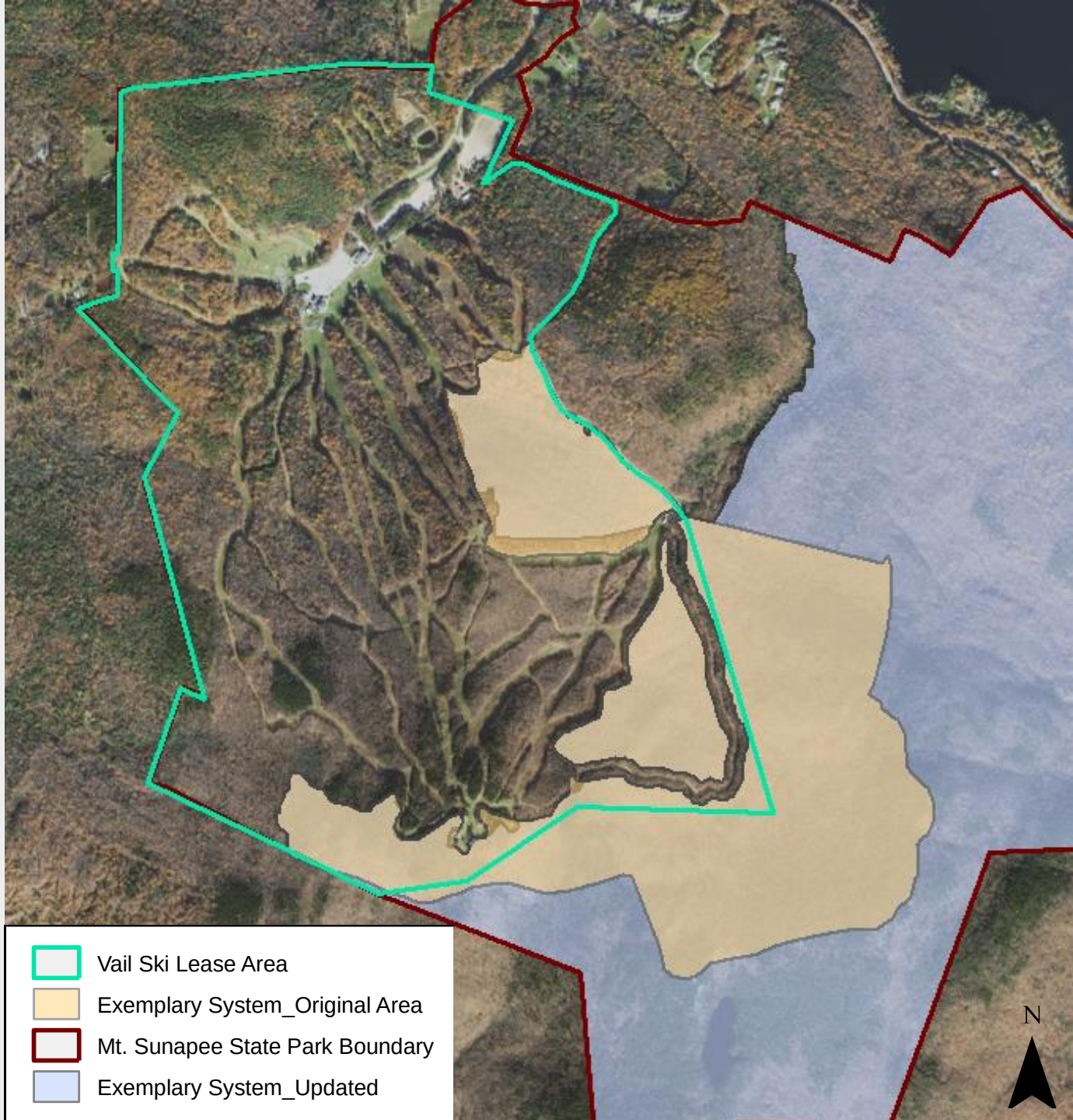
1999 — Designation of exemplary **northern hardwood - conifer forest system**



Exemplary Northern Hardwood - Conifer Forest System

Extent:

- Entirely within State Park
- Expanding to encompass ridgeline, eastern park boundary
- Johnson Brook forms northern boundary
- Slight reduction to extent within Vail lease area



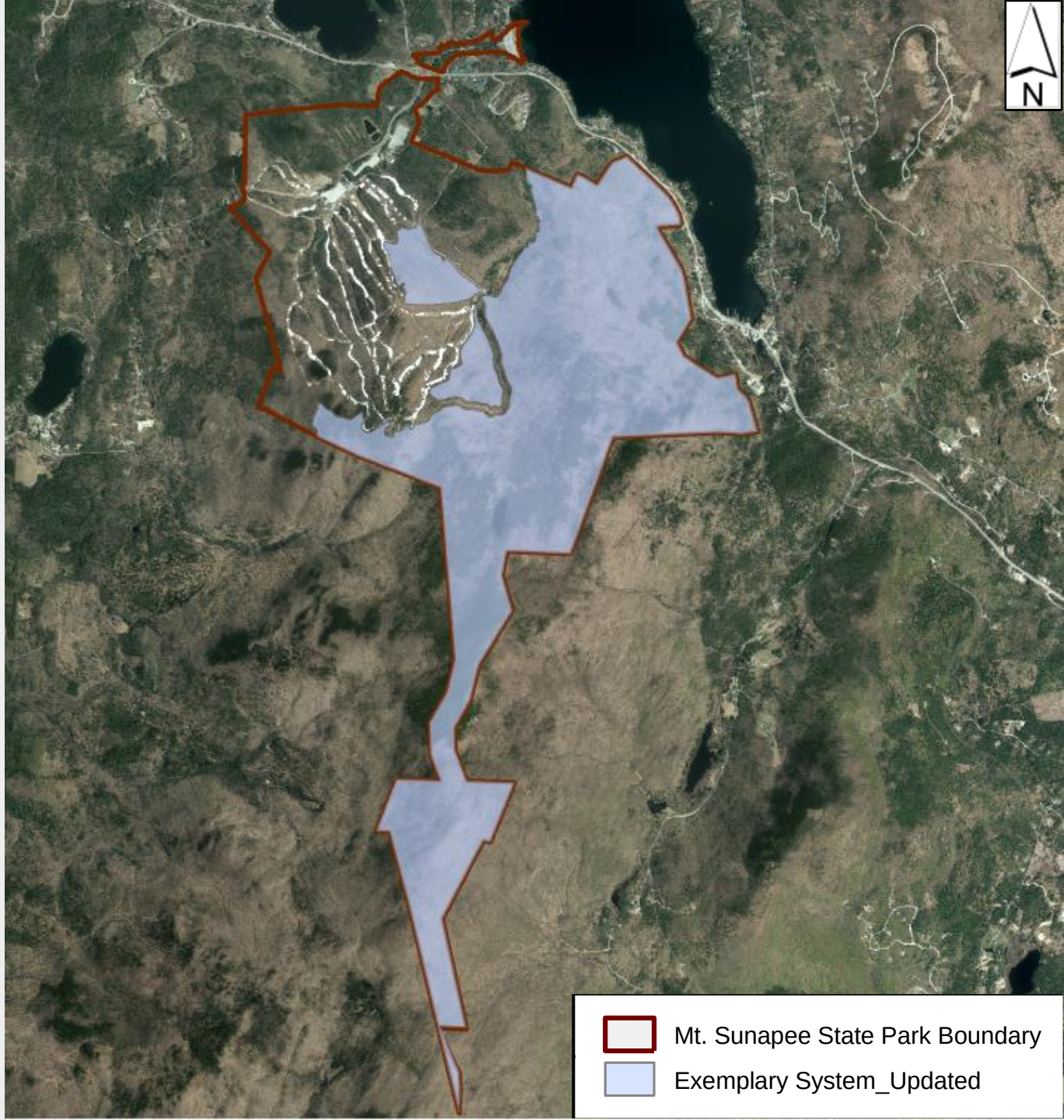
Ecological Significance of Exemplary Forest System

- Major diagnostic natural communities:
  - *sugar maple - beech - yellow birch forest*
  - *northern hardwood spruce - fir forest*
- Additional diagnostic natural community:
  - *semi-rich mesic sugar maple forest*
- One of two exemplary examples where these forest types co-occur in NH
- ~65 ac of very rare old forest in East Bowl
- High quality example of a common assemblage of forest types
- Small inclusions of:
  - *high elevation spruce - fir forest* (ridgeline)
  - *temperate acidic cliff* (Whites Ledge)

Why Enlarge the Exemplary Forest System?

- Spatial pattern type must be considered for adequate protection an ecosystem
- A **matrix forest** requires protection at a larger landscape scale to maintain optimal functioning

- Benefits include:
  - Enhanced biological legacy (genetic variation, seed sources, species diversity, etc.)
  - Integrity of ecological processes & patterns (buffering capacity from natural disturbances at various scales, succession, etc.)
  - Sustaining viable populations of area-dependent plants/animals
  - Forest buffering of the old growth areas, enhancing resiliency
  - Allows mature forest to reach old age
- Meets exemplary criteria, verified by Upland EIA method…



Massive Roots of Large Old Red Spruce

Old Stunted Beech Stand

Pete Bowman Coring Red Maple

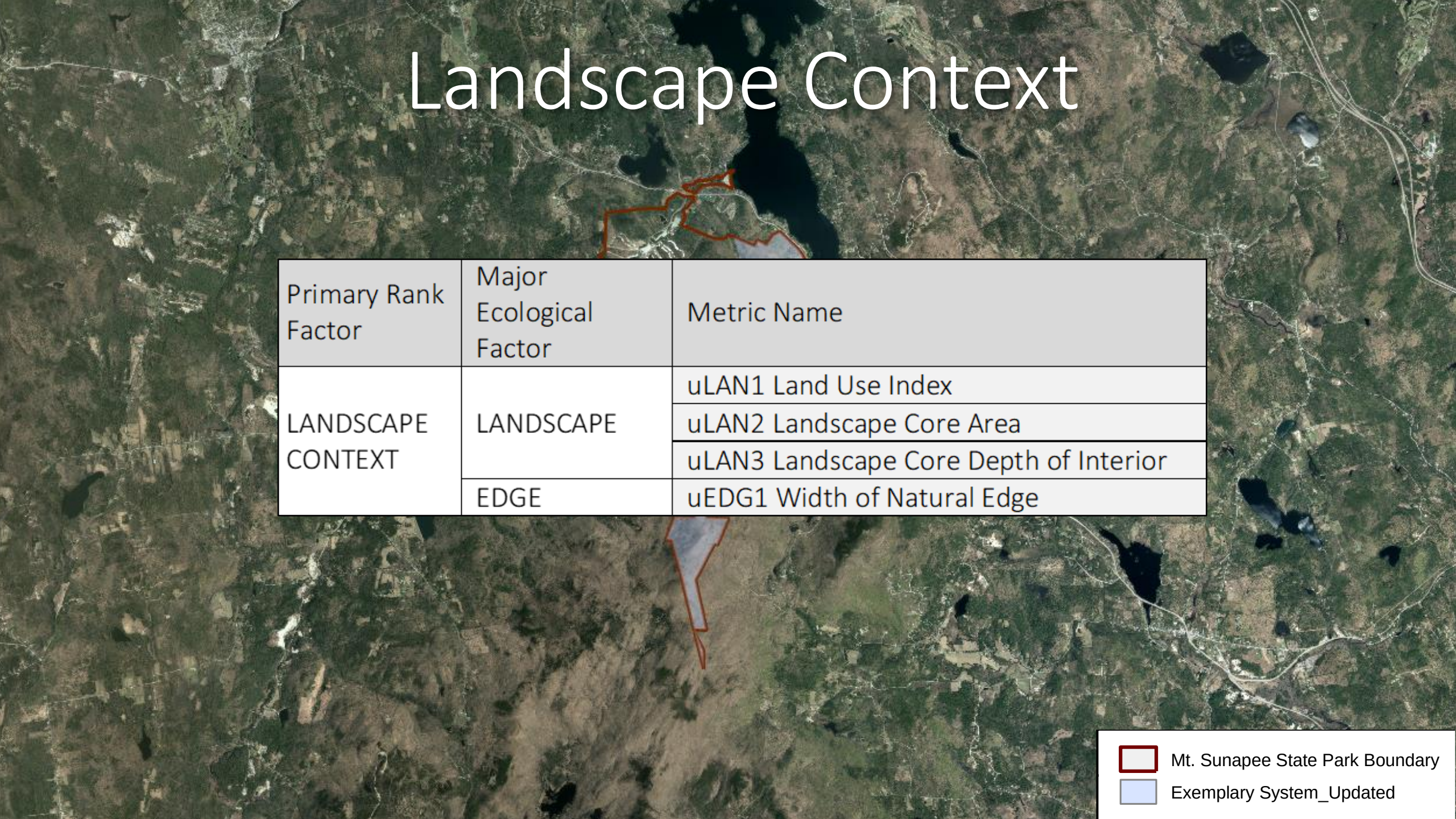
Sugar Maple – Beech – Yellow Birch Forest

Crown Regrowth on Yellow Birch

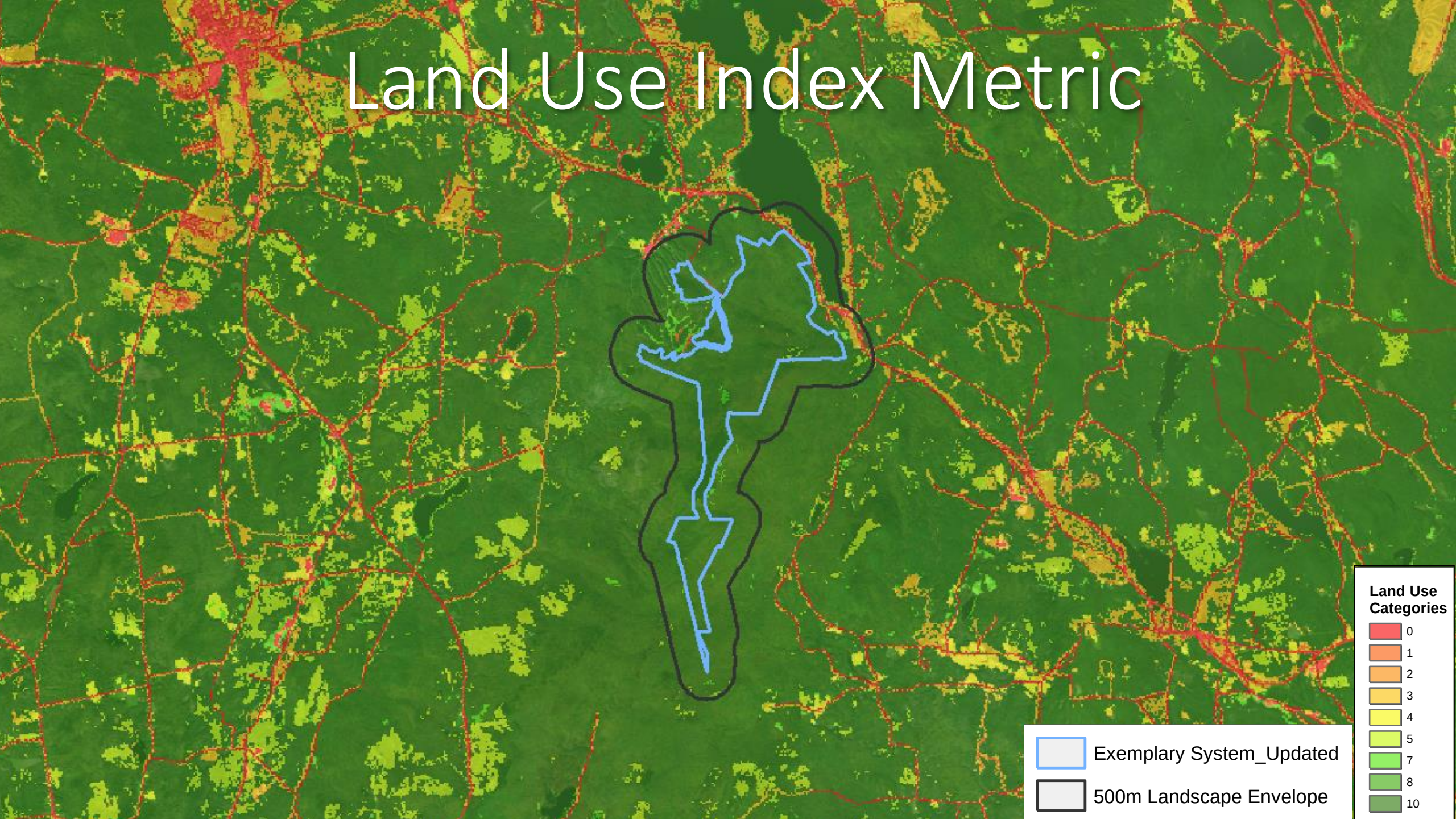
Stunted, Snag-Headed Old Yellow Birch

Landscape Context

Primary Rank Factor	Major Ecological Factor	Metric Name
LANDSCAPE CONTEXT	LANDSCAPE	uLAN1 Land Use Index
		uLAN2 Landscape Core Area
		uLAN3 Landscape Core Depth of Interior
	EDGE	uEDG1 Width of Natural Edge



Land Use Index Metric

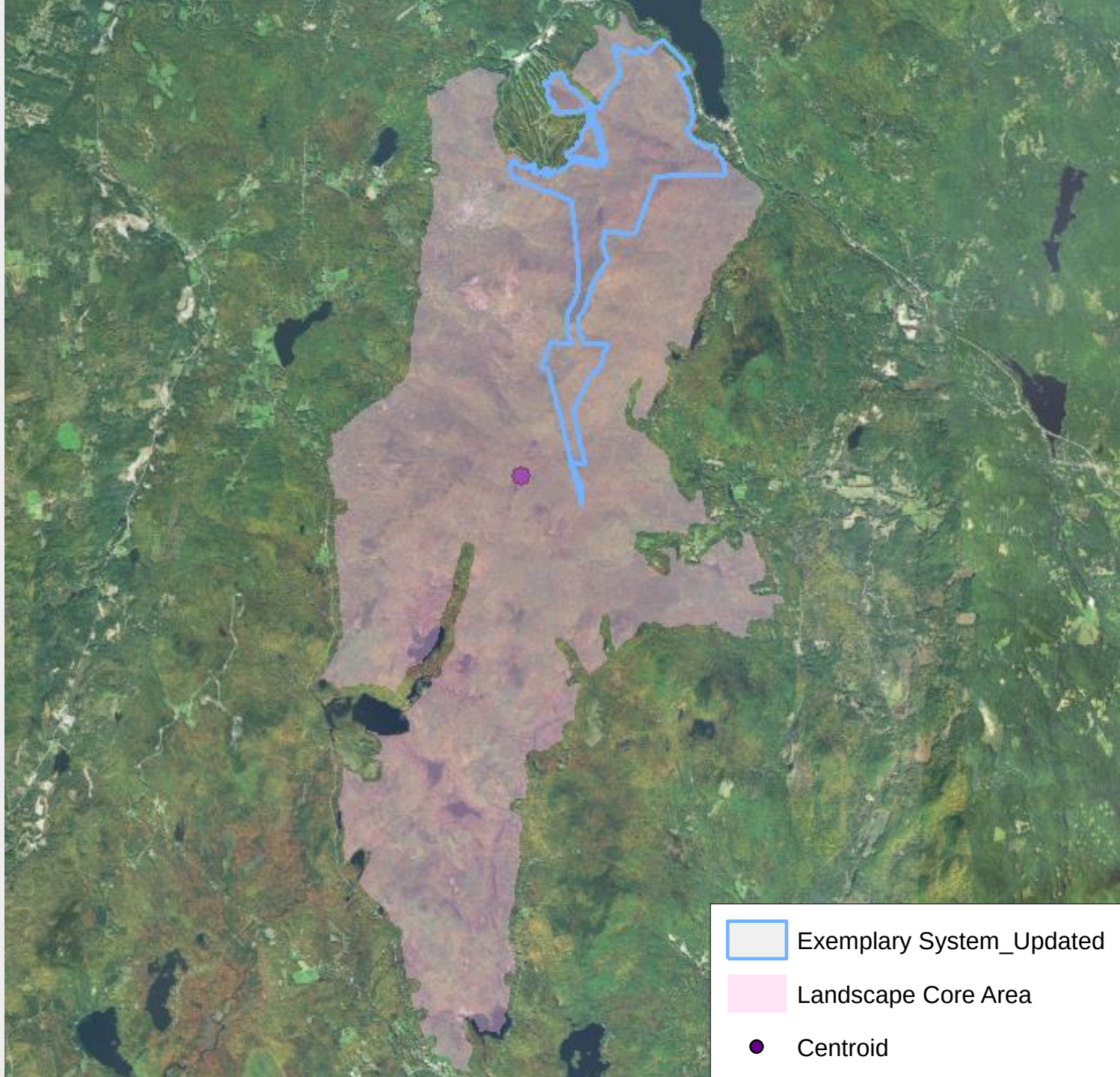


Landscape Core Area Metric

- Measures area of natural land cover encompassing the system that is beyond the influence of most edge effects
- Ecological integrity of system is contingent on context of matrix landscape it is within

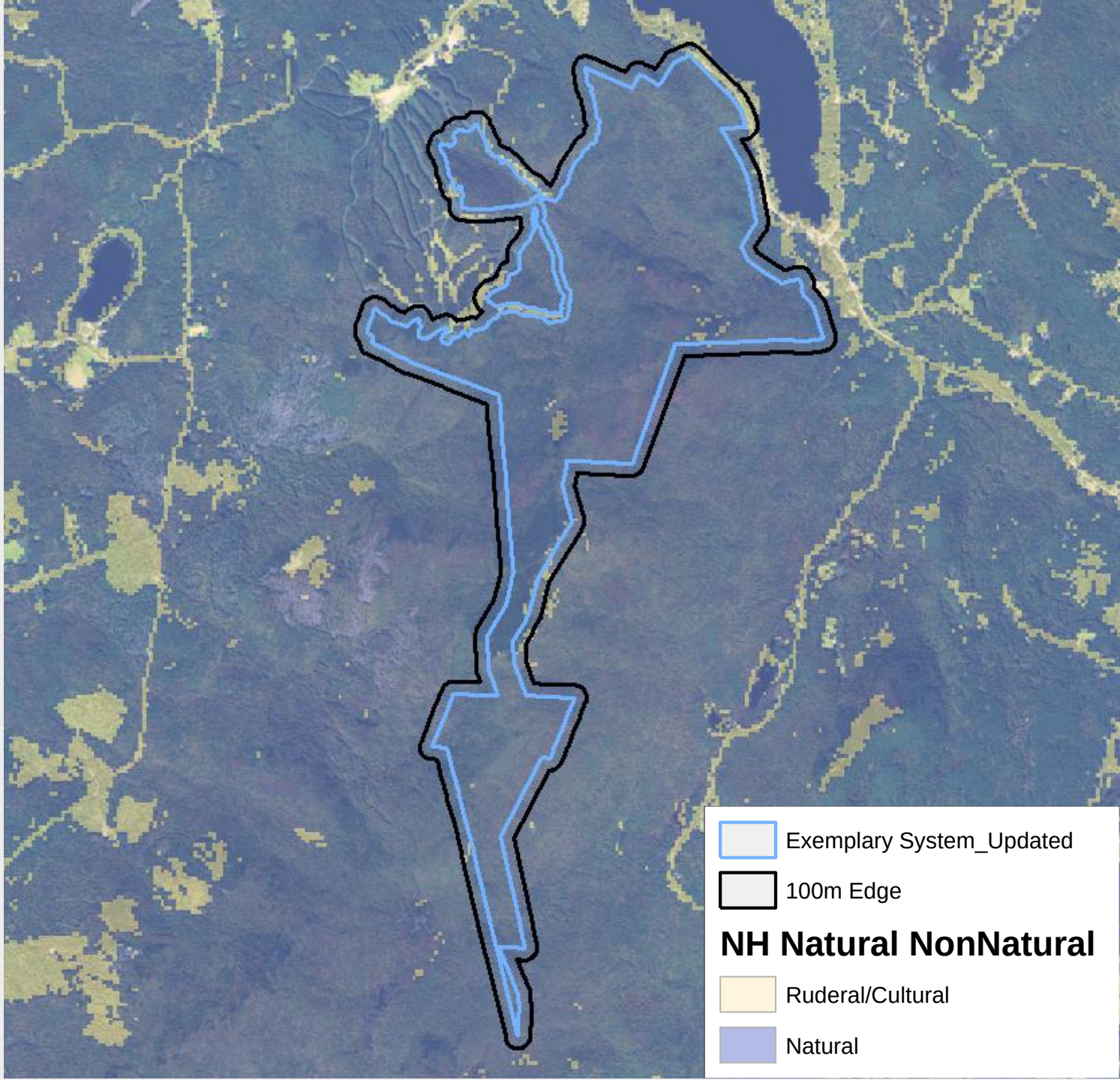
Landscape Core Depth of Interior Metric

- Extent that core is minimally impacted by non-natural processes
- Measures depth of centroid within core area



Width of Natural Edge Metric

- Assesses edge effects on ecosystem within 100m edge of system boundary
- Measures average width of natural edge



Landscape Context Metric Results

Primary Rank Factor	Major Ecological Factor	Metric Name	Metric Results
LANDSCAPE CONTEXT	LANDSCAPE	Land Use Index	B+
		Landscape Core Area	A-
		Landscape Core Depth of Interior	A
	EDGE	Width of Natural Edge	B+

Condition

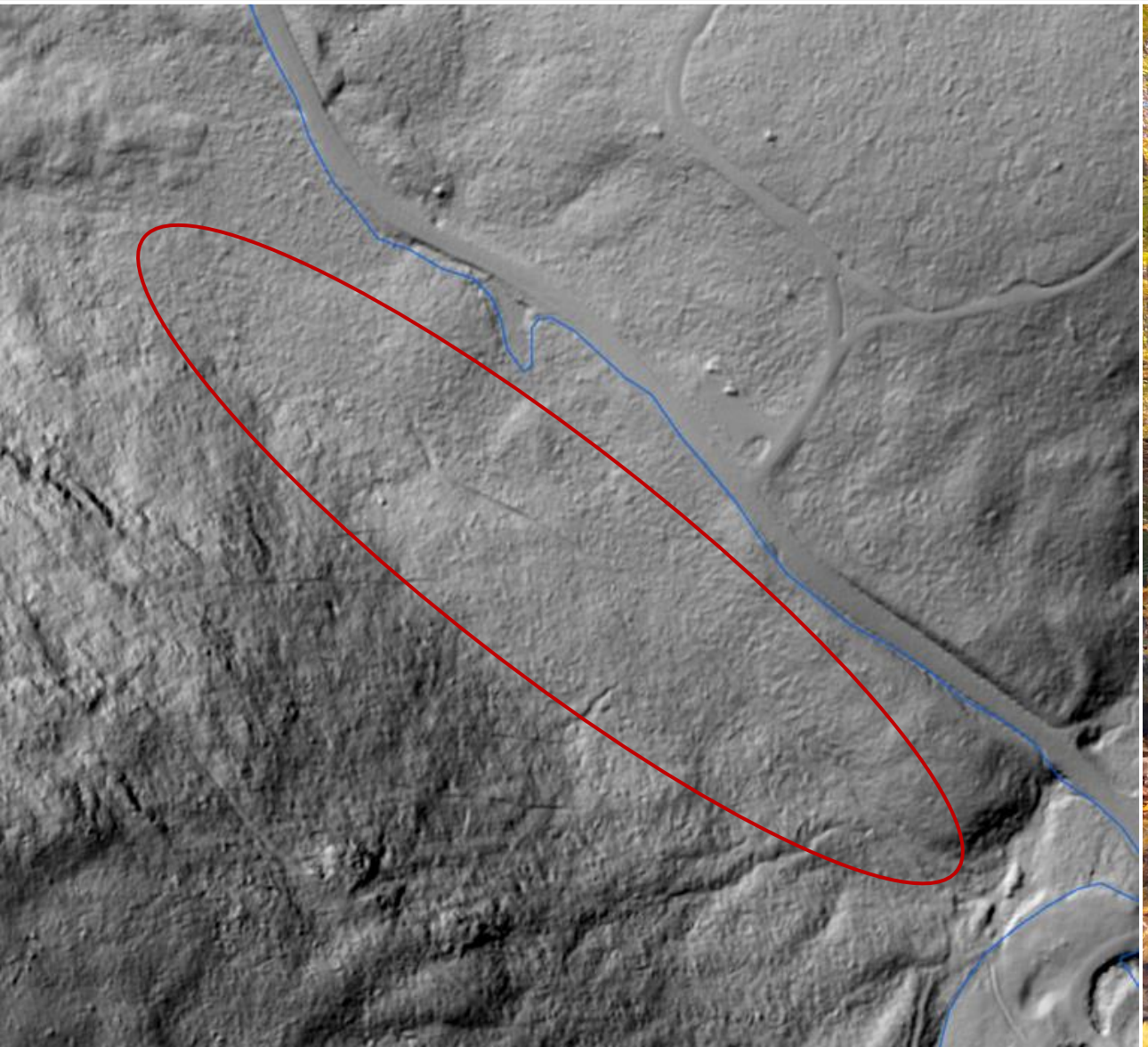
CONDITION	VEGETATION	uVEG1 Native Plant Species Cover
		uVEG2 Invasive Nonnative Plant Species Cover
		uVEG3 Native Plant Species Composition
		uVEG4 Vegetation Structure
		uVEG5 Woody Regeneration
		uVEG6 Coarse Woody Debris, Snags, and Litter
	SOIL	uSOI1 Soil/Substrate Condition

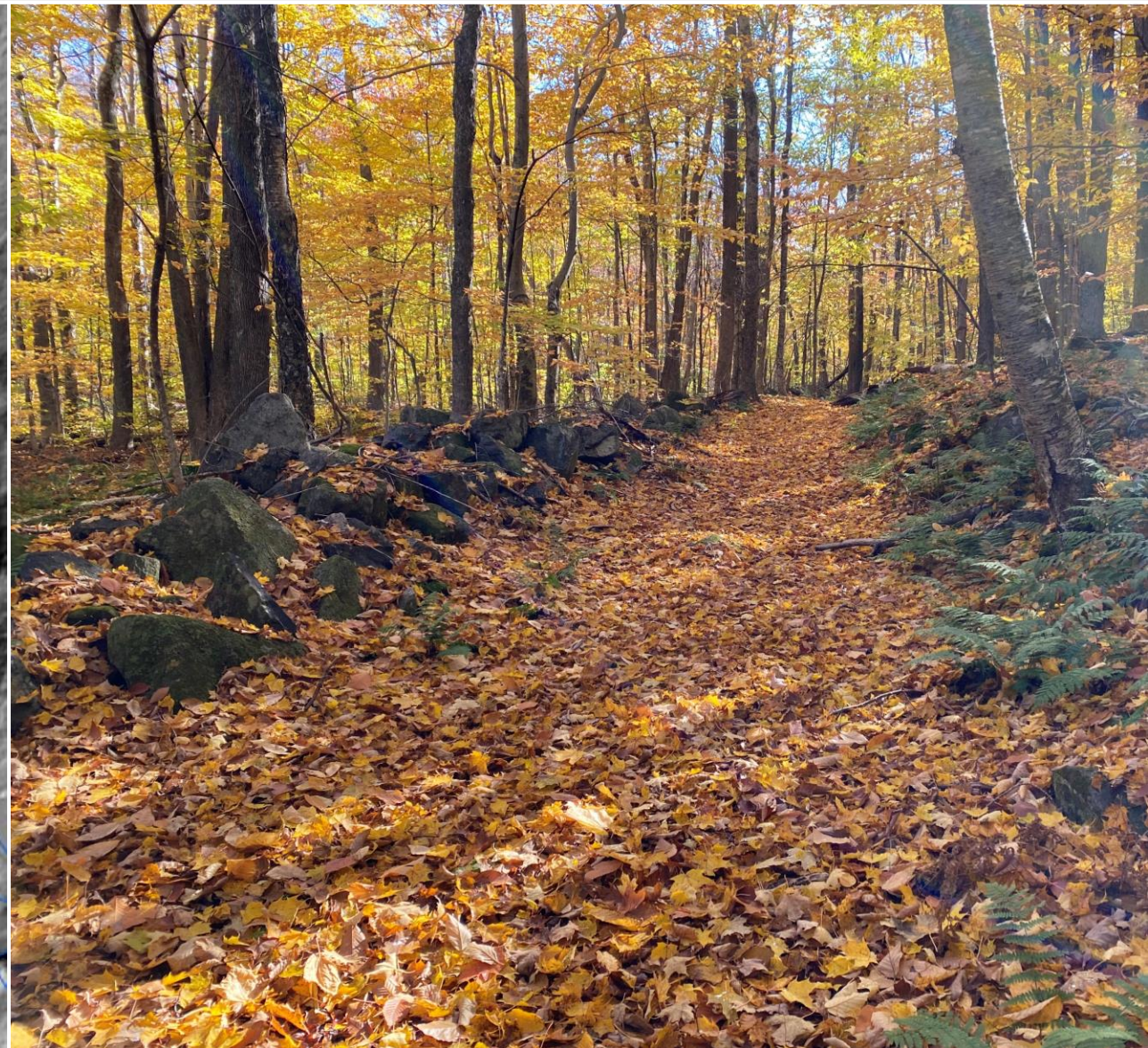
Native Plant Species Cover
Invasive Nonnative Plant Species Cover
Native Plant Composition



Vegetation Structure
Woody Regeneration
CWD & Snags

Soil/Substrate Condition





Condition Metric Results

Primary Rank Factor	Major Ecological Factor	Metric Name	Metric Results
CONDITION	VEGETATION	Native Plant Species Cover	A
		Invasive Nonnative Plant Species Cover	A
		Native Plant Species Composition	B
		Vegetation Structure	B
		Woody Regeneration	A
		Coarse Woody Debris & Snags	B
	SOIL	Soil/Substrate Condition	B+

Comparative Size Metric

SIZE							
4-20-2023 Draft Comparative Size Rating Table for Upland Systems (Acres)							
Spatial Pattern Type	Metric Rating						
	Excellent		Good		Fair		Poor
	A	A-	B+	B-	C+	C-	D
Matrix (ac) Hemlock - hardwood - pine forest system High-elevation spruce - fir forest system Northern hardwood - conifer forest system	≥12,500	12,499–11,275	11,274–6,250	6,249–1,250	1,249–750	749–250	<250

Primary Rank Factor	Major Ecological Factor	Metric Name	Metric Results
SIZE	SIZE	Comparative Size	B-

Upland EIA Results
Northern Hardwood - Conifer Forest System

Upland EIA Rank = B+

High quality example of a common ecological system with minimal impacts

- Results inform & enhance:
  - Regulatory/non-regulatory environmental reviews at Sunapee
  - Land Management Planning & Conservation Decisions
  - Restoration & Mitigation Actions
  - Monitoring of exemplary matrix forest system condition

THANK YOU

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