



8 Years of Forest Health Monitoring in Acadia National Park

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Introduction

Since 2006, the Northeast Temperate Network (NETN) has been monitoring forest health annually in Acadia National Park (Acadia NP). The NETN forest protocol is based on the USDA Forest Service's Forest Inventory and Analysis program, and was developed in collaboration with 4 other Inventory and Monitoring Networks in the eastern US.

The overall goals of the forest monitoring program are to assess status and trends in the composition, structure, and function of forested ecosystems, and to report the condition of forest systems in a way that effectively informs park managers and other stakeholders.

To interpret forest condition NETN developed an Ecological Integrity Scorecard that rates condition for a suite of metrics addressing forest structure, composition and function. For each metric, assessment points were defined that distinguish acceptable or expected conditions from undesired conditions based on current scientific understanding of their natural or historic range of variation. Ecological Integrity is interpreted using three categories, where **"Good"** represents acceptable or expected conditions; **"Caution"** indicates a problem may exist; and **"Significant Concern"** indicates undesired conditions that may need management action.

Methods

Permanent forest plots are sampled every 4 years using a rotating panel design. One panel is sampled each year at Acadia NP and in alternate years at the nine National Historical Parks and Historic Sites. Monitoring in Acadia NP covers east and west sections of Mount Desert Island (MDI), Isle au Haut (IAH), and Schoodic Peninsula (Schoodic). Plots were randomly located within each park. Data related to forest structure, function and composition are collected in each plot (Figure 1).

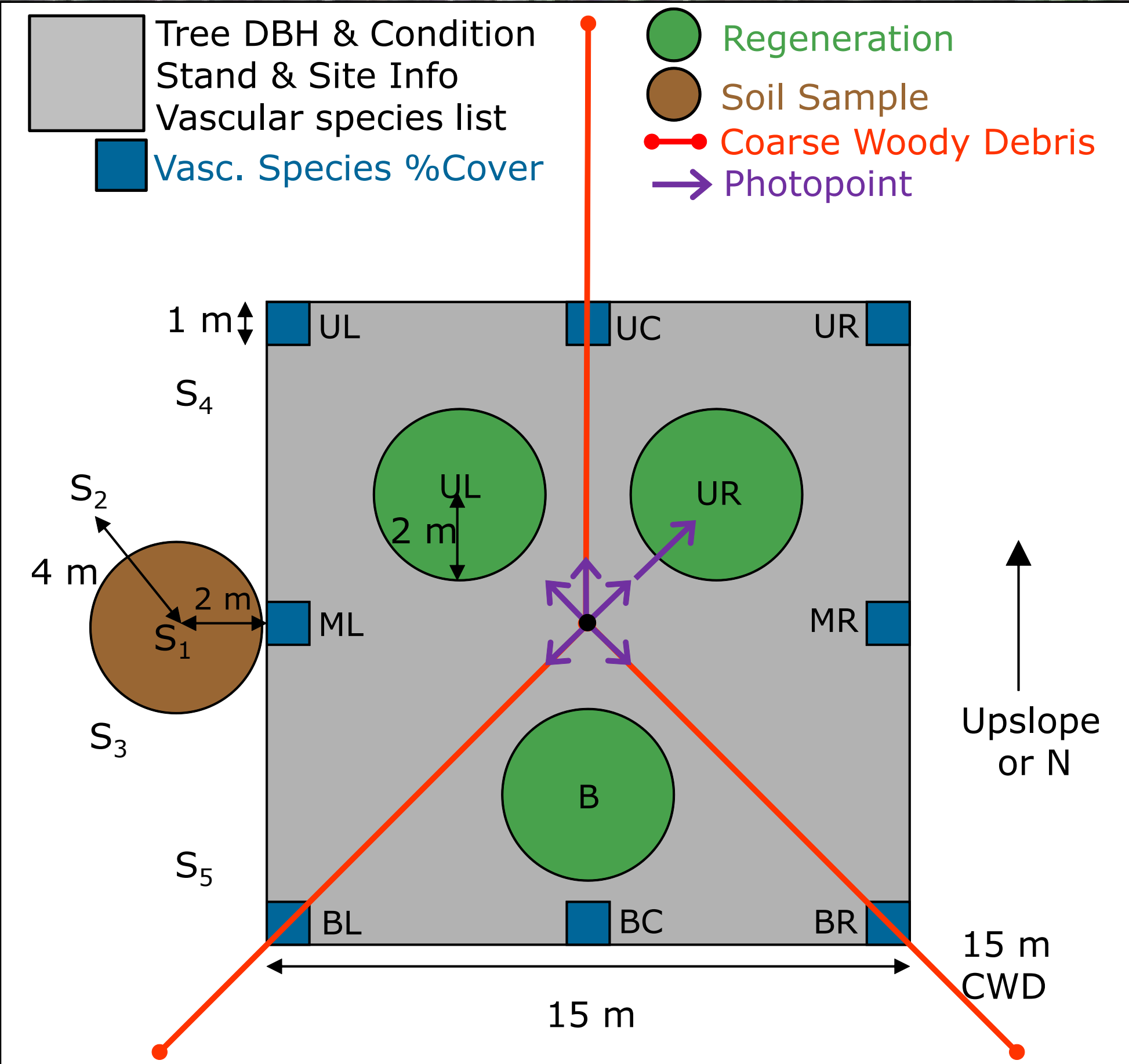


Figure 1. Diagram of NETN Forest plot. Diameter at Breast Height is abbreviated as DBH.

Results

2010-2013 Ecological Integrity Scorecard

Table 1. Ecological Integrity Scorecard for subunits of Acadia National Park. Ratings are based on data collected from 2010-2013. Green indicates "Good" condition, yellow is "Caution", and red is "Significant Concern". DBH refers to diameter at breast height.

Metric Type	Metric	Calculation	IAH	MDI-East	MDI-West	Schoodic
Landscape Context ¹	Anthropogenic Land Use (ALU)	% ALU within 400 m buffer of forest plots	0.9	4.1	1.8	3.8
	Forest Patch Size ²	% of forest area in each patch size category				
Structure	Structural Stage Distribution	% of late successional plots	0	8.8	18.5	0
		% of late successional and mature plots	66.7	42.6	77.8	100
	Snag Abundance	% of trees that are snags	12.9	14.6	16.6	25.1
		% of trees ≥ 30cm DBH that are snags	14.3	7.5	10.3	0
		# snags > 30cm DBH/ ha	11.7	5.4	10.9	0
	Coarse Woody Debris (CWD)	CWD volume (m3/ha)	21.9	15.9	34.1	19.4
Composition	Tree regeneration ³	% Live tree vol:CWD vol. ratio	11.3	10.0	14.8	10.7
		Stocking index	123.7	119.3	205.5	142.1
		sapling:small seedling ratio	0.60	0.70	0.54	0.19
	Tree condition & forest pests ⁴	Deer browse index	2.4	2.5	2.4	2.6
		% of plots with each rating				
	Indicator invasive species	# of plot detections/ total # of plots	0/19	3/82	0/65	0/10
Function	Soil Chemistry: acid stress ⁵	Median Ca:Al (O & A)	4.1	2.7	3.5	4.8
		Ave. pH (O horizon)	3.81	3.89	3.83	3.73
		Ave. % base saturation (O)	58.76	56.80	53.70	61.39
		Ave. % Al saturation (O)	16.29	16.31	17.44	12.20
	Soil Chemistry: N saturation ⁵	Median C:N (O & A)	33.6	29.9	34.6	40.8
	Tree growth and mortality rates	% Basal area growth/year	1.69	1.96	1.72	1.52
		% Annual mortality rate	0.45	0.88	1.07	4.57

¹Based on 2010 analysis

²Metric was not rated for ecological integrity, due to presence of naturally occurring woodland habitats. Pie charts represent the proportion of forest patches in the following patch size categories: >50 ha (dark green), 10-50 ha (green), <10 ha (light green).

³Tree regeneration is rated overall for abundance (Good) and pattern compared to late-successional forests (Caution). "—" indicates too few plots to rate the metric

⁴Pie charts represent the proportion of plots in each ecological integrity rating category.

⁵Based on 2009-2012 sample data.

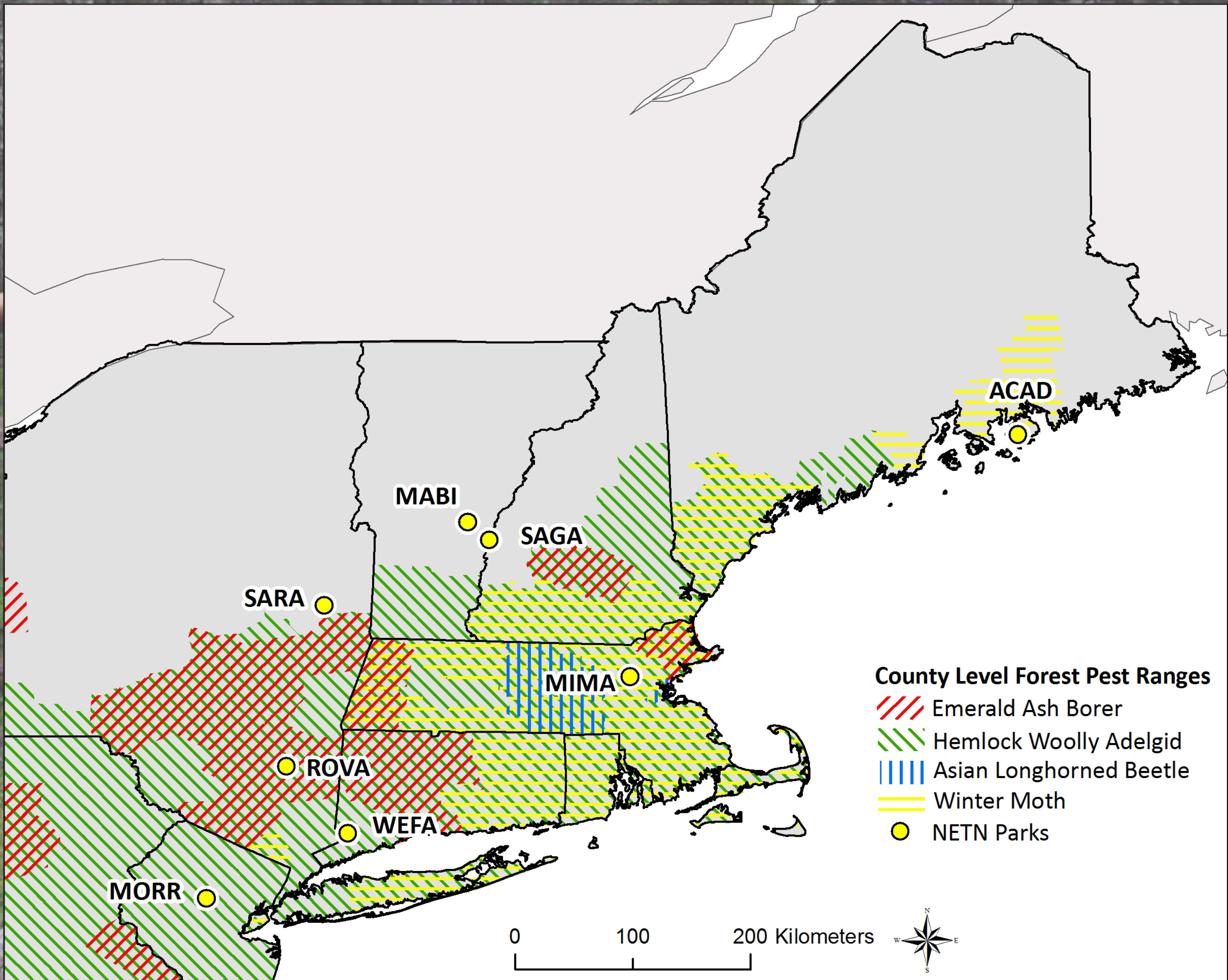


Figure 2. Exotic forest pest detections near NETN parks. Pest ranges were mapped at the county level and were downloaded from the Alien Forest Pest Explorer (<http://www.nrs.fs.fed.us/tools/afpe/maps/>), and the Cooperative EAB Project (<http://www.emerald-dashborer.info>). Asian Longhorned Beetle range only reflects the most recent detection that has not yet been eradicated.

Cycle 1 (2006-2009) and Cycle 2 (2010-2013) comparisons

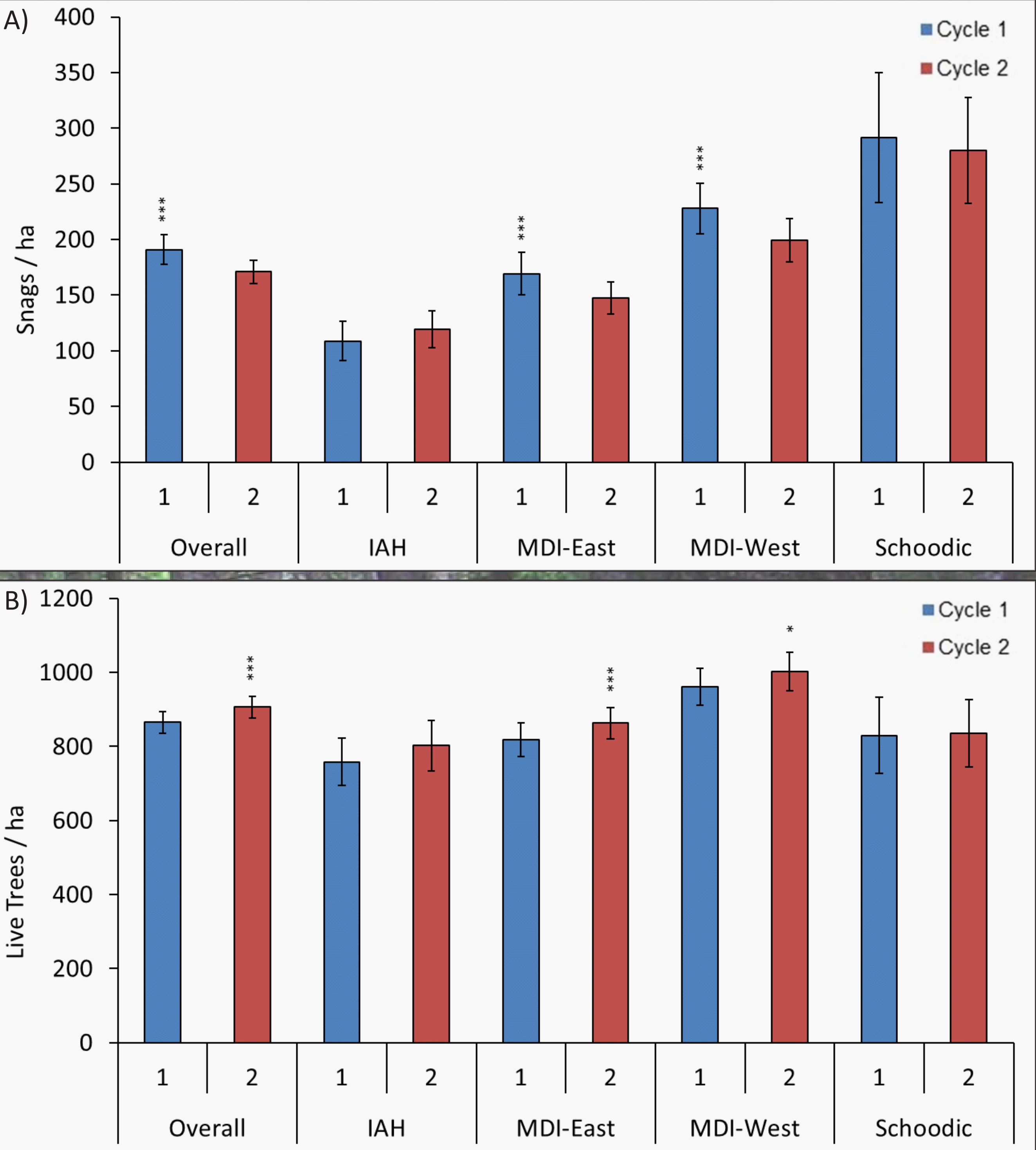


Figure 3: Average density of A) snags/ ha and B) live trees/ ha, by park unit and by cycle in ACAD. Error bars are ±1 standard error around the mean. Paired t-test significance levels are indicated by *, where * is significant at p-value < 0.1, ** is significant at p-value < 0.05, and *** is significant at p-value < 0.01, and are denoted on the higher mean.

Conclusions

- Forests in Acadia NP are largely composed of native species
- Regeneration is abundant, and deer impacts are minimal
- Overall tree condition is good, but threatened by several exotic pests
- Forest soils are vulnerable to acid deposition
- Late successional forest and structure (CWD & snags) are below desired levels
- Tree growth rates are below regional rates, and tree mortality rates are within expected ranges
- Snag density of birch/aspen is decreasing and live tree density of conifers is increasing on eastern MDI as forests transition from early successional hardwoods to spruce-fir forest
- Snag density of conifers is decreasing and live tree density of conifers is increasing on western MDI as forests succeed into mature spruce-fir forest
- As long as forests are left to succeed, and stressors do not disrupt forest processes, forest condition will continue to improve over time

For More Information

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Access protocols and reports online:
<http://science.nature.nps.gov/im/units/NETN/index.cfm>