

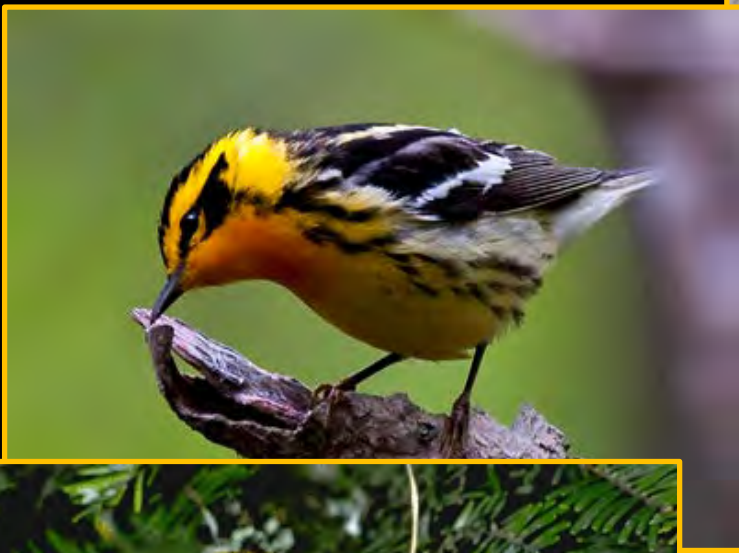
Forest Structure and Bird Assemblages in Old-Growth and Managed Hemlock–Hardwood Forests of the Western Laurentian Great Lakes Region, USA

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Definitions

Within Curtis's (1959) northern mesic forest and Kotar et al.'s (2002) ATD and ATM types. Sugar maple, hemlock, yellow birch, with basswood, white ash, red maple, ironwood.

Type

Hardwood: <22% hemlock basal area; Sylvania

Hemlock: 25-66% hemlock basal area; Sylvania and SNA/RNA

Treatment

Oldgrowth: no cutting except occasional white pine; >1/3 of canopy >60cm dbh & >150 yr old

Uneven-Age Managed: origin even-age or oldgrowth; single- or group selection; cut within 2-40 yr; multi-aged

Even-Age Managed: regenerated after clearcut, age 58-85 yr; 4 stands thinned 3-10 yr prior









Other Areas Surveyed

40+ managed stands

Oldgrowth at Porcupine Mts, Huron Mts, Sylvania

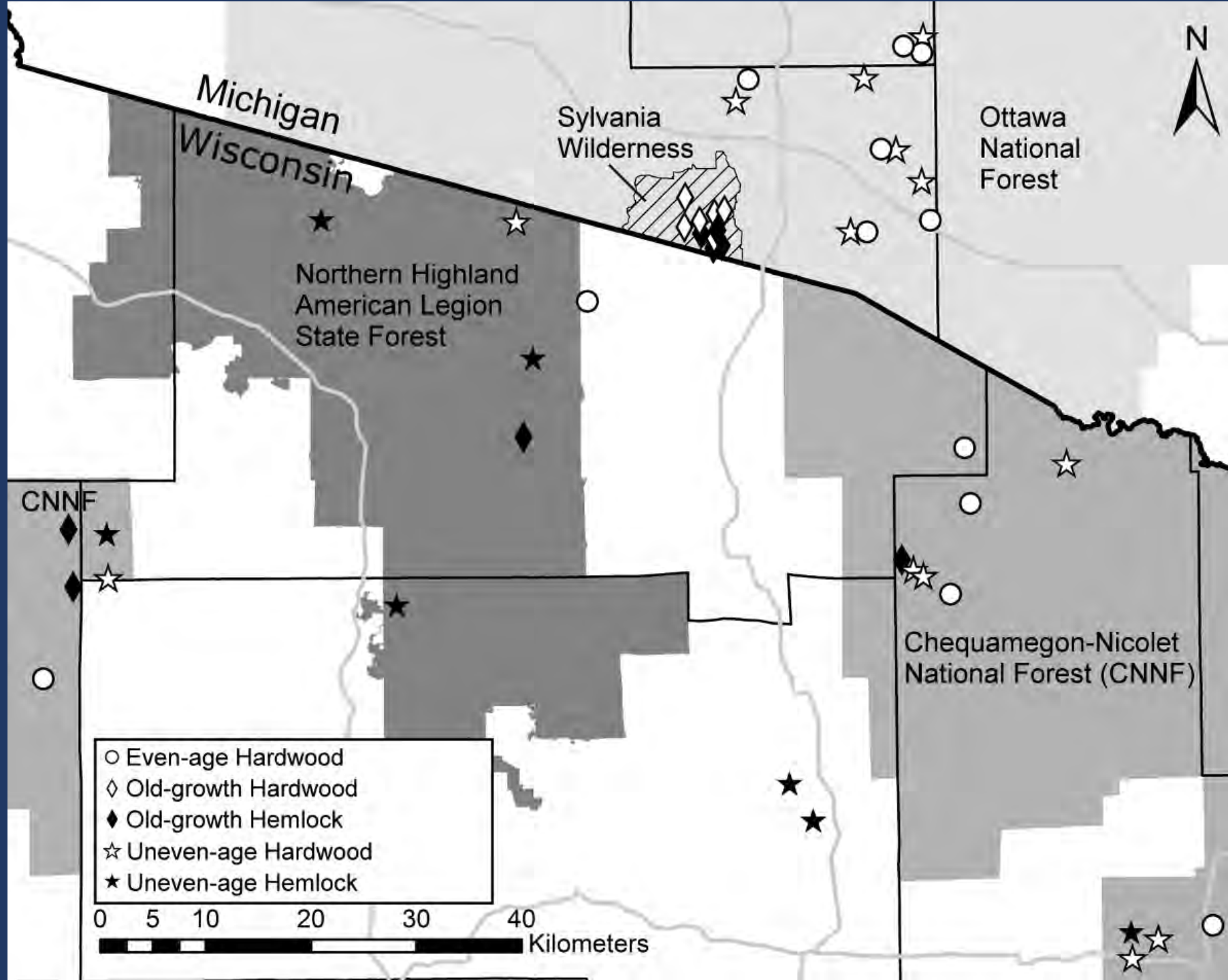
Additional SNAs and RNAs

Menominee Reservation

Outer Island managed and oldgrowth







Study Design

Total 46 sites

Northern Hardwoods



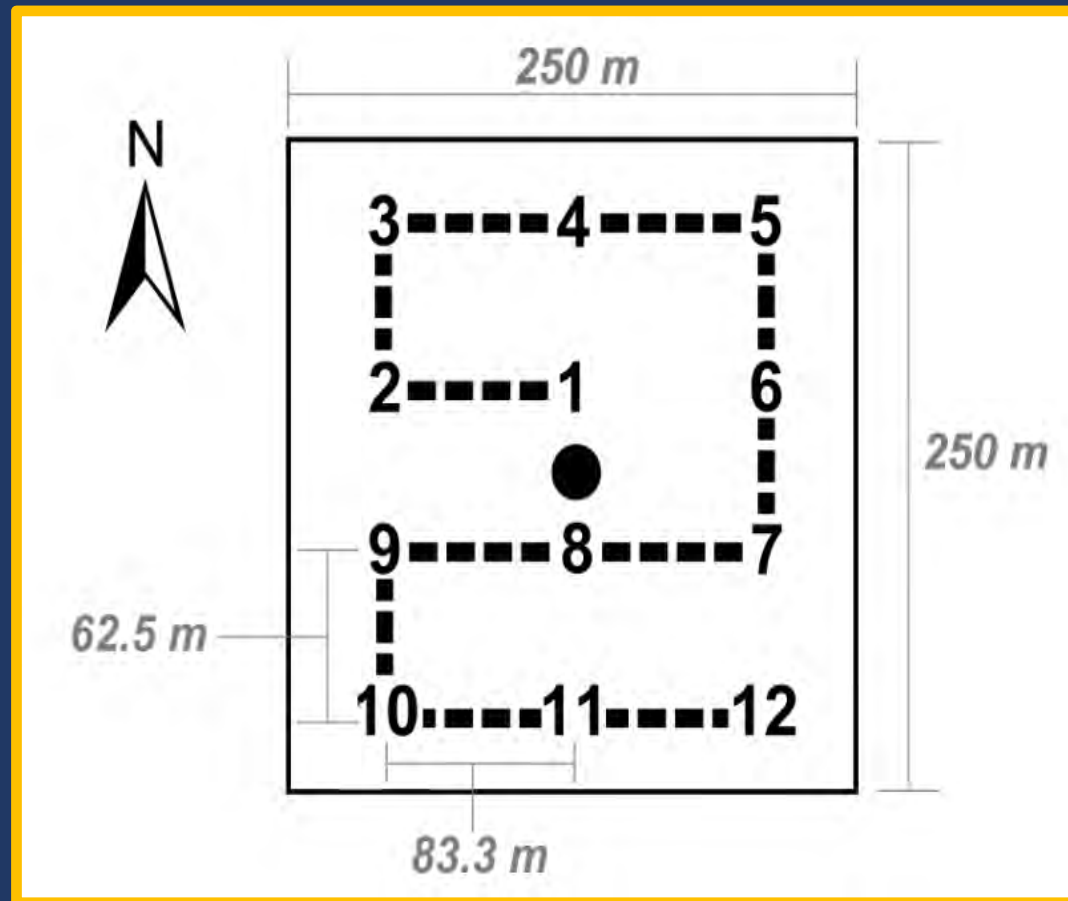
Hemlock



Bird Sampling

- 250x250m plots (6.25ha, 15 acre)
- 3 annual visits, 2 years
- Point-counts and 3-hr spot-map by team of 2
- Daily estimate of # individuals and pairs

Placement of 12 vegetation sampling plots and 833m-long line-intercept transect in 6.25ha study plot.



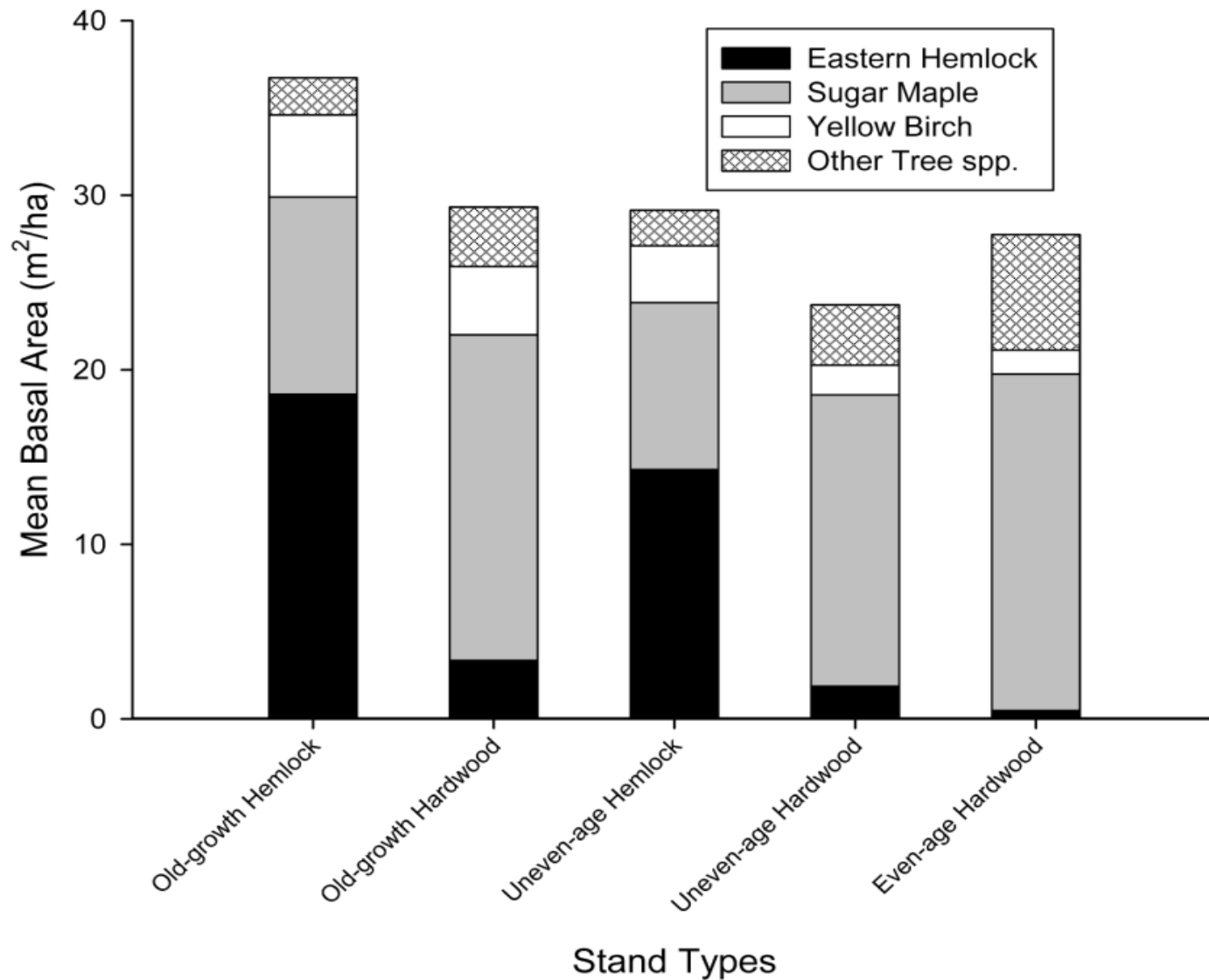
Habitat Sampling

- 12 sampling points and 11 transect segments
- Timber cruise with 10x gauge, by 10cm size class; max canopy ht
- Woody understory stems by species and 4 ht classes in 20m²
- Snags, loose bark plates >10x10cm; tip-ups
- Canopy gaps >2.5m wide
- DWD dia, species decay class, type, origin

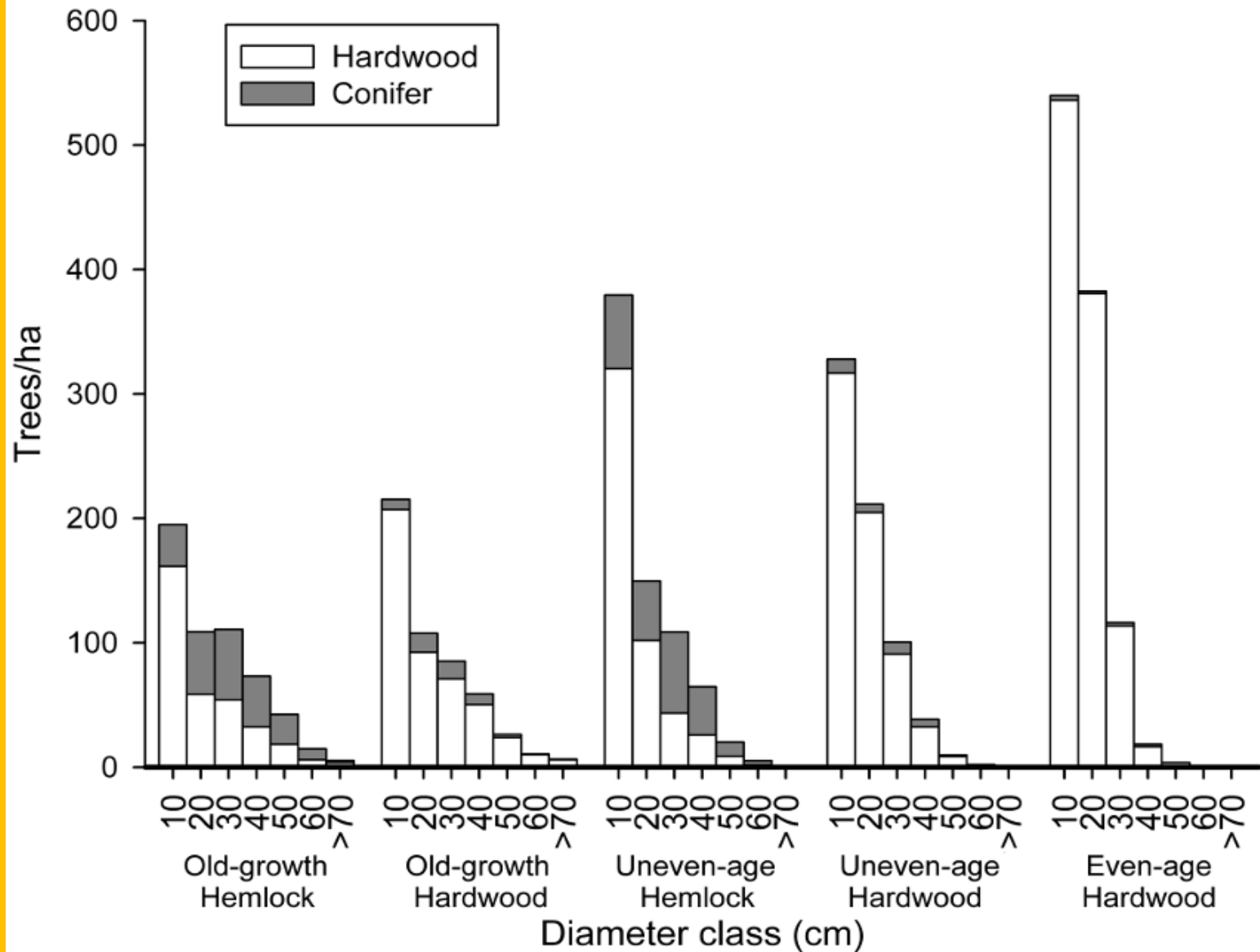
Landscape Variables

- Distance to nearest road
- Distance to nearest water body
- % forest cover within 500m

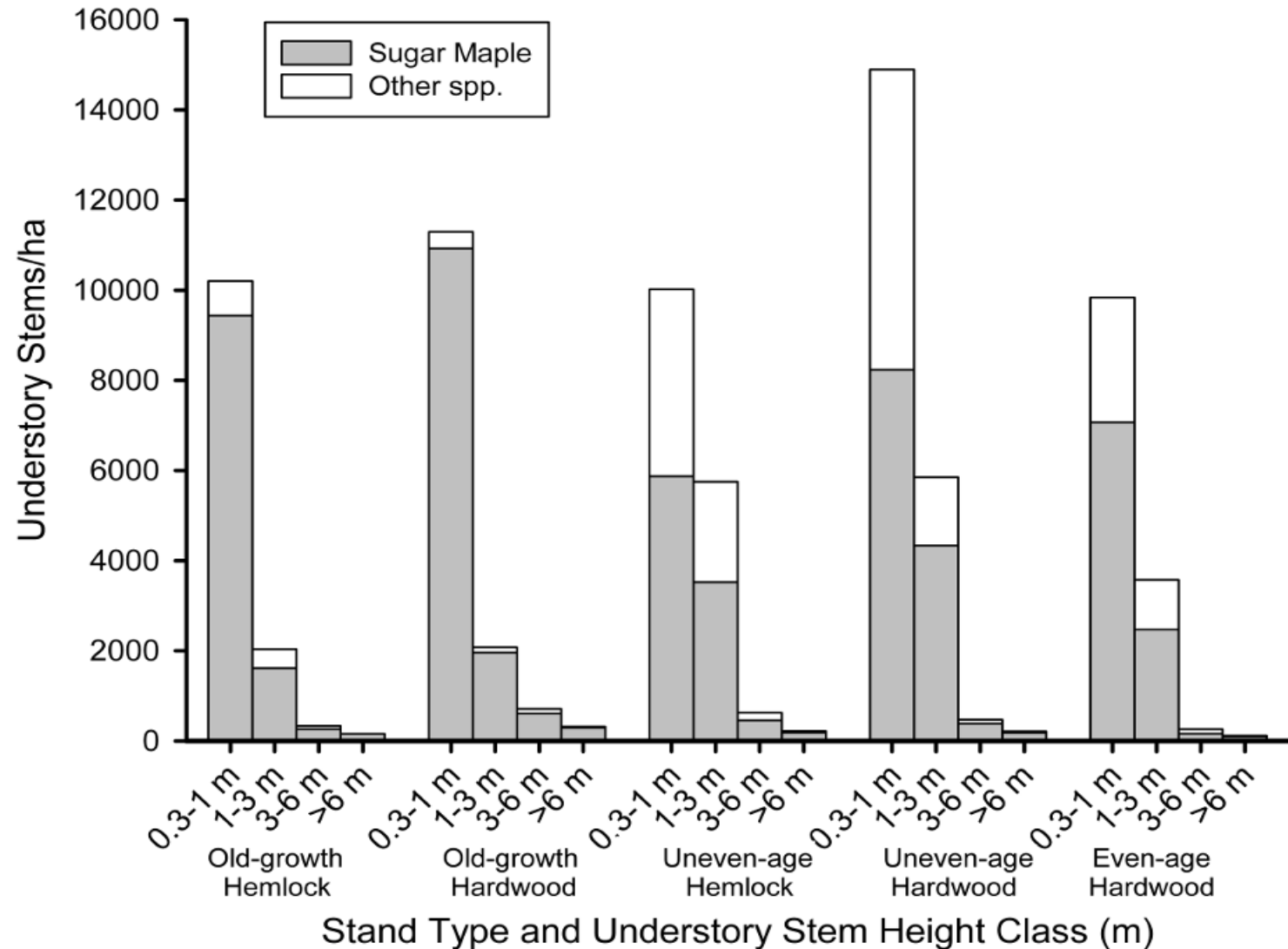
Basal area of live trees.



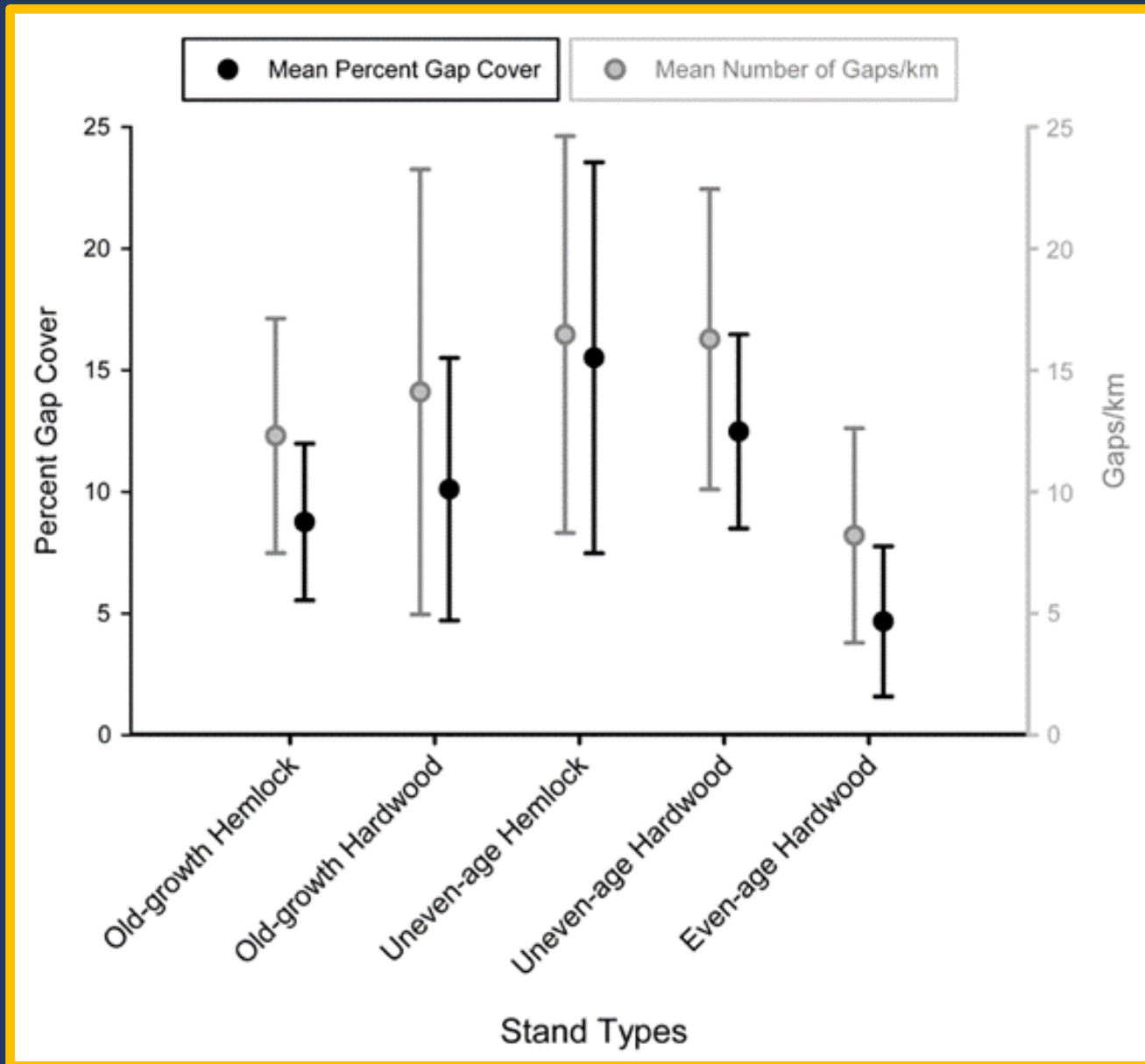
Tree size class distribution.



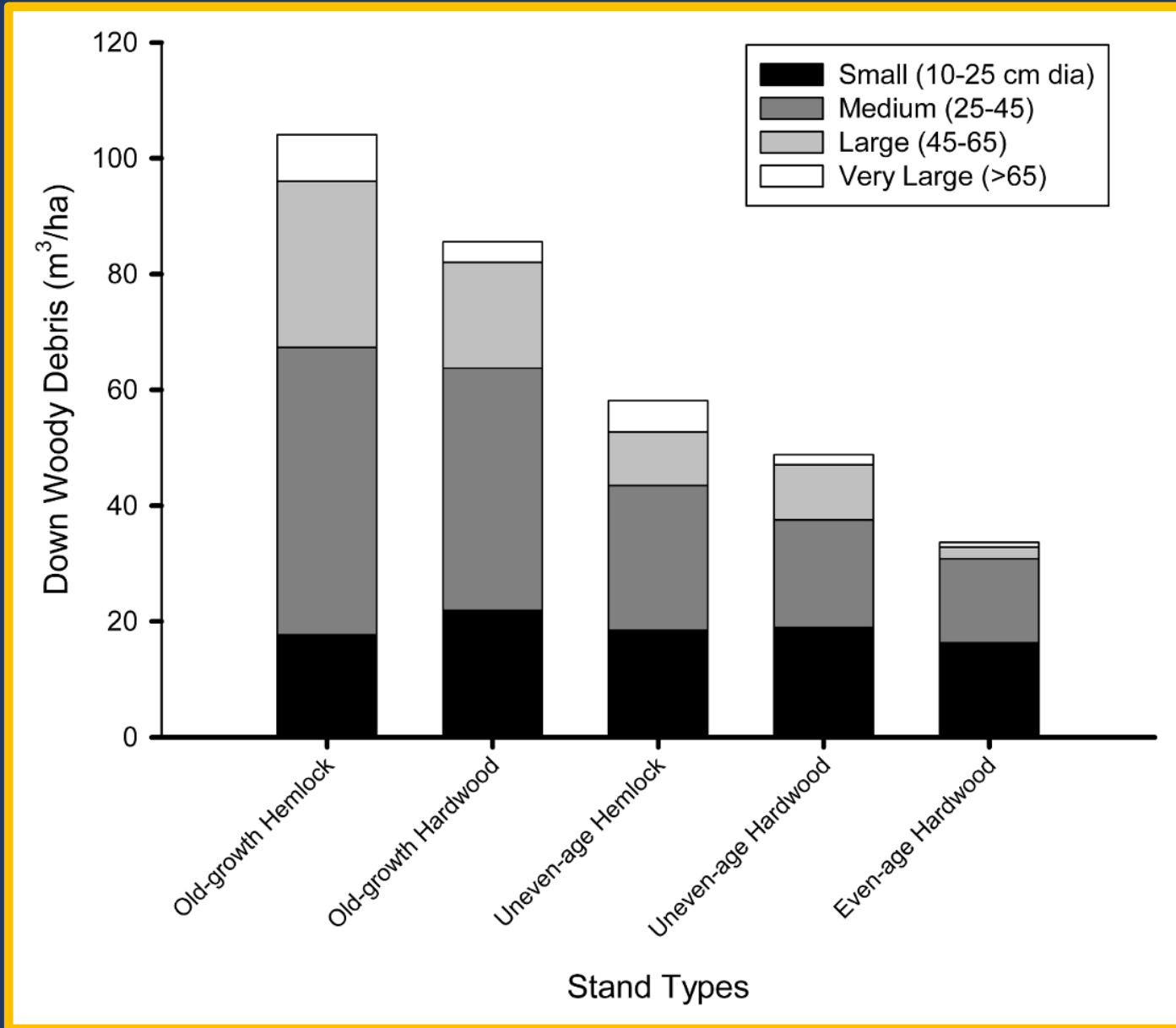
Height class distribution of woody understory stems (<10cm dbh)



Canopy gap frequency, % cover and 95% CI.



Down woody debris volumes according to diameter class.



Common Bird Species (Hardwoods)

	<u>Oldgrowth</u>	<u>Uneven-aged</u>	<u>Even-aged</u>
1	Red-eyed Vireo	Red-eyed Vireo	Red-eyed Vireo
2	Ovenbird	Black-thr. Green Warbler	Black-thr. Green Warbler
3	Black-thr. Green Warbler	Ovenbird	Ovenbird
4	Least Flycatcher	Least Flycatcher	Least Flycatcher
5	Winter Wren	Black-thr. Blue Warbler	Black-thr. Blue Warbler
6	Eastern Wood Pewee	Black-capped Chickadee	Brown Creeper
7	Blackburnian Warbler	Veery	Hermit Thrush
8	Hermit Thrush	Rose-breasted Grosbeak	Yellow-bellied Sapsucker
9	Brown Creeper	Brown Creeper	Rose-breasted Grosbeak
10	Black-capped Chickadee	Eastern Wood Pewee	Chestnut-sided Warbler

Common Bird Species (Hemlocks)

	<u>Sylvania</u>	<u>RNA</u>	<u>Managed</u>
1	Black-thr. Green Warbler	Black-thr. Green Warbler	Black-thr. Green Warbler
2	Red-eyed Vireo	Blackburnian Warbler	Red-eyed Vireo
3	Ovenbird	Ovenbird	Ovenbird
4	Blackburnian Warbler	Red-eyed Vireo	Least Flycatcher
5	Brown Creeper	Winter Wren	Blackburnian Warbler
6	Winter Wren	Black-capped Chickadee	Black-capped Chickadee
7	Black-capped Chickadee	Hermit Thrush	Hermit Thrush
8	Northern Parula	Northern Parula	Winter Wren
9	Hermit Thrush	Golden-crowned Kinglet	Veery
10	Myrtle Warbler	Myrtle Warbler	Brown Creeper

Modal Species: Oldgrowth Hemlock

According to PPI

- 5 canopy-nesting foliage gleaners: Blue-headed Vireo, Golden-crowned Kinglet, Northern Parula, Blackburnian Warbler, Yellow-rumped Warbler
- 3 cavity nesters: Red-breasted Nuthatch, Brown Creeper, Winter Wren
- 1 ground nester and forager: Hermit Thrush

Modal Species:

Oldgrowth Hardwood

According to PPI

- 5 cavity nesters: Downy Woodpecker, Hairy Woodpecker, Pileated Woodpecker. Great Crested Flycatcher, White-breasted Nuthatch
- 1 raptor: Broad-winged Hawk

Modal Species: Managed Hemlock

According to PPI

- 5 canopy/understory nesters and foliage gleaners:
Red-eyed Vireo, Black-capped Chickadee,
Nashville Warbler, Mourning Warbler, Black-
throated Green Warbler, Scarlet Tanager
- 3 ground feeders: Northern Flicker Ovenbird,
White-throated Sparrow
- 1 omnivore: Blue Jay

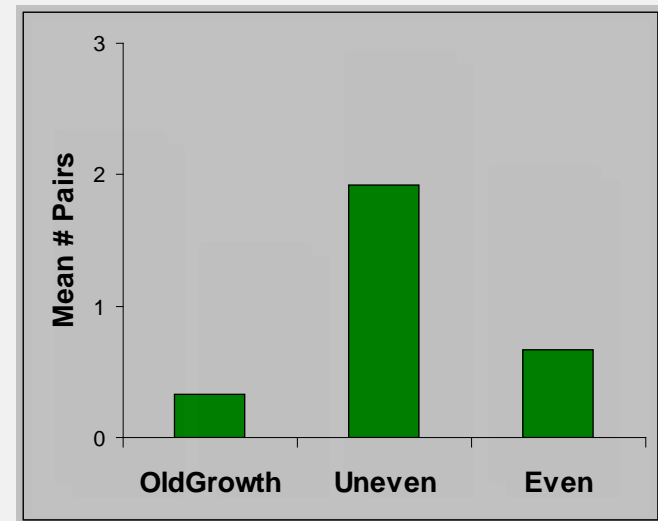
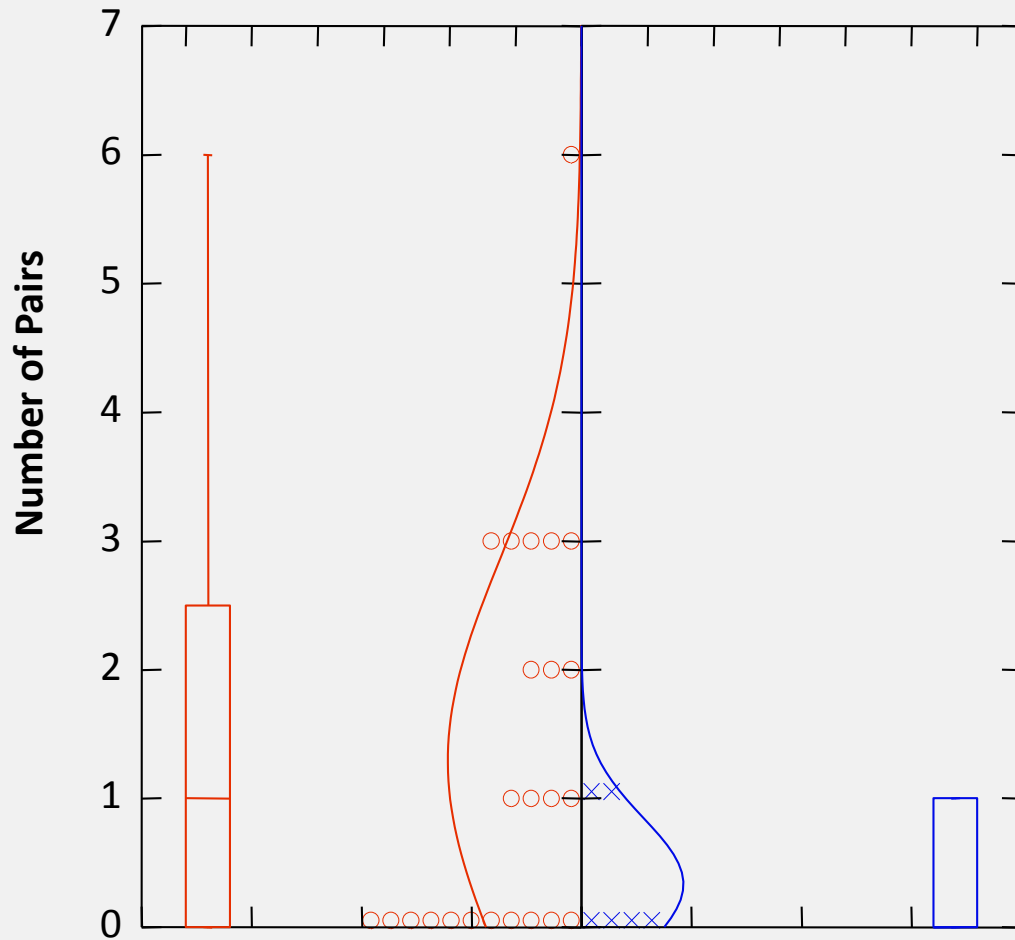
Modal Species: Uneven-Age Managed Hardwood

According to PPI

- 8 understory/low canopy nesters: Ruby-throated Hummingbird, Least Flycatcher, Swainson's Thrush, American Robin, Cedar Waxwing, Chestnut-sided Warbler, Black-throated Blue Warbler, Rose-breasted Grosbeak
- 2 ground nesters: Veery, Black-and-White Warbler
- 1 cavity nester: Yellow-bellied Sapsucker



Veery



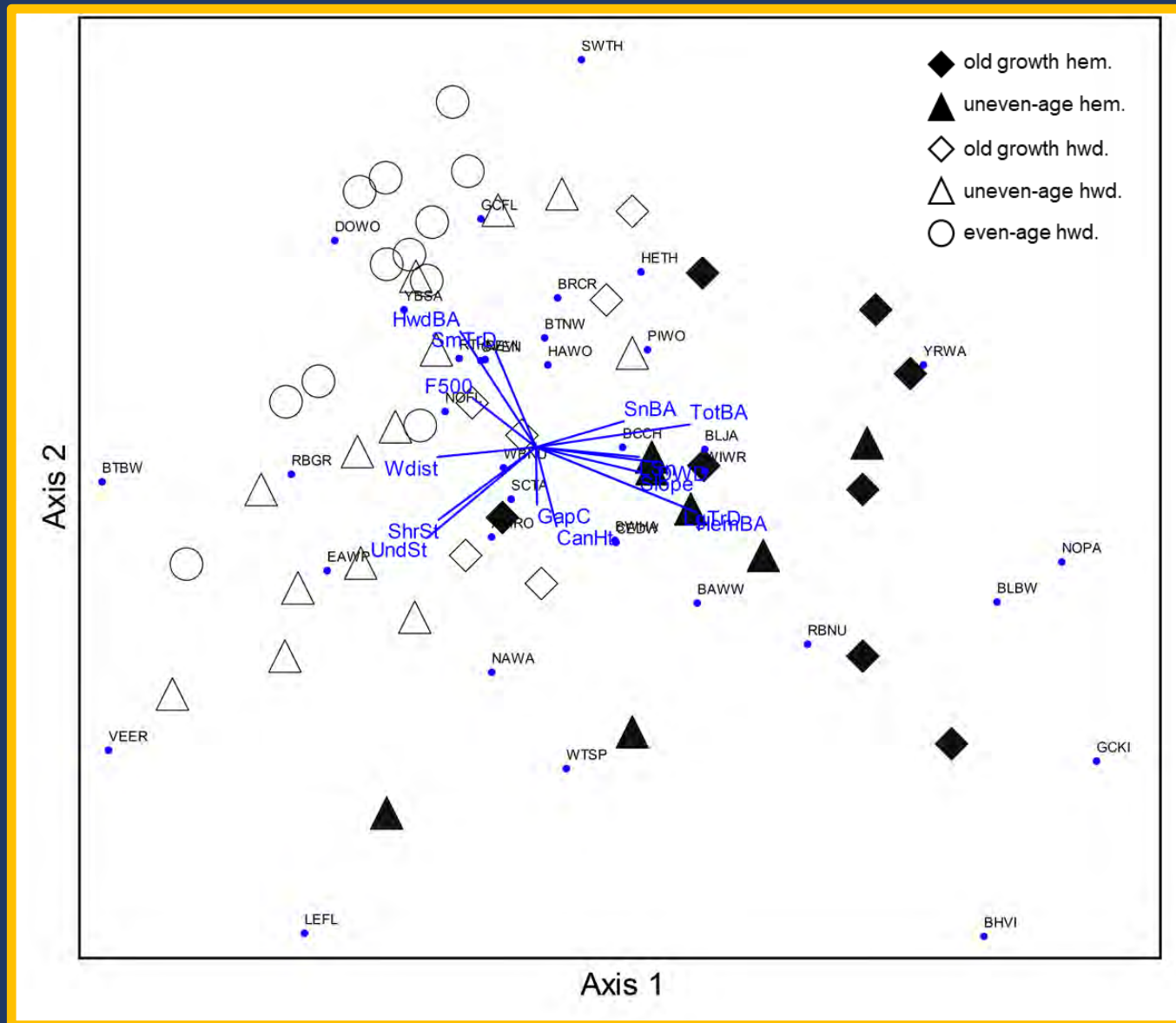
Modal Species:

Even-Age Managed Hardwood

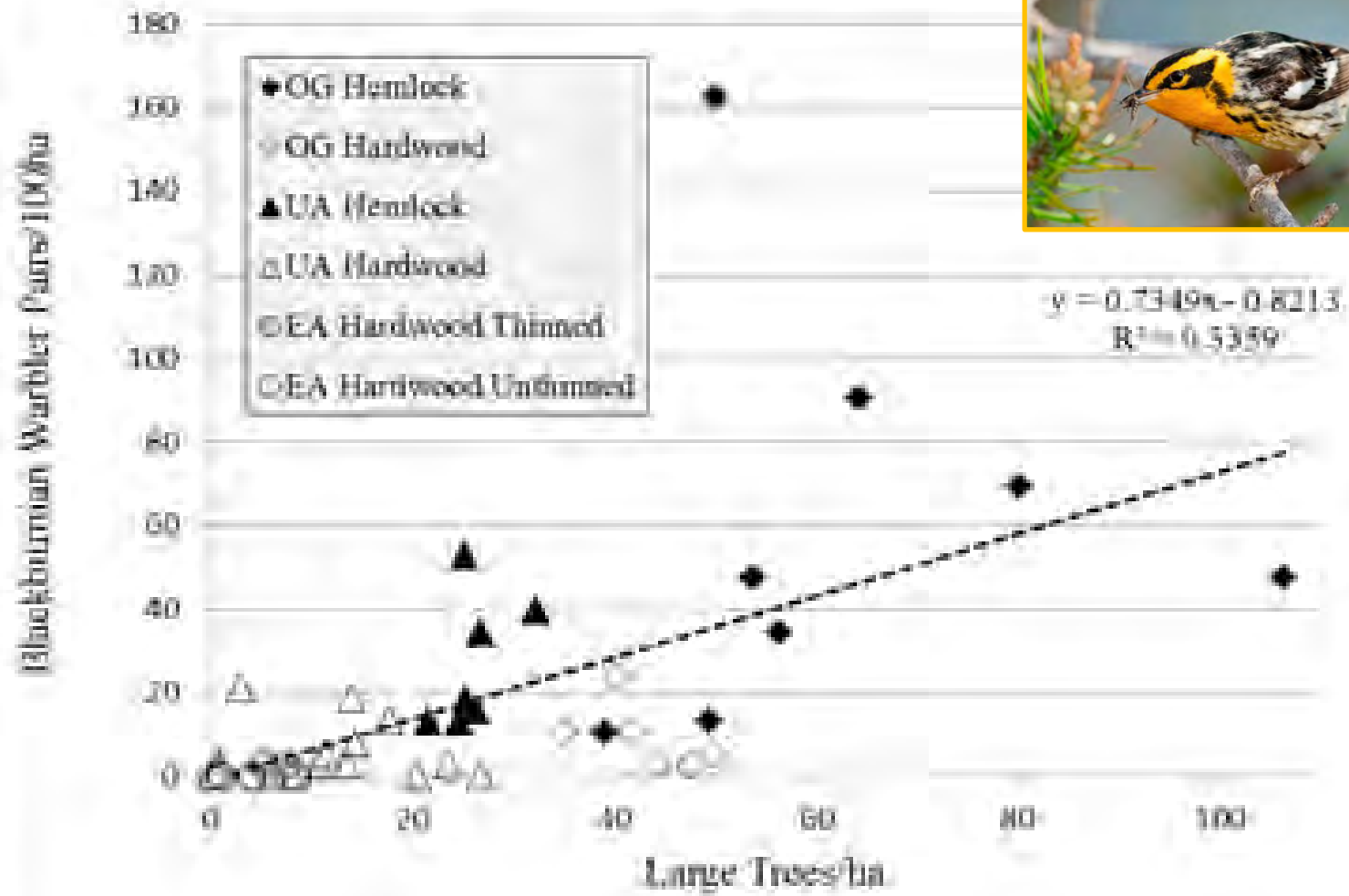
According to PPI

- NADA

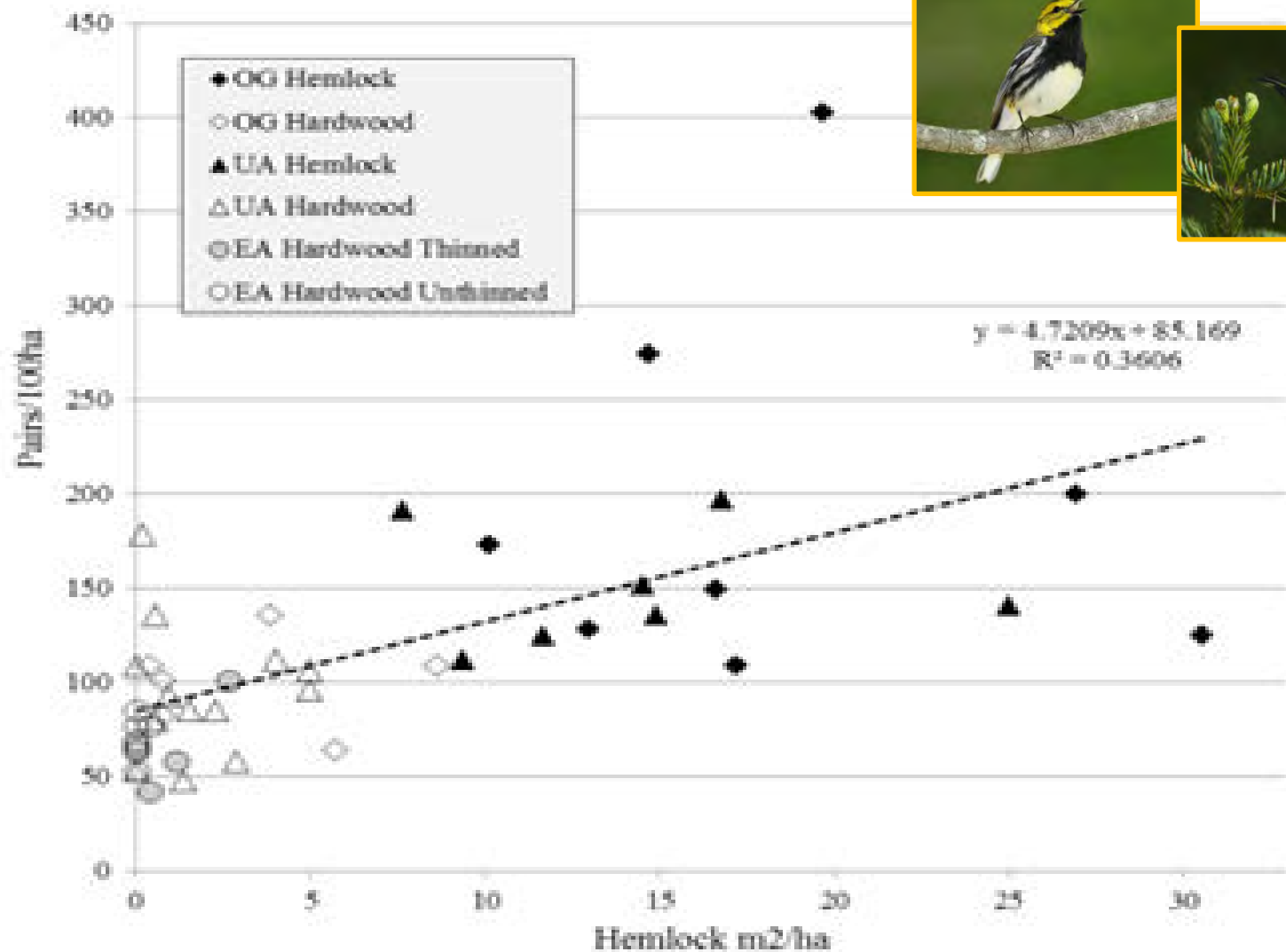
Canonical correspondence analysis ordination of 46 forest study plots based on 16 environmental variables (CSWA, MOWA excluded).



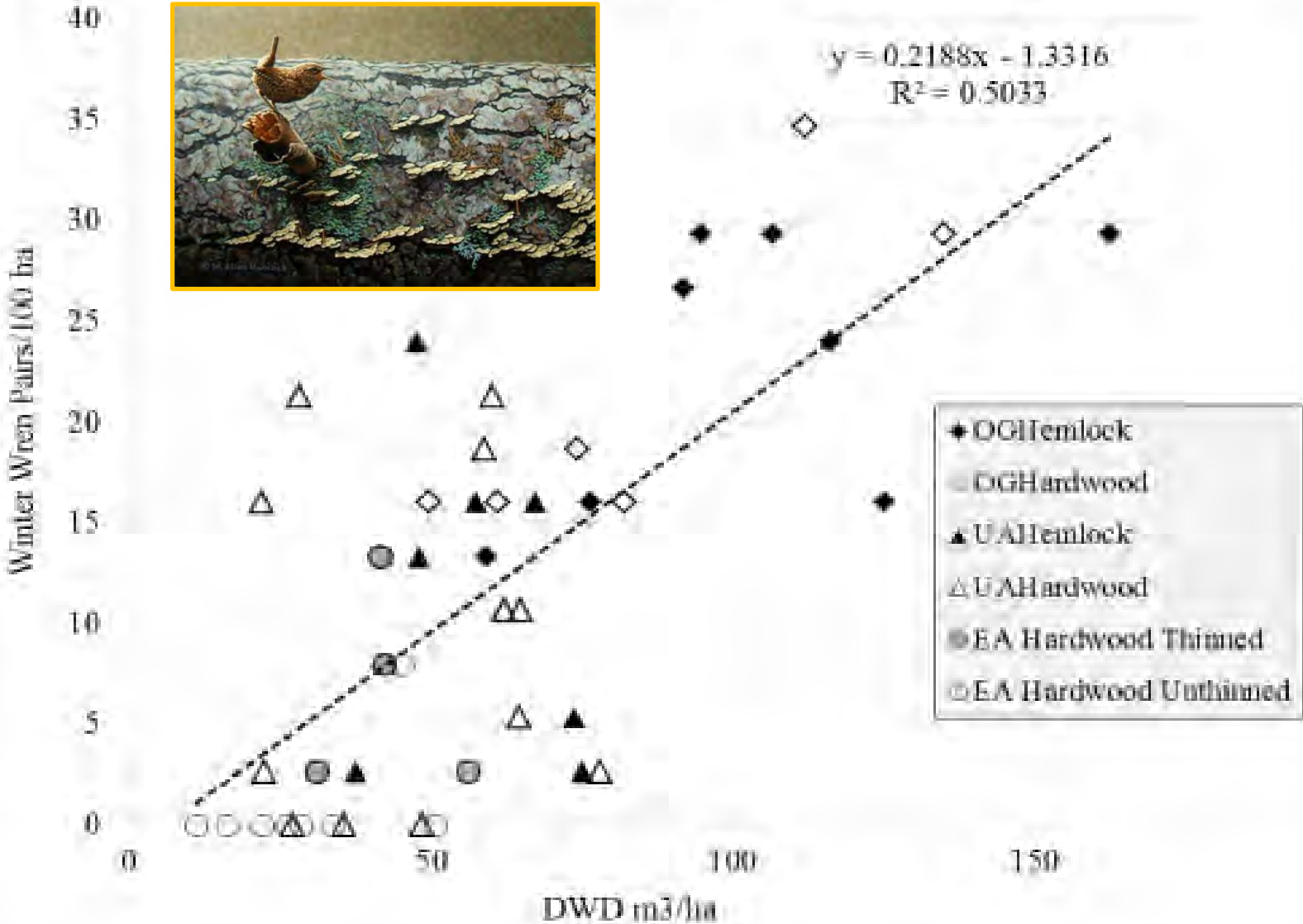
Blackburnian Warbler Response to Large Tree Density and Treatment-Type



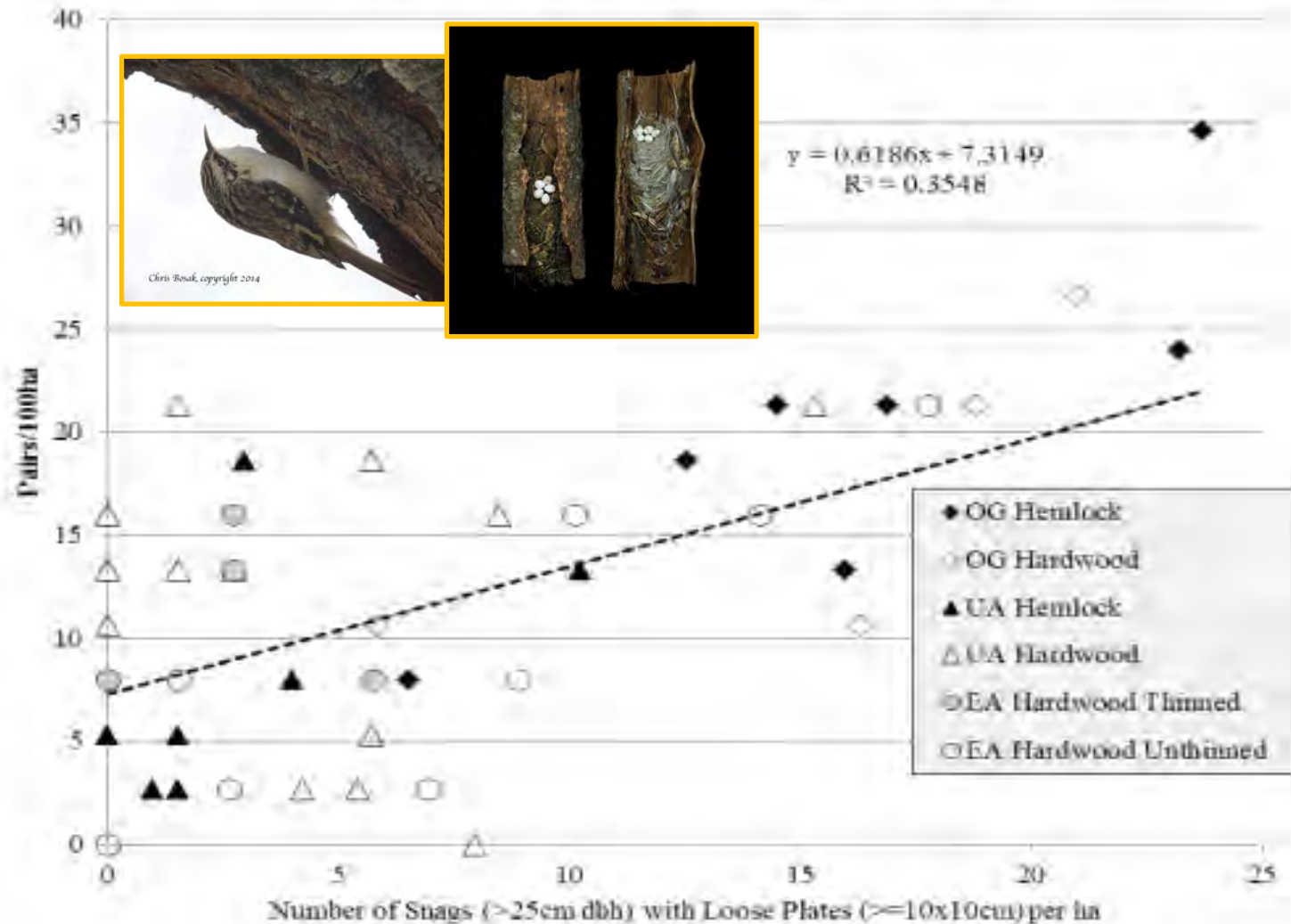
Response of Canopy Nesters to Hemlock Basal Area and Treatment-Type



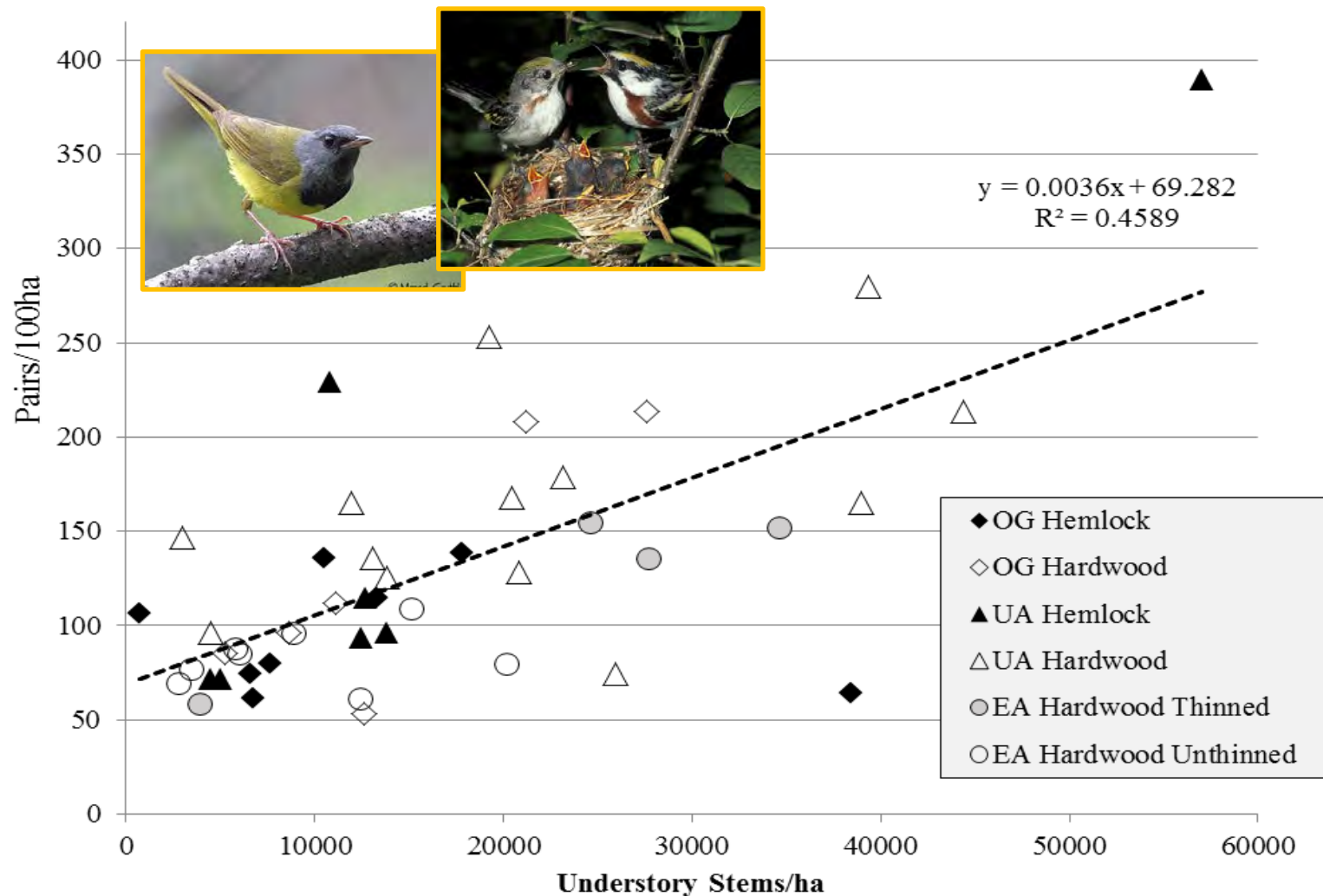
Winter Wren Response to DWD Volume & Treatment-Type



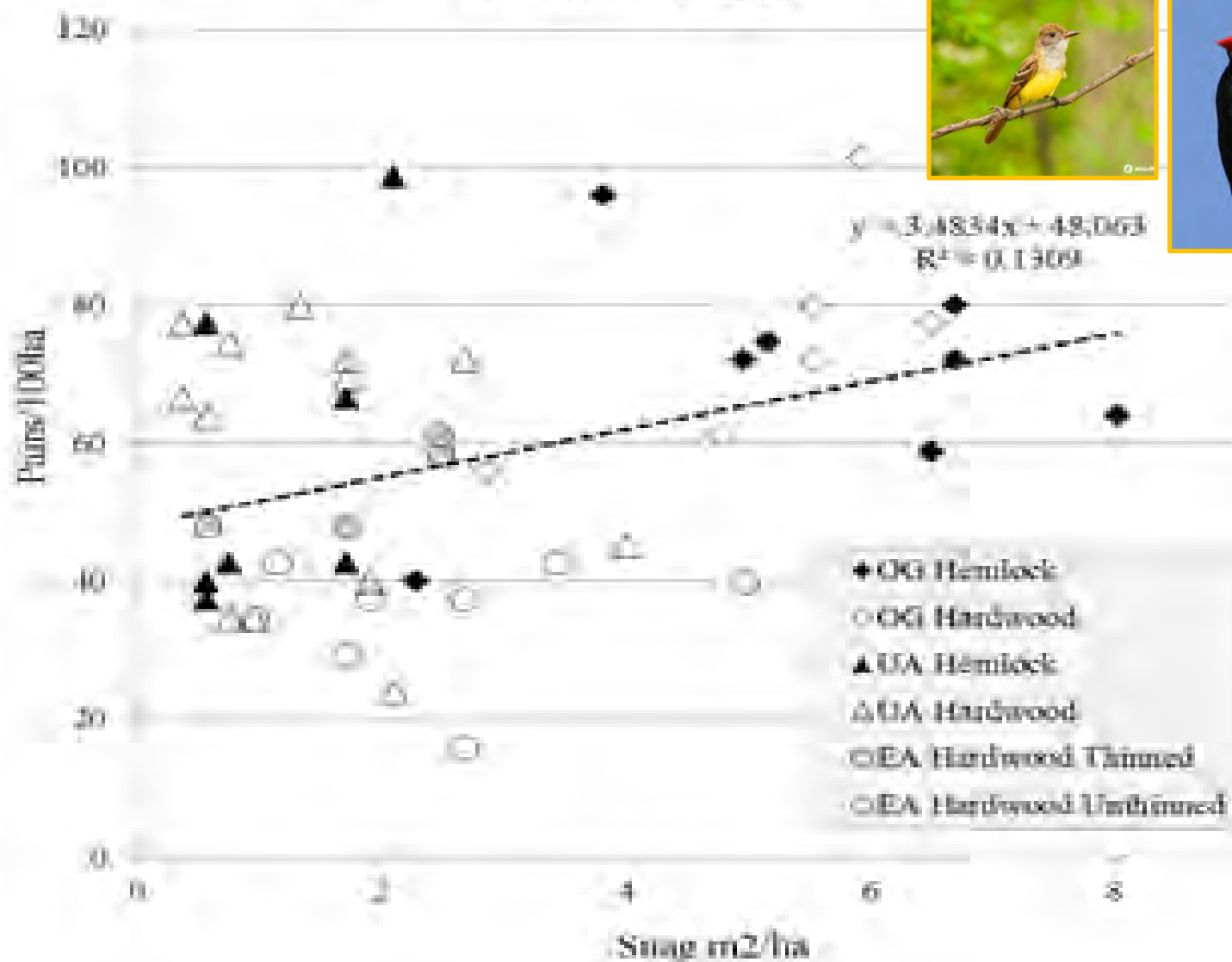
Brown Creeper Response to Density of Snags Bearing Loose Bark Plates

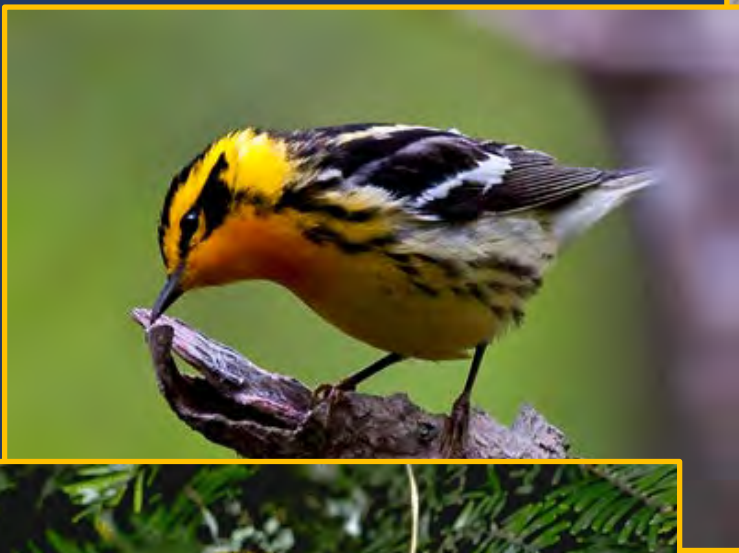


Response of Understory Nesters to Understory Stem Density and Treatment-Type

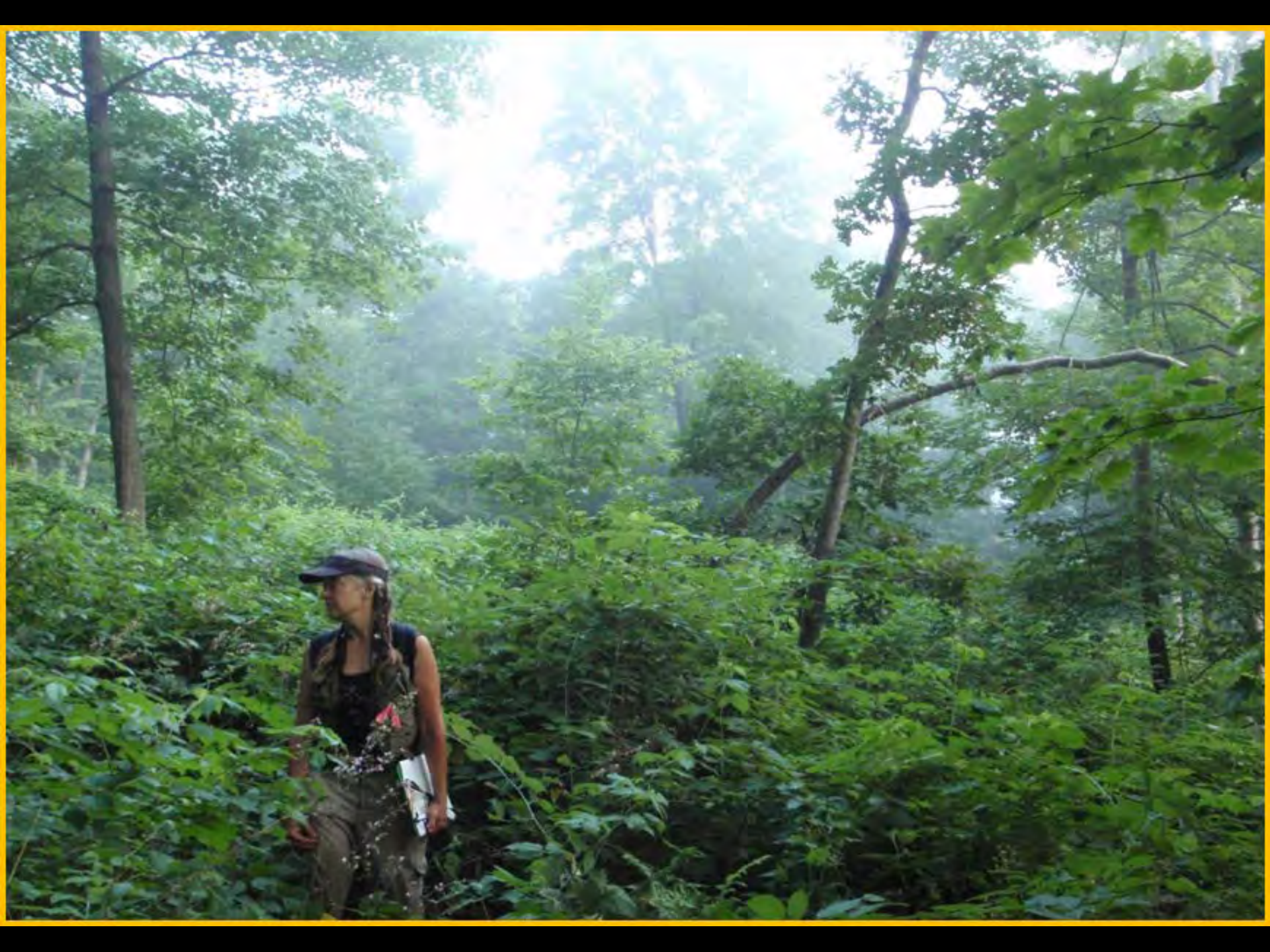


Response of Cavity Nesters to Snag Basal Area and Treatment-Type















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