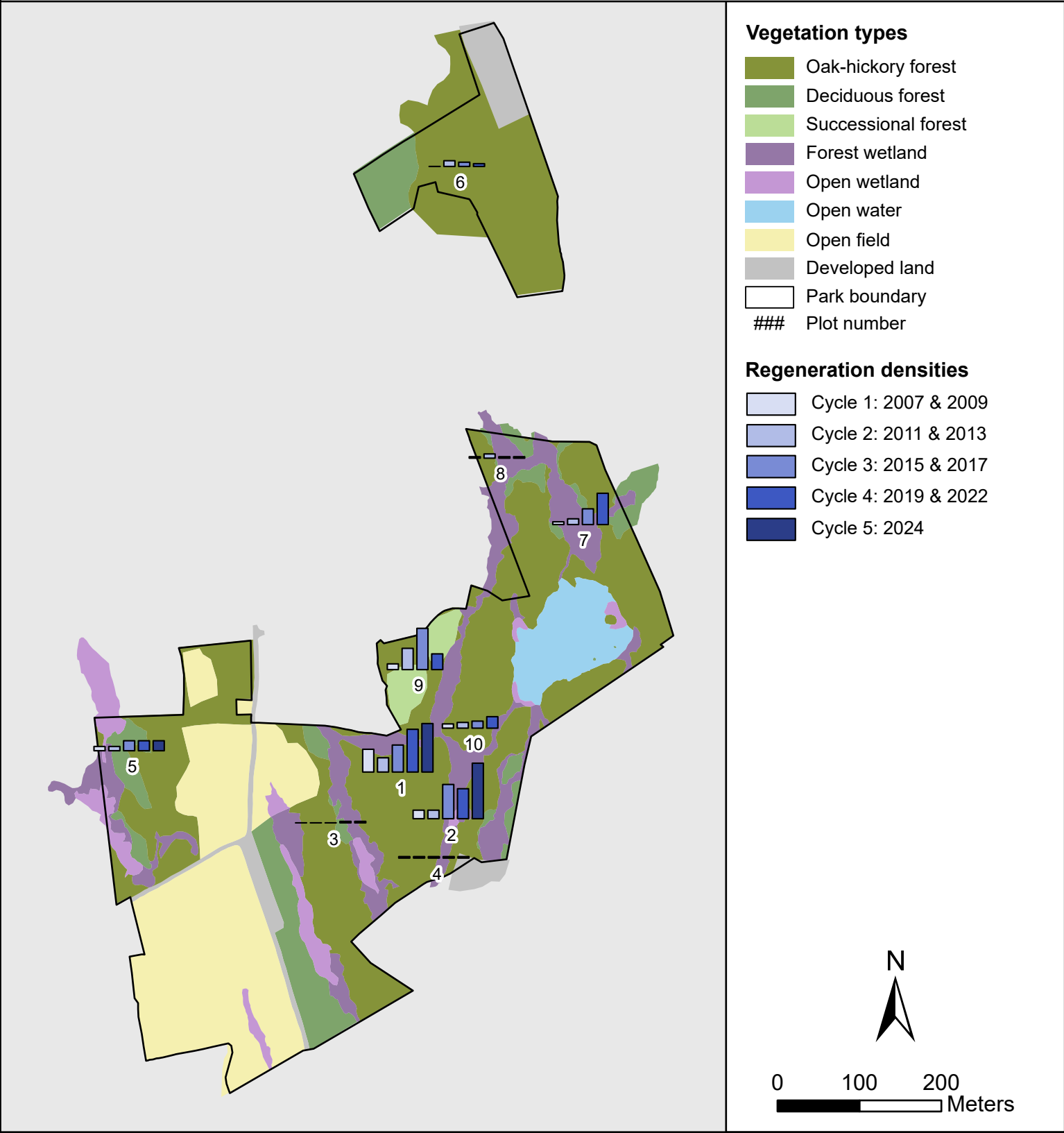




Map 1. Native Canopy-Forming Tree Regeneration by Cycle

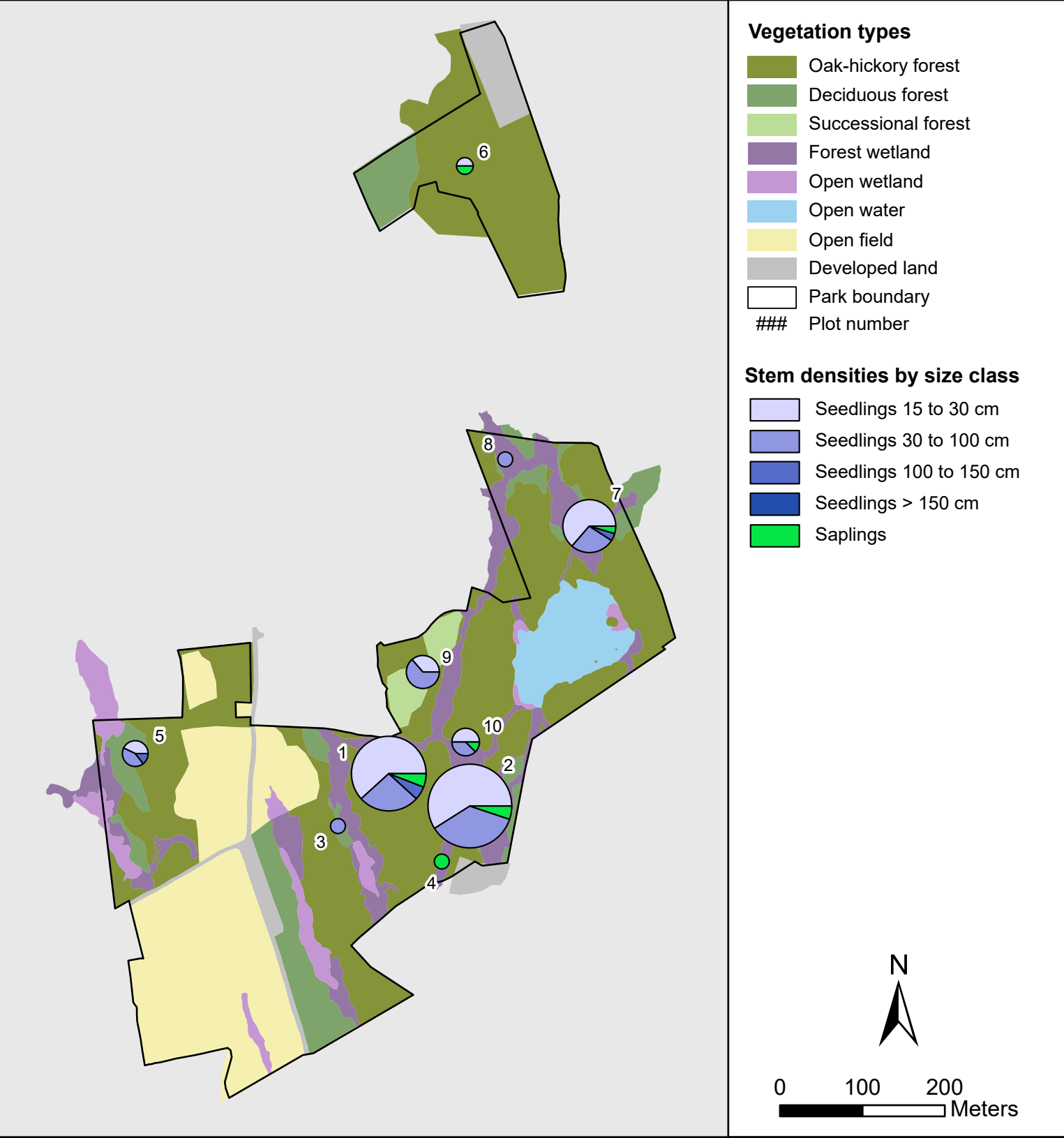
Trends in tree regeneration, including seedlings and saplings, observed in forest plots sampled from 2007-2024. Plots are sampled in an alternating panel, with plots 1-5 sampled in 2007, 2011, 2015, 2019, and 2024, and plots 6-10 sampled in 2009, 2013, 2017, and 2022. Densities range from 0 to 1.0 stems/m², and only include native canopy-forming species. Charts may be shifted from actual plot locations to prevent overlap. See Table 1 for more details. Reporting Date: 2/24/2025.





Map 2. Native Canopy-Forming Tree Regeneration by Size Class

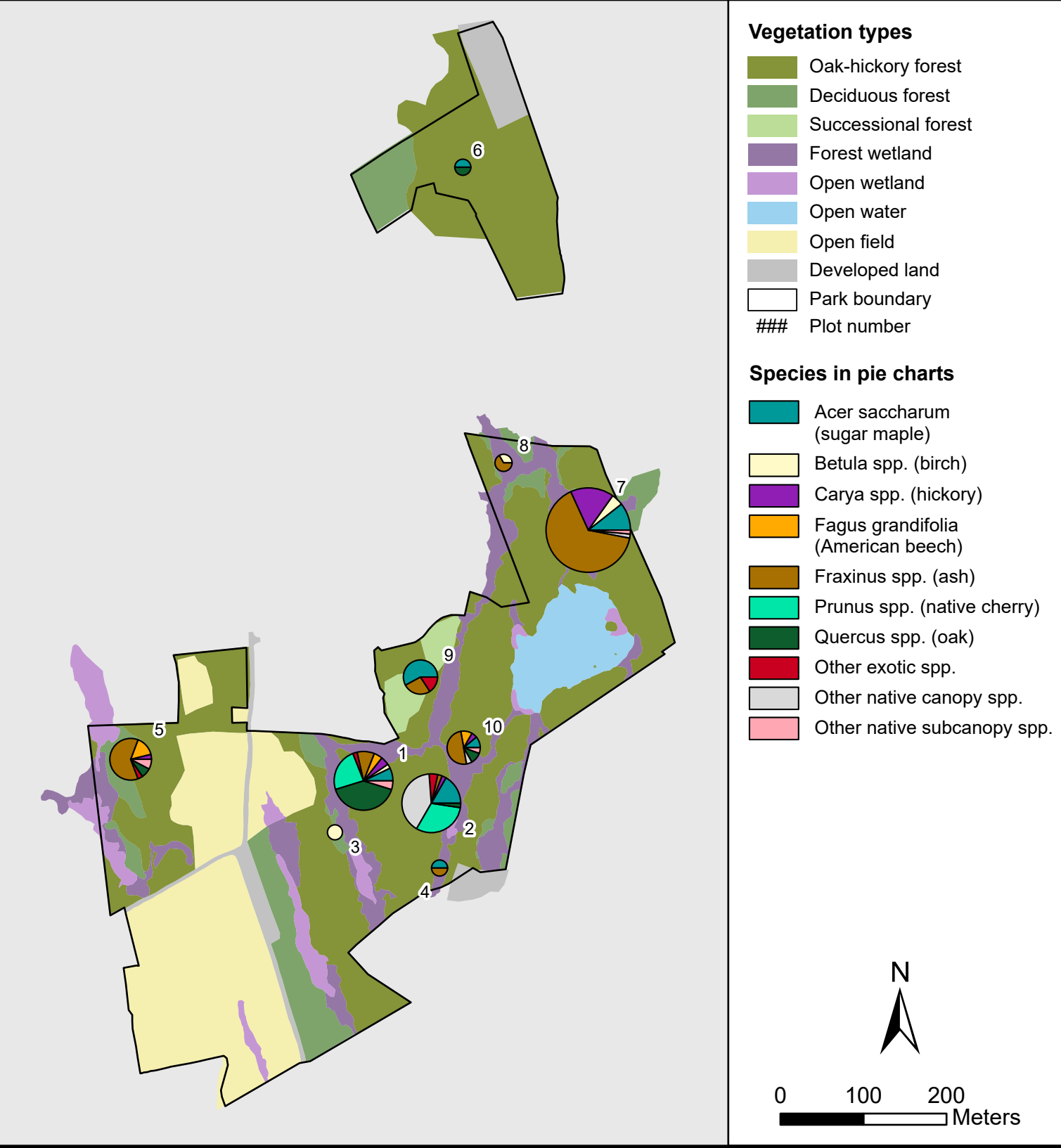
Tree regeneration stem densities by size class in forest plots from the most recent census (2022 & 2024). Plots are sampled in an alternating panel, with plots 1-5 sampled in 2024, and plots 6-10 sampled in 2022. Pie size is proportional to plot-level regeneration density. Pies may be shifted from actual plot locations to prevent overlap. Total densities range from 0.03 to 1.0 stems/m² and only include native canopy-forming species. Reporting Date: 2/24/2025.





Map 3. Tree Regeneration Composition

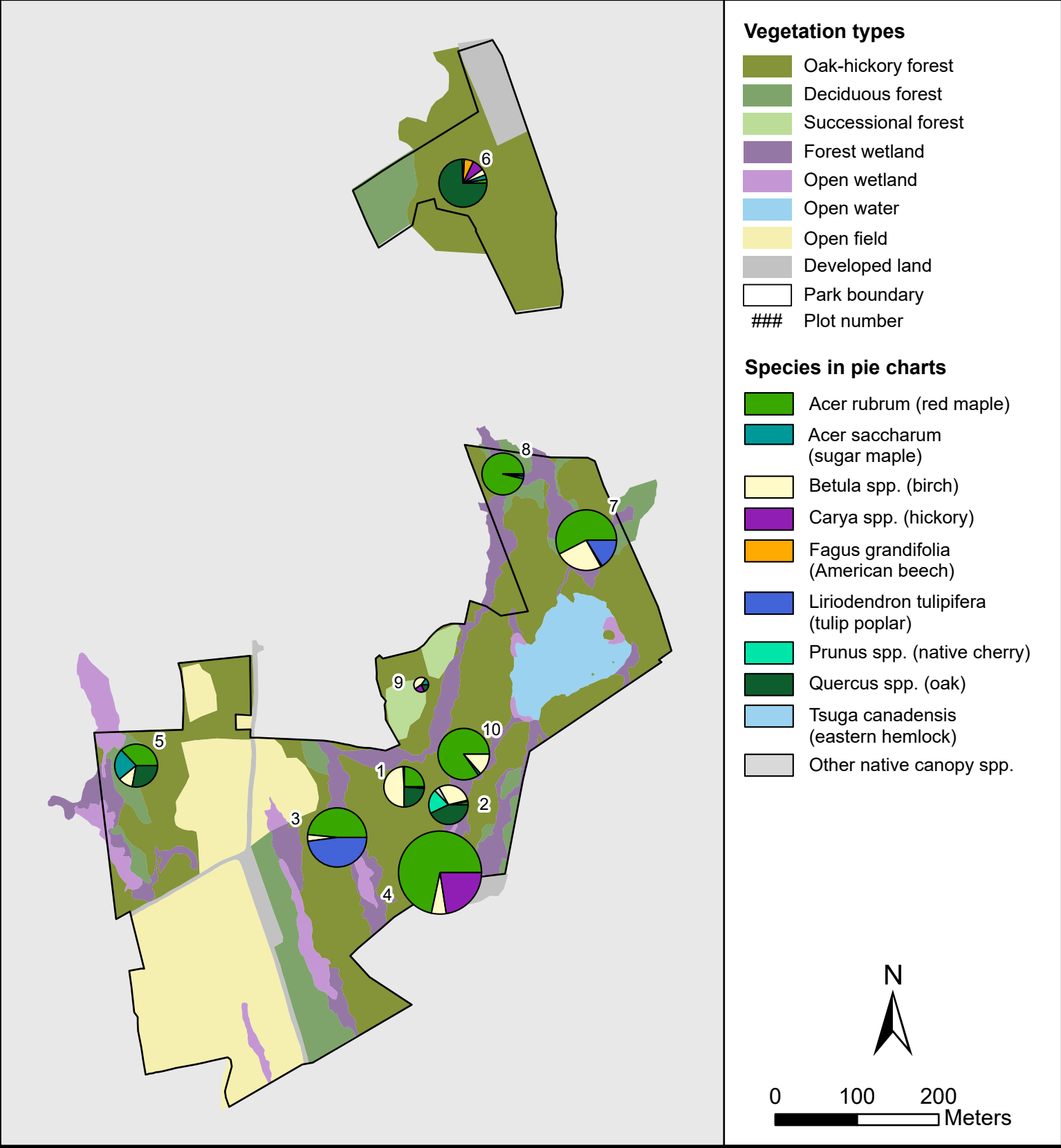
Tree regeneration, including seedlings and saplings, observed in forest plots sampled in the most recent census (2022 & 2024). Plots are sampled in an alternating panel, with plots 1-5 sampled in 2024, and plots 6-10 sampled in 2022. Pie size is proportional to plot-level basal areas. Pies may be shifted from actual plot locations to prevent overlap. Total densities ranges from 0.03 to 1.8 stems/m² and includes all species. Reporting Date: 2/24/2025.





Map 4. Tree Canopy Composition

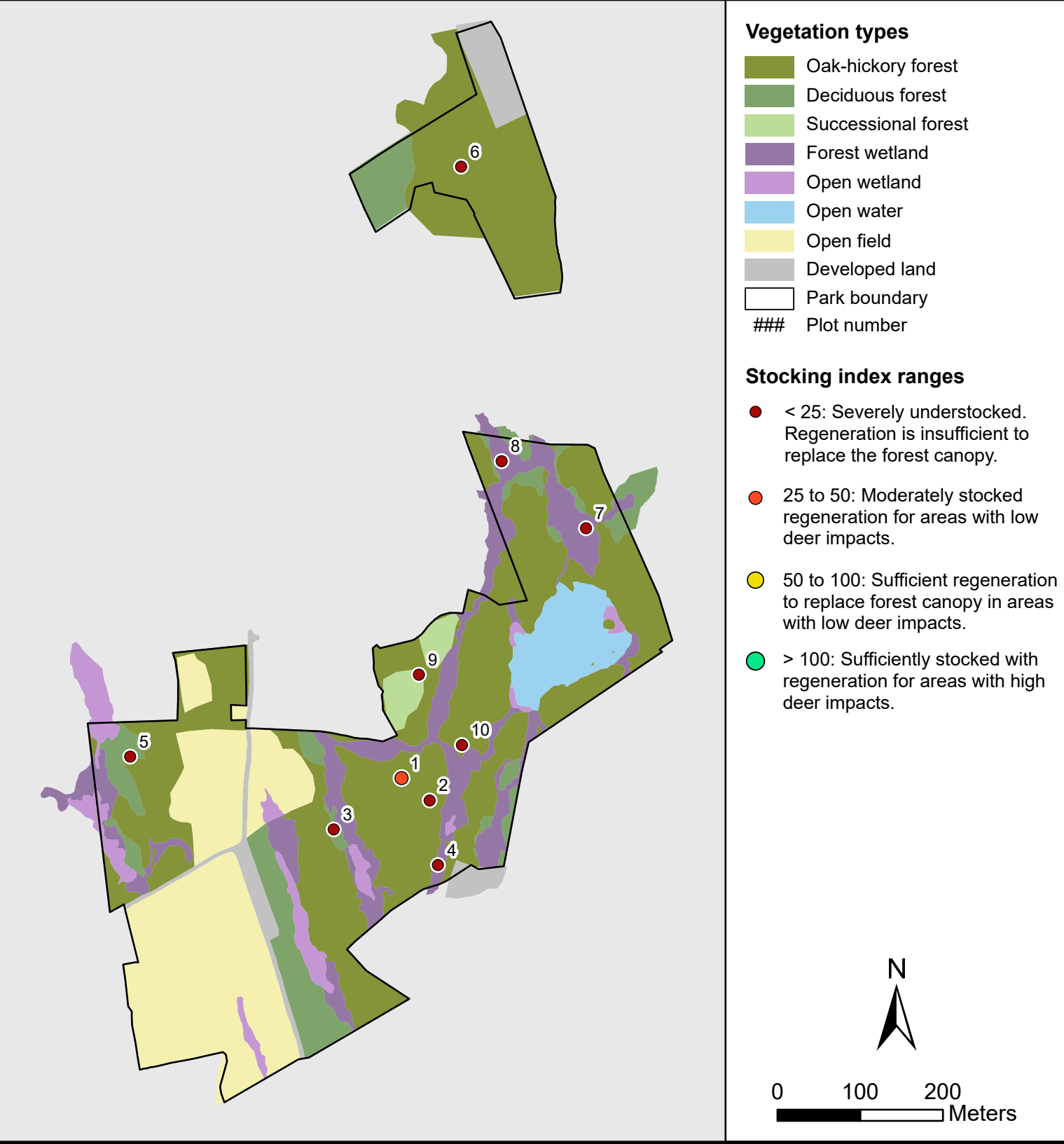
Tree composition, by species group, observed in forest plots sampled in the most recent census (2022 & 2024). Plots are sampled in an alternating panel, with plots 1-5 sampled in 2024, and plots 6-10 sampled in 2022. Pie size is proportional to plot-level basal areas. Pies may be shifted from actual plot locations to prevent overlap. Total basal area ranges from 15.2 to 42.8 m²/ha. Reporting Date: 2/24/2025.





Map 5. Tree Regeneration Stocking Index

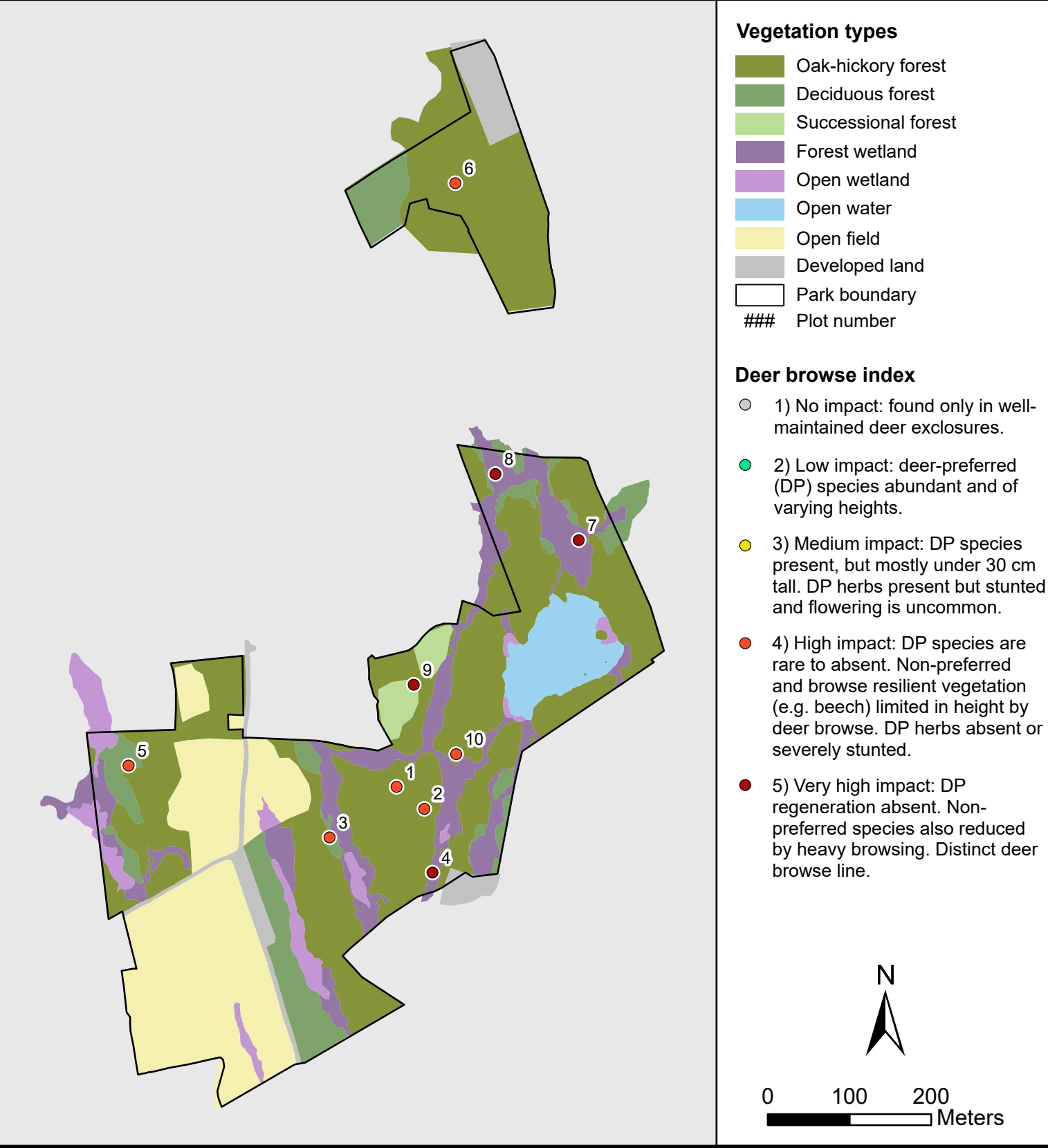
Regeneration stocking index for the most recent census (2022 & 2024). This index is a weighted sum of seedling and sapling densities where larger seedling size classes get higher weights and quantifies whether current regeneration densities are sufficient to restock a forest canopy. Stocking index is reported at a 2-m scale to maintain consistency with other regional publications (range 0 to 26.3). Only native canopy-forming species included. See Table 1 for stocking index values. Reporting Date: 2/24/2025.





Map 6. Index of Deer Browse Impacts

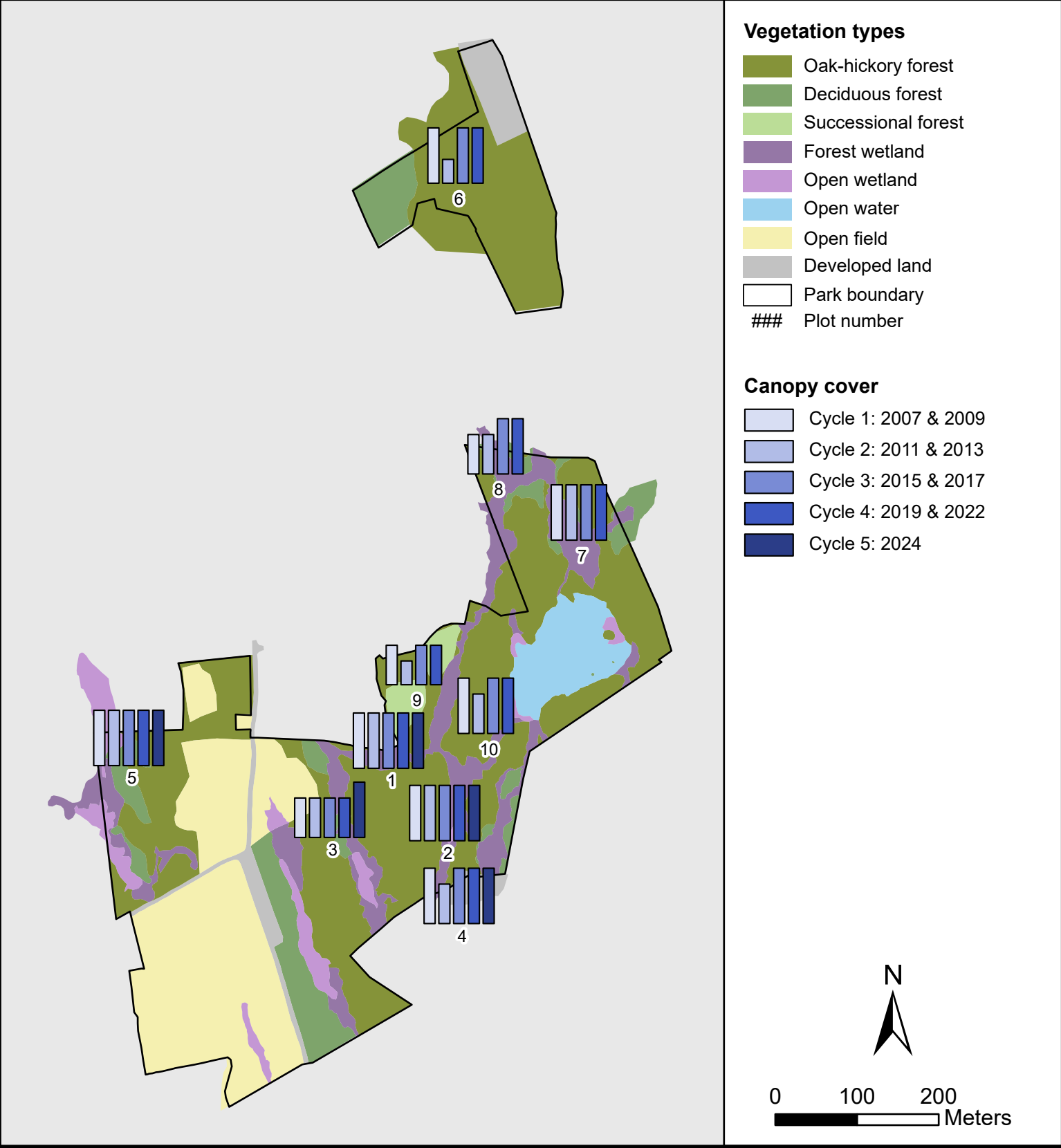
Index of deer browse impacts observed in forest plots in the most recent census (2022 & 2024). Plots are sampled in an alternating panel, with plots 1-5 sampled in 2024, and plots 6-10 sampled in 2022. Deer browse impacts are assessed on a scale of 1-5, with 1 representing no impact and 5 representing severe impacts. Reporting Date: 2/24/2025.





Map 7. % Canopy Cover by Cycle

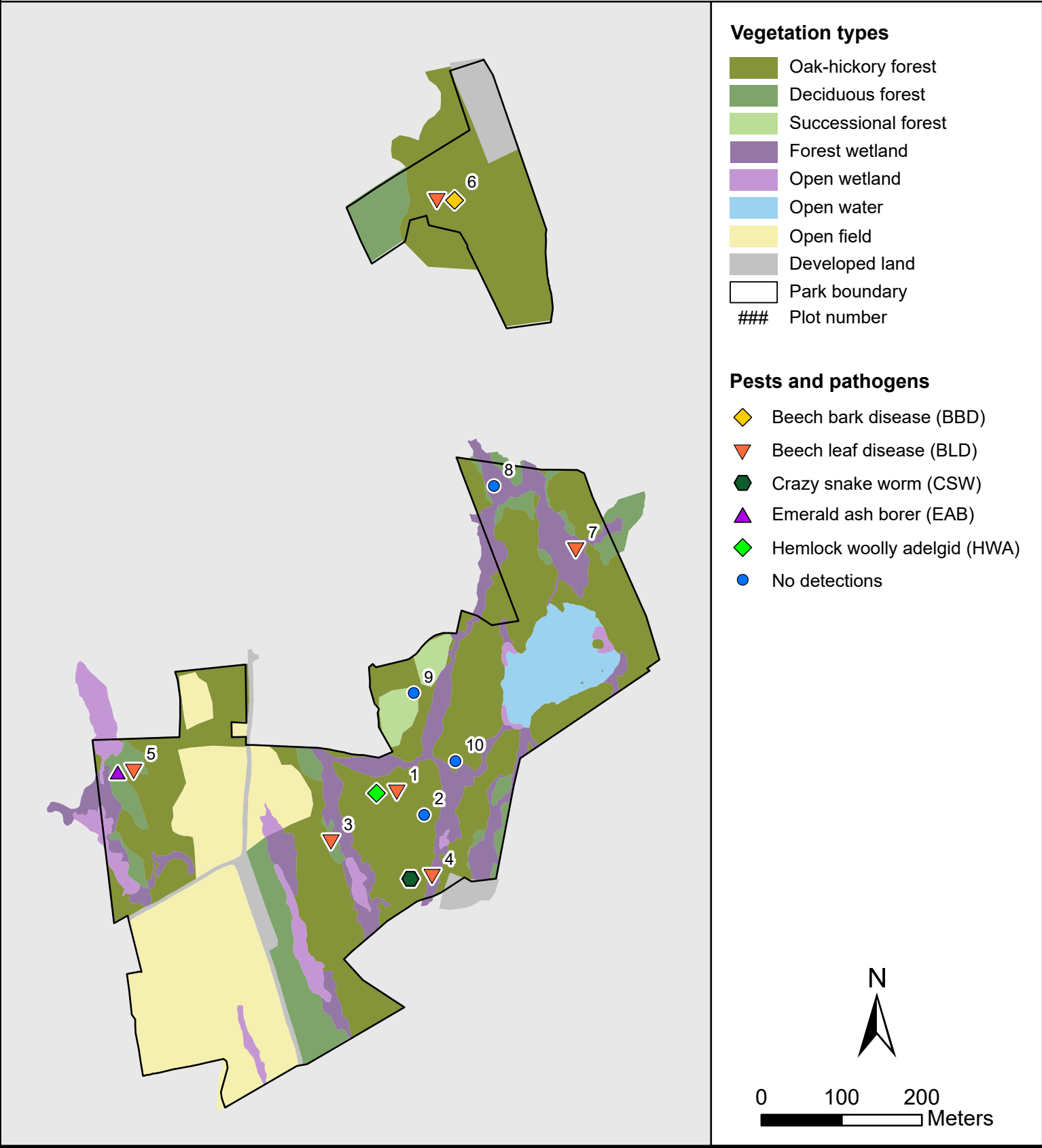
Trends in tree canopy cover in forest plots from 2007-2024. Plots are sampled in an alternating panel, with plots 1-5 sampled in 2007, 2011, 2015, 2019, and 2024, and plots 6-10 sampled in 2009, 2013, 2017, and 2022. Canopy cover ranges from 25 - 50% to >75%. Charts may be shifted from actual plot locations to prevent overlap. Reporting Date: 2/24/2025.





Map 8. Forest Pest and Pathogen Detections

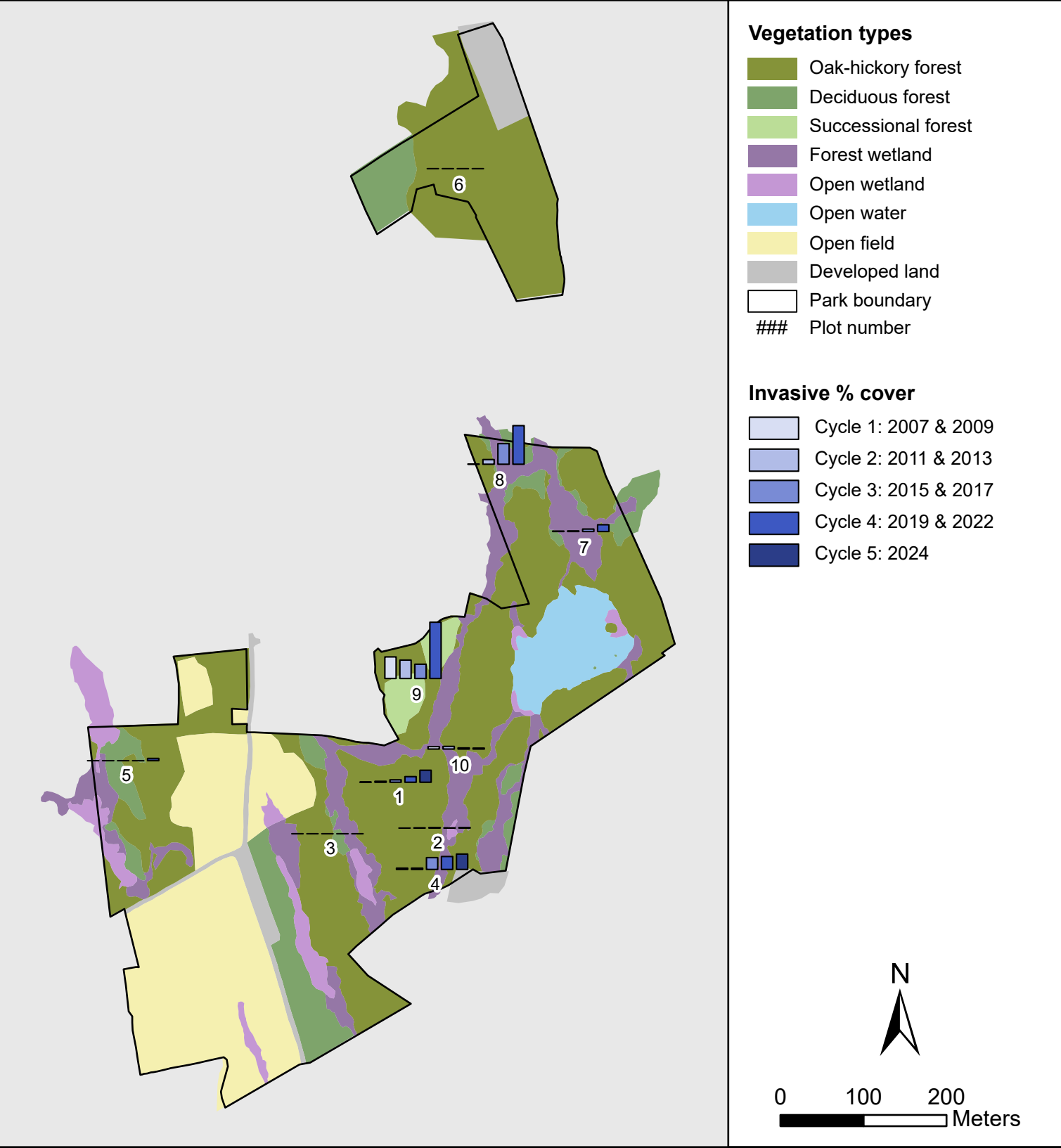
Detection of priority forest pests in forest plots sampled during the most recent census (2022 & 2024). Plots are sampled in an alternating panel, with plots 1-5 sampled in 2024, and plots 6-10 sampled in 2022. Reporting Date: 2/24/2025.





Map 9. Invasive % Cover by Cycle

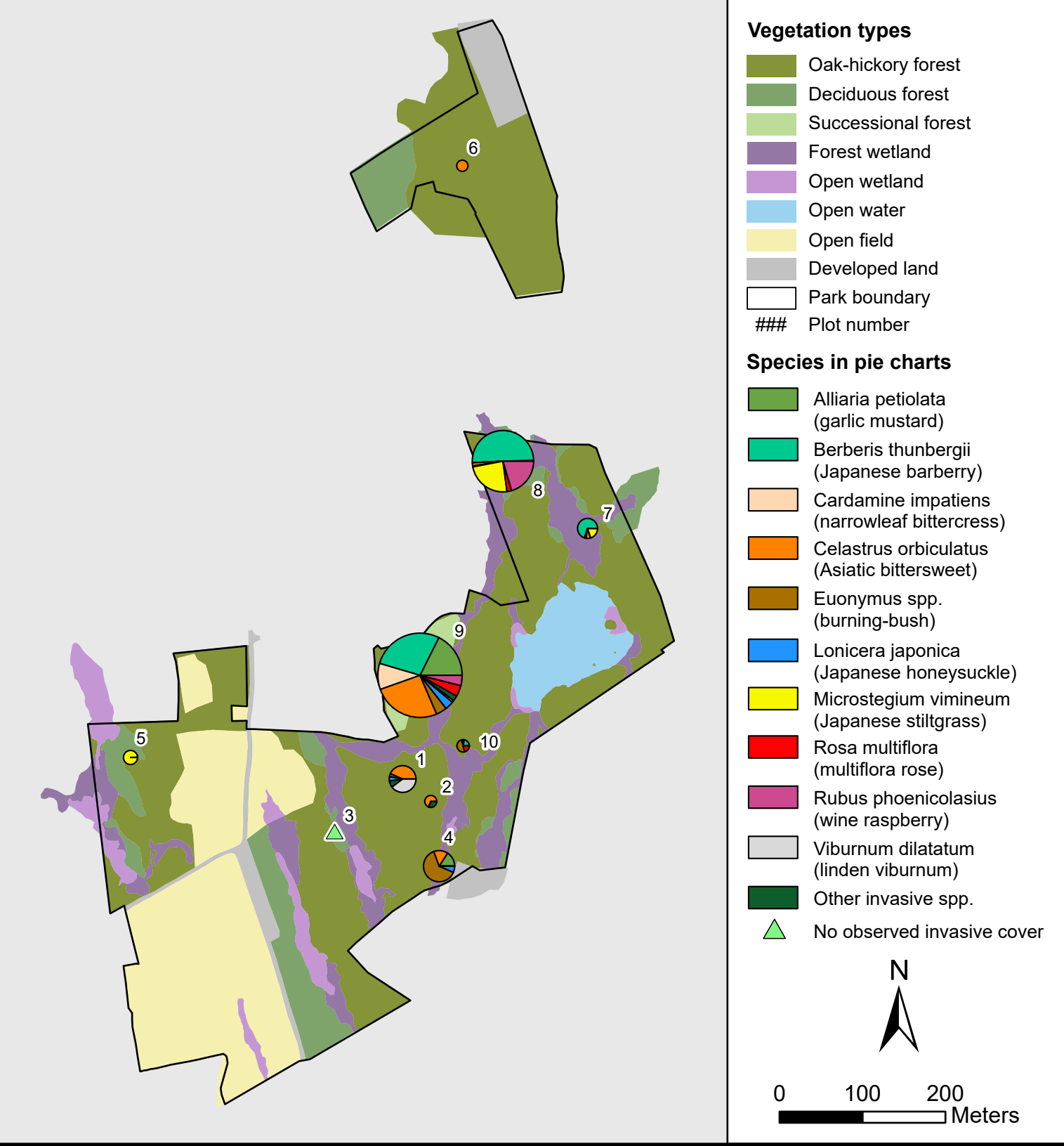
Trends in percent cover of invasive species observed in quadrats in forest plots sampled from 2007-2024. Plots are sampled in an alternating panel, with plots 1-5 sampled in 2007, 2011, 2015, 2019, and 2024, and plots 6-10 sampled in 2009, 2013, 2017, and 2022. Average invasive cover per plot ranges from 0 to 55.8%. See Table 2 for % cover values. Charts may be shifted from actual plot locations to prevent overlap. Reporting Date: 2/24/2025.





Map 10. Invasive % Cover by Species

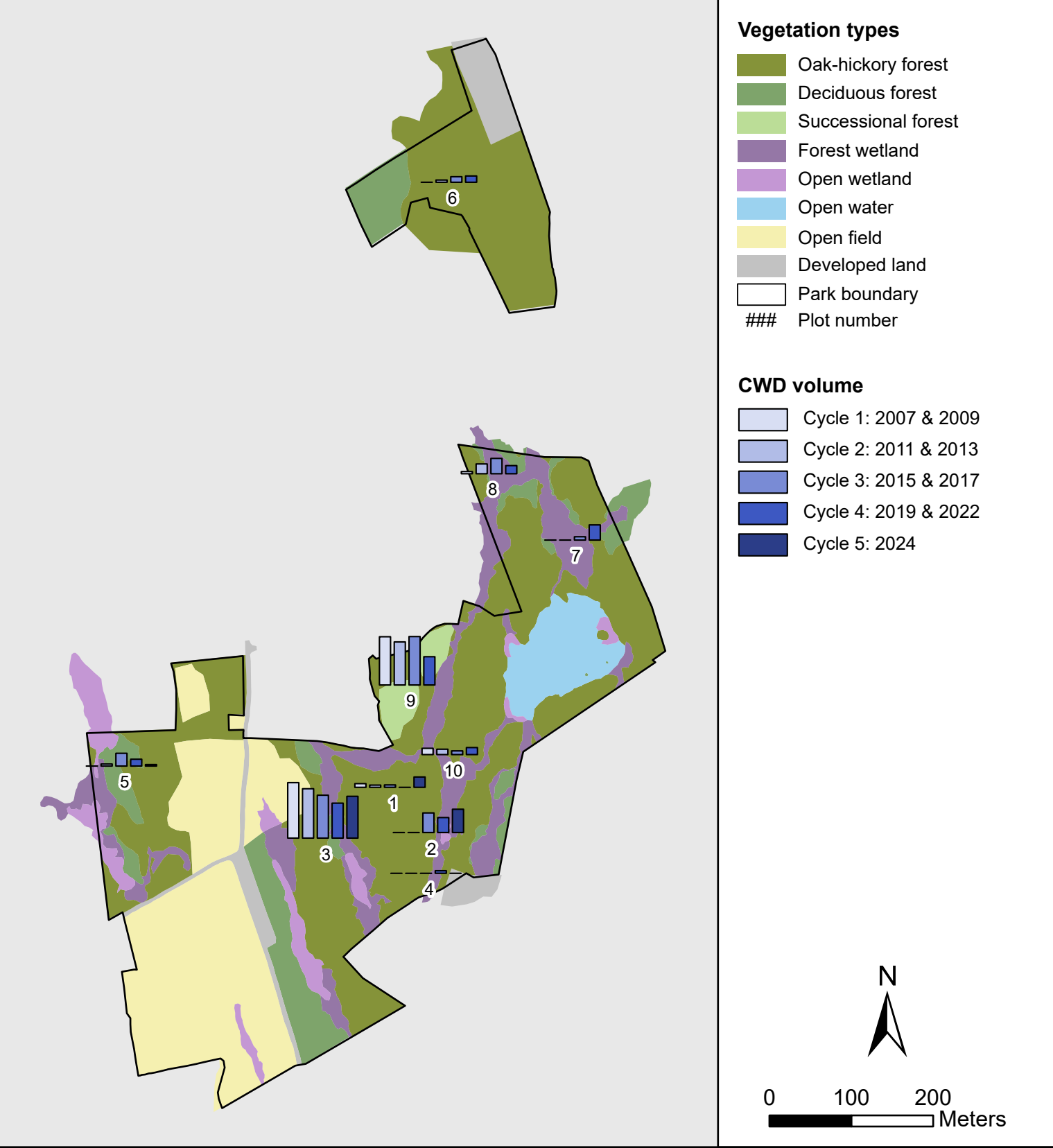
Percent invasive cover by species observed in quadrats in forest plots sampled in the most recent census (2022 & 2024). The top 10 species or genera are displayed individually; less common species are grouped as 'Other invasive spp.'. Plots are sampled in an alternating panel, with plots 1-5 sampled in 2024, and plots 6-10 sampled in 2022. Pie size is proportional to total invasive cover (range: 0.03 to 55.8%), and location may be shifted from actual plot locations to prevent overlap. See Table 3 for more information. Reporting Date: 2/24/2025.





Map 11. Coarse Woody Debris by Cycle

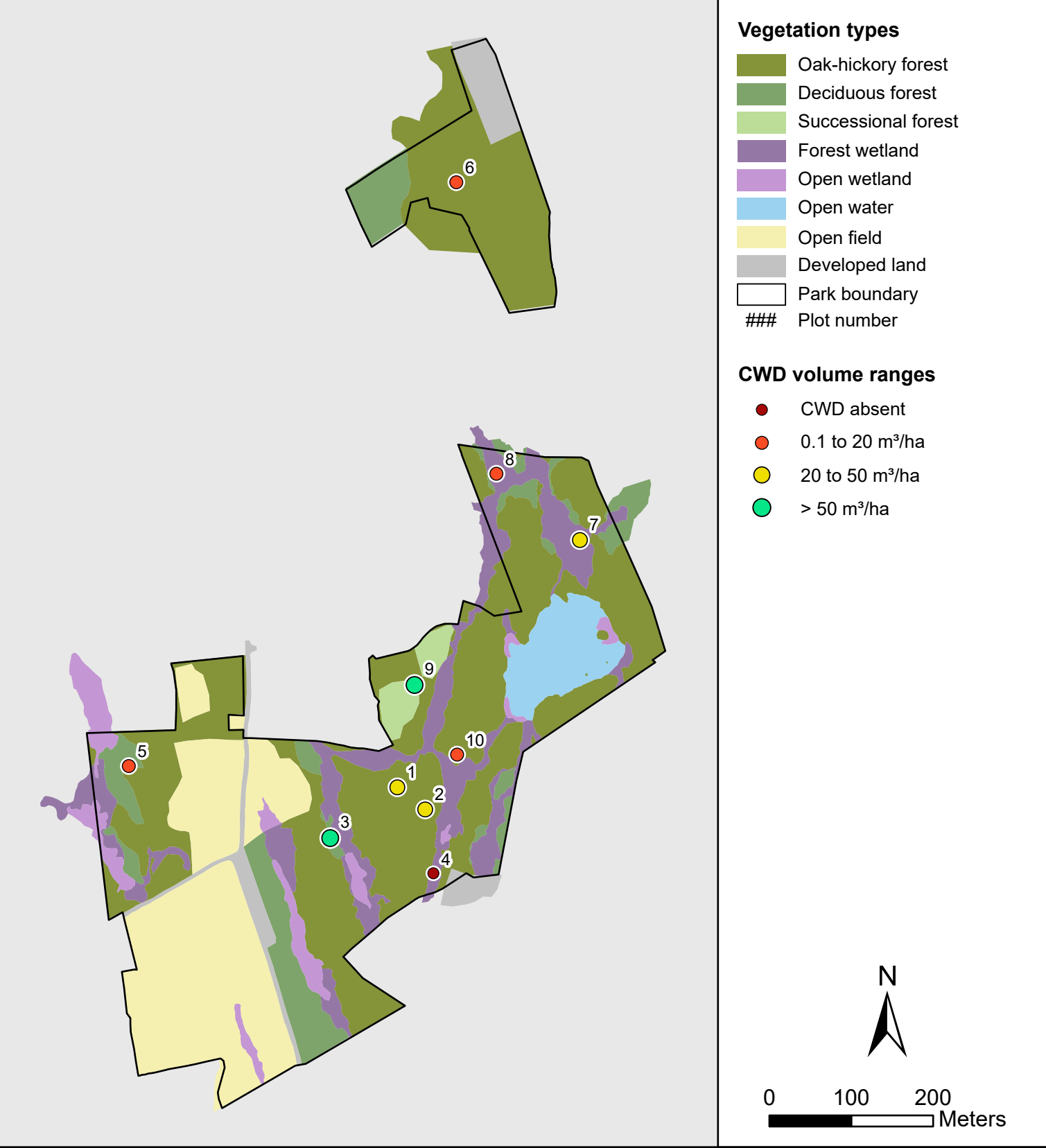
Trends in coarse woody debris (CWD) volume observed in plots sampled from 2007-2024. Plots are sampled in an alternating panel, with plots 1-5 sampled in 2007, 2011, 2015, 2019, and 2024, and plots 6-10 sampled in 2009, 2013, 2017, and 2022. CWD volume ranges from 0 to 107.7 m³/ha (1,539.6 ft³/ac). Charts may be shifted from actual plot locations to prevent overlap. Reporting Date: 2/24/2025.





Map 12. Coarse Woody Debris Ratings

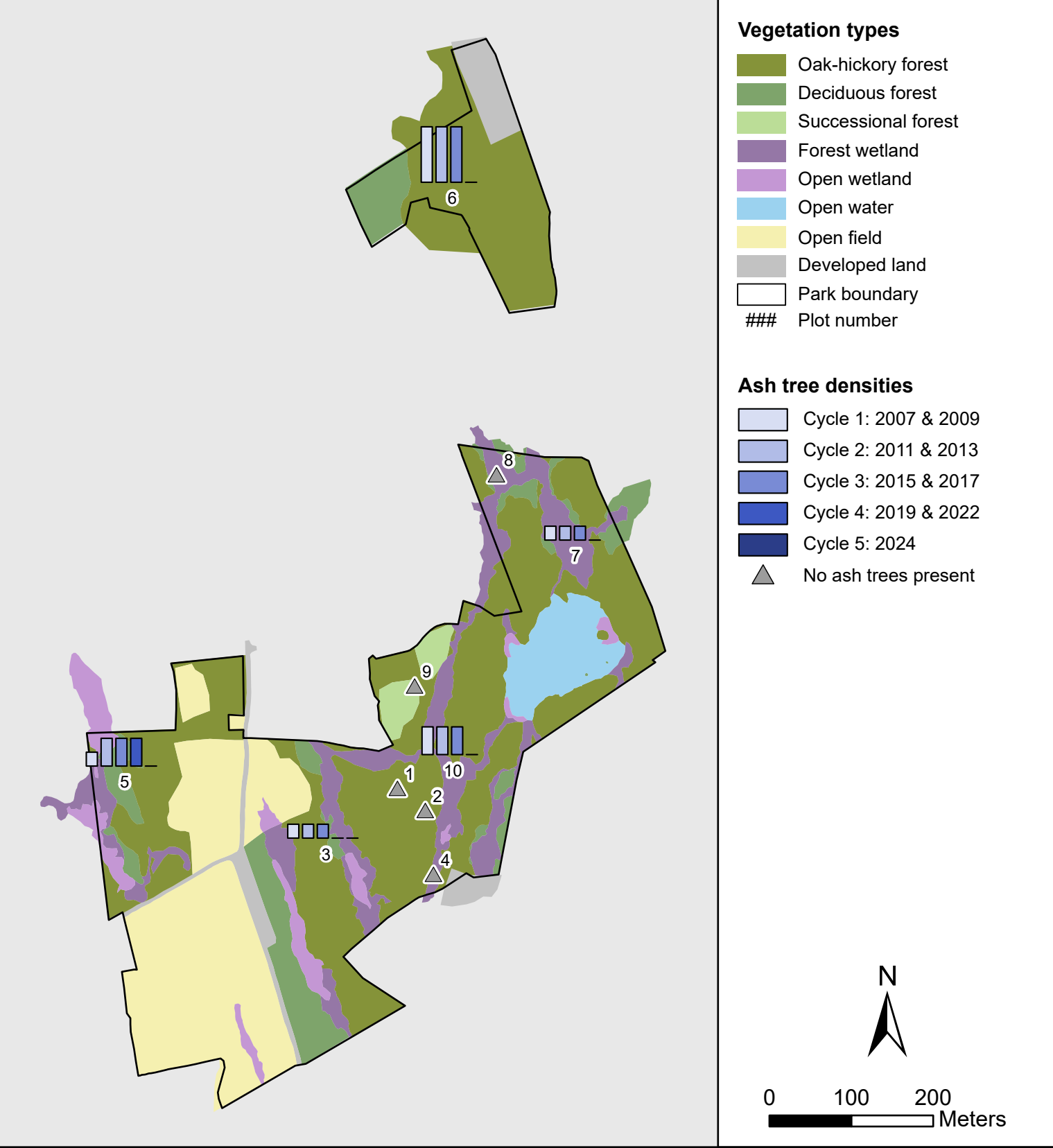
Coarse woody debris volume in forest plots sampled in the most recent census (2022 & 2024). Plots are sampled in an alternating panel, with plots 1-5 sampled in 2024, and plots 6-10 sampled in 2022. Volumes range from 0 to 81.2 m³/ha (1,159.9 ft³/ac). Plots are color coded by volume to indicate whether they meet the 20-50 m³/ha (285.8-714.6 ft³/ac) threshold in Müller and Büttler (2010). Reporting Date: 2/24/2025.





Map 13. Ash Tree Density by Cycle

Trends in live ash tree density in forest plots sampled from 2007-2024. Plots are sampled in an alternating panel, with plots 1-5 sampled in 2007, 2011, 2015, 2019, and 2024, and plots 6-10 sampled in 2009, 2013, 2017, and 2022. Densities range from 0 to 4 stems/plot (400m²) and only include individuals > 10 cm DBH. Charts may be shifted from actual plot locations to prevent overlap. Reporting Date: 2/25/2025.



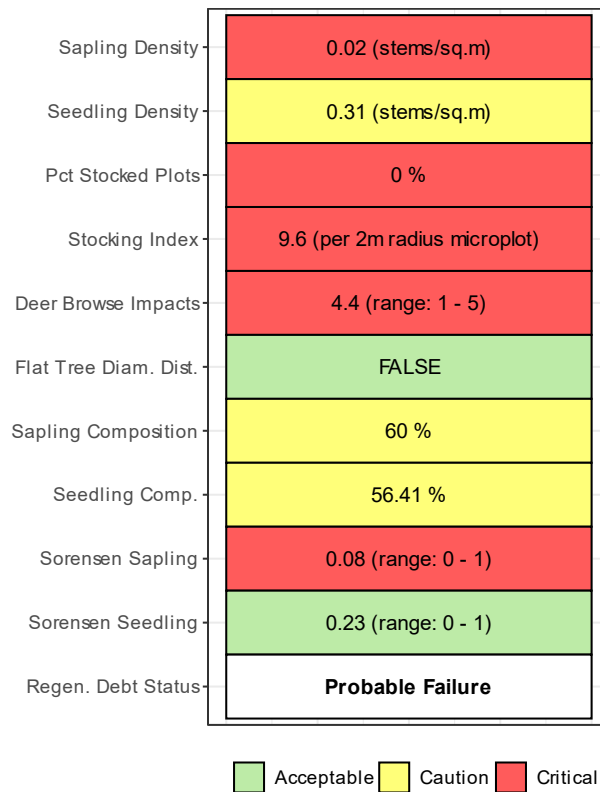


Figure 1. Regeneration Debt metrics and status for the most recent 4-year census (2022 and 2024) in Weir Farm National Historical Park. Flat Tree Diam. Dist. stands for Flat Tree Diameter Distribution. If TRUE, the density of small trees is lower than expected due to chronic regeneration failure. Sapling/Seedling Composition is the % of total stems composed of native canopy-forming species. Sorensen is a measure of how closely the regen. layer matches canopy composition. For more details on metric calculations, thresholds and assessment of status, see Miller et al. 2023.

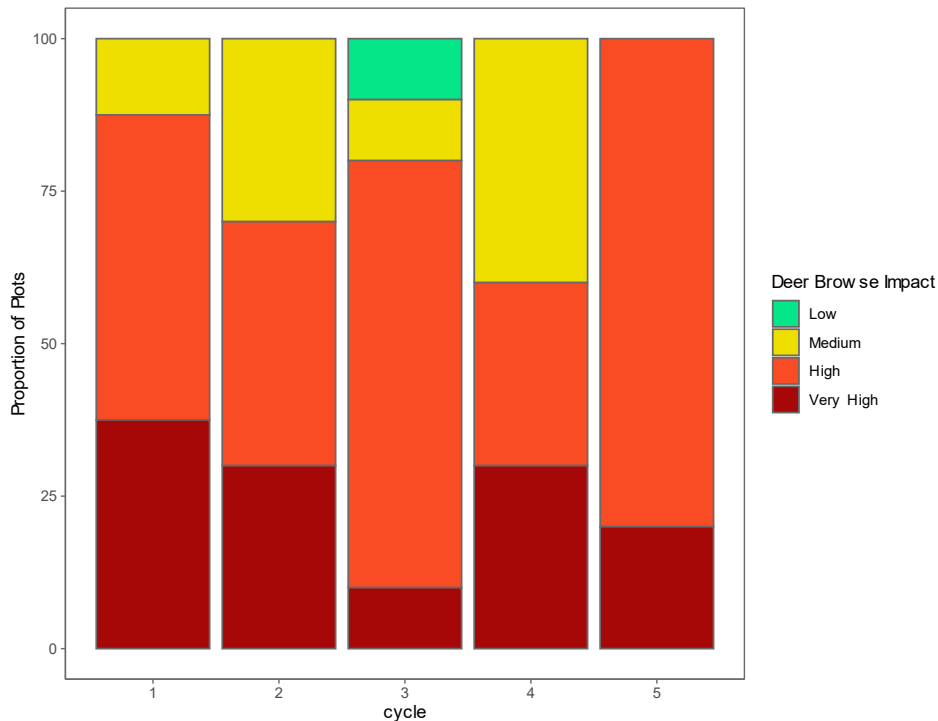


Figure 2. Deer browse impacts by cycle Weir Farm National Historical Park. Cycle 1: 2006 – 2009; Cycle 2: 2010 – 2013; Cycle 3: 2014 – 2017; Cycle 4: 2018 – 2022; Cycle 5: 2024. Note that Cycle 5 is only partially complete.

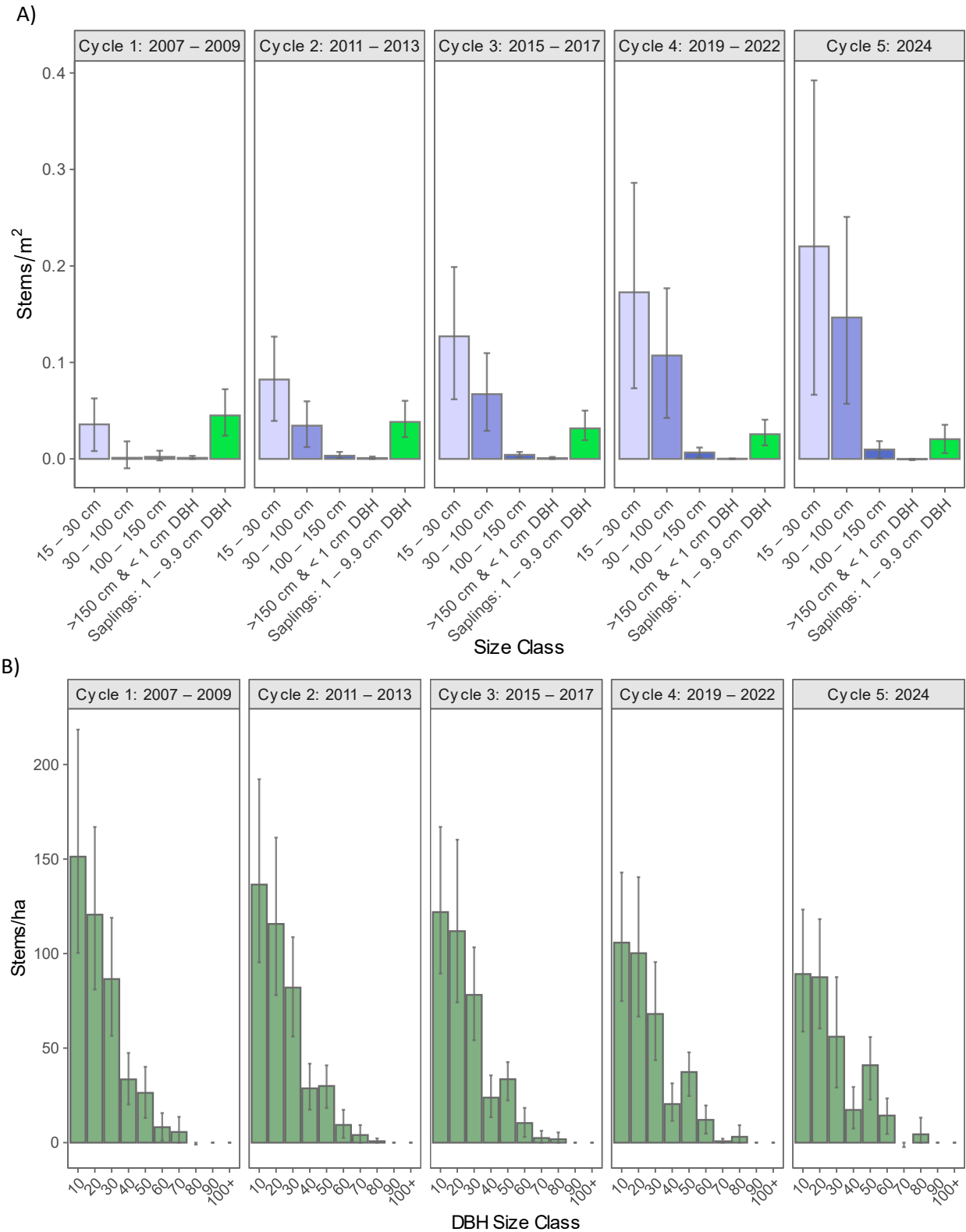


Figure 3. Stem density distributions in 10 cm by cycle in Weir Farm National Historical Park. Cycle 1: 2006 – 2009; Cycle 2: 2010 – 2013; Cycle 3: 2014 – 2017; Cycle 4: 2018 – 2022; Cycle 5: 2024. Note that Cycle 5 is only partially complete. Figure A shows regeneration densities by size class. Figure B shows tree density by diameter at breast height (DBH) increments. Error bars are 95% bootstrapped confidence intervals. An asterisk denotes a linear DBH distribution that is indicative of long-term recruitment failure.

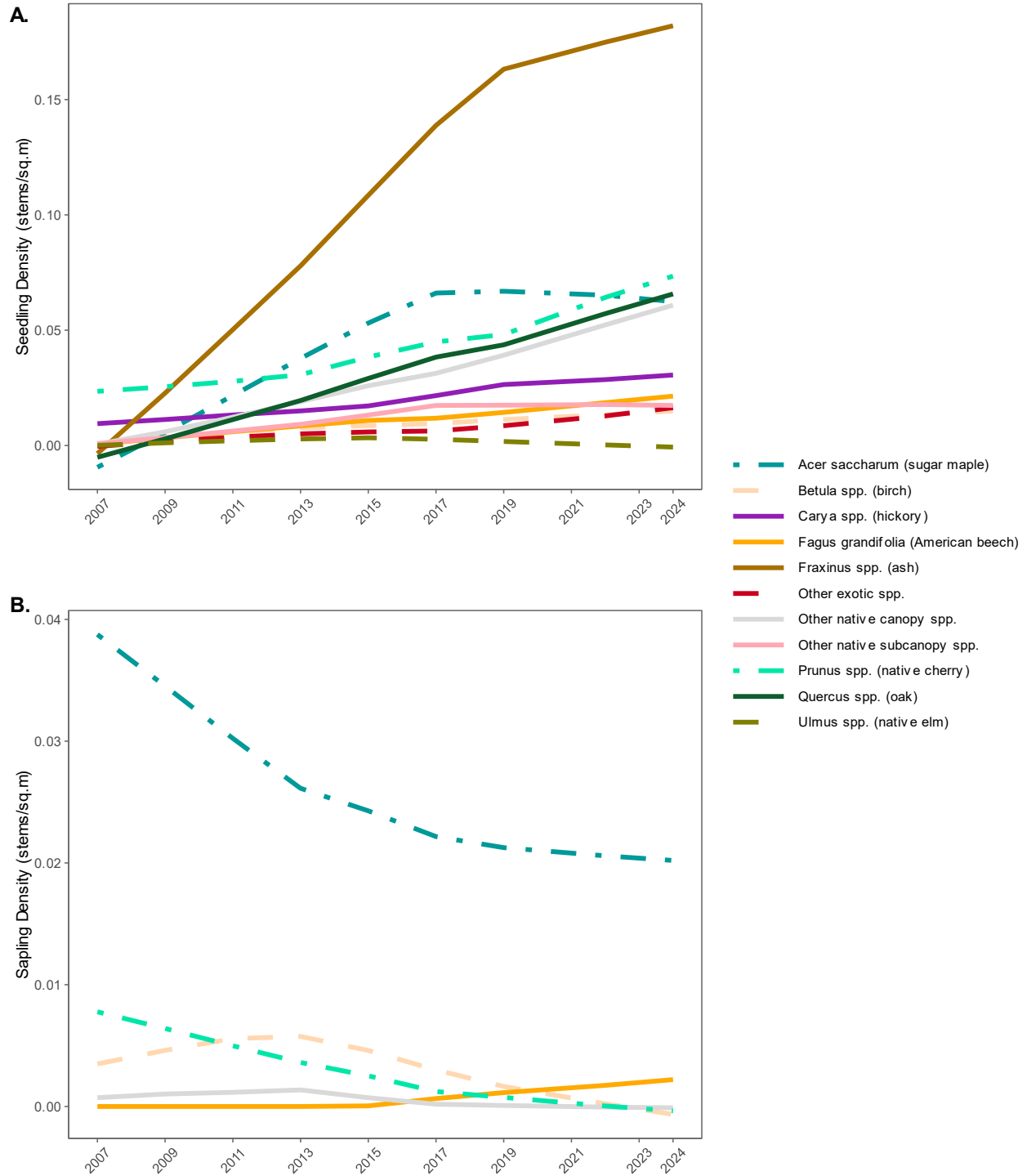


Figure 4. Loess smoothed changes in stem density for seedlings (A) and saplings (B) by species group and sample year in Weir Farm National Historical Park. Specified loess span approximated a linear trend between consecutive sample events per panel.

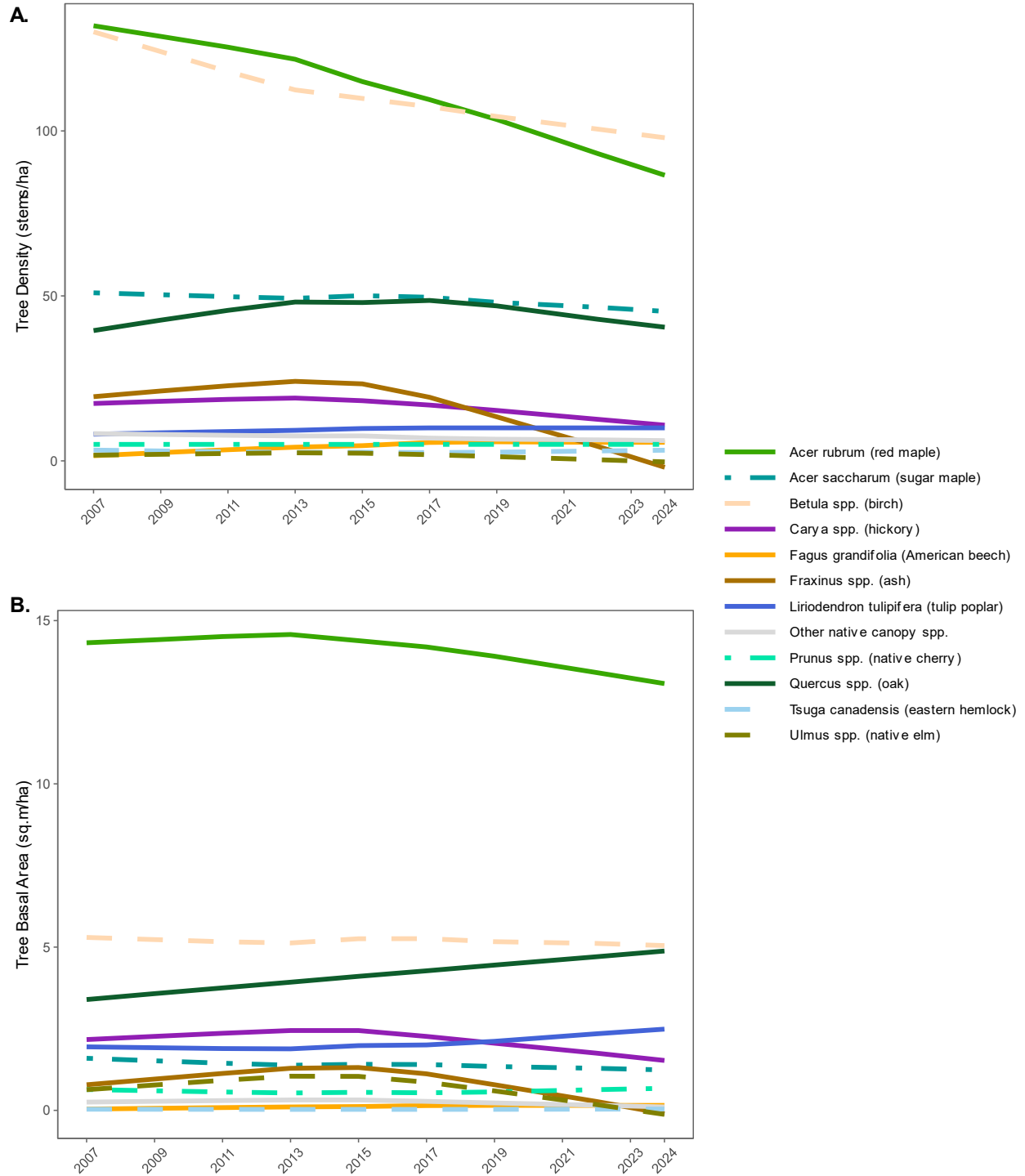


Figure 5. Loess smoothed changes in tree stem density (A) and basal area (B) by species group and sample year in Weir Farm National Historical Park. Specified loess span approximated a linear trend between consecutive sample events per panel.

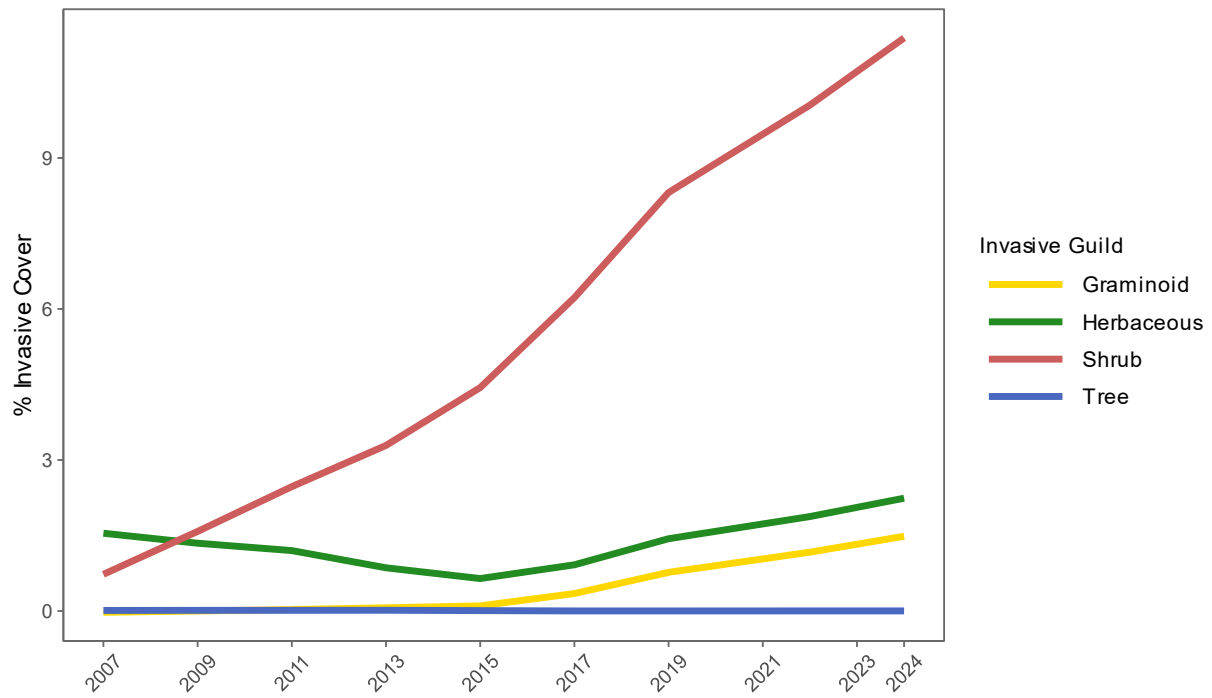


Figure 6. Loess smoothed changes in invasive plant percent cover by guild and sample year in Weir Farm National Historical Park. Specified loess span approximated a linear trend between consecutive sample events per panel.

Table 1. Average plot-level seedling and sapling stem densities (stems per m²) and stocking index by cycle (at the 2m radius scale). Only native, canopy-forming species are included. Note that *Fraxinus* spp. (ash species) are no longer considered canopy-forming species. Cycle 1: 2006 – 2009; Cycle 2: 2010 – 2013; Cycle 3: 2014 – 2017; Cycle 4: 2018 – 2022; Cycle 5: 2024. Plots are sampled in an alternating panel, with Panel 1 sampled first, and Panel 2 sampled two years later. The stocking index quantifies whether current regeneration densities are sufficient to restock a forest canopy. The index is a weighted sum of seedling and sapling densities where larger seedling size classes get higher weights. Cells highlighted in green are plots that meet the minimum management target of 0.25 seedlings/m² (~1,000 seedlings/acre) and 0.14 saplings/m² (~550 saplings/acre) or have a stocking index >100. These are the same thresholds used in Figure 2 and are described in Miller et al. 2023. Note that Cycle 5 is only partially complete.

Plot	Panel	Seedlings per m ²					Saplings per m ²					Stocking Index				
		Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
1	1	0.29	0.16	0.42	0.74	0.85	0.13	0.11	0.08	0.05	0.05	22.00	36.33	29.33	14.00	26.33
2	1	0.08	0.08	0.56	0.50	0.98	0.08	0.08	0.08	0.05	0.05	1.33	1.33	10.33	9.33	17.00
3	1	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.67
4	1	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00
5	1	0.00	0.00	0.16	0.16	0.19	0.08	0.08	0.03	0.03	0.00	16.67	16.67	18.67	19.67	9.67
6	2	0.00	0.08	0.08	0.03	---	0.00	0.03	0.00	0.03	---	0.00	1.00	1.00	0.33	---
7	2	0.03	0.08	0.27	0.56	---	0.03	0.03	0.03	0.03	---	0.33	1.33	4.67	15.33	---
8	2	0.00	0.05	0.03	0.03	---	0.03	0.03	0.00	0.00	---	0.00	0.67	0.67	0.67	---
9	2	0.05	0.32	0.74	0.29	---	0.05	0.08	0.03	0.00	---	23.67	43.33	10.67	6.00	---
10	2	0.08	0.11	0.13	0.19	---	0.00	0.00	0.00	0.03	---	1.00	1.67	8.33	20.00	---

Table 2. Average % cover and number of invasive species detected in each plot by cycle. Cycle 1: 2006 – 2009; Cycle 2: 2010 – 2013; Cycle 3: 2014 – 2017; Cycle 4: 2018 – 2022; Cycle 5: 2024. Plots are sampled in an alternating panel, with Panel 1 sampled first, and Panel 2 sampled two years later. Plots with at least 10% average cover or 4 or more invasive species present are highlighted in yellow. Note that Cycle 5 is only partially completed.

Plot	Panel	Average % Cover					Number of Species per Plot				
		Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
1	1	0.24	0.86	2.43	5.54	11.84	3	6	6	6	10
2	1	0.04	0.24	0.64	0.26	0.64	4	4	5	10	8
3	1	0.00	0.00	0.01	0.00	0.00	1	1	1	2	4
4	1	1.35	1.33	11.74	12.79	15.23	3	7	8	10	10
5	1	0.00	0.01	0.04	0.05	2.20	1	5	6	7	7
6	2	0.00	0.00	0.00	0.00	---	1	0	0	2	---
7	2	0.44	0.65	2.41	6.71	---	3	5	8	9	---
8	2	0.23	4.70	20.50	38.25	---	4	5	10	10	---
9	2	21.43	18.18	14.18	55.75	---	9	12	13	12	---
10	2	2.39	2.60	1.16	0.89	---	4	5	5	6	---

Table 3. Number of plots out of 40 where exotic species were detected by cycle. Cycle 1: 2006 – 2009; Cycle 2: 2010 – 2013; Cycle 3: 2014 – 2017; Cycle 4: 2018 – 2022; Cycle 5: 2024. Priority invasive species that capable of dominating Northeastern US forest habitats are highlighted in yellow. Note that Cycle 5 is only partially completed.

Latin Name	Common Name	Priority Invasive	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
<i>Acer platanoides</i>	Norway maple	Yes	0	3	1	3	3
<i>Aesculus hippocastanum</i>	horse chestnut	No	0	0	1	0	0
<i>Alliaria petiolata</i>	garlic mustard	Yes	1	5	6	6	2
<i>Berberis thunbergii</i>	Japanese barberry	Yes	8	9	9	9	5
<i>Berberis vulgaris</i>	common barberry	Yes	0	0	0	1	0
<i>Cardamine impatiens</i>	narrowleaf bittercress	Yes	1	1	4	7	1
<i>Celastrus orbiculatus</i>	Asiatic bittersweet	Yes	8	7	8	8	5
<i>Duchesnea indica</i>	mock strawberry	No	0	0	0	2	0
<i>Elaeagnus angustifolia</i>	Russian olive	Yes	0	0	1	0	0
<i>Epipactis helleborine</i>	broadleaf helleborine	No	1	0	1	1	1
<i>Euonymus</i>	burning-bush	Yes	1	0	2	0	0
<i>Euonymus alatus</i>	burning-bush	Yes	5	6	8	8	5
<i>Euonymus fortunei</i>	climbing euonymus	Yes	1	1	3	5	1
<i>Galium mollugo</i>	false baby's breath	No	0	1	0	0	0
<i>Ligustrum</i>	privet	Yes	0	1	2	2	2
<i>Lonicera - Exotic</i>	honeysuckle - exotic	Yes	0	0	0	3	1
<i>Lonicera japonica</i>	Japanese honeysuckle	Yes	1	4	4	4	3
<i>Malus</i>	apple	No	1	2	4	3	0
<i>Microstegium vimineum</i>	Japanese stiltgrass	Yes	1	2	5	5	3
<i>Nasturtium officinale</i>	watercress	No	2	0	0	0	0
<i>Persicaria longiseta</i>	Asiatic lady's thumb	Yes	0	1	0	0	0
<i>Persicaria maculosa</i>	spotted lady's thumb	No	0	1	1	1	0
<i>Photinia villosa</i>	Asiatic photinia	Yes	0	0	0	0	1
<i>Picea abies</i>	Norway spruce	No	0	0	1	1	1
<i>Poa compressa</i>	Canada bluegrass	No	0	1	0	0	0
<i>Poa trivialis</i>	rough bluegrass	No	2	0	0	1	0
<i>Prunus avium</i>	sweet cherry	No	0	0	1	0	2
<i>Prunus subhirtella</i>	winter-flowering cherry	No	0	0	0	0	1
<i>Rosa multiflora</i>	multiflora rose	Yes	5	6	5	6	3
<i>Rubus phoenicolasius</i>	wine raspberry	Yes	0	2	2	4	0
<i>Taraxacum officinale</i>	common dandelion	No	0	0	2	0	0
<i>Veronica officinalis</i>	common speedwell	No	1	0	0	2	1
<i>Viburnum dilatatum</i>	linden arrowwood	Yes	0	0	0	0	1
<i>Viburnum plicatum</i>	Japanese snowball	Yes	0	0	0	0	2
<i>Viburnum sieboldii</i>	Siebold's arrowwood	Yes	0	0	0	1	0
<i>Vincetoxicum</i>	swallow-wort	Yes	1	0	0	0	0
<i>Vincetoxicum nigrum</i>	black swallow-wort	Yes	0	2	2	2	1

Table 4. Invasive plant and pest/pathogen early detections in Weir Farm National Historical Park observed in the most recent census of each plot. Coordinates are in UTM NAD83 Zone 18N.

Plot	Year	X	Y	Latin Name	Common Name	Type
WEFA-006	2022	629579	4569301	<i>Rubus phoenicolasius</i>	wine raspberry	shrub
WEFA-007	2022	629730	4568864	<i>Rubus phoenicolasius</i>	wine raspberry	shrub
WEFA-008	2022	629628	4568945	<i>Rubus phoenicolasius</i>	wine raspberry	shrub
WEFA-009	2022	629528	4568687	<i>Rubus phoenicolasius</i>	wine raspberry	shrub
WEFA-001	2024	629507	4568562	<i>Adelges tsugae</i>	hemlock woolly adelgid	pest
WEFA-005	2024	629179	4568588	<i>Agrilus planipennis</i>	emerald ash borer	pest
WEFA-001	2024	629507	4568562	<i>Fiorinia externa</i>	elongate hemlock scale	pest
WEFA-001	2024	629507	4568562	<i>Litylenchus crenatae ssp. Mcannii complex</i>	beech leaf disease	pest
WEFA-003	2024	629425	4568500	<i>Litylenchus crenatae ssp. Mcannii complex</i>	beech leaf disease	pest
WEFA-004	2024	629551	4568457	<i>Litylenchus crenatae ssp. Mcannii complex</i>	beech leaf disease	pest
WEFA-005	2024	629179	4568588	<i>Litylenchus crenatae ssp. Mcannii complex</i>	beech leaf disease	pest
WEFA-006	2022	629579	4569301	<i>Litylenchus crenatae ssp. Mcannii complex</i>	beech leaf disease	pest
WEFA-007	2022	629730	4568864	<i>Litylenchus crenatae ssp. Mcannii complex</i>	beech leaf disease	pest

Table 5. List of tree species included in Maps 3 and 4 and how each was displayed.

Latin Name	Group: Map 3. Regeneration	Group: Map 4. Tree Canopy
<i>Acer pensylvanicum</i>	Other native subcanopy spp.	---
<i>Acer platanoides</i>	Other exotic spp.	---
<i>Acer rubrum</i>	---	<i>Acer rubrum</i> (red maple)
<i>Acer saccharum</i>	<i>Acer saccharum</i> (sugar maple)	<i>Acer saccharum</i> (sugar maple)
<i>Betula alleghaniensis</i>	<i>Betula</i> spp. (birch)	<i>Betula</i> spp. (birch)
<i>Betula lenta</i>	<i>Betula</i> spp. (birch)	<i>Betula</i> spp. (birch)
<i>Carpinus caroliniana</i>	Other native subcanopy spp.	---
<i>Carya</i>	<i>Carya</i> spp. (hickory)	<i>Carya</i> spp. (hickory)
<i>Carya cordiformis</i>	<i>Carya</i> spp. (hickory)	---
<i>Carya ovata</i>	---	<i>Carya</i> spp. (hickory)
<i>Crataegus</i>	Other exotic spp.	---
<i>Fagus grandifolia</i>	<i>Fagus grandifolia</i> (American beech)	<i>Fagus grandifolia</i> (American beech)
<i>Fraxinus americana</i>	<i>Fraxinus</i> spp. (ash)	---
<i>Fraxinus pennsylvanica</i>	<i>Fraxinus</i> spp. (ash)	---
<i>Liriodendron tulipifera</i>	---	<i>Liriodendron tulipifera</i> (tulip poplar)
<i>Malus</i>	Other exotic spp.	---
<i>Nyssa sylvatica</i>	Other native canopy spp.	Other native canopy spp.
<i>Prunus</i>	<i>Prunus</i> spp. (native cherry)	---
<i>Prunus avium</i>	Other exotic spp.	---
<i>Prunus serotina</i>	<i>Prunus</i> spp. (native cherry)	<i>Prunus</i> spp. (native cherry)
<i>Quercus alba</i>	<i>Quercus</i> spp. (oak)	<i>Quercus</i> spp. (oak)
<i>Quercus coccinea</i>	---	<i>Quercus</i> spp. (oak)
<i>Quercus montana</i>	<i>Quercus</i> spp. (oak)	<i>Quercus</i> spp. (oak)
<i>Quercus rubra</i>	<i>Quercus</i> spp. (oak)	<i>Quercus</i> spp. (oak)
<i>Quercus velutina</i>	---	<i>Quercus</i> spp. (oak)
<i>Tsuga canadensis</i>	---	<i>Tsuga canadensis</i> (eastern hemlock)