

Rapid Ecological Assessment of Forest Cover of Harbor Island NWR (2014)

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Highlights

- *Overstory* is primarily dominated by northern white-cedar, with balsam fir and sugar maple also present at high levels.
- *Midstory* is dominated by balsam fir saplings.
- *Ground cover* is primarily made up of lichen, moss or bare ground; virtually no seedlings are present.
- Combined with past observations, these data suggest that white-tailed deer (*Odocoileus virginianus*) browse is heavy and has been for some time. Moreover, the effects of non-native earthworms may exacerbate the browse effects.

Methods

We established three transects of different lengths and bearings according to the shape of the island and collected forest compositional and structural data within 28 fixed-radius circular plots (see Appendix 1). Plots were established at fixed intervals of 440 ft along each transect. One transect traversed the south end of the island from east to west, while the other two transects ran north-south on the eastern and western sides of the island. Aerial photos were used to first determine the general transect direction and the GPS coordinates (DD, NAD83) of the start and end points of each transect. Lateral movements were made as necessary to sample as much forest diversity as possible.

Circular plots of 0.025 ac (1/40th ac) were established (Figure 1), each with a radius of 18.4 ft using the closest tree as the plot center. Three sub-plot transects were established for use in measuring coarse woody debris (CWD) and ground flora: one transect at 0 degrees, one transect at 135 degrees, and one transect at 225 degrees, all with respect to plot center. One length of rope was used to lay out the sub-plot transects, with ground flora measured within 3.3 sq ft (1 m²) quadrats at 3.3 ft, 6.6 ft, and 13.1 ft. In total, 10 plots were measured along Transect A, 12 plots along Transect B, and 6 plots along Transect C (Appendix 1).

At each plot, a photo was taken facing north from plot center and four densiometer measurements were taken from plot center facing north, east, south, and then west. If any invasive species were present within the plot, the species presence was noted. For each tree (defined as a woody stem ≥ 5 in diameter breast height or DBH) the species name, DBH, status (alive or dead), and crown class (dominant, co-dominant, intermediate or suppressed) were recorded. Saplings (defined as a woody stem between 1 in and 5 in DBH) were counted by species within $\frac{1}{4}$ of each 0.025 ac plot, rotating which $\frac{1}{4}$ area was counted from plot to plot. For

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example, if starting at Plot 1 and measuring the number of saplings in the NE ¼ area, then at Plot 5 one would be back to the NE ¼ area to measure again. If CWD was intersecting a sub-plot transect, the following measurements were recorded: tree species, diameter at the small end of the CWD (no less than 5 in), diameter at the large end of the CWD, length from the small end to the large end, and decay class. CWD was measured along each sub-plot transect only if: 1) the central axis of the piece intersected a transect, 2) the diameter at the small end was ≥ 5 in, 3) the piece was at least 3.3 ft (1 m) long, 4) the piece was in decay class 1-4, not 5. At each quadrat along the established transects, percent cover of ground flora functional groups or species (e.g., woody plants, herbaceous plants, and lichens/mosses/bare ground) were ranked in each quadrat as 0 (not present), T (trace), 1 (1-25%), 2 (26-50%), 3 (51-75%) or 4 (>75%). More on methods can be found in the 2014 *Forest Rapid Ecological Assessment Manual* by G. Corace and H. Petrillo (see ServCat). Data reside in Excel format at Seney NWR.

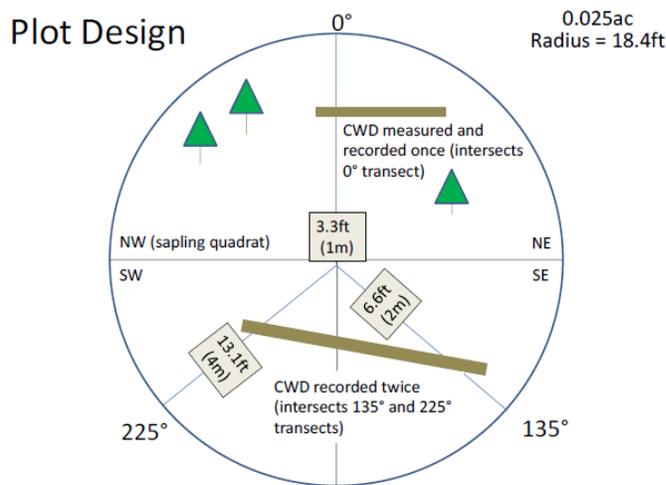


Figure 1. Plot design with coarse woody debris (CWD) sub-plot transects at 0, 135 and 225 degrees. CWD is measured based on intercept anywhere along the sub-plot transect and minimum diameter requirements (nothing is measured that is <5 in). Sub-plot 1 m² quadrats were placed on each line: one at 3.3 ft from center, one at 6.6 ft, and one at 13.1 ft.

Results

Overstory

Overall, 13 tree species were observed over the 28 plots (Table 1). The overall dominant tree species according to both trees per acre and basal area per acre (ft²/ac) was northern white-cedar (see Table 1 for binomials) and the mean number of species observed per plot was 2.2 (± 1.0). Transect B was the only transect not to be dominated by northern white-cedar and was instead dominated by sugar maple (Table 2). The overall trees per acre across all transects was 173.5 (± 105.1), with Transect A having the greatest number of trees per acre (Table 3). Overall live tree basal area was 130.4 (± 101.6) ft²/ac, with Transect A have the greatest live tree basal area. Transect A also had the highest percent canopy closed. Overall, there were on average 30 (± 47) snags per acre and an average snag basal area of 10.7 (± 17.9) ft²/ac. Transect C had both the highest number of snags per acre and average snag basal area (Table 3). The

overall average live tree DBH was 10.6 (± 5.0) inches, with the majority of trees sampled falling into the 5-6.9 inches size class (Table 3, Figure 2). The overall average snag DBH was 7.9 (± 1.5) inches with the majority of snags sampled falling into the 7- 8.9 inches size class (Table 3, Figure 3).

Table 1. Overstory tree species encountered (by U.S. Forest Service species code).

Code	Common name	Genus species
012	Balsam fir	<i>Abies balsamea</i>
129	White pine	<i>Pinus strobus</i>
241	Northern white-cedar	<i>Thuja occidentalis</i>
315	Striped maple	<i>Acer pensylvanicum</i>
316	Red maple	<i>Acer rubrum</i>
318	Sugar maple	<i>Acer saccharum</i>
375	Paper birch	<i>Betula papyrifera</i>
541	White ash	<i>Fraxinus americana</i>
741	Balsam poplar	<i>Populus balsamifera</i>
743	Bigtooth aspen	<i>Populus grandidentata</i>
746	Quaking aspen	<i>Populus tremuloides</i>
809	Northern pin oak	<i>Quercus ellipsoidalis</i>
833	Northern red oak	<i>Quercus rubra</i>

Table 2. Composition summary of overstory trees sampled.

Transect	Number of plots	Number of species	Mean (\pmSD) number of species per plot	Dominant species (greatest number of trees per acre)	Dominant species (greatest basal area, ft²/ac)
A	10	7	2.2 \pm 1.0	Northern white-cedar	Northern white-cedar
B	12	9	2.2 \pm 1.0	Sugar maple	Sugar maple
C	6	7	2.2 \pm 1.2	Northern white-cedar	Northern white-cedar
Overall	28	13	2.2 \pm 1.0	Northern white-cedar	Northern white-cedar

Table 3. Structure summary (mean (\pm SD) and range across plots within each transect) of overstory trees sampled.

Transect	Trees per acre	Tree basal area (ft ² /ac)	Tree DBH (in)	Tree crown class ^a	% Closed canopy ^b	Snags per acre	Snag basal area (ft ² /ac)	Snag DBH (in)
A	224 (\pm 129.5), 40-400	176.2 (\pm 138.1), 7.9-428.1	10.9 (\pm 5.1), 5.0-35.0	2.5 (\pm 0.9) 1-4	92.5 (\pm 6.4) 86.0-95.8	16 (\pm 28), 0-80	4.5 (\pm 7.7) 0-20.5	7.2 (\pm 0.8) 6.5-8.2
B	160 (\pm 88.6), 40-360	104.8 (\pm 71.9), 6.6-239.7	9.9 (\pm 4.9), 5.1-24.5	2.3 (\pm 0.7) 1-3	85.3 (\pm 10.5) 70.3-96.5	20 (\pm 27), 0-80	6.8 (\pm 9.3) 0-25.0	7.7 (\pm 2.0) 5.1-10.7
C	120 (\pm 56.6), 40-200	105.3 (\pm 59.3), 20.5-206.3	11.4 (\pm 5.8), 5.0-24.4	2.5 (\pm 1.2) 1-4	84.2 (\pm 16.2) 54.5-95.3	73.3 (\pm 77.6), 0-200	28.7 (\pm 30.6) 0-81.7	8.4 (\pm 1.4) 6.4-11.0
Overall	174.3 (\pm 105.1), 40-400	130.4 (\pm 101.6), 6.6-428.1	10.6 (\pm 5.0), 5.0-35.0	2.4 (\pm 0.8) 1-4	87.8 (\pm 9.0) 54.5-96.5	30 (\pm 47), 0-200	10.7 (\pm 17.9) 0-81.7	7.9 (\pm 1.5) 5.1-11.0

^a Crown class codes (numeric value): 1= dominant, 2= co-dominant, 3= intermediate, 4= suppressed.

^b Densimeter readings may be high because a tree was always chosen as plot center.

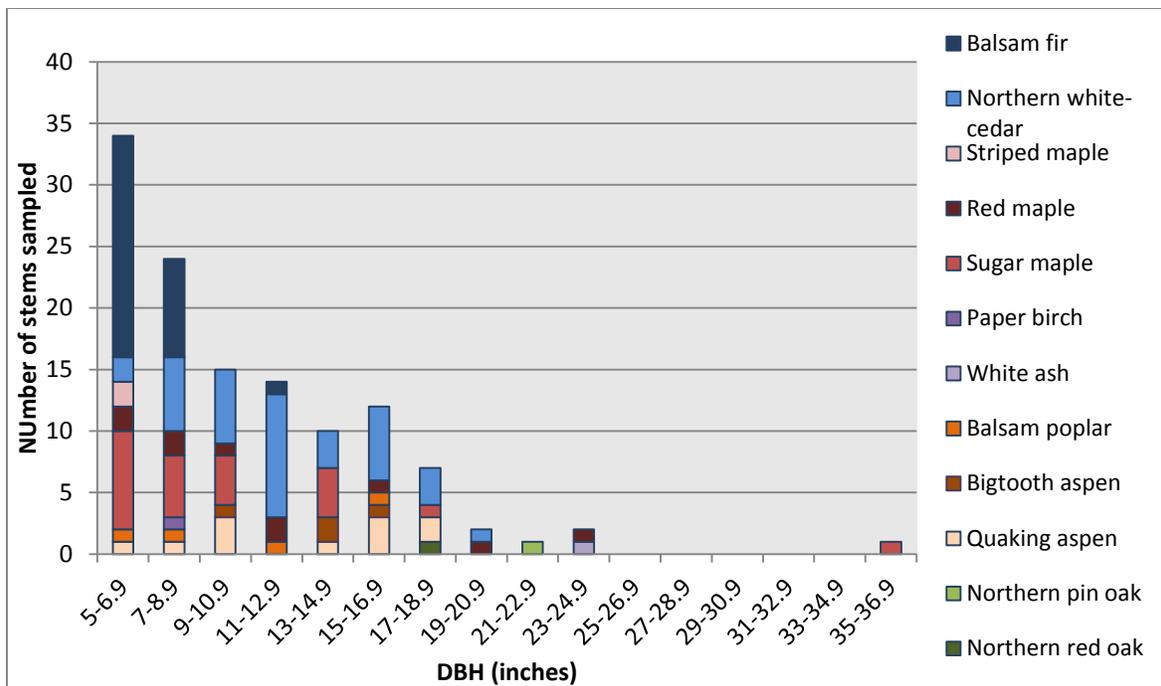


Figure 2. Size classes for live tree species observed according to diameter at breast height (DBH, inches).

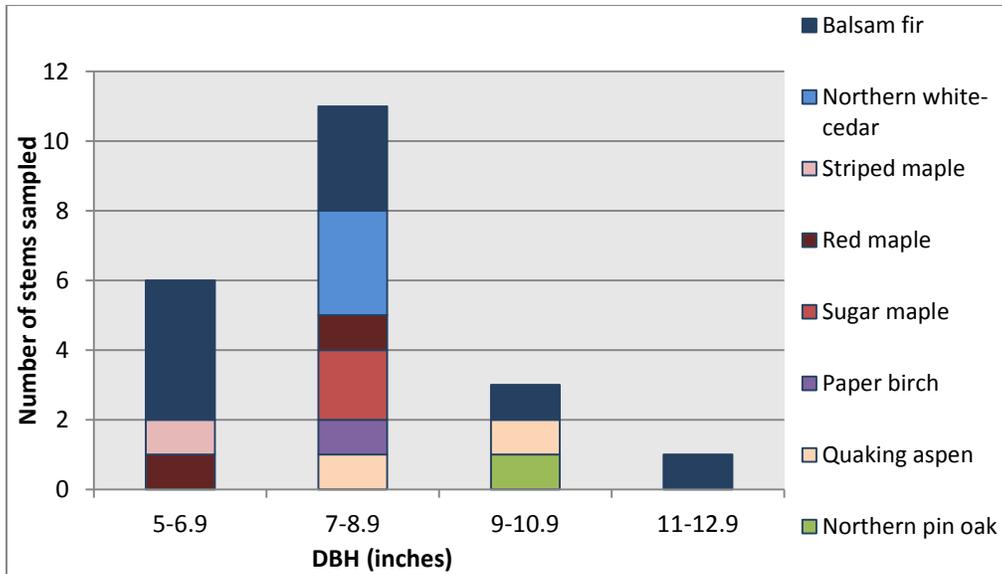


Figure 3. Size classes for snag species observed according to DBH (inches).

Midstory

For the midstory, the number of saplings per acre was calculated based on data from each quarter plot sampled. For Transect A there were on average 368 (± 377.5 , range: 0-960) saplings per acre, for Transect B there were on average 280 (± 342.0 , range: 0-960) saplings per acre, and for Transect C there were on average 1066.7 (± 942.1 , range: 0-2560) saplings per acre. No saplings were present in 32.1% (9/28) of plot quarters sampled. Overall, the average number of saplings per acre was 420 (± 513.7 , range: 0-2560). By species, balsam fir was the only species to be present as saplings for all three transects (Figure 4).

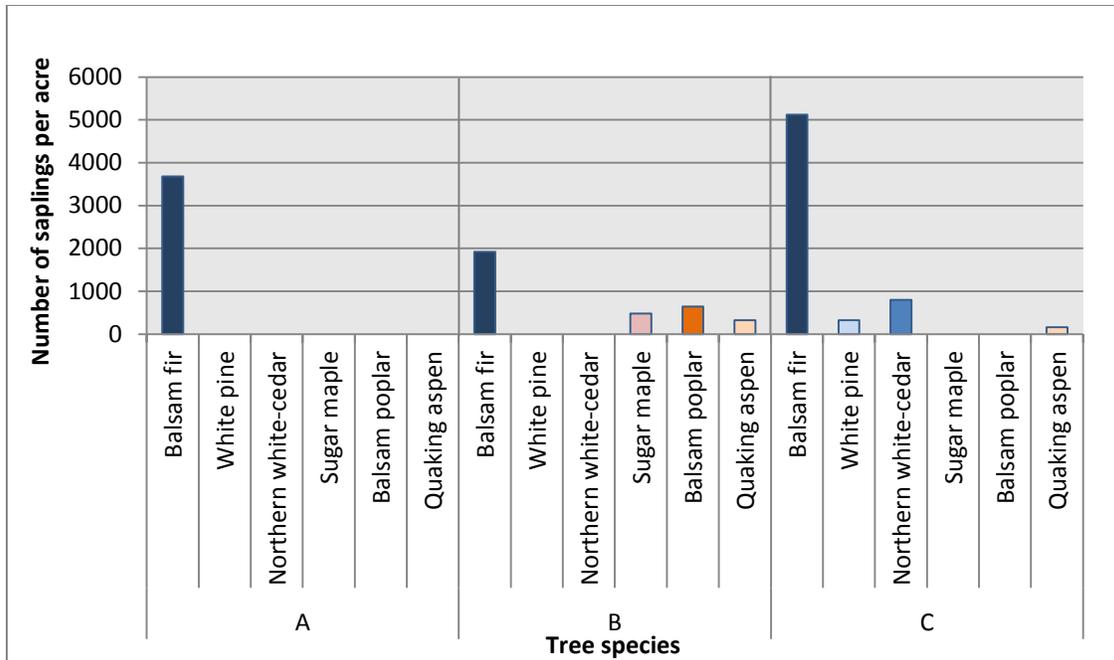


Figure 4. Numbers of saplings per acre for species observed along each transect.

Ground Cover

Groundcover was primarily dominated by lichen, moss and/or bare ground (82.5%); very few seedlings were present (Table 4). The invasive species, St. John’s wort, was present in one of the plots along Transect B.

Table 4. Average percent cover of woody plants, herbaceous plants and lichen/moss/bare ground from subplot 3.3 sq ft (1 m²) quadrat. The midpoints of each categorical percentage range were used for analysis.

Transect	Average Woody % Cover	Average Herbaceous % Cover	Average Lichen/Moss/Bare ground % Cover
A	5	20.45	78.4
B	7	24.3	83.1
C	6.4	10.25	88
Overall	6.2	19.9	82.5

Coarse Woody Debris (CWD)

Overall, 67.9% (19/28) of plots had CWD with 70% (7/10) of Transect A plots, 66.7% (8/12) of Transect B plots, and 66.7% (4/6) of Transect C plots having CWD intersecting along one of the three sub-plot transects. Overall, there were 1.1 (±1.2) pieces of CWD per plot. One piece (±0.9) per plot was along Transect A, 1.2 per plot (±1.4) were along Transect B, and 1.3 (±1.5) per plot were along Transect C. It should be noted that pieces of CWD were often present in plots but excluded from being counted because the DBH was less than 5.0 inches.

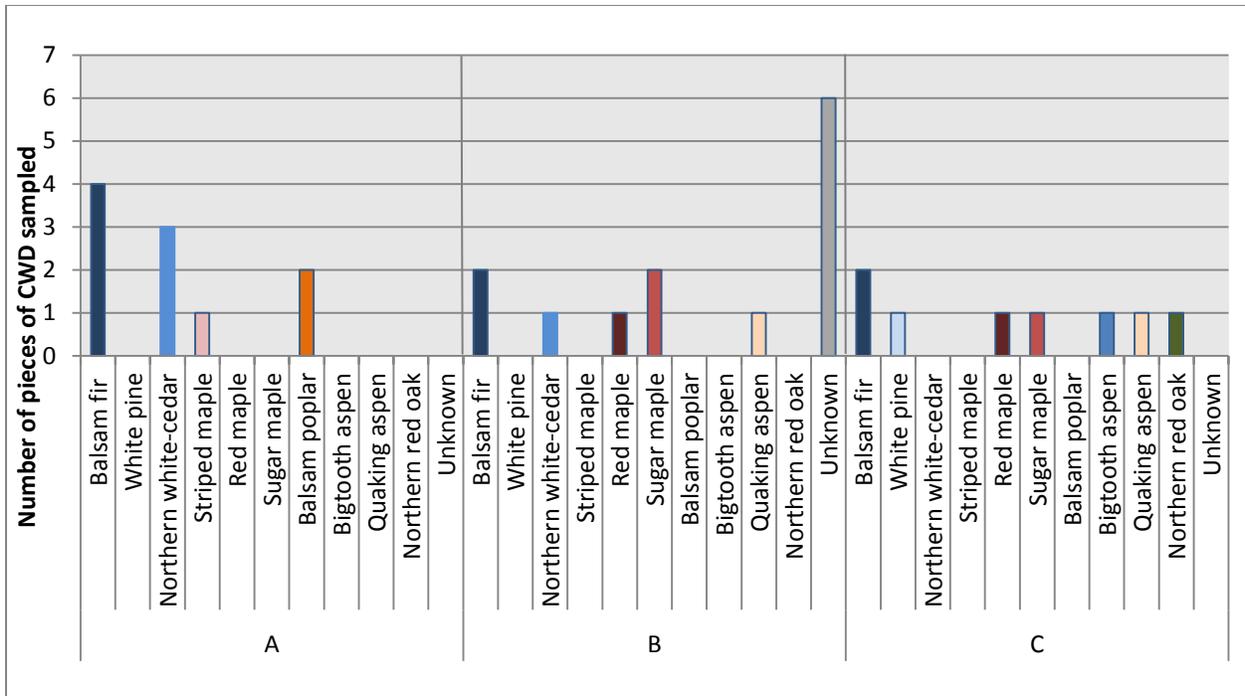


Figure 5. Numbers of pieces of CWD observed crossing sub-plot transect.

Discussion

Overall, Harbor Island NWR forests are quite heterogeneous and not suitable to thinking in terms of “forest stands.” Forest cover shifts from lowland conifers to mixed upland forests as topography changes. Many of the trees are growing in rocky soils. Site potential for many existing tree species is good, but the future of this forest is uncertain due to the potential adverse effects of climate change, non-native pathogens, and browse. For instance, our findings suggest that browse by white-tailed deer (*Odocoileus virginianus*) is—and has been for some time—a significant factor affecting forests at Harbor Island NWR. Balsam fir (a species not browsed upon unless deer are in starvation mode) comprises the majority of the midstory and groundcover, even though many other coniferous and deciduous species comprise the overstory. Past observations of non-native earthworms (*Corace pers. obs.*) may indicate that browse and the effects of earthworms are working together to alter these forests.

Appendix 1. Three transects along which a forest rapid ecological assessment was conducted at Harbor Island NWR in 2014, with corresponding starting and end point coordinates (DD, NAD83).

