

DATE: July 8, 2022

TO: Andy Stoltman, Tom Shockley

FROM: Brad Hutnik, Greg Edge, Lewis Wiechmann

SUBJECT: NHAL State Forest Hodge Podge timber sale post-harvest RMZ inventory

### Background

Per request, Greg Edge, Lewis Wiechmann, and Brad Hutnik, WDNR Division of Forestry silviculture staff, inventoried the 100 foot lake riparian management zone (RMZ) associated with the NHAL State Forest Hodge Podge timber sale on June 16, 2022. The Hodge Podge timber sale is located near Boulder Junction, adjacent to Whitney Lake. Prior to the timber sale being harvested, C. Matula inventoried the RMZ on May 4, 2021. This inventory was intended to augment C. Matula's review by inventorying the RMZ post-sale.

Prior to this inventory, 22 random plots within the 100' RMZ were generated and mapped by H. Keller using ArcGIS software. This map was converted into a georeferenced PDF and used with Avenza Maps to navigate to plot centers in the field. 21 plots were inventoried, 5 were moved to avoid overlap with other plots. Where plot locations were altered, the new plot centers were determined by pacing three chains from the previous plot location, and 100 was added to the original plot number to distinguish these plots (See Appendix A). At each plot center, a fixed area, 1/20<sup>th</sup> acre, circular plot was established. Within each plot, all trees greater than 5" DBH were inventoried. Each tree was evaluated for species, DBH (measured to the nearest 1"), and whether it was alive or dead. Notes regarding tree regeneration were also recorded.

### Findings

Based on post-sale inventory analysis, the mean basal area within the 100 foot RMZ is 121.5 ft<sup>2</sup> per acre. Within the RMZ, basal area ranged from 51.9 to 205.6 ft<sup>2</sup> per acre. This analysis estimates with 94% confidence that the true mean RMZ basal area lies between 103.8 and 139.3. Under similar conditions, about 94% of repeated samples in this stand (using the same number of plot clusters) will contain the true mean. Assuming the variation between the sample points is representative of the RMZ, sampling intensity was sufficient to ensure that the calculated mean is within 15 percent of the true mean with 94% confidence.

Table 1: Hodge Podge TS RMZ Statistics

Overstory Data	
cluster	Over basal area (sq.ft./ac.)
13	192.7
110	109.6
12	121.5
17	89.7
7	106.6
105	99.6
4	98.2

20	110.7
2	147.0
19	101.0
21	122.7
22	88.4
1	112.6
18	159.0
16	64.8
15	51.9
103	81.9
11	151.5
108	161.0
14	205.6
106	176.0
Minimum	51.9
Maximum	205.6
Mean	121.5
Variance	1669.1
Standard deviation	40.9
Standard error	8.9
Percent error	14.6
CI mean lower limit	103.8
CI mean upper limit	139.3
clusters for w/in 15%	20
clusters for w/in 10%	45

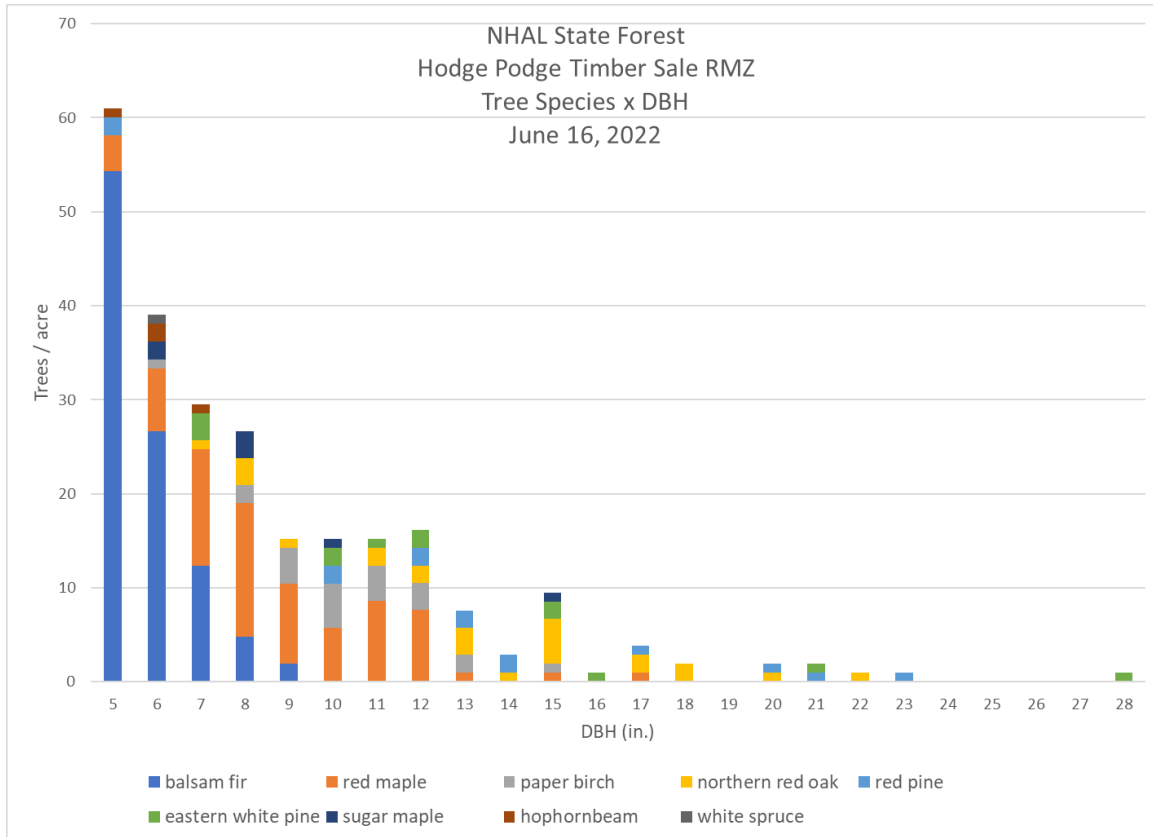
Post-sale inventory analysis also shows that there are approximately 250 live trees per acre in the RMZ greater than 5” DBH (See Appendix B). They are comprised primarily of red maple, northern red oak, balsam fir, red pine, eastern white pine, paper birch, sugar maple, ironwood, and white spruce. The relative importance value (IV) for each species is listed below.

Species	Density	Relative Density	Frequency	Relative Frequency	Dominance (BA)	Relative Dominance	Relative Importance Value
red maple	70.5	28.03	95.24	29.41	32.2	26.51	27.98
balsam fir	100	39.77	66.67	20.59	18.5	15.18	25.18
northern red oak	22.9	9.09	33.33	10.29	24.9	20.47	13.29
paper birch	21	8.33	57.14	17.65	12.8	10.54	12.17
eastern white pine	12.4	4.92	33.33	10.29	14	11.48	8.9
red pine	13.3	5.3	19.05	5.88	15.2	12.51	7.9
sugar maple	6.7	2.65	4.76	1.47	3.1	2.52	2.21
hophornbeam	3.8	1.52	9.52	2.94	0.8	0.62	1.69
white spruce	1	0.38	4.76	1.47	0.2	0.15	0.67
Totals	251.43	100	323.81	100	121.53	100	100

Table 2: Post-sale Hodge Podge RMZ tree species relative importance values (IV)

Note, IV is a measure of how dominant a tree species is in a stand. IV is a sum of relative density, relative frequency, and relative dominance (basal area) for a species expressed as a percent of total stand IV and ranges from 0 to 100.

Tree species composition is not consistent across size classes. In general, northern red oak, red pine, and eastern white pine are predominantly found in the large sawtimber size class, QMD approximately 14.3” while balsam fir is predominantly found in the pole timber size class, QMD approximately 5.8” (See Appendix B & C). Other species can be found across a wider DBH range. In addition, 28.6 snags per acre were present in the RMZ, predominantly composed of paper birch (See Appendix D).



## Discussion

The post-sale basal area within the Hodge Podge RMZ meets the target basal area minimum cited in the WDNR Best Management Practices for Water Quality manual. The RMZ also meets the manual’s criteria of having residual, larger diameter trees and long- lived species where appropriate and available.

Appendix A: Hodge Podge timber sale RMZ inventory map

## Hodge Podge - Whitney Lake



**Legend**

Plots 6/22/2022	Gates
100 Foot Buffer	Section Corner
Harvest Area	Survey Marker
Highways/Town Roads	
Woods Roads	
Non-motor Trails	
Snowmobile Trails	

**Point Generation - UPDATED 6/22/2022:**

- 22 points
- Generated randomly - UPDATED
- 37.2 Foot Buffer from the edges of the 100-foot buffer of Whitney Lake



This map is not a survey of the actual boundary of any property this map depicts.

## Appendix B: Hodge Podge RMZ Post Sale Inventory, 2022

Only observations that are greater than or equal to 1.0, and whose species growth form is "Tree" are used. Dead observations are not included when calculating values in this report.

### Composition

Overstory only										
	All species	red maple ( <i>Acer rubrum</i> )	northern red oak ( <i>Quercus rubra</i> )	balsam fir ( <i>Abies balsamea</i> )	red pine ( <i>Pinus resinosa</i> )	eastern white pine ( <i>Pinus strobus</i> )	paper birch ( <i>Betula papyrifera</i> )	sugar maple ( <i>Acer saccharum</i> )	hophornbeam ( <i>Ostrya virginiana</i> )	white spruce ( <i>Picea glauca</i> )
Basal area (sq.ft./ac.)	121.5	32.2	24.9	18.5	15.2	14.0	12.8	3.1	0.8	0.2
Percent of stand basal area (%)	100.0	26.5	20.5	15.2	12.5	11.5	10.5	2.5	0.6	0.2
Stems/area (stems/ac.)	251.4	70.5	22.9	100.0	13.3	12.4	21.0	6.7	3.8	1.0

### Diameters

Merchantable Medial DBH and Merchantable Quadratic DBH only include observations where DBH is greater than 5.5 inches

Overstory only										
	All species	red maple ( <i>Acer rubrum</i> )	northern red oak ( <i>Quercus rubra</i> )	balsam fir ( <i>Abies balsamea</i> )	red pine ( <i>Pinus resinosa</i> )	eastern white pine ( <i>Pinus strobus</i> )	paper birch ( <i>Betula papyrifera</i> )	sugar maple ( <i>Acer saccharum</i> )	hophornbeam ( <i>Ostrya virginiana</i> )	white spruce ( <i>Picea glauca</i> )
Medial DBH (in.)	12.6	10.2	15.7	6.1	17.1	18.6	11.1	10.8	6.2	6.0
Merchantable Medial DBH (in.)	13.1	10.2	15.7	6.8	17.3	18.6	11.1	10.8	6.4	6.0
Quadratic Mean DBH (in.)	9.4	9.2	14.1	5.8	14.5	14.4	10.6	9.2	6.0	6.0
Merchantable Quadratic DBH (in.)	10.4	9.3	14.1	6.7	15.5	14.4	10.6	9.2	6.4	6.0
Mean DBH (in.)	8.6	8.8	13.6	5.7	13.5	13.2	10.4	8.7	6.0	6.0

## Relative Density

Overstory only										
	All species	red maple ( <i>Acer rubrum</i> )	northern red oak ( <i>Quercus rubra</i> )	balsam fir ( <i>Abies balsamea</i> )	red pine ( <i>Pinus resinosa</i> )	eastern white pine ( <i>Pinus strobus</i> )	paper birch ( <i>Betula papyrifera</i> )	sugar maple ( <i>Acer saccharum</i> )	hophornbeam ( <i>Ostrya virginiana</i> )	white spruce ( <i>Picea glauca</i> )
Relative density (%/ac.)	82.5	22.2	21.9	11.5	6.8	4.9	11.9	2.6	0.7	0.1
Percent of stand (%)	100.0	26.9	26.5	13.9	8.3	5.9	14.4	3.1	0.8	0.1

## Volumes

The boardfoot volumes were calculated using the 'Scrivani-Wiant' equation with the 'Scribner' log rule.

Overstory only										
	All species	red maple ( <i>Acer rubrum</i> )	northern red oak ( <i>Quercus rubra</i> )	balsam fir ( <i>Abies balsamea</i> )	red pine ( <i>Pinus resinosa</i> )	eastern white pine ( <i>Pinus strobus</i> )	paper birch ( <i>Betula papyrifera</i> )	sugar maple ( <i>Acer saccharum</i> )	hophornbeam ( <i>Ostrya virginiana</i> )	white spruce ( <i>Picea glauca</i> )
Gross sawtimber volume (bd.ft./ac.)	6,296	901	1,810	37	1,578	1,450	407	113	0	0
Net sawtimber volume (bd.ft./ac.)	6,296	901	1,810	37	1,578	1,450	407	113	0	0
Gross pulpwood volume (cords/ac.)	19	6	4	2	2	2	2	1	0	0
Net pulpwood volume (cords/ac.)	15	5	3	2	1	1	2	0	0	0
Gross total volume (cords/ac.)	33	9	8	2	5	4	3	1	0	0
Net total volume (cords/ac.)	26	7	6	2	4	4	3	1	0	0

## Biomass

Overstory only										
	All species	red maple ( <i>Acer rubrum</i> )	northern red oak ( <i>Quercus rubra</i> )	balsam fir ( <i>Abies balsamea</i> )	red pine ( <i>Pinus resinosa</i> )	eastern white pine ( <i>Pinus strobus</i> )	paper birch ( <i>Betula papyrifera</i> )	sugar maple ( <i>Acer saccharum</i> )	hophornbeam ( <i>Ostrya virginiana</i> )	white spruce ( <i>Picea glauca</i> )
Foliage biomass (tons/ac.)	2	0	0	0	0	0	0	0	0	0
Stem biomass (tons/ac.)	47	12	14	4	5	5	5	1	0	0
Branch biomass (tons/ac.)	17	5	5	1	1	1	2	1	0	0
Bark biomass (tons/ac.)	9	3	3	1	1	1	1	0	0	0
Aboveground biomass (tons/ac.)	75	20	21	7	8	8	8	2	0	0
Root biomass (tons/ac.)	15	4	4	2	2	2	2	0	0	0
Total biomass (tons/ac.)	90	24	25	9	10	9	10	3	0	0

**Appendix C: Hodge Podge RMZ Post Sale Species X DBH Table (stems/ac.), 2022**

<b>DBH</b>	<b>balsam fir</b>	<b>red maple</b>	<b>paper birch</b>	<b>northern red oak</b>	<b>red pine</b>	<b>eastern white pine</b>	<b>sugar maple</b>	<b>hophornbeam</b>	<b>white spruce</b>	<b>row sum</b>
<0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	54.29	3.81	0.00	0.00	1.90	0.00	0.00	0.95	0.00	60.95
6	26.67	6.67	0.95	0.00	0.00	0.00	1.90	1.90	0.95	39.05
7	12.38	12.38	0.00	0.95	0.00	2.86	0.00	0.95	0.00	29.52
8	4.76	14.29	1.90	2.86	0.00	0.00	2.86	0.00	0.00	26.67
9	1.90	8.57	3.81	0.95	0.00	0.00	0.00	0.00	0.00	15.24
10	0.00	5.71	4.76	0.00	1.90	1.90	0.95	0.00	0.00	15.24
11	0.00	8.57	3.81	1.90	0.00	0.95	0.00	0.00	0.00	15.24
12	0.00	7.62	2.86	1.90	1.90	1.90	0.00	0.00	0.00	16.19
13	0.00	0.95	1.90	2.86	1.90	0.00	0.00	0.00	0.00	7.62
14	0.00	0.00	0.00	0.95	1.90	0.00	0.00	0.00	0.00	2.86
15	0.00	0.95	0.95	4.76	0.00	1.90	0.95	0.00	0.00	9.52
16	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.95
17	0.00	0.95	0.00	1.90	0.95	0.00	0.00	0.00	0.00	3.81
18	0.00	0.00	0.00	1.90	0.00	0.00	0.00	0.00	0.00	1.90
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.95	0.95	0.00	0.00	0.00	0.00	1.90
21	0.00	0.00	0.00	0.00	0.95	0.95	0.00	0.00	0.00	1.90
22	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.95
23	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.00	0.95
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.95
<b>column sum</b>	100.00	70.48	20.95	22.86	13.33	12.38	6.67	3.81	0.95	251.43



## Appendix D: Hodge Podge RMZ Post Sale Snag Summary, 2022

The following table lists the number of snags per acre by species for 6-inch size classes.

Dead standing snags						
DBH range (in.)	Total	paper birch	balsam fir	red maple	northern red oak	eastern white pine
<6	3.8		2.9	1.0		
6 - 12	21.0	18.1		1.9		1.0
12 - 18	2.9	1.9			1.0	
18 - 24	1.0				1.0	
24 - 30	0.0					
>30	0.0					
<b>Total</b>	<b>28.6</b>	20.0	2.9	2.9	1.9	1.0