

Project Title: Washburn County Ironwood Control

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Abstract: In many Washburn county forest northern hardwood stands, ironwood is observed as a limiting factor of desirable natural regeneration in northern hardwood stands. In 2012, several methods were used to determine what may help in suppressing ironwood, (*Ostrya virginiana*). Nine sites were chosen with varying pre-harvest treatments including soil scarification with root rake and salmon blade, mowing with a drum mulching head or rotary mower, and being left untouched as a control. The goal of these trials was to help determine what may be the most efficient and effective method to minimize ironwood and promote the regeneration of northern hardwood species.

<u>Location Description</u>
<u>County:</u> Washburn
<u>Township:</u> 41N/42N
<u>Range:</u> 10W/11W
<u>Property Name:</u> Washburn County Forest

Baseline Stand Data:

- ***Cover Type:*** Northern Hardwoods
- ***Acres:*** 299
- ***Habitat Type:*** Listed in site descriptions
- ***Soil Type:*** Listed in site descriptions

Prescription and Methods:

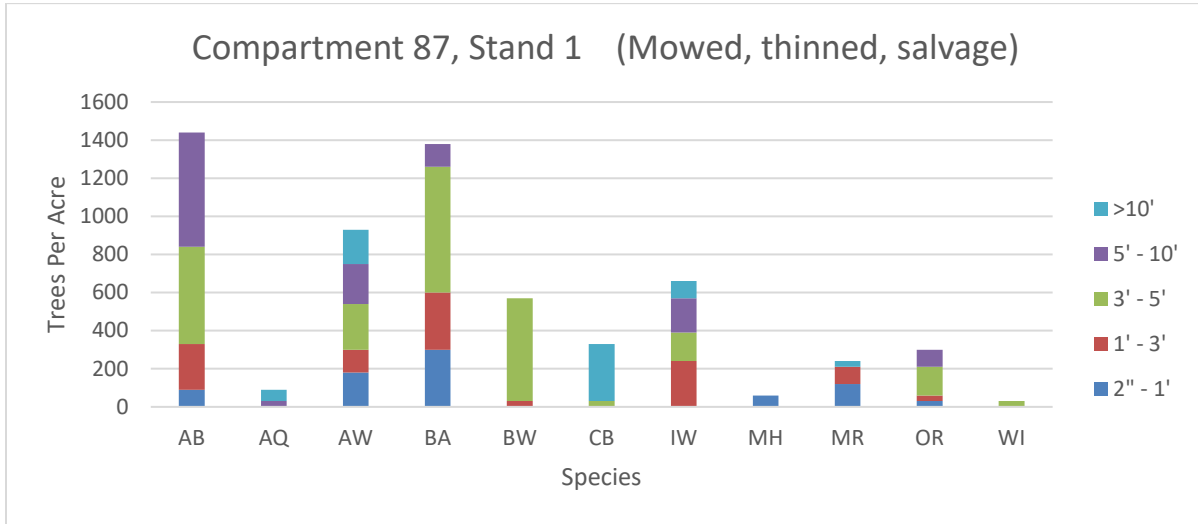
- ***Type of prescription:*** Mechanical pre-harvest scarification
- ***Year initiated:*** 2012 - 2018
- ***Establishment methods (timing, equipment, etc.):***
 - Stands in this trial were treated pre-harvest as follows:
 - 56 acres mowed via drum mulcher and rotary mower
 - 110 acres reserved as a control area
 - 133 acres mechanically scarified via root rake, salmon blade and straight blade
- ***Data collection methods:***
 - Sites were revisited in summer of 2021. Data was collected by randomly selecting ninety-one plots placed approximately one plot per three acres. Data was then collected using the WDNR Forest Regeneration Metric (FRM) protocol - 1/300th acre plots collecting regeneration data (species, number, and height). All results are expressed as “trees per acre” basis.

Site Descriptions and Results:

Compartment 87, Stand 1:

- Location: T. 42, R. 11W, S. 36; T. 42, R. 10W, S. 31
- Area: 27 Acres ; Number of Plots: 10;

- Soil: Silt Loam; Habitat Type: ATM;
- Basal Area: 43 ft²
- Timeline:
 - 2012: Site was mowed pre-harvest
 - 2013: Canopy gaps installed/thinned between gaps
 - Notes from sale narrative: Moderate to poorly stocked pole/saw timber size NH stand. Poorly established NH regen with strong component of ironwood.
 - 2014: Severe wind damage
 - 2016: Wind damaged trees were salvaged and overstory was harvested to seed tree conditions. Target residual basal area was 20 sq ft/ac.



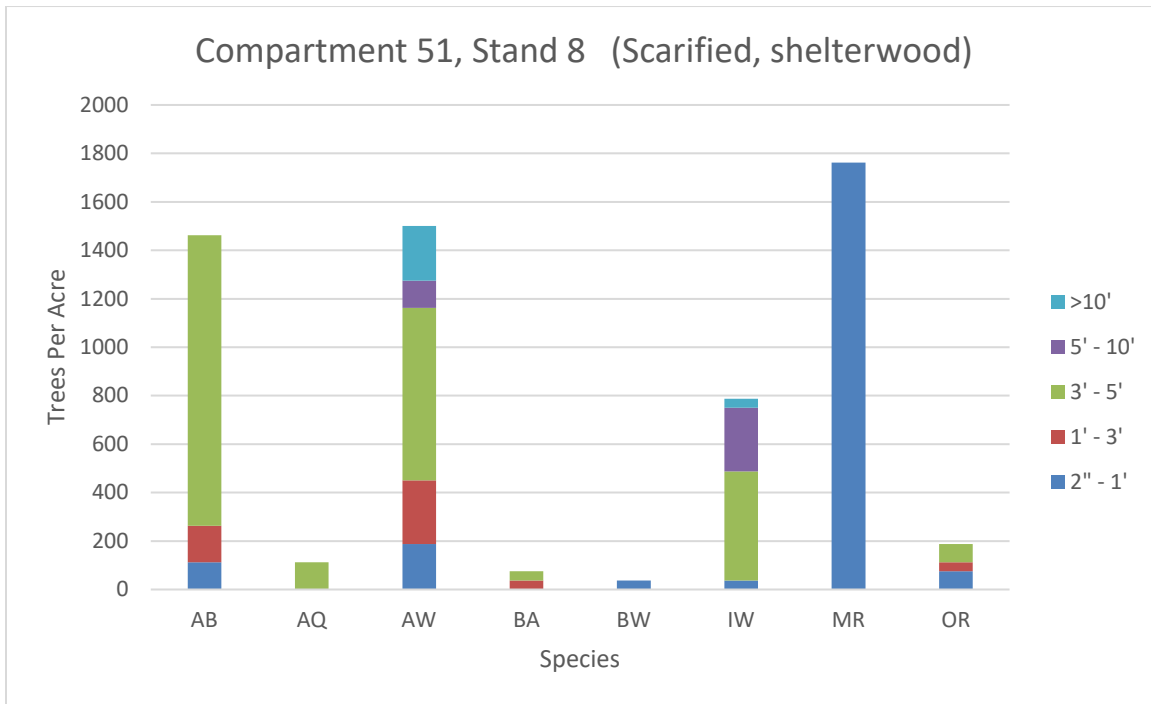
	AB	AQ	AW	BA	BW	CB	IW	MH	MR	OR	WI	Totals
2'' - 1'	90	-	180	300	-	-		60	120	30	-	780
1' - 3'	240	-	120	300	30	-	240	-	90	30	-	1050
3' - 5'	510	-	240	660	540	30	150	-	-	150	30	2310
5' - 10'	600	30	210	120	-	-	180	-	-	90	-	1230
>10'	-	60	180	-	-	300	90	-	30	-	-	660
Totals	1440	90	930	1380	570	330	660	60	240	300	30	6030

Stand Observations: This stand consisted of many moist areas with an abundance of black ash and some white ash and basswood. While much of the stand had a relatively open canopy with large amounts of light penetration, there was a large musclewood component, that was noted, but not recorded for this trial.

Compartment 51, Stand 8

- Location: T. 41N, R 10W, S. 9; T. 41N, R 10W, S. 10
- Area: 25 Acres ; Number of Plots: 8
- Soil: Silt Loam and Sandy Loam; Habitat Type: ATM and AAT
- Basal Area: 46 ft²
- Timeline:
 - ~1977: Aspen removal
 - 2015: Salmon blade and root rake scarification

- 2018: Shelterwood harvest

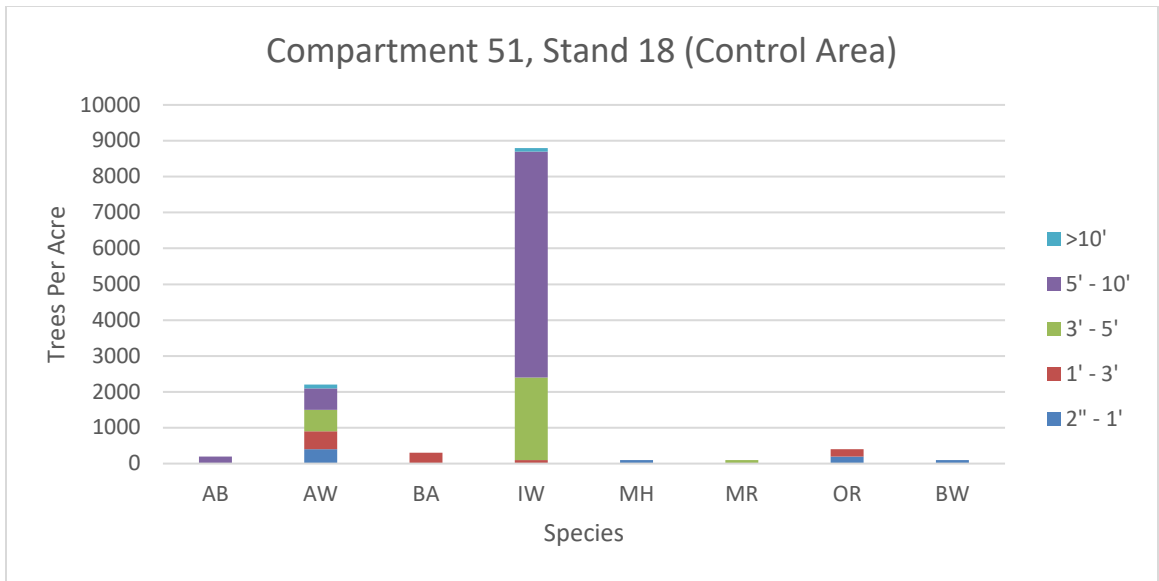


	<u>AB</u>	<u>AQ</u>	<u>AW</u>	<u>BA</u>	<u>BW</u>	<u>IW</u>	<u>MR</u>	<u>OR</u>	<u>Totals</u>
<u>2'' - 1'</u>	112.5	-	187.5	-	37.5	37.5	1762.5	75	2212.5
<u>1' - 3'</u>	150	-	262.5	37.5	-	-	-	37.5	487.5
<u>3' - 5'</u>	1200	112.5	712.5	37.5	-	450	-	75	2587.5
<u>5' - 10'</u>	-	-	112.5	-	-	262.5	-	-	375
<u>>10'</u>	-	-	225	-	-	37.5	-	-	262.5
<u>Totals</u>	1462.5	112.5	1500	75	37.5	787.5	1762.5	187.5	5925

Stand Observations: Like many other stands in this trial, this stand had a large black ash component, as well as an abundance of red maple and white ash. The overstory was relatively open, resulting in much of the understory dominated by Pennsylvania sedge and rubus. Despite this understory, ironwood was still abundant in this stand in the 3 to 5 foot height class.

Compartment 51, Stand 18 (Control Area)

- Location: T. 41N, R 10W, S. 9; T. 41N, R 10W, S. 10
- Area: 3 Acres ; Number of Plots: 3
- Soil: Silt Loam and Sandy Loam; Habitat Type: ATM and AAT
- Basal Area: 37 ft²
- Three acres of stand 18 were not scarified, used as a control

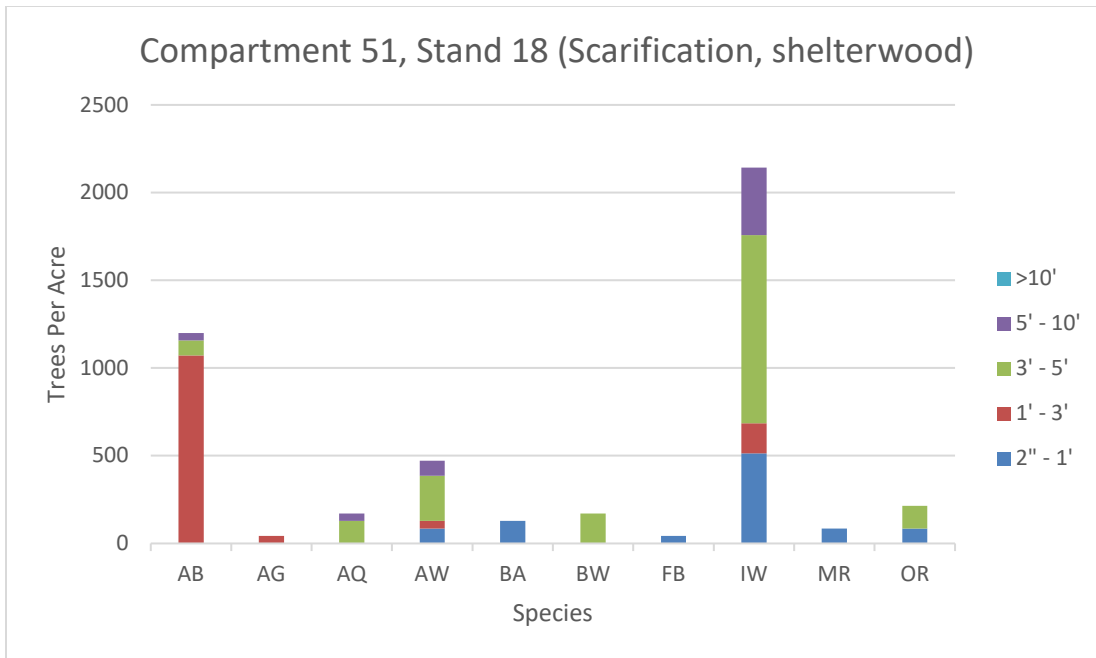


	<u>AB</u>	<u>AW</u>	<u>BA</u>	<u>IW</u>	<u>MH</u>	<u>MR</u>	<u>OR</u>	<u>BW</u>	<u>Totals</u>
<u>2'' - 1'</u>	-	400	-	-	100	-	200	100	800
<u>1' - 3'</u>	-	500	300	100	-	-	200	-	1100
<u>3' - 5'</u>	-	600	-	2300	-	100	-	-	3000
<u>5' - 10'</u>	200	600	-	6300	-	-	-	-	7100
<u>>10'</u>	-	100	-	100	-	-	-	-	200
<u>Totals</u>	200	2200	300	8800	100	100	400	100	12200

Stand Observations: This stand was used as a control, receiving three plots to determine if scarification was needed in this area. The result was a large abundance of ironwood, primarily in the 5 to 10-foot class. When compared to the other control (Compartment 47, Stand 6), the results were very different. This stand had an abundance of ironwood while the other had more sugar maple regeneration. This stand also had a very open canopy and was bordering the main access road to the compartment. The light penetration allowed for easier seed dispersal from the neighboring stands.

Compartment 51, Stand 18 (Scarified Area)

- Location: T. 41N, R 10W, S. 9; T. 41N, R 10W, S. 10
- Area: 21 Acres ; Number of Plots: 7
- Soil: Silt Loam and Sandy Loam; Habitat Type: ATM and AAT
- Basal Area: 33 ft²
- Timeline:
 - ~1977: Aspen removal
 - 2015: Salmon blade and root rake scarification
 - 2018: Shelterwood

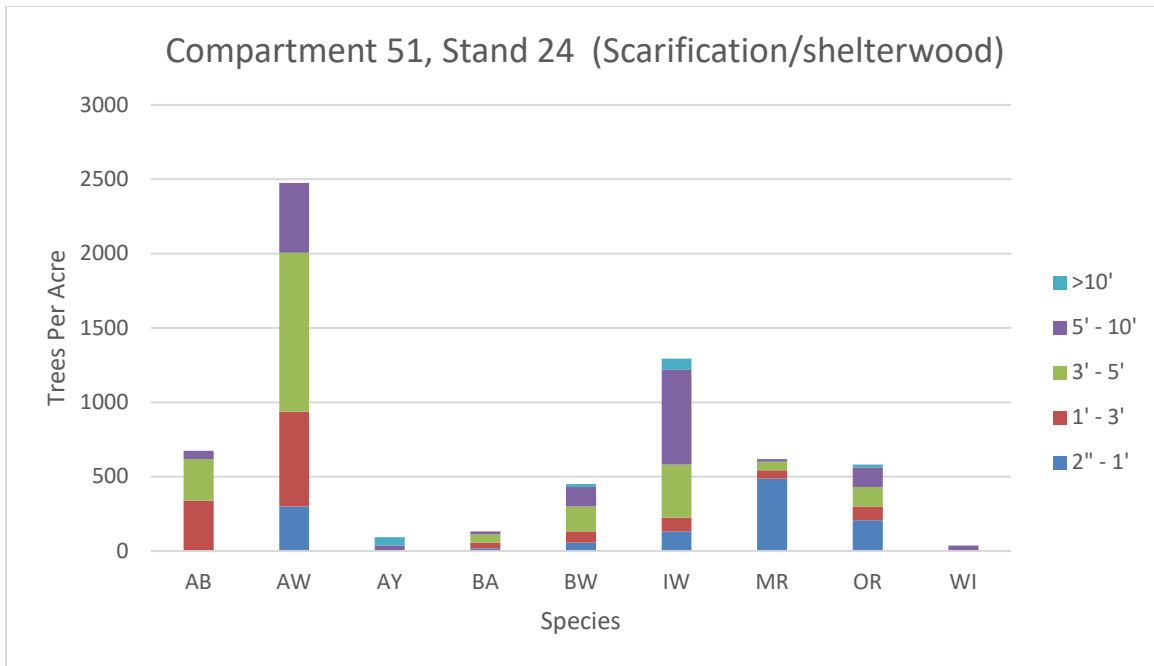


	<u>AB</u>	<u>AG</u>	<u>AQ</u>	<u>AW</u>	<u>BA</u>	<u>BW</u>	<u>FB</u>	<u>IW</u>	<u>MR</u>	<u>OR</u>	<u>Totals</u>
<u>2'' - 1'</u>	-	-	-	85.71	128.57	-	42.86	514.29	85.71	85.71	942.85
<u>1' - 3'</u>	1071.43	42.86	-	42.86	-	-	-	171.43	-	-	1328.58
<u>3' - 5'</u>	85.71	-	128.57	257.14	-	171.43	-	1071.43	-	128.57	1842.85
<u>5' - 10'</u>	42.86	-	42.86	85.71	-	-	-	385.71	-	-	557.14
<u>>10'</u>	-	-	-	-	-	-	-	-	-	-	0
<u>Totals</u>	1200	42.86	171.43	471.42	128.57	171.43	42.86	2142.86	85.71	214.28	4671.42

Stand Observations: This stand consisted of a very similar structure to its control portion. Ironwood was the main component, but there were many moist areas throughout the stand which resulted in a larger black ash component. This stand also had a very open overstory with an understory dominated by Pennsylvania sedge and rubus. It is interesting to note that this stand was the only one surveyed throughout this trial that did not have any observed regeneration that was over ten feet in height.

Compartment 51, Stand 24

- Location: T. 41N, R 10W, S. 9; T. 41N, R 10W, S. 10
- Area: 44 Acres ; Number of Plots: 16
- Soil: Silt Loam and Sandy Loam; Habitat Type: ATM and AAT
- Basal Area: 50 ft²
- Timeline:
 - 1991-2001: hardwood thinning
 - 2015: Salmon blade and root rake scarification
 - 2018: Shelterwood

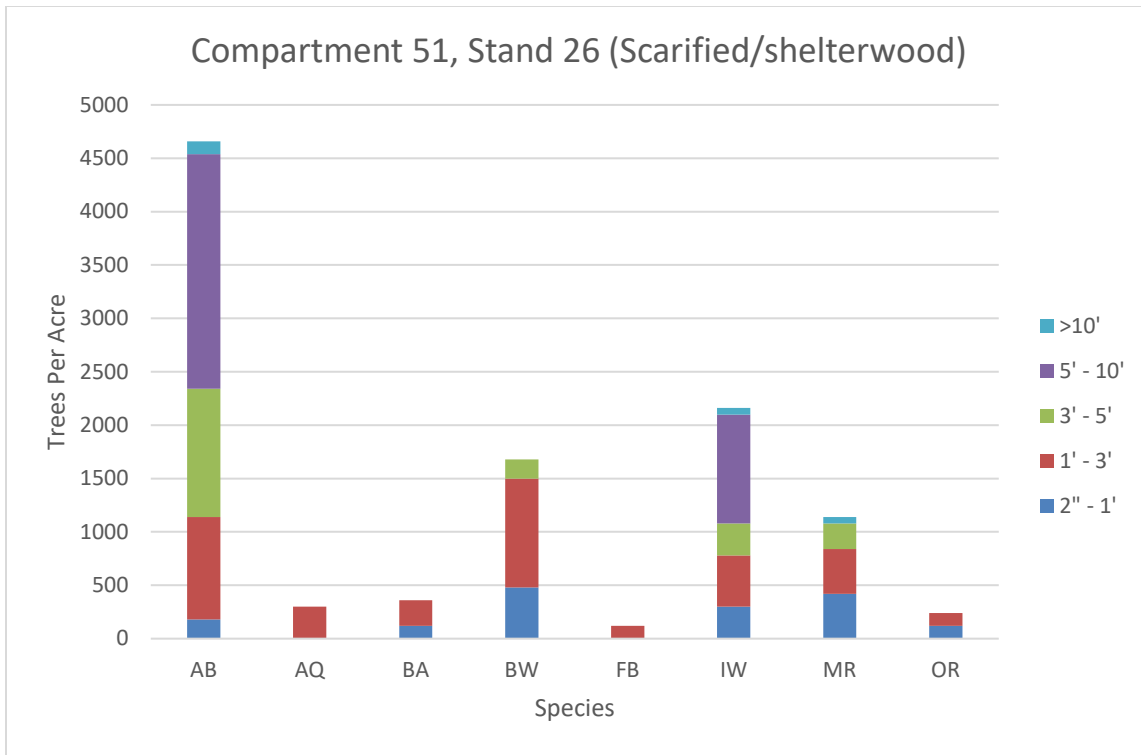


	<u>AB</u>	<u>AW</u>	<u>AY</u>	<u>BA</u>	<u>BW</u>	<u>IW</u>	<u>MR</u>	<u>OR</u>	<u>WI</u>	<u>Totals</u>
<u>2'' - 1'</u>	-	300	-	18.75	56.25	131.25	487.5	206.25	-	1200
<u>1' - 3'</u>	337.5	637.5	-	37.5	75	93.75	56.25	93.75	-	1331.25
<u>3' - 5'</u>	281.25	1068.75	-	56.25	168.75	356.25	56.25	131.25	-	2118.75
<u>5' - 10'</u>	56.25	468.75	37.5	18.75	131.25	637.5	18.75	131.25	37.5	1537.5
<u>>10'</u>	-	-	56.25	-	18.75	75	-	18.75	-	168.75
<u>Totals</u>	675	2475	93.75	131.25	450	1293.75	618.75	581.25	37.5	6356.25

Stand Observations: This stand was separated into two parts by stands 8 and 18 but was observed as one. The overstory basal area was higher than other stands in the compartment, but still resulted in an understory that was heavily dominated by rubus. Despite the dense understory, many species were observed predominantly of ironwood, white ash and black ash. In the eastern portion of this stand, there were also several stems of common buckthorn identified and removed

Compartment 51, Stand 26:

- Location: T. 41N, R 10W, S. 9; T. 41N, R 10W, S. 10
- Area: 15 Acres ; Number of Plots: 5
- Soil: Silt Loam and Sandy Loam; Habitat Type: ATM and AAT
- Basal Area: 44 ft²
- Timeline:
 - 2001: hardwood thinning to 85 sq. ft. basal area
 - 2015: Salmon blade and root rake scarification
 - 2018: Shelterwood



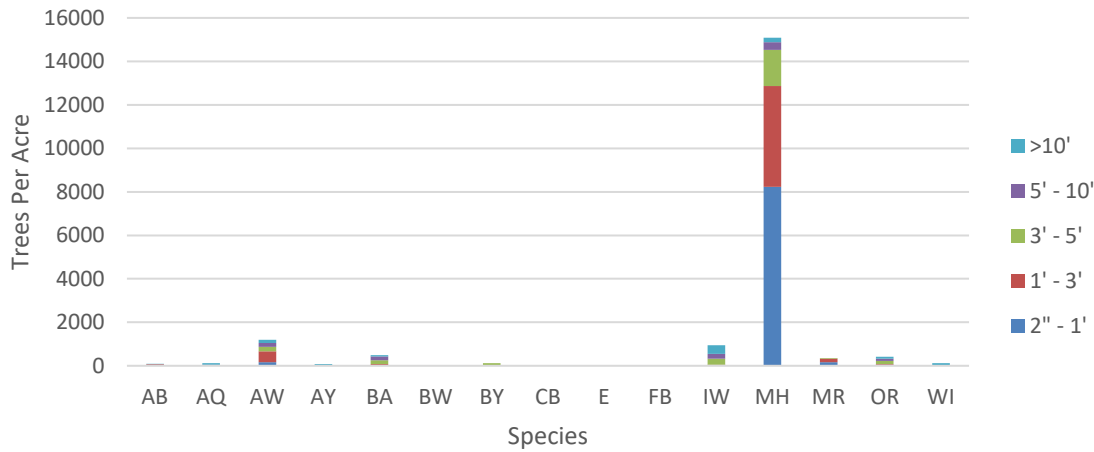
	<u>AB</u>	<u>AQ</u>	<u>BA</u>	<u>BW</u>	<u>FB</u>	<u>IW</u>	<u>MR</u>	<u>OR</u>	<u>Totals</u>
<u>2'' - 1'</u>	180	-	120	480	-	300	420	120	1620
<u>1' - 3'</u>	960	300	240	1020	120	480	420	120	3660
<u>3' - 5'</u>	1200	-	-	180	-	300	240	-	1920
<u>5' - 10'</u>	2200	-	-	-	-	1020	-	-	3220
<u>>10'</u>	120	-	-	-	-	60	60	-	240
<u>Totals</u>	4660	300	360	1680	120	2160	1140	240	10660

Stand Observations: This stand was very similar in structure to the others within Compartment 51. The understory consisted of a large rubus component but had more desirable regeneration in the plots that were examined. The lower density overstory contributed to the larger size class in much of the regeneration, as well as the understory vegetation.

Compartment 47, Stand 6:

- Location: T. 42, R. 10W, S. 34
- Area: 107 Acres ; Number of Plots: 22
- Soil: Silt Loam and Sandy Loam; Habitat Type: ATM
- Basal Area: 53 ft²
- Timeline:
 - Site was not treated pre harvest and is used as a control
 - 1989: Aspen removal, selective harvest on parts of stand.
 - 2013: Combination of improvement thinning, harvest of overmature.
 - Notes from sale write-up: well developed ironwood component through much of the stand.
 - 2014: Severe wind damage
 - 2016: Salvage harvest of wind damaged trees

Compartment 47, Stand 6 (Control/salvage)

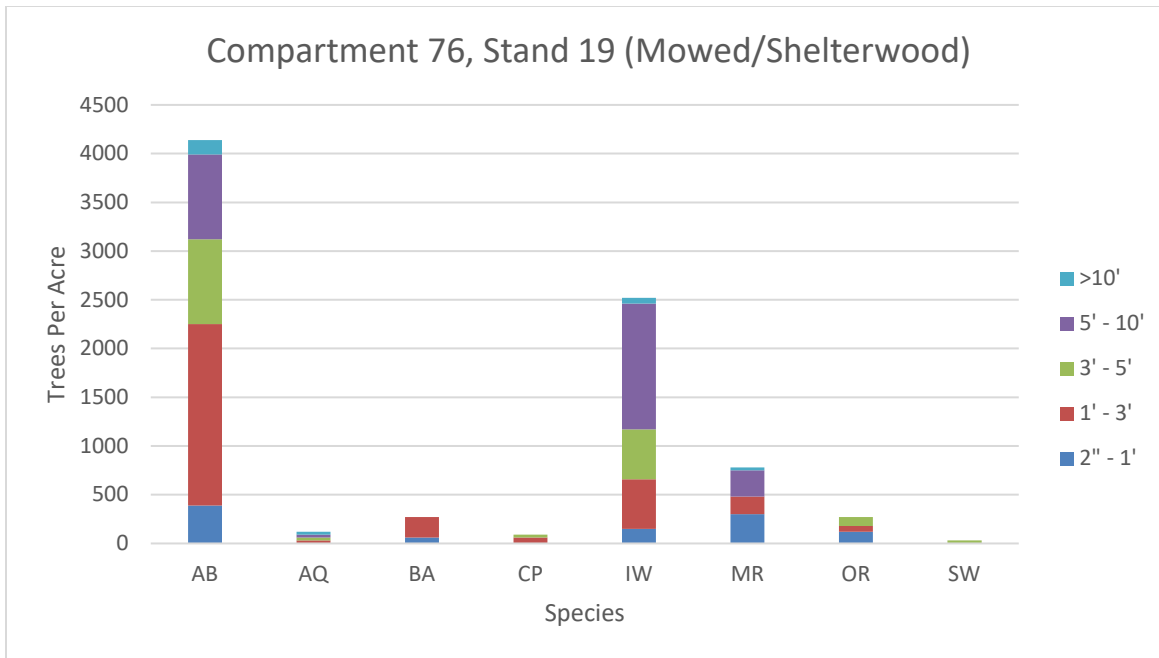


	<u>AB</u>	<u>AQ</u>	<u>AW</u>	<u>AY</u>	<u>BA</u>	<u>BW</u>	<u>BY</u>	<u>CB</u>	<u>E</u>	<u>FB</u>	<u>IW</u>	<u>MH</u>	<u>MR</u>	<u>OR</u>	<u>WI</u>	<u>Totals</u>
<u>2'' - 1'</u>	40.9	-	163.6	-	27.3	-	-	-	-	-	-	8236.4	163.6	54.6	-	8686.4
<u>1' - 3'</u>	40.9	-	504.6	-	54.5	-	13.6	13.6	-	-	54.6	4622.7	163.6	27.3	-	5495.5
<u>3' - 5'</u>	-	13.6	204.6	13.6	177.3	-	109.1	-	27.3	13.6	272.7	1677.3	27.3	136.4	13.6	2686.4
<u>5' - 10'</u>	-	27.3	177.3	-	177.3	13.6	-	-	-	-	218.2	340.9	-	109.1	-	1063.6
<u>>10'</u>	13.6	81.8	150.0	68.2	54.6	-	-	13.6	-	-	395.5	204.6	-	95.5	109.1	1186.4
Totals	95.5	122.7	1200.0	81.8	490.9	13.6	122.7	27.3	27.3	13.6	940.9	15081.8	354.6	422.7	122.7	19118.2

Stand Observations: When sampling this stand, observations were noted regarding several different factors. While it was the largest single stand that was observed, it was not scarified pre-harvest and was used as a control. This stand had the largest number of sugar maple seedlings seen throughout this trial, as well as several areas with open canopy dominated by rubus. This stand had the largest number of northern hardwood species observed in a single stand, more than likely due to its size.

Compartment 76, Stand 19

- Location: T. 42, R. 11W, S. 2; T. 42, R. 11W, S. 3
- Area: 29 Acres ; Number of Plots:10
- Soil: Silt Loam and Sandy Loam; Habitat Type: ATM
- Basal Area: 44 ft²
- Timeline:
 - 2012: Site was mowed pre-harvest
 - 2012/13: Shelterwood

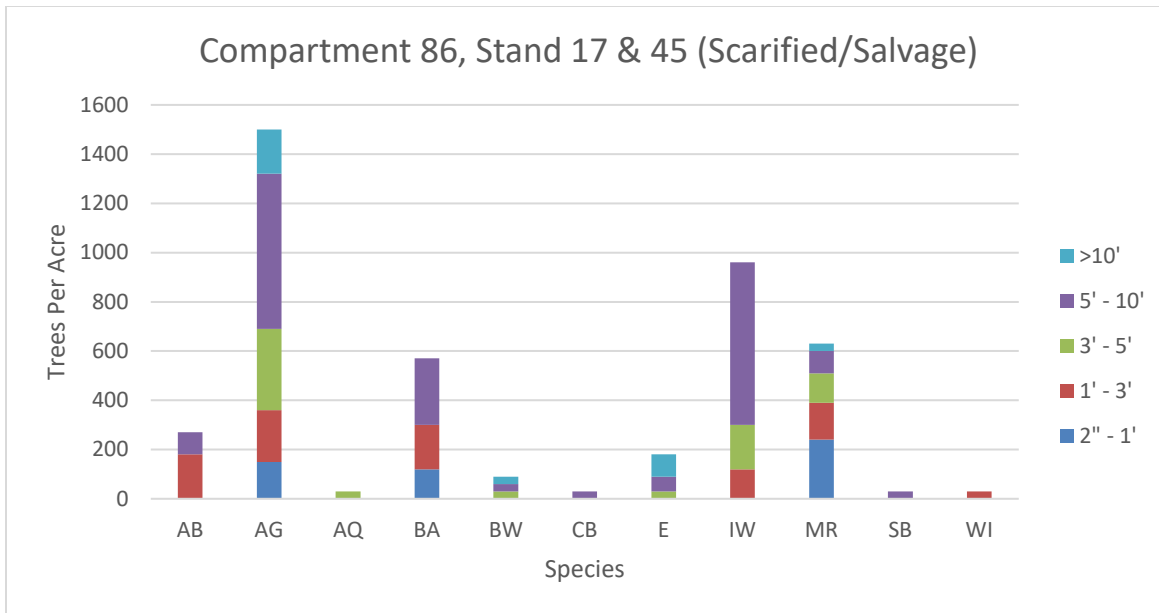


	<u>AB</u>	<u>AQ</u>	<u>BA</u>	<u>CP</u>	<u>IW</u>	<u>MR</u>	<u>OR</u>	<u>SW</u>	<u>Totals</u>
<u>2'' - 1'</u>	390	-	60	-	150	300	120	-	1020
<u>1' - 3'</u>	1860	30	210	60	510	180	60	-	2910
<u>3' - 5'</u>	870	30	-	30	510	-	90	30	1560
<u>5' - 10'</u>	870	30	-	-	1290	270	-	-	2460
<u>>10'</u>	150	30	-	-	60	30	-	-	270
<u>Totals</u>	4140	120	270	90	2520	780	270	30	8220

Stand Observations: This stand was the most remote of the stands observed, as well as having the longest period since the last harvest entry. This stand was not as adversely affected by the wind event that the others suffered in 2014, and therefore did not receive the salvage harvest and scarification as the other stands. This stand contained a large black ash component, as well as a more ironwood component in a variety of size classes.

Compartment 86, Stand 17 & 45

- Location: T. 42, R. 11W, S. 36; T. 42, R. 10W, S. 31
- Area: 28 Acres ; Number of Plots: 10
- Soil: Silt Loam and Sandy Loam; Habitat Type: AAT
- Basal Area: 49 ft²
- Timeline:
 - 1986: Stand 46 thinned
 - 2013: Straight/Salmon blade scarification
 - Scarification avoided areas with established MH saplings
 - 2014: Severe wind damage
 - 2015: Combination intermediate thinning and salvage harvest.



	<u>AB</u>	<u>AG</u>	<u>AQ</u>	<u>BA</u>	<u>BW</u>	<u>CB</u>	<u>E</u>	<u>IW</u>	<u>MR</u>	<u>SB</u>	<u>WI</u>	<u>Totals</u>
<u>2'' - 1'</u>	-	150	-	120	-	-	-	-	240	-	-	510
<u>1' - 3'</u>	180	210	-	180	-	-	-	120	150	-	30	870
<u>3' - 5'</u>	-	330	30	-	30	-	30	180	120	-	-	720
<u>5' - 10'</u>	90	630	-	270	30	30	60	660	90	30	-	1890
<u>>10'</u>	-	180	-	-	30	-	90	-	30	-	-	330
<u>Totals</u>	270	1500	30	570	90	30	180	960	630	30	30	4320

Stand Observations: These two stands were observed as one due to their proximity and similar structure. Both stands had a heavy understory of rubus, which is believed to have been influenced by the relatively open overstory. This open canopy influenced the rapid growth of regeneration with the presence of taller height classes. The dense understory limited the establishment of new regeneration in the shorter height classes of ironwood.

Discussion/Recommendations:

- While there were varying treatment options, there was not one that stood out as being more effective at controlling ironwood.
- The two control areas produced vastly different results with one being largely dominated by sugar maple regeneration, and the other predominately advanced ironwood regeneration.
- Much of the ironwood appeared to be advanced, indicating presence before the harvest or wind event. Both of those instances appeared to have released the established regeneration.
- Lower overstory densities tended to have more advanced ironwood regeneration, than those of higher densities.
- Areas with less dense overstories and more light penetration appeared to have a much higher density of rubus covering the understory which could be limiting factor for the establishment of new regeneration.
- Black ash was consistently found throughout all the observed stands, regardless of the treatment.
- The three most common species among the treatment areas were ironwood, sugar maple and black ash.