Rotation Lengths in Red Pine and Aspen Forests

Recommendations				
Topic	**Recommendation**	**Basis for Recommendation**	**Anticipated Impact to Forest Industry**	**Anticipated Impact to Social/ Ecologic Benefits of the Forest**
Rotation length guidelines	Allow variance from biological rotations, or the culmination of mean annual increment (MAI), to allow markets to adapt to forest resource.	Economic considerations are a valid reason for a variance or for widening rotation age sideboards.		
Set range of rotation ages	Rotation age sideboards should be wide enough to accommodate a wide range of landowner objectives.	A lot of variables to consider in determining when to establish a rotation age. Challenge in following a specific rotation age range (i.e., "it has to be a minimum of 33 years")		

Rotation Lengths in Red Pine and Aspen Forests

Additional Information Needs			
Topic	**Information Need**	**Basis for Need**	**How will additional information help to improve the dialogue on the economic and ecological impacts of forest practices and harvesting restrictions?**
Economic	What is the IRR for various rotation age scenarios for both aspen and red pine?	Need to have a better sense of rates of return for stand management decisions	
Economic	Information showing impact of varying discount rates on economic rotations (i.e., LEV) across the given scenarios (e.g. 3-6%)	Discount rates vary across landownership and objectives To be able to show relative differences between varied discount rates. Model 3.5% and 7.5%	
Rotation Ages	Ecological considerations associated with proposed alternative rotation ages	Report does not adequately address ecological consideration for alternative rotation ages.	

<u>Additional Questions/Clarifications for Principal Investigator</u>

1. Does shortening rotation lengths limit supply to some markets (e.g. bolts, veneer, etc.) due to tree size?
2. How do product classes (e.g.-pulpwood, bolts) change as rotation lengths get shorter?
3. Can you do same scenarios at 3% discount rate?
4. Please provide more ecological considerations associated the proposed alternative rotation ages?

Rotation Lengths in Red Pine and Aspen Forests

Sub-Committee would like to acknowledge:

- Additional conversation on market fluctuations and their impact on cutting cycles and rotations
- Although a minimum rotation age may be recommended based on culmination of MAI, it is not always the appropriate measure due to various reasons such as economics, landowner objectives, operational issues, wildlife considerations, or forest health.

Single Tree Selection Order-of-Removal Procedures in Northern Hardwood Forests

Recommendations				
Topic	**Recommendation**	**Basis for Recommendation**	**Anticipated Impact to Forest Industry**	**Anticipated Impact to Social/ Ecologic Benefits of the Forest**
Training	Continue the ongoing exposure to forest product specifications used by industry for foresters.	Knowing current industry specifications provides additional knowledge base to foresters in the development of silvicultural prescriptions and the implementation of timber sales.		
Training	Improve forester training, especially related to tree quality assessment, order of retention, and northern hardwood management principles.	Help accomplish proposed recommendations.		
Practices	Develop tools to help foresters more consistently define crop trees and assist with sound tree marking decisions. (Tree-level)	This study uses a Growing Stock Classification system, which is not currently in the WDNR Silviculture Handbook to help define tree risk, vigor, quality (i.e. define the crop tree),		

		and economic maturity.		
Practices	Develop better field tools to assess timber quality, particularly in northern hardwood stands. (Stand-level)	Foresters should assess timber quality within a stand so that this information can be incorporated into prescriptions and marking guides.		
Practices	Explore "order of retention" concept and tree harvest at economic maturity into the decision making process.	The three indices used as selection criteria in the study better reflect "order of retention" rather than "order of removal". Order of retention promotes future quality growth while capturing (harvesting) present economic maturity.		
	Provide written clarification in report that the maximum diameters stated in the two scenarios do not imply diameter limit cutting.	The reference to "maximum diameter" does not mean diameter limit cutting. It is one component of the model that is used to simulate single-tree selection.	Avoid confusion that the maximum diameters given in the two scenarios may imply diameter limit cutting For non-forestry interests, there may be confusion/misinterpretation.	

Additional Information Needs			
Topic	**Information Need**	**Basis for Need**	**How will additional information help to improve the dialogue on the economic and ecological impacts of forest practices and harvesting restrictions?**
Study Alternatives	Ecological considerations associated with proposed alternatives described i.e. how do the results tie into regional ecological considerations?	Lack of citations and analysis on the "ecological" aspects of study, yet this is referenced in the title of the project reports.	Examine the relationships and tradeoffs with economic and ecological impacts.
Study Alternatives	The impacts of alternatives on wildlife habitat needs to be further understood.	Committee feels that this information is needed. It is outside the scope of the current project.	
Study Alternatives	Should the order of removal for the described alternatives be implemented; what is the impact on stand structure, quality, and products over multiple cutting cycles and can similar economic returns be expected in future cutting cycles?	Study looked at current cutting cycle but didn't model long-term impacts to quality and structure. Committee feels that this information is needed. It is outside the scope of the current project.	

Additional Questions/Clarifications for Principal Investigator

1. How do results from this study tie into regional ecological/social considerations?
2. Provide clarification that the cutting scenarios do not imply diameter limit harvests as another term for high-grading. Need to clarify that objective is to not take only large and good trees to avoid concern that smaller maximum diameter structures will lead to diameter limit harvesting and high grading.
3. How will the proposed scenarios, if implemented, impact stand structure, quality, and products over multiple cutting cycles? Can similar economic returns be expected in future cutting cycles under the given scenarios?
4. If possible, better quantify the impacts of the study design on wildlife habitat?
5. How do the scenarios impact post-harvest tree species composition/diversity?

Sub-Committee would like to acknowledge:

- Industry and wildlife habitat (ecological) goals are not mutually exclusive.
- Additional research needed to quantify internal tree defect based on site and tree characteristics.
- In regards to the recommendation above, 'Explore "order of retention" concept and tree harvest at economic maturity into the decision making process' ...the main point of the concept of order of retention is generally to identify future crop trees you want to leave and make sure they are in a free-to-grow position. The indices used in the study model however are 1) Remove Risk (60-65% of harvest BA), 2) Harvest Mature (25% harvest BA), and 3) Release Crop Trees (10-15% harvest BA). These indices emphasis removal as a first priority, not retention and release of crop trees. It may be more accurate to say that the study design points out the potential implications of priority marking guides like order of removal or order of retention on the selection of trees to cut within a stand.

Responses to Single-Tree Selection and Order-of-Removal and Rotation Age Projects

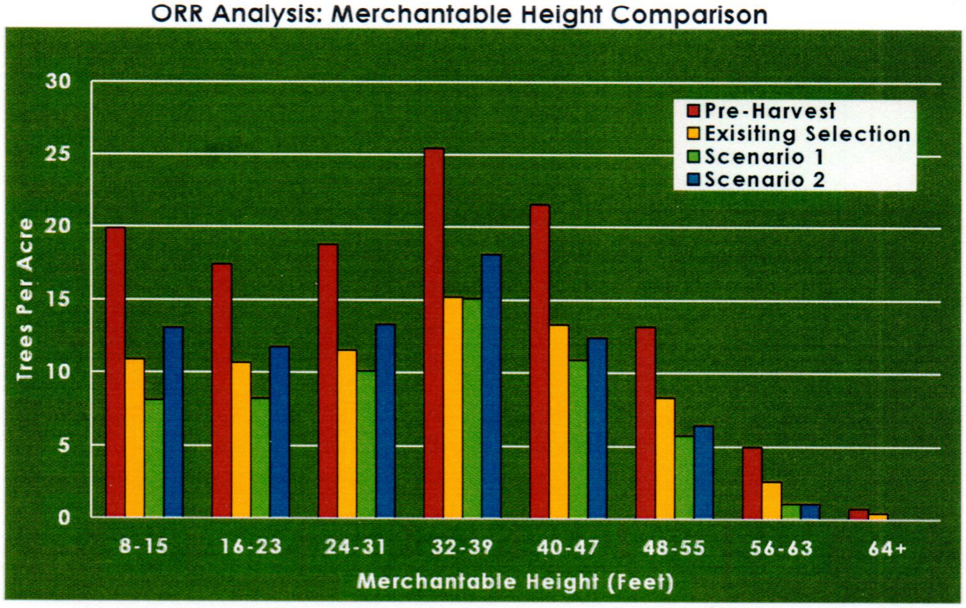
Questions relative to Single-Tree Selection and Order-of-Removal:

1. **How do results from this study tie into regional ecological considerations?**

The alternative order of removal models developed in this study do not consider tree species during the selection criteria. However, the models are highly driven by tree quality, or more specifically growing stock status (refer to page 6 of the inventory manual, Exhibit 1). The growing stock ranking includes risk of degrade, growth potential, wood product quality, and tree vigor considerations, so the modeled alternative scenarios select in favor of the best tree form. Therefore, tree species with superior tree form qualities have a higher probability of being retained. At the landscape level, selection for only the best quality form, may inadvertently shift species composition by promoting species that exhibit the best form on a given site. This could increase risk to northern hardwood forests if a trees species with good form is adversely impacted by insect and disease agents, especially dominant on a given site is impacted by a significant forest health event. This may be a concern with ash spp., given the impending concern with emerald ash borer. Our response to subcommittee question #6, compared species composition of the two scenarios to the existing selection on state, county, and private MFL lands. This comparison found that hard maple retention in scenario 1 decreased by 8.6 percent, while basswood, a species that typically exhibits better form, increased by 13.2 percent in the scenario 1. White ash decreased by about 1.4 percent for scenario 1 when compared to the existing marking (All of these comparisons are not statistically significant at the 95 percent confidence interval). Since our findings were not significant is it difficult to assess the level of risk that may be introduced of this marking guideline was strictly followed without consideration for species.

We also evaluated structural diversity within the 1-acre sample set. Merchantable tree height was reviewed in the residual forest conditions, using the summed height of the product segments measured on the 1 acre plots. Although height to crown and total height measurements would provide better statistics in evaluating vertical structure, these measurements were not recorded as part of this project. The following figure reports that prior to harvest heights are distributed somewhat evenly through 31 feet, followed by a peak in the 32 to 39-foot class, and a substantial tail-off in the subsequent age classes.

ORR Analysis: Merchantable Height Comparison



There appears to be very little difference in the distribution of tree merchantable height in the post-harvest forest created by the existing selection or within the alternate scenarios. Overall, the harvests appear to have similar height distribution to the pre-harvest condition. Scenario 1 does have a slight bell shaped height distribution, peaking in the 32-39 feet height class. This suggests that more suppressed and codominant trees are being selected in Scenario 1, where more basal area is removed (residual of 75 ft.2 per acre). So, when adhering to the strict removal of poor quality stems multi-canopy structure may be impacted in stands with poorer growing stock in the understory. The order of removal in the alternative scenarios does not directly consider tree height, therefore the distribution trend shown above may not occur if implemented at the landscape level.

So, we are unable to provide further reference or insight into landscape level studies that would relate to our findings within the northern hardwood forest type.

<u>Sub-Committee Response:</u>
The Study that the alternative tree removal scenarios do not consider tree species during the selection criteria. So, at the landscape level, the models may inadvertently shift tree species composition. The Study found non-significant results when species composition was compared for the two scenarios and the existing selection on state, county, and MFL lands after one cut. The Study concludes "Since our findings were not significant it is difficult to assess the level of risk that may be introduced if this marking guideline was strictly followed without consideration of species."

<u>Sub-Committee Concern:</u> Tree species composition in northern hardwood stands is one of the two critical components of biodiversity (including wildlife habitat). Uniform marking guidelines that select only for quality will likely reduce tree species diversity across the regional landscape by removing (over multiple cutting cycles) conifers such as eastern hemlock and poorly formed trees such as yellow birch.

2. **Provide clarification that the cutting scenarios do not imply diameter limit harvests as another term for high-grading. Need to clarify that objective is to not take only large and good trees to avoid concern that smaller maximum diameter structures will lead to diameter limit harvesting and high grading.**

The study looked at two methods of selecting trees through the application of all-aged single-tree selection in sawtimber-sized northern hardwood forests. The scenarios were not diameter limit harvests, and are presented in detail on page 11 (section 2.1.4.1), and are also discussed in the results sections of the report. The scenarios selected trees using a three-tiered system, which prioritized <u>low quality trees and the sawtimber size-classes in Index 1 and 2 - not large good trees</u>. Index 2 assessed mature trees, removing the poorest trees of the diameter threshold, as well as some quality trees. The poorest and the best trees were considered high risk for Index 2. Yet, 60 to 65 percent of the harvest was selected in Index 1, where only the worst trees were removed. Sensitivity tests were implemented to ensure that our scenarios did not just remove the trees of the highest "value". However, value did increase in some cases; which was primarily due to the removal of more stocking in the larger size-classes. The model approaches removed significantly more low quality stems when compared to the existing tree selections. Please refer to the report for more details.

<u>Sub-Committee Response:</u>
The scenarios presented for county, state, and MFL lands were definitely not a strict diameter limit cut or a high-grading cut. There were, however, 17" and 19" diameter limits placed on the sawtimber stands analyzed in the scenarios. This is different than the 20", 24" or 30" maximum diameters possible in the current DNR Northern Hardwood Chapter.

Sub-Committee Concern: Forest stand structure in northern hardwood stands is the second critical component of biodiversity (including wildlife habitat). Trees larger than 20' diameter are a very important component of northern hardwood stands (at 2 to 4 trees per acre). These trees provide one important element of stand structure providing nest sites, forage, and cover for 61 species of terrestrial vertebrates and many more invertebrates. A portion of these large trees (especially large cavity trees) become coarse woody debris. Coarse woody debris is a critical component of forest ecology and wildlife habitat. If diameter limits of 17" or 19" were applied across broad landscapes then biodiversity (including wildlife habitat) would be compromised.

3. **How will the proposed scenarios, if implemented, impact stand structure, quality, and products over multiple cutting cycles?**

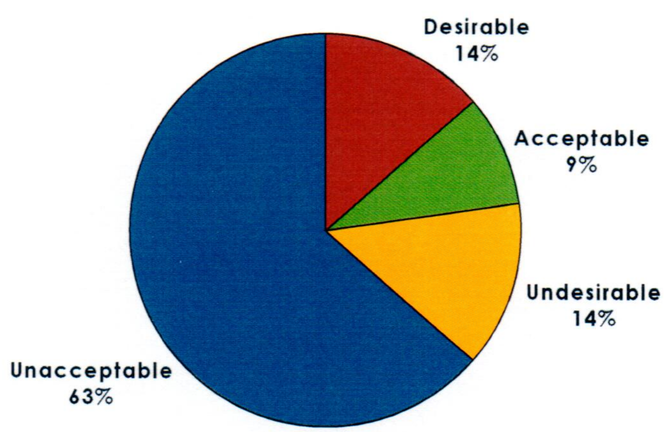
   This is a question we are very interested in looking into, but it would require additional time to setup and model.

4. **Can similar economic returns be expected in future cutting cycles under the given scenarios?**
   This is a question we are very interested in looking into, but it would require additional time to setup and model.

5. **If possible, better quantify the impacts of the study design on wildlife habitat?**

   As identified in the report our study design decreased the amount of cavity trees within the 1-acre plot dataset. All three Indices used in the alternative marking scenarios focused in some way on removing low quality growing stock trees. It should be noted that the alternative order of removal approaches did not directly apply to all wildlife/snag trees, as only live cavity trees were modeled. Inferring from the data collected in the larger sample of multi-radial plots we found that nearly 80 percent of cavities found on state, county, and private lands were classified as the lowest growing stock rating (Unacceptable and Undesirable). The following figure displays the growing stock status of all cavity recorded within the 240 BAF plots allocated to the three ownership groups.

ORR Analysis: Growing Stock Classification of Live Cavity Trees Measured on State, County, and Private MFL Forests



The distribution of growing stock status of cavity trees indicates that removal of these trees following our alternative scenarios could impact the inventory of future coarse wood debris (CWD), especially standing CWD over time.

Yamasaki M. and Leak L., B. 2006 found snags from sawtimber and large sawtimber sized trees provided better wildlife habitat than pole sized trees due to that fact they remained in the stand for a longer period of time. They also provide the largest range of cavity-dwelling sites. Indices 1 and 2 in our selection criteria both selected against large poor growing stock trees, which have the highest potential of becoming large snags.

All of the poorest growing stock were removed from the larger size classes in Scenario 1 and 2. The following table displays the removal of Undesirable and Unacceptable (GS 4 and 5) trees greater than 14 inches.

Large Undesirable and Unacceptable Growing Stock
Tree Removal Comparison (TPA)

OOR Selection of Large Undesirable and Unacceptable Growing Stock						
DBH Inch Class	Existing Selection		Scenario 1		Scenario 2	
	Cut	Leave	Cut	Leave	Cut	Leave
14 to 17 inch	2.8	4.1	6.9	0.0	6.9	0.0
18 to 21 inch	1.7	1.0	2.7	0.0	2.7	0.0
21> inch	0.1	0.4	0.6	0.0	0.6	0.0
Total	**4.6**	**5.6**	**10.1**	**0.0**	**10.1**	**0.0**

This comparison reports a notable difference in tree selection approach during an all-aged section harvest. The long term impact of this is unknown; however, it could be assumed that without the designation of "wildlife" or 'snag" trees the modeled approaches would greatly reduce the chance of large cavity trees existing in the stand.

Sub-Committee Response:
The Study does a good job of summarizing the impacts the alternative scenarios have on large cavity trees and coarse woody debris components of wildlife habitat.

Sub-Committee Concern: Large cavity trees and coarse woody debris would be eliminated over several cutting cycles.

6. **How do the scenarios impact post-harvest tree species composition/diversity?**

The alternative scenarios did not directly consider tree species in their selection criteria. Therefore, trends in species composition were controlled primarily by growing stock rating and tree form characteristics. The following paragraphs summarize the results of the OOR Analysis.
Table 1 shows the existing selection removed a similar proportion of each species as that of the model scenarios, especially for scenario 2. Comparing the species that made up the largest percentage of the average stand suggests that the largest differences occurred in hard maple, basswood, and yellow birch. The scenarios report less hard maple (scenario 1) and soft maple (scenario 1), and a greater dominance of basswood. However, there was no statistical difference between the residual stocking of dominant species identified in the table below. A test of significance performed between the existing selection and scenario 1 for black ash, red oak, yellow

birch, soft maple, white ash, basswood, and hard maple found no statistical difference across the average stand stocking.

Table 1 – Species Composition Analysis

OOR Effect on Species Composition				
		Existing Selection	Scenario 1	Scenario 2
	Trees Per Acre	Percent Residual	Percent Residual	Percent Residual
Hard Maple	114.89	69%	63%	74%
Basswood	28.33	66%	76%	83%
White Ash	13.22	70%	69%	76%
Soft Maple	13.11	73%	63%	73%
Yellow Birch	6.89	79%	56%	69%
Red Oak	4.78	91%	79%	81%
Black Ash	3.22	69%	69%	72%
Ironwood	2.00	39%	39%	67%
Hemlock	1.78	100%	19%	31%
White Birch	1.67	60%	80%	87%
White Spruce	1.00	44%	33%	67%
Cherry	0.56	80%	60%	60%
Elm	0.56	60%	40%	60%
Balsam Fir	0.33	0%	100%	100%
Aspen	0.22	50%	0%	0%
Hickory	0.11	0%	100%	100%

The following figures display the data in bar chart format (Figures 1 and 2).

Figure 1 – Species Distribution

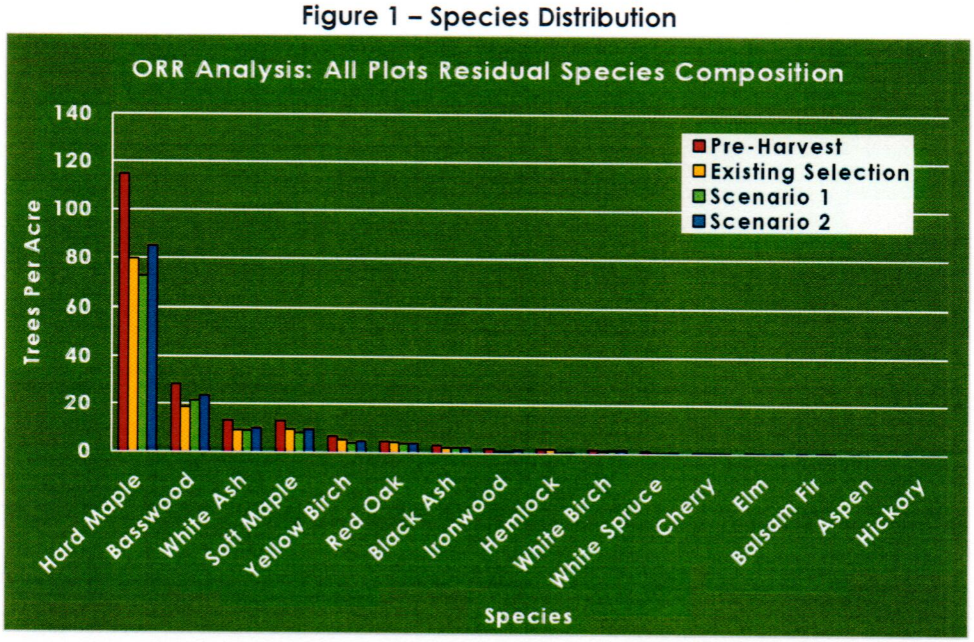
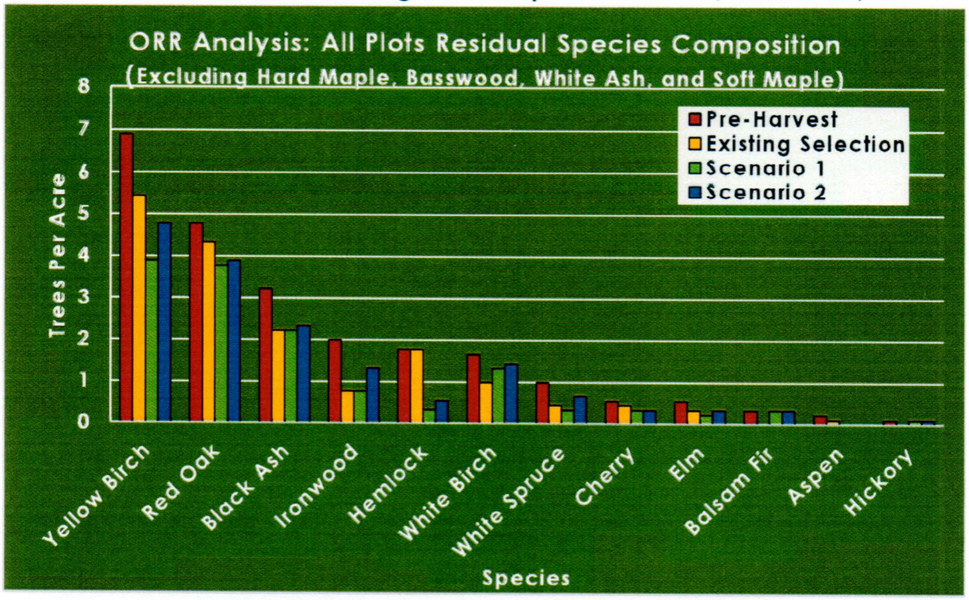


Figure 2 – Species Distribution Excluding Hard Maple, Basswood, White Ash, and Soft Maple



Response of Sub-Committee:
The Study does a good job of answering this question. Hard and soft maple decreased in scenario 1 while yellow birch and hemlock decreased in both scenarios. Basswood increased in both scenarios. In the first cut there was no significant difference (at the 95% level) in residual stocking for the dominant tree species.

Sub-Committee Concern: Over multiple cutting cycles tree species diversity would decrease due to criteria that selects only on the basis of growing stock rating.

Questions relative to Rotations Ages:

7. Does shortening rotation lengths limit supply to some markets (e.g. bolts, veneer, etc.) due to tree size?

Table 2 displays red pine product breakdown, as modeled in the report. This summary shows that stands rotated at age 48 will have roughly half the board feet volume than stands age 60. This may be a concern for industries dependent on the largest red pine saw products. However, the volume of planation origin material utilized by traditional sawmills is unknown, and there is a high level of completion for these stands, especially by the chip-n-saw and pole industries. Additionally, material meeting MBF specifications is utilized by pulp and paper facilities in many regions. In managed plantations quality is quite uniform and the primary characteristic defining cordwood from sawtimber is size alone (Table 2).

Table 2 – Product Summary

Red Pine Average Product Proportions at Different Rotation Lengths on Small Block MFL Lands						
Age (Years)	**Average Cords Per Acre**	**Percent of Total Volume**	**Average MBF Per Acre**	**Percent of Total Volume**	**Average Total Volume (Cords)**	**Average DBH**
48	24.0	78%	3.1	22%	30.8	9.3
50	23.0	72%	4.0	28%	32.0	9.8
52	22.0	70%	4.3	30%	31.6	9.9
60	19.6	57%	6.8	43%	34.6	11.1

8. **How do product classes (e.g.-pulpwood, bolts) change as rotation lengths get shorter?**
Product makeup can only be estimated from our study approach. The following summary assumes that stands begin producing volume at an average size of 8 inches DBH.

Table 3 reports that a decrease in rotation age from 40 to 33 years old would result in a 6% loss in volume from boltwood sized stands (greater than 8 inches DBH).

Table 3 – Aspen Average Stand Size Analysis

Aspen Average Stand Size Proportions at Different Rotation Lengths on Small Block MFL Lands			
Age (Years)	**Total Cords**	**Percent of Volume in Stands ≥8" DBH**	**Percent of Volume in Stands <8" DBH**
33	27.3	29%	59%
36	28.1	34%	66%
40	28.9	35%	65%

9. **Can you do same scenarios at 3% discount rate?**

This is a question we are very interested in looking into, but it would require additional time to setup and model.

10. **Please provide more ecological considerations associated the proposed alternative rotation ages?**

There is some evidence that shortening rotation age in aspen forest may increase the potential for Armillaria root rot in succeeding stands. However, current research has looked at stands much younger than that presented in the report. According to Bates et. (1989), al. "Repeated, short rotations may create physiologically stressed root systems that are more predisposed to root rot infection." This study evaluated rotation harvests in stands age13 years and younger; therefore, more research is needed to determine if minimum rotation ages between 30 and 40 years would increase the risk of this disease. Our study found that only the mid to higher quality sites would result in a rotation age younger than 40 years (current rotation age minimum, regardless of site). At a discount rate of 5.5 percent, the study found rotation age to decrease by 4 years for site index 70 and by 7 years for stands site index 80. The Woodstock model results identify an average aspen rotation age of 37 years, when landowners are maximizing present net value of future cash flows. This provides insight to a regional impact, and given the fact that not all MFL landowners would manage to the minimum, the impact would likely be less than three years over the ±326,000-acre model area.

The impact of rotation age on age-class distribution has been recently studied in the western Upper Peninsula of Michigan. This study looked at a flexible model approach loosely using an 80, 60 and 40-year rotation scheme. All aspen stands were not harvested at each rotation age break, but were harvested stands based on site and ownership class beginning at the rotation age threshold. Locher et al. used the "HARVEST" program and studied different aspen rotation ages in a defined landscape level study area. Each age scenario (80, 60 and 40) had a primary goal of creating an even distribution stands across multiple age classes. An objective of the Locher et al. study was to identify how an imbalance in age class across the landscape may negatively affect wildlife habitat and populations. The results of the model predicted that a 60 or 80-year rotation age allows for an even distribution of the aspen resource, while a stricter 40-year rotation age distribution would remain unbalanced. The 40-year term was designed to be more intensive, with about 60 percent of the acres harvested at age 40, while the remaining 40 percent could be harvested beyond age 40. The other scenarios were allowed more flexibility in harvest timing. These results suggest that allowing for extended rotation age (based on site, landowner objectives, in addition to other considerations) may help to develop a more even distribution over time. The findings of the Locher et al. harvest schedule found that strictly following at ≥40-year rotation does not allow for a sustained all age class forest over the landscape.

It was also suggested that long-term availability of ruffed grouse habitat may be inconsistent over time, as the age distribution would exhibit more of a cyclic distribution. Yet, all three management scenarios produced high quality ruffed grouse habitat (such as short distances between food and cover, and the proper structure for drumming) in areas with habitat types highly suited for aspen (Locher et al., 2012).

The current aspen distribution within the tax law programs is depicted in the following figure.

Aspen Rotation Age Analysis:
Modeled Aspen Age Class Distribution on WI MFL/FCL Forests

The above figure shows a surplus of acres' age 30 to 39 years, given the current bell shaped distribution. There is somewhat of an even distribution from age 1- through 44(understanding that 30 to 34-year bucket has a substantial surplus), so relaxing the rotation age could allow some landowners the opportunity to shift some acres to the younger age classes that are deficient. Since our model reported only a three-year decrease in average stand age the relaxing of the minimum rotation age may not adversely impact the distribution. Our study looked at strictly following rotation to maximize present value, essentially creating a worst-case scenario. Since the average minimum rotation age decreased by only three years, a significant landscape level change in distribution is unlikely.

Regarding red pine, we are not aware of any ecologically related research looking at plantation red pine.

Response of Sub-Committee:
The Study did a good job on answering the questions for aspen and ruffed grouse.

Sub-Committee Additional information on aspen forests: There are communities of terrestrial vertebrates that reach their highest population levels in the various stand ages of aspen forest. Some species do best right after a clearcut. Other species do best in the 5 to 25 year old aspen forest. Another group of species do best in old aspen stands with mature trees, abundant cavity trees, and (many times) a dense understory of shrubs (hazel) and sapling trees. Wildlife diversity always increases with a mix of conifers and scattered large reserve trees (red oak, white pine) in aspen stands.

Sub-Committee Additional information on red pine plantations: Wildlife abundance and diversity in red pine plantations is low. The greatest abundance and diversity occurs during the first few years of a red pine plantation (early successional wildlife). The pole stage is very poor wildlife habitat. After the third thinning (when a dense shrub and small tree understory has developed) there is an increase in use by some wildlife.

Single-Tree Selection and Order-of-Removal and Rotation Age Study Ecological Citations

Bates, Peter, Charles R. Blinn, Alvin A. Alm, and Donald A. Persala. "Aspen Stand Development Following Harvest in the Lake States Region." Northern Journal of Applied Forestry 6 (1989): 178-183. Web.

Locher, Alexandra, Henry Campa, Larry Leefers, and Dean E. Beyer. "Understanding Cumulative Effects of Aspen Harvest on Wildlife Habitat and Timber Resources in Northern Michigan." Northern Journal of Applied Forestry 29.3 (2012): 113-27. Web.

Yamasaki, Mariko, and William B. Leak. "Snag Longevity in Managed Northern Hardwoods." Northern Journal of Applied Forestry 23.3 (2006): 215-17. Web.

Fred Souba

From: Ron Eckstein <roneckstein@charter.net>
Sent: Monday, August 29, 2016 7:47 AM
To: 'Fred Souba'
Subject: FW: WFPS Sub-Committee C - August 19 Request for Review
Attachments: Ecological Responses and Citations 7-8-16.pdf; Response to Questions 6-7-8 _Revised.pdf; OOR Study w-Edits and Input_6.23.16.docx; Rotation Lengths w_Edits and Inputs_6.23.16.docx

Hello Fred. Hope all is well. I was out of town for most of the last two weeks. Here is my review of the WFPS information .

Committee C asked Forrest 10 questions per our June 21, 2016 meeting. Forrest has answered 7 of the 10 questions. For the three unanswered questions, Forrest indicated that answers would require additional time to setup and model. The three unanswered questions are important and include ecological conditions and economic returns after multiple cutting cycles as well as the scenarios at the 3% discount rate.

Question 1: Regional ecological considerations (in northern hardwoods).

Forrest states that the alternative tree removal scenarios do not consider tree species during the selection criteria. So, at the landscape level, the models may inadvertently shift tree species composition. Forrest found non-significant results when species composition was compared for the two scenarios and the existing selection on state, county, and MFL lands after one cut. Forrest concludes "Since our findings were not significant it is difficult to assess the level of risk that may be introduced if this marking guideline was strictly followed without consideration of species."

My concern: Tree species composition in northern hardwood stands is one of the two critical components of biodiversity (including wildlife habitat). Uniform marking guidelines that select only for quality will likely reduce tree species diversity across the regional landscape by removing (over multiple cutting cycles) conifers such as eastern hemlock and poorly formed trees such as yellow birch.

Question 2: Clarification that the scenarios do not imply diameter limit cutting or high grading.

The scenarios presented by Forrest for county, state, and MFL lands were definitely not a strict diameter limit cut or a high-grading cut. There were, however, 17" and 19" diameter limits placed on the sawtimber stands analyzed in the scenarios. This is different than the 20", 24" or 30" maximum diameters possible in the current DNR NH Chapter.

My concern: Forest stand structure in northern hardwood stands is the second critical component of biodiversity (including wildlife habitat). Trees larger than 20' diameter are a very important component of northern hardwood stands (at 2 to 4 trees per acre). These trees provide one important element of stand structure providing nest sites, forage, and cover for 61 species of terrestrial vertebrates and many more invertebrates. A portion of these large trees (especially large cavity trees) become coarse woody debris. Coarse woody debris is a critical component of forest ecology and wildlife habitat. If diameter limits of 17" or 19" were applied across broad landscapes then biodiversity (including wildlife habitat) would be compromised.

Question 3: How will the scenarios impact stand structure, quality, and products over multiple cutting cycles?

No answer at this time.

My concern: Stand structure would be simplified and, after several cutting cycles, wildlife habitat would be compromised.

Question 4: Can similar economic returns be expected in future cutting cycles?

No answer at this time.

Question 5: Quantify the impacts on wildlife habitat.

Forrest does a good job of summarizing the impacts the alternative scenarios have on large cavity trees and coarse woody debris components of wildlife habitat.

Concern: As Forrest states, both large cavity trees and coarse woody debris would be eliminated over several cutting cycles.

Question 6: How do the scenarios impact post-harvest tree species composition/diversity?

Forrest does a good job of answering this question. Hard and soft maple decreased in scenario 1 while yellow birch and hemlock decreased in both scenarios. Basswood increased in both scenarios. In the first cut there was no significant difference (at the 95% level) in residual stocking for the dominant tree species.

My concern: Over multiple cutting cycles tree species diversity would decrease due to criteria that selects only on the basis of growing stock rating.

Question 7: Does short rotation limit some markets?

This is not my area of expertise.

Question 8: How do product classes change with shorter rotations?

This is not my area of expertise.

Question 9: Run scenarios at 3% discount rate.

No answer at this time.

Question 10: Provide ecological considerations at alternative rotation ages.

Forrest did a good job of answering the question for aspen and ruffed grouse.

Additional information on aspen forests: There are communities of terrestrial vertebrates that reach their highest population levels in the various stand ages of aspen forest. Some species do best right after a clearcut. Other species do best in the 5 to 25 year old aspen forest. Another group of species do best in old aspen stands with mature trees, abundant cavity trees, and (many times) a dense understory of shrubs (hazel) and sapling trees. Wildlife diversity always increases with a mix of conifers and scattered large reserve trees (red oak, white pine) in aspen stands.

Additional information on red pine plantations: Wildlife abundance and diversity in red pine plantations is low. The greatest abundance and diversity occurs during the first few years of a red pine plantation (early successional wildlife). The pole stage is very poor wildlife habitat. After the third thinning (when a dense shrub and small tree understory has developed) there is an increase in use by some wildlife.

Ron Eckstein, Rhinelander

From: Fred Souba [mailto:fred@provisionforestry.com]
Sent: Friday, August 19, 2016 2:48 PM
To: alk@kretzlumber.com; Carothers Matt; Collin Buntrock; Eckstein Ron; Edge Greg; James Kerkman; Krawze Dick; Michael Demchik; Peterson Eric; Tuttle Andy
Cc: Henry Schienebeck; wcfa@frontier.com; Mark Rickenbach; Darrell.Zastrow@wisconsin.gov
Subject: WFPS Sub-Committee C - June 23 Meeting Follow-Up

To: Members of the Wisconsin Forest Practices Study Sub-Committee C- Silvicultural Considerations for Northern Forest Types
From: Fred Souba, Jr – Wisconsin Forest Practices Study Project Manager

At our last meeting information on the ecological consequences was forthcoming from Forrest. Attached is that information. Also please note that the ecological responses to questions 1 and 2 applies to OOR analysis utilizing state, county and private MFL data.

In addition, we asked Forrest to supply additional information regarding a statistical analysis of the Table 1 – Species Composition Analysis for the OOR study and to add average DBH to Table 2 – Product Summary for the Rotation Length study on red pine. This information is also attached with the additions noted in red text. Also please note that the ecological response to question 6 applies to OOR analysis utilizing state, county and private MFL data.

Finally, I have attached the updated templates of recommendations and additional information needs. The information added at the 23rd meeting is in red text.

Please review this information and if you have any questions or comments please let me know by end of business, Friday, August 26th. Our next step in the process is to meet with all the Sub-Committees (late September) to review their respective templates and develop a combined template of recommendations and additional information needs to present at the Council on Forestry meeting in November.

I apologize for getting this information to you so late after our last meeting. Unfortunately vacations and work schedules did not allow providing this information to you any sooner.

Thank you.

Fred

Fred Souba, Jr.
WFPS Project Manager

Fred Souba

From: Kerkman, James R CIV USARMY IMCOM CENTRAL (US) <james.r.kerkman.civ@mail.mil>
Sent: Friday, August 26, 2016 11:52 AM
To: 'Fred Souba'
Subject: RE: MCAFEE E-MAIL SCAN ALERT!~[NON-DOD SOURCE] WFPS SUB-COMMITTEE C - JUNE 23 MEETING FOLLOW-UP

Fred,

The one comment I have involves the statement addressing question 1. It states; "... selection for only the best quality form, may inadvertently shift species composition by promoting species that exhibited the best form on a given site." It is easy to see how this might occur. Should a recommendation be included to consider the species mix on the site and strive to keep species represented on the site even if they don't have the best form?

Jim

James Kerkman, CF
Forester
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2171 South 8th Ave
Fort McCoy, WI 54656-5136
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james.r.kerkman.civ@mail.mil

-----Original Message-----
From: Fred Souba [mailto:fred@provisionforestry.com]
Sent: Friday, August 19, 2016 2:48 PM
To: alk@kretzlumber.com; Carothers Matt <mlcarothers@prentissandcarlisle.com>; Collin Buntrock <collin.buntrock@wisconsin.gov>; Eckstein Ron <roneckstein@charter.net>; Edge Greg <gregory.edge@wisconsin.gov>; Kerkman, James R CIV USARMY IMCOM CENTRAL (US) <james.r.kerkman.civ@mail.mil>; Krawze Dick <prl139@networth.net>; Michael Demchik <mdemchik@uwsp.edu>; Peterson Eric <icfadmin@ironcountyforest.org>; Tuttle Andy <groeschl@centurytel.net>
Cc: Henry Schienebeck <henry@gltpa.org>; wcfa@frontier.com; Mark Rickenbach <mgrickenbach@wisc.edu>; Darrell.Zastrow@wisconsin.gov
Subject: MCAFEE E-MAIL SCAN ALERT!~[NON-DOD SOURCE] WFPS SUB-COMMITTEE C - JUNE 23 MEETING FOLLOW-UP

Attachment file : OOR Study w-Edits and Input_6.23.16.docx Scanner Detected: Suspicious Extensions (Virus) Action taken : Deleted (Clean failed, file has multiple extensions)