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Nantahala and Pisgah National Forests

Proposed Land Management Plan

Appendix B: Timber Calculations

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Appendix B. Timber Calculations

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Suitability of Lands for Timber Production

During forest plan development and revision, assessment of the suitability of lands for timber production is required under the 2012 planning rule and National Forest Management Act. Lands identified as suitable for timber production have a regularly scheduled timber harvest program that contributes to forestwide desired conditions and multiple use goals, such as providing mosaics of habitats for wildlife and plant species and contributing to the economic sustainability of local communities by producing timber, pulp, specialty woods, and fuelwood as renewable resources.

Forest Service Handbook 1909.12 CH 60.5[1] provides key definitions used in developing and revising forest plans in regard to forest vegetation resource management. The timber section of the EIS and a detailed white paper in the project record detail the suitability determination process used to develop the numbers displayed in Table 1. Because there is not a preferred alternative at this time, suitability is displayed for all alternatives that are analyzed in the EIS. The final plan will only include the resulting suitable acres of the selected alternative.

Table 1: Timber Production Suitability Classification

Land Classification Category	Alternative A* Acres	Alternative B Acres	Alternative C Acres	Alternative D Acres
A. Total National Forest System lands in the plan area	1,042,060			
B. Lands not suited for timber production due to legal or technical reasons	339,014			
C. Lands that **may be** suited for timber production (A-B)	703,046			
D. Total lands **suited** for timber production because timber production is compatible with the desired conditions and objectives established by the plan	361,176*	405,657	321,670	409,337
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan (C-D)	341,870	297,389	381,376	293,709
Total lands **not suited** for timber production (B+E)	680,884	636,403	720,390	632,723

1 http://www.fs.fed.us/im/directives/fsh/1909.12/wo_1909.12_60.docx

Land Potentially Impacted by Timber Operations

Using the acres identified as suitable for timber production as a proxy for how much of the forest would be treated during the life of the plan would not be accurate for two reasons. First, the total amount of lands suitable for timber production identifies the total number of acres on the forest that could be planned for multiple entries. To treat this, many acres would potentially require multiple centuries. There is not a desire to treat every suitable acre during the 10 to 15 lifespan of the plan nor would that be possible with existing capacity, infrastructure, and stocking opportunities. Secondly, the total amount of acres suitable for timber production does not take into account other timber harvest operations that would occur on lands that would not have regularly scheduled entries. Acres suitable for timber production only consider those places where repeat scheduled entry is planned and does not include acres where a harvest may only be needed once or a few times until a desired condition is met and then may no longer require mechanical maintenance over this planning period (i.e., thinned woodland structure maintained with prescribed fire in the unsuited land base). Timber harvest occurs on both lands identified as suited for timber production as well as lands identified as not suited for timber production.

Therefore, in order to better estimate how many acres of the Forests may experience timber operations during plan implementation, an analysis was undertaken to estimate the total amount of land base that is available and accessible for timber harvest by geographic area and management area by alternative. This analysis, which is still programmatic and does not substitute for project level evaluation, aimed to better consider the current age and condition of the forest, landscape topography, existing and potential future road access, and the constraints associated with using contemporary harvest equipment.

The analysis used the existing road network as a base for accomplishing objectives but also recognizes that road construction would be required to access all of the acres that the Spectrum vegetation model showed as treated acres. Site-specific analysis in the last ten years demonstrates that some new road construction is necessary to maintain the current amount of annual acres treated (see EIS, “Transportation and Access” section). Therefore, given topographic and site-specific conditions that are not possible to consider accurately at this landscape scale, this analysis assumes that current road building levels will continue under Tier 1 and that additional permanent and temporary road construction would be needed under Tier 2, depending on alternative (see EIS “Transportation and Access” section). During implementation, if an area does not have road access, access options may be pursued during district level projects

Table 2. Various Timber Harvest Access Constraints by Alternative (Acres)

Acres Available in MAs That Allow Timber Harvest	Alternative A	Alternative B	Alternative C	Alternative D
Total acres with current access (1)	206,011	239,843	238,242	242,686
Acres with potential future access (road building) (2)	223,721	300,203	249,357	292,316
Total	429,732	540,046	487,599	535,002

Acres Likely to be Commercially Viable Within MAs That Allow Timber Harvest*	Alternative A	Alternative B	Alternative C	Alternative D
Acres estimated to have mature and productive forests with current access (3)	97,903	112,660	111,366	113,400
Potential future access (road building) (4)	118,217	152,497	123,728	146,686
Total	216,120	265,157	235,094	260,086

It must be noted that the intended purpose of this estimate is to inform planning at the forestwide scale and not to predict or design harvest projects. Projects require more site-specific analysis and consideration of fine scale information about the site and forest resources.
*Over the life of the plan. Commercially viable is based on FSVeg data (select age and condition classes).

As a result, on a forest of just over one million acres, the total acres of the forest likely to have potential for commercial operations varies between 265,000 and 235,000 acres between the action alternatives, however only an estimated 111,000 to 113,000 acres would be available if current levels of road construction are maintained. Operability could increase if additional roads are added. To put this another way, about 10% of the Forests could foreseeably be impacted by commercial timber operations if current levels of road construction are maintained with about 90% of the Forests unlikely to be impacted by timber operations. All of these totals are programmatic estimates, and sites-specific conditions would likely further reduce the land operable for commercial timber harvest including local topographic considerations, mitigations necessary for public health and safety, threatened and endangered species, rare ecological communities, cultural resources, scenery, and recreation. The consolidated terrestrial ecosystems objectives in the plan that would use timber harvesting (regeneration and thinning) identify roughly 16,000 acres per decade (Tier 1) or up to roughly 40,000 acres per decade (Tier 2). This equates to approximately 1.5 percent (Tier 1) to 3.8 percent (Tier 2) of the total land base over a decade being impacted by timber harvesting.

Forest Utilization Standards

The Forest Utilization Standards were based on the NC Supplement of the timber sale preparation handbook, Chapter 50 (R8 NC 2409.18, 2012). Species not assigned to a volume group by the supplement were added to the most appropriate group. This handbook may be updated and species groups changed at any time.

For more information about the use of the Forest Utilization Standards in Forest Vegetation Simulator (FVS), refer to the white paper: FVS Modeling for the National Forests of North Carolina Land and Resource Management Plan in the project record. For more information about the Spectrum model and its use in the effects analysis for the Nantahala and Pisgah Plan Revision EIS refer to the EIS Appendix B.

Table 3: Minimum DBH for Pulpwood and Sawlog Calculations

Volume Group	Pulpwood Minimum DBH	Sawlog Minimum DBH
WTP, HEM	8.0	12.0
SYP, SFi	8.0	10.0
JU	8.0	12.0
PBC, OAK	8.0	12.0
HWD, LGH	8.0	13.0

In Table 3:

WTP = eastern white pine

HEM = hemlock species

JU = redcedar species

SFi = spruce species, fir species

SYP = loblolly pine, shortleaf pine, table mountain pine, Virginia pine, pitch pine

PBC = yellow-poplar, cucumbertree, basswood species

OAK = northern red oak, white oak, black oak, black cherry, sugar maple, chestnut oak, white ash, black walnut

HWD= red maple, birch species, sweet birch, American beech, sycamore, buckeye/horsechesnut species

LGH = hickory species, black locust, scarlet oak, sourwood, blackgum, southern red oak, silverbell, hackberry species, sweetgum, Florida maple, boxelder, silver maple, American hornbeam, catalpa, eastern redbud, flowering dogwood, common persimmon, green ash, honeylocust, silverbell, American holly, southern magnolia, bigleaf magnolia, apple species, mulberry species, water tupelo, eastern hophornbeam, cottonwood species, bigtooth aspen, cherrybark oak, overcup oak, blackjack oak, swamp chestnut oak, chinkapin oak, water oak, post oak, willow species, sassafras, elm species, winged elm, American elm, other hardwood species, other species

Sustained Yield Limit Calculation

The calculations for the sustained yield limit (SYL) involved the use of two nationally supported management models. In 2013 to 2014, the Forest Vegetation Simulator, an inventory-based (plots) growth and yield modeling system, was used to create yield profiles for forested land managed by the Pisgah and Nantahala NFs. Forest Inventory and Analysis (FIA) plots from across the southern Appalachian Mountains were used along with information on ecological zones, prominent forest health conditions, and common management prescriptions to develop the yield profiles representing information on 41 variables ranging from snags per acre to volumes harvested under simulated treatments. Refer to the project record for further information regarding FVS model development.

The annual SYL is 45.0 MMCF / 700,993 acres and does not vary by alternative (see Table 4 below).

Projected Wood Sale Quantity, Projected Timber Sale Quantity and Quantity of Timber Sold

To clearly display the intended timber program, the plan identifies the **projected wood sale quantity (PWSQ**) and the **projected timber sale quantity (PTSQ)**. The PWSQ is the estimated output of timber and all other wood products (such as fuelwood, firewood, or biomass) expected to be sold during the plan period for any purpose (except salvage harvest or sanitation harvest) on all lands in the plan area. The PTSQ is the portion of the PWSQ that is the quantity that meets applicable utilization standards. Both the PWSQ and the PTSQ are based on the fiscal capability and organizational capacity to achieve the desired conditions and objectives in the plan for the plan period. Fiscal capability and organizational capacity is based on current budget levels.

Both the projected wood sale quantity and projected timber sale quantity vary for each alternative considered in the EIS. Since no preferred alternative has been identified at this time, results for all alternatives are shown below.

Table 4: Projected Wood and Timber Sale Quantity, Including Sustained Yield, by Alternative

Alternative A				
Sustained Yield Limit	45.0 MMCF*/year			
	First Decade		**Second Decade**	
	MMCF/ year	**MMBF+/ year**	**MMCF/ year**	**MMBF/ year**
Timber Products Volumes other than salvage or sanitation volumes that meet timber product utilization standards)				
Lands suitable for timber production				
A1. Sawtimber	1	5.3	0.7	4.1
A2. Other products	1.4	7.6	1.1	5.8
Lands NOT suitable for timber production				
B1. Sawtimber	0	0.1	0	0
B2. Other products	0	0.2	0	0
C. Projected Timber Sale Quantity (PTSQ) (A1+A2+B1+B2)	2.4	13.2	1.8	9.9
Other Wood Products (Est.) Fuelwood, biomass, and other volumes that do not meet timber product utilization standards				
	MMCF	**Tons**	**MMCF**	**Tons**
D. Fuelwood	1.6	3,200	1.6	3,200
E. Posts	0.1	100	0.1	100
F. Projected Wood Sale Quantity (PWSQ)	4.1		3.5	

*MMCF: Millions of cubic feet

+MMBF: Millions of board feet

Alternative B				
Sustained Yield Limit	45.0 MMCF*/year			
	First Decade		**Second Decade**	
	MMCF/ year	**MMBF+ / year**	**MMCF/ year**	**MMBF/ year**
Timber Products Volumes other than salvage or sanitation volumes that meet timber product utilization standards)				
Lands suitable for timber production				
A1. Sawtimber	1.6/6.0	8.6/33.2	2.1/3.5	11.7/19.4
A2. Other products	2.2/8.6	12.3/47.4	3.0/5.0	16.7/27.7
Lands NOT suitable for timber production				
B1. Sawtimber	0/0.1	0/0.8	0/0	0/0.2
B2. Other products	0/0.2	0/1.1	0/0.1	0/0.3
C. Projected Timber Sale Quantity (PTSQ) (A1+A2+B1+B2)	3.8/14.9	20.9/82.5	5.1/8.6	28.4/47.6
Other Wood Products (Est.) Fuelwood, biomass, and other volumes that do not meet timber product utilization standards				
	MMCF	**Tons**	**MMCF**	**Tons**
D. Fuelwood	1.6	3,200	1.6	3,200
E. Posts	0.1	100	0.1	100
F. Projected Wood Sale Quantity (PWSQ)	5.5/16.6		6.8/10.3	

*MMCF: Millions of cubic feet

+MMBF: Millions of board feet

Alternative C				
Sustained Yield Limit	45.0 MMCF*/year			
	First Decade		**Second Decade**	
	MMCF/ year	**MMBF+ / year**	**MMCF/ year**	**MMBF/ year**
Timber Products Volumes other than salvage or sanitation volumes that meet timber product utilization standards)				
Lands suitable for timber production				
A1. Sawtimber	1.6/5.9	9.0/32.2	2.1/3.8	11.7/20.7
A2. Other products	2.3/8.4	12.9/46.1	3.0/5.4	16.7/29.5
Lands NOT suitable for timber production				
B1. Sawtimber	0/0.1	0/0.6	0/0	0/0.2
B2. Other products	0/0.2	0/0.9	0/0	0/0.3
C. Projected Timber Sale Quantity (PTSQ) (A1+A2+B1+B2)	3.9/14.6	21.9/79.8	5.1/9.2	28.4/50.7
Other Wood Products (Est.) Fuelwood, biomass, and other volumes that do not meet timber product utilization standards				
	MMCF	**Tons**	**MMCF**	**Tons**
D. Fuelwood	1.6	3,200	1.6	3,200
E. Posts	0.1	100	0.1	100
F. Projected Wood Sale Quantity (PWSQ)	5.6/16.3		6.8/10.9	

*MMCF: Millions of cubic feet

+MMBF: Millions of board feet

Alternative D				
Sustained Yield Limit	45.0 MMCF*/year			
	First Decade		**Second Decade**	
	MMCF/ year	**MMBF+ / year**	**MMCF/ year**	**MMBF/ year**
Timber Products Volumes other than salvage or sanitation volumes that meet timber product utilization standards)				
Lands suitable for timber production				
A1. Sawtimber	1.6/5.9	8.6/32.7	2.1/3.3	11.6/18.1
A2. Other products	2.2/8.5	12.3/46.6	3.0/4.7	16.5/25.9
Lands NOT suitable for timber production				
B1. Sawtimber	0/0.1	0/0.5	0/0.3	0/1.4
B2. Other products	0/0.1	0/0.7	0/0.4	0/2.0
C. Projected Timber Sale Quantity (PTSQ) (A1+A2+B1+B2)	3.8/14.6	20.9/80.5	5.1/8.7	28.1/47.4
Other Wood Products (Est.) Fuelwood, biomass, and other volumes that do not meet timber product utilization standards				
	MMCF	**Tons**	**MMCF**	**Tons**
D. Fuelwood	1.6	3,200	1.6	3,200
E. Posts	0.1	100	0.1	100
F. Projected Wood Sale Quantity (PWSQ)	5.4/16.3		6.8/10.8	

*MMCF: Millions of cubic feet

+MMBF: Millions of board feet

Summary of Planned Methods of Timber Harvest

Section 65.1 of the 2012 planning rule requires that revised plans contain estimates of expected vegetation management practices. The average values contained in the subsequent tables are derived from estimated output from the Spectrum model. Tabular results listed here are approximations and should not be related directly to future forest level treatment levels. The plan must be revised at least once every 15 years.

Estimated Vegetation Management Practices

Table 5. Forestwide Vegetation Management Practices for Alternative B (Decade Level Estimate)

Forest Community Types/ Vegetation Management Practices	Average of First Two Decades (Acres)	
	Tier 1	Tier 2
White Pine and White Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	7,960	8,135
Intermediate treatments	2,770	1,344
Prescribed Fire	496	19,070
Spruce and Fir Forest Types		
Balanced & Irregular uneven-aged regeneration harvests	6	9
Shortleaf Pine and Shortleaf Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	1,174	22
Intermediate treatments	396	361
Prescribed Fire	12,248	32,888
Other Pine and Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	1,351
Intermediate treatments	198	6,439
Prescribed Fire	47,658	40,211
Dry Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	2,966	12,639
Intermediate treatments	4,530	782
Prescribed Fire	4,931	12,296
Dry/Mesic Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	6,000	7,556
Intermediate treatments	1,674	11,228
Prescribed Fire	10,148	90,196
Cove and Mesic Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	10,726

Forest Community Types/ Vegetation Management Practices	Average of First Two Decades (Acres)	
	Tier 1	Tier 2
Balanced uneven-aged regeneration harvests	603	1,669
Prescribed Fire	0	281
Northern Hardwood Forest Types		
None Estimated	0	0
Other Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	14
Intermediate treatments	0	61
Prescribed Fire	0	530
Openings Management		
Prescribed Fire	1,241	4,521
Total Treatments --		
All regeneration harvests	18,702	42,119
Intermediate treatments	9,566	20,213
Prescribed Fire	76,720	199,992

Table 6. Forestwide Vegetation Management Practices for Alternative C (Decade Level Estimate)

Forest Community Types/ Vegetation Management Practices	Average of First Two Decades (Acres)	
	Tier 1	Tier 2
White Pine and White Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	8,159	7,056
Intermediate treatments	3,335	1,653
Prescribed Fire	0	19,626
Spruce and Fir Forest Types		
Balanced & Irregular uneven-aged regeneration harvests	6	54
Shortleaf Pine and Shortleaf Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	51	19
Intermediate treatments	430	518
Prescribed Fire	12,521	32,501
Other Pine and Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	1	2,024
Intermediate treatments	280	6,480

Forest Community Types/ Vegetation Management Practices	Average of First Two Decades (Acres)	
	Tier 1	Tier 2
Prescribed Fire	48,130	55,781
Dry Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	3,047	8,524
Intermediate treatments	2,823	996
Prescribed Fire	4,943	13,715
Dry/Mesic Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	6,129	10,654
Balanced uneven-aged regeneration harvests	0	0
Intermediate treatments	3,859	7,078
Prescribed Fire	11,754	71,864
Cove and Mesic Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	12,591
Balanced uneven-aged regeneration harvests	501	2,179
Intermediate treatments	0	8
Prescribed Fire	0	4
Northern Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	23
Other Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	56
Intermediate treatments	2	0
Prescribed Fire	0	542
Openings Management		
Prescribed Fire	878	5,965
Total Treatments		
All regeneration harvests	17,892	43,178
Intermediate treatments	10,728	16,732
Prescribed Fire	78,225	199,996

Table 7. Forestwide Vegetation Management Practices for Alternative D (Decade Level Estimate)

Forest Community Types/ Vegetation Management Practices	Average of First Two Decades (Acres)	
	Tier 1	Tier 2
White Pine and White Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	6,893	9,308
Intermediate treatments	4,348	959
Prescribed Fire	0	19,170
Spruce and Fir Forest Types		
Balanced & Irregular uneven-aged regeneration harvests	6	177
Shortleaf Pine and Shortleaf Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	806	9
Intermediate treatments	410	153
Prescribed Fire	11,636	34,020
Other Pine and Pine Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	2,115
Intermediate treatments	144	6,575
Prescribed Fire	44,946	46,842
Dry Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	6,019	11,730
Intermediate treatments	1,033	592
Prescribed Fire	4,938	14,743
Dry/Mesic Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	6,000	9,293
Balanced uneven-aged regeneration harvests	0	0
Intermediate treatments	1,662	12,192
Prescribed Fire	10,228	79,465
Cove and Mesic Oak Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	8,534
Balanced uneven-aged regeneration harvests	582	1,738
Intermediate treatments	0	0
Prescribed Fire	0	12
Northern Hardwood Forest Types		
None Estimated	0	0

Forest Community Types/ Vegetation Management Practices	Average of First Two Decades (Acres)	
	Tier 1	Tier 2
Other Hardwood Forest Types		
Even-aged & irregular uneven-aged regeneration harvests	0	56
Intermediate treatments	0	10
Prescribed Fire	0	536
Openings Management		
Prescribed Fire	975	5,212
Total Treatments		
All regeneration harvests	20,304	42,957
Intermediate treatments	7,596	20,480
Prescribed Fire	72,722	199,998

Estimates of Culmination of Mean Annual Increment

On lands classified as suitable for timber production, the regeneration harvest of even-aged stands of trees is limited (although there are some exceptions) to stands that "generally have reached the culmination of mean annual increment (CMAI) of growth" (FSH 1909.12 64.26).

Based on forest plan revision FVS model development, estimations of CMAI were developed for the different forest type groups modeled. Refer to the FVS white paper in the project record to determine the number of plots contributing to each forest type groups CMAI estimate. These estimates are based on FIA plot data throughout the southern Appalachians. They should serve as a guide for Nantahala and Pisgah land managers when prescribing treatments. Always keep in mind those factors that contribute to stand development (i.e., site productivity) when comparing actual stands to modeled data results.

Typically, rotation ages for even age stands would have reached culmination of mean annual increment (CMAI) before regeneration harvests, however there may be opportunity for focused harvest of popular, white pine or red maple in order to meet other desired conditions.

Table 8. Modeled Culmination of Mean Annual Increment using FVS and FIA Data Across the Southern Blue Ridge

Forest Type/Group	CMAI Age (Years)	Merchantable Volume (Cubic Feet/Acre/Year)
White Pine	68	82.6
Shortleaf Pine	48	95.1
Pitch/Virginia Pine	78	50.6
White Pine/HWD	75	60

Forest Type/Group	CMAI Age (Years)	Merchantable Volume (Cubic Feet/Acre/Year)
Shortleaf Pine/HWD	104	43.3
Pitch/Virginia Pine/HWD	69	60.3
Dry Oak	98	39.6
Intermediate Oak	94	43.5
Cove Hardwoods	73	72.8
Mixed Hardwoods	92	56.1
Northern Hardwoods	94	52.7