APPENDIX C: TIMBER ANALYSES

INTRODUCTION

This appendix describes the analysis of lands suitable and not suitable for timber production, the Allowable Sale Quantity (ASQ), Total Timber Sale Program, and describes conditions where different silvicultural systems could be used.

LANDS SUITABLE FOR TIMBER PRODUCTION

During forest land and resource management planning, the Forest Service is required to identify lands unsuited for timber production (16 USC 1604(k); 36 CFR 219.14). Timber production is defined as "the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of forest planning, timber production does not include the production of fuelwood or harvests from unsuitable lands." (36 CFR 219.3, 1982 rule). This identification process involves three stages of analysis. Stage I analysis identifies lands tentatively suitable for timber production. Stage II analysis is designed to explore the financial aspect of varying intensities of timber management on lands identified as tentatively suitable for timber production from Stage I. Stage III analysis identifies lands as unsuited for timber production as determined by the desired conditions and land allocations in the Forest Plan.

STAGE I: PHYSICAL SUITABILITY

The first stage of the timber suitability analysis addresses the administrative and physical suitability of the land to be managed for the production of timber. Stage I lands unsuitable for timber production include:

- Lands that do not meet the definition of forest land (land at least 10% occupied by forest trees of any size).
- Lands that have been administratively or congressionally withdrawn from timber production by an act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service.
- Forest lands incapable of producing industrial wood.
- Lands where technology is not available to ensure timber production from the land without irreversible soil and water resource damage.
- Lands where there is no reasonable assurance that they can be adequately restocked.
- Lands where there is inadequate information.

Table C-1 describes the information used to estimate the acreage within the six categories of the Stage I tentatively suitable lands.

Table C-1. Tentatively Suitable Lands, Stage I Suitability Analysis

Categories of Stage I Unsuitable Lands	Defining Information	Current Net Acres
Total National Forest System Lands:		1,065,000
Non Forest Land	FSVeg Land Class Codes: 110-Lake 120-Reservoir 140-River 210-Cemetery 220-Powerline 230 Road/Railroad 240-Special Use 250-Wildlife Clearing	(7,000)
Withdrawn	Designated Wilderness (1A) Mt. Pleasant National Scenic Area (4F) Research Natural Areas (4B)	(53,000)
Irreversible Damage	Land Class Code: 826 - Physical barriers AND Site Index < 70	(28,000)
Can't Restock	Forest Type: 99 – Brush AND Stand Condition Class: 15 – Non Stocked	(1,000)
Incapable of producing industrial wood	Land Class Code: 900 – Incapable of Industrial Wood OR Site Index < 40	(65,000)
Tentatively Suitable Forest Lands		**911,000**

It is important to note that the net acres displayed in Table C-1 refer to the acres within that particular category that have not already been removed in a previous category. For instance, there are a total of some 41,000 acres on the Forest that meet the criteria for 'Irreversible Damage and Can't Restock', but only about 29,000 are shown as removed because the other 12,000 acres were already removed by the 'Withdrawn' category.

STAGE II: FINANCIAL ANALYSIS

The second stage analysis is designed to explore the financial efficiency of different timber intensities on the lands identified as tentatively suitable for timber production in Stage I. It does not identify any lands as unsuitable for timber production. Stage III analysis considers the results of these financial efficiencies in making the final determination of lands suited for timber production.

STAGE III: IDENTIFICATION OF SUITABLE ACRES

The third stage analysis is determined by Forest Plan direction. Several criteria were used during this stage to identify lands in this category:

- Based upon consideration of multiple-use objectives, the land is proposed for resource uses that preclude timber production. However, in some management prescription areas that are classified as unsuitable for timber production, timber harvest may occur to meet the desired condition of other resources.
- Other management objectives limit timber production activities to the point where management requirements set forth in 36 CFR 219.27 cannot be met.
- The lands are not cost-efficient, over the planning horizon, in meeting forest objectives, which includes timber production.

Table C-2 describes the information used to estimate the final acres suitable for timber production from considering all three stages of analyses.

Table C-2. Determination of Acres Suitable for Timber Production for Stage III Suitability Analysis

Categories of Stage III Unsuitable Lands	Defining Information	Current Net Acres
Tentatively Suitable Forest Lands from Stage I Analysis		911,000
Withdrawn for Other Resource Purposes by Management Prescription Area	Recommended Wilderness Study (1B) Eligible Scenic River Corridors (2C2&3) Appalachian National Scenic Trail Corridor (4A) Geologic (4C1) Special Biological Areas (4D) Key Natural Heritage Community Areas (4D1) Special Heritage (4E) Shenandoah Mountain Recommended National Scenic Area (4FA) All Administrative Areas (5A, 5B, 5C) Concentrated Recreation (7D) Dispersed Recreation-Unsuitable for Timber Production – (7E1) Blue Ridge Parkway Corridor (7F) Pastoral Landscapes (7G) Indiana Bat Primary (8E4a) Riparian Corridors (11) Remote Backcountry (12D) Possible Old Growth not in Old Growth Forest Types 21 & 25	(344,000)
Lands Not Appropriate Because They Are Not Cost-Effective to Achieve Timber Production Goals	Site Index <= 40 or Slope >55% and Forest Type <> 48, 53, 56 and 81*	(115,000)
Total Suitable Land		**452,000**

* Forest types 48, 53, 56, and 81 are northern red oak-hickory-yellow pine, white oak-red oak-hickory, yellow poplar-white oak-red oak, and sugar maple-beech-yellow birch, respectively.

Lands suitable for timber production are located in eight management prescriptions. These prescriptions contain both suitable and unsuitable lands. Final determination of suitability for timber production is determined at the site-specific project level. During this project level determination, lands identified as suitable for timber production must total no more than 452,000 acres across the forest.

TIMBER SALE PROGRAM

The Allowable Sale Quantity (ASQ) is defined as the maximum amount of timber that may be sold on lands suitable for timber production during a decade of implementing the Forest Plan (FSH 2409.13). The ASQ plus volume produced on lands unsuitable for timber production through achievement of desired conditions or salvage operations comprise the total Timber Sale Program. However, the volume from timber harvest that may occur on unsuitable lands to support other resource objectives (non-scheduled volume) is incidental and difficult to quantify. Table C-3 displays a breakdown of the ASQ and Total Timber Sale Program for the first decade of the Revised Plan. The ASQ is a decadal ceiling; there are no constraints on the amount of volume that can be sold annually on the Forest.

Table C-3. ASQ and Total Timber Sale Program for the First Decade

Total Allowable Sale Quantity	55.3 MMCF
Total Non-Scheduled Volume	0 MMCF
Total Timber Sale Program Quantity	55.3 MMCF

The silviculture/timber sale program areas apply active management to the overstory, midstory and understory vegetation in order to move the forest toward desired conditions (see Chapter 2, DC-ESD-1 through DC-ESD-12). Activities described in this section include timber sales such as intermediate timber harvest (thinning), and silvicultural harvest treatments that are even-age in nature (clearcut, or two-age regeneration), or uneven-age (group selection). The estimated or projected size of the silviculture program (acres of management activity) is based on the ecological needs of the resource, and historical budget and personnel levels for the George Washington National Forest. The following table shows the estimated average annual silvicultural treatments, acres treated and volume to be applied to the GWNF for the first decade covered by the Forest Plan.

Table C-4. Estimated Silvicultural Treatments (Annual Average Treatment Acres and Volume) in the First Decade on Lands Suitable for Timber Production, based on 3,000 acres of regeneration per year.

Silvicultural Treatment	Acres	Approximate Volume MMCF	Approximate Volume MMBF
Clearcutting	90	2.4	12.0
Shelterwood	2,860	49.6	248.0
Uneven-age	50	0.9	4.5
Commercial Thinning	400	2.4	12.0
Reforestation	2,890	n/a	n/a
Timber Stand Improvement	1,200	n/a	n/a

The volume proposed for harvest must be compared to the long-term sustained-yield capacity (LTSYC) calculated for the GWNF. The LTSYC is defined [36 CFR 219.3] as "the highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple-use objectives." LTSYC is the potential average growth (mean increment) of the forest on acres allocated to timber production after the stand has reached a managed stand structure. It can be thought of as steady state timber output after the existing stands have been cut and each acre allocated to timber production has settled into a particular management intensity and rotation age. NFMA regulations require: "each sale schedule shall provide for a forest structure that will enable perpetual timber harvest which meets the principle of sustained yield and multiple-use objectives of the alternative." The LTSYC is calculated as 64 MMCF per decade, which is higher than the timber sale program of 55.3 MMCF per decade.

Vegetation Management Requirements at the Project Level

This plan makes the general determination about GWNF lands that are suitable timber production. Final decisions about a proposed project that involves timber harvest are made at the project level. In making this determination, the following factors must be evaluated at the project level and documented in the project or case file (Reference FSH 1909.12, Chapter 61):

- A determination must be made that the project will not cause irreversible damage to resources such as soil productivity or watershed condition;
- The area can be adequately re-stocked according to the Forest Plan's objectives for achieving desired conditions;
- In the case of regeneration harvest, stands should generally have reached culmination of mean annual increment (CMAI).

VEGETATION MANAGEMENT PRACTICES

This section evaluates the usefulness of various vegetation management practices, with a major focus on silvicultural systems used to manage vegetation in management prescriptions suitable for timber production. This Appendix recommends practices that meet NFMA regulations for manipulating vegetation to regenerate stands to desirable native species, usually of the pre-harvest forest type. This Appendix was prepared for compliance with 36 CFR 219.

SILVICULTURAL SYSTEMS

There are three silvicultural systems used to provide regulated and sustainable yield of wood products for local wood processing facilities on the GWNF.

The EVEN-AGED SILVICULTURAL SYSTEM is a planned sequence of treatments for tending, harvesting and re-establishing a stand designed to maintain trees composed of a single age class in which the range of tree ages is usually 20% of rotation. This system creates a mosaic of single age class stands across the forestlands

suitable for producing forest products, where collectively, on the suitable forest land, all aged classes are present and maintained. When the stand reaches the desired product objective, usually expressed as the rotation (the time frame for growing the product objective for a given set of environmental conditions), but may also be expressed as specific wood product(s). Harvesting is scheduled to remove all or most all of the merchantable trees (from which the desired wood products can be produced) in a stand. Whether all or some of the merchantable trees are harvested is dependent upon the regeneration method chosen to accomplish the management prescription objectives. Regeneration, designed to replace desirable tree species, takes place within 5 years after the final harvest.

The TWO-AGED SILVICULTURAL SYSTEM is a planned sequence of treatments for tending, harvesting and re-establishing a stand and maintaining trees of two distinct age classes. The trees in each distinct age class could have tree ages that span up to 20% of the rotation. This system creates a mosaic of two-age class stands across the forestlands suitable for timber production, where collectively, on the suitable forest land, all aged classes are present and maintained. When one age class of the stand reaches the desired product objective, usually expressed as a rotation, harvesting is scheduled to remove that age class, usually the older age class. In a stand, all merchantable trees (from which wood products can be produced) in the older age class are scheduled for harvest. The resulting stand may be two-aged or tend toward an uneven-aged condition as a consequence of both an extended period of regeneration established and the retention of reserve (green) trees that may represent older age classes. When trees in one of the age classes have reached the desired product objective or rotation, that part of the stand is harvested. This harvest regenerates a new age class of desirable tree species to perpetuate the two-aged stand structure within 5 years of the removal of an age class.

The UNEVEN-AGED SILVICULTURAL SYSTEM is a planned sequence of treatments for tending, harvesting and re-establishing a stand and maintaining trees in three or more age classes. Because this system creates a multi-aged stand structure, rotations are not applicable as a management tool. Instead, periodic inventories of the multi-aged stands provide information about the site's productivity, the species present, their size and growth. From this inventory information, product objectives can be determined, as well as the period of time it takes to grow a marketable volume on a sustainable basis. This time frame is used to determine a cutting cycle for producing periodic yields of desired wood products. Additionally, the periodic inventory provides information about the distribution of age classes in the uneven-aged stand. This distribution information is used to plan needed stand improvement practices that adjust the number of trees in each age class to a desired distribution, thus permitting the sustainable production of the product objective. Trees selected for harvest can be dispersed individual trees (i.e., single tree selection) or small groups of trees (i.e., group selection). The system generally maintains a continuous high forest cover across the land while providing a sustained yield of forest products and the orderly growth and development of desired trees with a variety of diameter and ages.

BASIS FOR ALLOCATION OF SILVICULTURAL SYSTEMS

The selection of which silvicultural system and regeneration method to use is based on the existing forest/stand's condition and the desired condition of the management prescription area of which the stand is a part.

During the period from about 1880 through 1930, much of the lands now managed as the GWNF were logged and sometimes burned or badly eroded. Some of the Forest was created from abandoned farmland. Today, these lands have healed and been rejuvenated as a result of Federal investment in tree planting, fire suppression, timber stand improvement, and time. The resultant growth of predominately upland oak, cove hardwood, white pine-hemlock, and southern yellow pine forests consist of essentially even-aged stands, although the chestnut blight of the 1930s created many two-aged stands as well. Since becoming National Forest System lands, some stands have been managed for wood production.

The National Forest Management Act and its Federal Regulations require the identification of forest lands to be used for producing sustainable yields of wood products, thus the need to identify (1) which lands and (2) which silvicultural systems are to be used. Although conceptually possible, the random application of mixing uneven-aged, two-aged, and even-aged stands is not practical over the present predominately even-aged forest. Even though the production of wood products is an objective, equally important objectives are wildlife habitats, water quality and aesthetics. Even-aged, two-aged and uneven-aged management practices each create

different vegetation conditions and stand structures, and have different practices and objectives which have limitations when protecting the forest resources is of primary concern. Likewise each species of tree has unique requirements insofar as light levels, site productivity, and soil moisture in order to regenerate adequately and grow to maturity. Thus, the silvicultural system chosen must also consider the needs of the desirable tree species occupying the site or the species we wish to regenerate. This Revised Plan operates under the principle of management prescription areas, where portions of the Forest have similar environmental conditions, management emphasis and/or specific multiple resource objectives. Therefore, uneven-aged, two-aged and even-aged silvicultural system's practices will not be applied individually to intersperse the silvicultural systems, but rather to portions of management prescription areas where they simultaneously contribute to accomplishing other renewable resource objectives and are appropriate for the desirable tree species to be regenerated or tended.

The initial uneven-aged silvicultural system screening criteria included areas of tentatively suitable forest land that had:

- at least a stand of 100 acres to provide a sufficient total volume harvested in any single entry to allow for an economically viable sale
- slopes from 0% to 20% to minimize the potential damage to the soil and water resource due to the greater number of temporary roads, skid roads, and skid trails required to implement uneven-aged management, as well as to facilitate the economic viability of the timber sale; and
- existing system roads in place for the same reasons identified above.

Uneven-aged regeneration methods are also allowed on lands that do not meet the above criteria when site-specific project objectives include canopy gap creation, scenic enhancement, or restoration/enhancement of old growth forest conditions. Note that frequent entries to maintain an uneven-aged condition in these situations may not be practical due to physical and/or economic limitations.

When using uneven-aged silvicultural system for a given vegetation community, frequent entries are planned into the same area, usually 5-20 year cutting cycles (cutting cycle lengths are a function site productivity for the desired species). Since, on a given harvest entry, only a small portion of a stand's tree density is harvested, the cutting cycles generally result in lower per acre volumes and possible lower total volume, thus reducing the total stumpage value for the harvested products (timber sale revenues are returned to the U.S. Treasury). Rubber-tired skidders are the predominant equipment used on the NFS lands and are capable of skidding the longer distances necessary with the lower marked volume and value removed per acre as compared to even-aged and two-aged silvicultural systems. The repeated exposure of mineral soil every 5 to 20 years as the skid trails are reused is a concern. However, with limiting uneven-aged silvicultural systems to terrain under 20%, a more dispersed skidding pattern can be prescribed, avoiding much of the exposure of mineral soil than would occur on steeper terrain over 20% slope. The visual impact of the bladed skid trails on the ground would be less on the gentler slopes.

In a given entry, the uneven-aged silvicultural system removes a small number of stand's total trees. On slopes over 20%, the maneuverability of a rubber-tired skidder is reduced. This reduced maneuverability—where unmarked trees are to be left undamaged—greatly increases the physical damage to those trees. On gentle slopes, equipment mobility is less restricted, thus less damage occurs to residual trees. Additionally, the less damage means less agents that cause rot being introduced through bole damage, resulting in reduced future yields and value from the stand.

The uneven-aged silvicultural system requires road access over a larger area than even-aged or two-aged management to harvest an equal volume during each entry. These roads have to be constructed (where existing access is lacking) at the first entry and then reopened during each subsequent entry at a 5 to 20 year cutting cycle. Selecting areas where most of the roads are already in place reduces the need for new roads. In most cases where access exists, only dispersed skid trails and some landings are needed.

The final criterion was to provide an efficient means of regulating a sustained yield of forest products from areas where uneven-aged silvicultural system would be applied. This meant determining where land meeting

the other criteria could be consolidated into large, contiguous areas. Even with the 100-acre minimum size constraint, the analysis revealed a large number of interspersed potential areas throughout the Forest. When the smaller scattered parcels were eliminated, the remaining lands could be allocated to several large, contiguous areas of the Forest, thereby providing for the application of cost effective uneven-aged silvicultural system.

On all other suitable land, where uneven-aged silvicultural system criteria are not applicable uneven-aged systems are not considered viable. Vegetation management is limited to two-aged and even-aged silvicultural system on these lands except where stated above where canopy gaps, scenic enhancement, or restoration is the purpose and need of the site-specific project.

REGENERATION METHODS AND STAND IMPROVEMENT PRACTICES

Regeneration methods are the practice by which forest stands of desirable species are established at an adequate stocking level so that they may be sustained for a specific purpose(s), be it the production of wood products, the production of specific habitat for viable wildlife populations, or a combination of both. Depending on the management area emphasis and desired condition, the selected silvicultural system and regeneration method will result in an uneven-aged stand, a two-aged stand, or an even-aged stand. Silvicultural systems are a means of manipulating vegetation to help achieve a management prescription area's desired condition.

Table C-5. Silvicultural Methods within Each of Three Silvicultural Systems

EVEN-AGED stands	TWO-AGED stands	UNEVEN-AGED stands
Regeneration Method:	**Regeneration Method:**	**Regeneration Method:**
1. clearcutting	1. clearcutting with reserves	1. group selection
2. seed tree	2. coppice with reserves	2. single tree selection
3. shelterwood	3. seed tree with reserves	
	4. shelterwood with reserves	
Stand Improvement practices:	**Stand Improvement practices:**	**Stand Improvement practices:**
1. thinning	1. thinning	1. thinning
2. release & weeding	2. release & weeding	2. release & weeding
3. prescribed burning	3. prescribed burning	3. prescribed burning
4. improvement cutting	4. improvement cutting	4. improvement cutting
5. salvage cutting	5. salvage cutting	5. salvage cutting
6. sanitation cutting	6. sanitation cutting	6. sanitation cutting

The Information contained in the following two references provides the scientific explanation for applying silvicultural systems for vegetation manipulation of the forest types on the GWNF.

The Scientific Basis for Silvicultural and Management Decisions in the National Forest System. Russell M. Burns, General Technical Report WO-55, September 1989.

- Silviculture of Northeastern Hardwoods, The Pine Group, pg 21-22, the White Pine forest cover type and the Eastern Hemlock forest cover type
- Silviculture of Southern Pines, Oak-Pine types, pg 34-35
- Silviculture of Eastern Hardwoods, pg 9-17

Silvicultural Systems for the Major Forest Types of the United States. Russell M. Burns, Agriculture Handbook #445-19M.

- Oak-Hickory, pg 116-120 and pg 141-144 (Appalachian Mixed Hardwood)
- Eastern White Pine including Eastern Hemlock, pg 131-134
- Northern Hardwoods, pg 121-127
- Oak-Pine, pg 172-174
- Pitch Pine, pg 135-136

- Yellow Poplar, pg 180-182
- Virginia Pine, pg 167-169

The specific portions of the above listed publications are included by reference and should be read in conjunction with this Appendix to provide comprehensive analysis of vegetation practices applicable to appropriate management areas that allow vegetative manipulation.

Table C-6. Crosswalk of Ecological Systems, Forest Community Types, Eastern Forest Cover Types, and FSVeg Forest Types

Ecological System [2]	**Forest Community Type [1]**	**Eastern Forest Cover Type [3]**	**Forest Types from the FSVeg Database**
Appalachian (Hemlock)-Northern Hardwood Forest (Includes Southern Appalachian Northern Hardwood Forest)	Northern Hardwood Forest	Northern Hardwoods	Black Cherry (70) Black Ash-American Elm-Red Maple (FSVeg 71) Sugar maple-Beech-Yellow birch (FSVeg 81)
Southern and Central Appalachian Cove Forest	Mixed Mesophytic Forest& Conifer-Northern Hardwood Forest	Appalachian Mixed Hardwoods & Yellow Poplar & Eastern White Pine including Eastern Hemlock	White pine (FSVeg 3) White pine-Hemlock (FSVeg 4) Hemlock (FSVeg 5) Hemlock-Hardwood (FSVeg 8) Beech-Magnolia (FSVeg 69) White pine-Cove hardwood (FSVeg 9) Cove hardwood-White pine-Hemlock (FSVeg 41) Yellow poplar (FSVeg 50) Yellow polar-White oak-Red oak (FSVeg 56)
Central Appalachian Floodplain	River Floodplain and Eastern Riverfront Forest	Bottomland Hardwoods	Sweetgum-Yellow poplar (FSVeg 58) River birch-Sycamore (FSVeg 72) Cottonwood (FSVeg 73) Sycamore-Pecan-American elm (FSVeg 75) Undrained Flatwoods (FSVeg 98)
Northeastern Interior Dry-Mesic Oak Forest (includes Southern Appalachian Oak Forest in part and Southern Ridge and Valley/Cumberland Dry Calcareous Forest)	Dry-Mesic Oak Forest	Oak - Hickory	White pine-Upland hardwoods (FSVeg 10) Post oak-Black oak (FSVeg 51) White oak-Red oak-Hickory (FSVeg 53) White oak (FSVeg 54) Northern red oak-Hickory (FSVeg 55) Black walnut (FSVeg 82)
Central and Southern Appalachian Montane Oak Forest (includes Southern Appalachian Oak Forest in part)	Dry and Xeric Oak Forest; Woodland and Savanna	Oak - Hickory	Chestnut oak (FSVeg 52) Scrub oaks (FSVeg 57) Scarlet oak (FSVeg 59) Chestnut oak-Scarlet oak (FSVeg 60)

Ecological System [2]	Forest Community Type [1]	Eastern Forest Cover Type [3]	Forest Types from the FSVeg Database
Southern Appalachian Montane Pine Forest and Woodland (includes Southern Appalachian Low-Elevation Pine Forest)	Xeric Pine & Pine-oak Forest & Woodland	Pitch Pine & Longleaf Pine & Shortleaf Pine & Virginia Pine	Shortleaf pine-oaks (FSVeg 12) Pitch pine-oaks (FSVeg 15) Virginia pine-oaks (FSVeg 16) Table Mountain pine-Hardwoods (FSVeg 20) Loblolly Pine-hardwood (FSVeg 31) Shortleaf pine (FSVeg 32) Virginia pine (FSVeg 33) Eastern red cedar (FSVeg 35) Pitch pine (FSVeg 38) Table Mountain pine (FSVeg 39) Black locust (FSVeg 88)
Central Appalachian Dry Oak-Pine	Dry and Dry-Mesic Oak-Pine Forest	Oak-Pine	Upland hardwoods-white pine (FSVeg 42) Chestnut oak-Scarlet oak-Yellow pine (FSVeg 45) Bottomland hardwoods-Yellow pine (FSVeg 46) White oak-Black oak-Yellow pine (FSVeg 47) Northern red oak-Hickory-Yellow pine (FSVeg 48) Bear oak- southern scrub oaks-yellow pine (FSVeg 49)
Central & Southern Appalachian Spruce-Fir Forest	Montane Spruce-fir Forest	Eastern Spruce - Fir	Red Pine (FSVeg 2) Fraser fir (FSVeg 6) Red spruce-Fraser fir (FSVeg 7) Red spruce-Northern hardwood (FSVeg 17)

1 - per *Guidance for Conserving and Restoring Old Growth Forest Communities on National Forests in the Southern Region*.
2 - per *Chapter 3 of the GWNF Land and Resource Management Plan Draft Environmental Impact Statement*.
3 - per *Silvicultural Systems for the Major Forest Types of the United States*.

Table C-7 summarizes the range of feasible applications of silvicultural regeneration methods that can be used to manipulate vegetation on land suitable for timber production in the Forest Community Types on the Forest. Any of the following methods can be applied to manipulate vegetation when based on site specific project analysis and disclosure in an environmental analysis document.

Table C-7. Applicability of Silvicultural System for Forest Community Types

Ecological System	Even-Aged Silvicultural System			Uneven-Aged Silvicultural System	
	Clearcut	Seed Tree	Shelter-wood	Group Selection	Single Tree Selection
Appalachian (Hemlock)-Northern Hardwood Forest	RC	NR	RC	RC	RC
Southern and Central Appalachian Cove Forest (White pine)	RC	NR	R	P	P
Southern and Central Appalachian Cove Forest (Hemlock))	NR	NR	R	P	P
Southern and Central Appalachian Cove Forest (Cove Hardwoods)	R	NR	RC	P	NR
Central Appalachian Floodplain	R	NR	RC	P	NR
Northeastern Interior Dry-Mesic Oak Forest	RC	NR	RC	P	NR
Central and Southern Appalachian Montane Oak Forest	RC	NR	RC	P	NR
Southern Appalachian Montane Pine Forest and Woodland	R	RC	NR	NR	NR
Central Appalachian Dry Oak-Pine	RC	RC	RC	P	NR
Central & Southern Appalachian Spruce-Fir Forest	NR	NR	RC	P	R

Ecological System	Two-Aged Silvicultural System			
	Clearcut w/ Reserves	Seed Tree w/ Reserves	Coppice w/ Reserves	Shelterwood w/ Reserves
Appalachian (Hemlock)-Northern Hardwood Forest	RC	NR	RC	RC
Southern and Central Appalachian Cove Forest (White Pine)	RC	NR	NR	R
Southern and Central Appalachian Cove Forest (Hemlock)	NR	NR	NR	RC
Southern and Central Appalachian Cove Forest (Cove Hardwoods	R	NR	R	RC
Central Appalachian Floodplain	R	NR	R	RC
Northeastern Interior Dry-Mesic Oak Forest	RC	NR	R	RC
Central and Southern Appalachian Montane Oak Forest	RC	NR	RC	RC
Southern Appalachian Montane Pine Forest and Woodland	RC	RC	NR	NR
Central Appalachian Dry Oak-Pine	RC	RC	RC	RC
Central & Southern Appalachian Spruce-Fir Forest	NR	NR	NR	RC

Codes Used in Table C-7: Range of Regeneration Methods
R = recommended
RC = recommended with conditions
P = possible
NR = not recommended

RECOMMENDED (R) means that the silvicultural regeneration method has been reliable in creating conditions favorable for establishing regeneration of the desired species and to maintain growth of the desirable species using natural regeneration site preparation treatments.

RECOMMENDED WITH CONDITIONS (RC) means that for the silvicultural regeneration method to be reliable, some specific condition must either exist prior to cutting, some limits will apply to the regenerated species, or some special treatment is needed after cutting to obtain and maintain desirable species.

POSSIBLE (P) means the silvicultural practice is not reliable in creating conditions favorable for regenerating the desired species, unless significant alteration of the species composition, growth or sustainability is

acceptable. For example, using single tree selection in the Oak-Hickory type will not perpetuate oaks or other intolerant species in the same proportion as currently exists in the even-aged forest stands of the Forest. If the loss of oaks and the shift to a forest of more shade tolerant species is compatible with the Desired Future Condition of any management area, then single tree selection is a possible silvicultural practice.

NOT RECOMMENDED (NR) means the silvicultural system is not reliable in creating conditions favorable for establishing desired regeneration and to maintain growth of the desirable species using standard or special treatments.

Justification for Codes Selected In Silvicultural Practices Table

The following summarizes the information presented in the two cited references.

- For NR- not recommended, the reason for not recommending the method of cut.
- For RC- recommended with conditions, the specific condition necessary that allows the method of cut to be recommended.
- For P- possible, the likely alteration in species composition, growth or sustainability if the method of cut is applied.

Tables C-8 through C-15 display the justification for the range of silvicultural regeneration methods disclosed in Table C-7.

Table C-8. Even Aged Silvicultural System Justification for Not Recommended (NR)

Ecological System	Regeneration Method	Reason for Not Recommending
Appalachian (Hemlock)-Northern Hardwood Forest	Seed Tree	Natural seeding ability produces sufficient seedlings for adequate advance reproduction; density of seed trees is not sufficient to affect proportion of tolerant/intolerant species. Risk of windthrow of residual stems.
Southern and Central Appalachian Cove Forest (All)	Seed Tree	Risk of windthrow and not necessary since there is plentiful seed present on the site or will be blown in from adjacent stands. White pine seed crops only occur infrequently on a 3-10 year cycle.
Southern and Central Appalachian Cove Forest (Hemlock)	Clearcut	Too much sunlight and dry conditions for seedling development.
Central Appalachian Floodplain	Seed Tree	Risk of windthrow and not necessary since there is plentiful seed present on the site or will be blown in from adjacent stands.
Northeastern Interior Dry-Mesic Oak Forest	Seed Tree	Heavy seed is poorly distributed and slow growing seedlings are not able to compete with other vegetation; light seeded species have abundant seed on the site or available nearby.
Central and Southern Appalachian Montane Oak Forest	Seed Tree	Heavy seed is poorly distributed and slow growing seedlings are not able to compete with other vegetation; light seeded species have abundant seed on the site or available nearby.
Southern Appalachian Montane Pine Forest and Woodland	Shelterwood	Does not provide sufficient sunlight to reach forest floor for seed germination and seedling development.
Central & Southern Appalachian Spruce-Fir Forest	Seed Tree	Too much sunlight and dry conditions for seedling development. Risk of windthrow.
	Clearcut	Too much sunlight and dry conditions for seedling development. Risk of windthrow.

Table C-9. Even Aged Silvicultural System Justification for Recommended with Conditions (RC)

Ecological System	Regeneration Method	Conditions for Recommendation
Appalachian (Hemlock)-Northern Hardwood Forest	Clearcut	Size of harvest unit will control proportion of tolerant and intolerant species that regenerate; pre-commercial treatments are needed to achieve the desired species composition. May be too much sunlight and dry conditions for seedling development.
	Shelterwood	Use if adequate advanced regeneration is not established. To regenerate hemlock in old stands and/or drier site, lacking sufficient hemlock advanced reproduction; two or three cuts may be required.
Southern and Central Appalachian Cove Forest (Cove Hardwoods)	Shelterwood	Will remove overstory within five years to prevent severe reduction in height and diameter growth.
Southern and Central Appalachian Cove Forest (White Pine)	Clearcut	To regenerate white pine, Sufficient white pine advanced reproduction exists in the understory.
Central Appalachian Floodplain	Shelterwood	Will remove overstory within five years to prevent severe reduction in height and diameter growth.
Northeastern Interior Dry-Mesic Oak Forest	Shelterwood	Use if adequate advanced regeneration is not established.
	Clearcut	Use if adequate advanced reproduction is present.
Central and Southern Appalachian Montane Oak Forest	Clearcut	Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a pine component
	Shelterwood	Use if adequate advanced regeneration is not established. Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a pine component
Southern Appalachian Montane Pine Forest and Woodland	Seed Tree	Use when non-serotinous cones are present.
Central Appalachian Dry Oak-Pine	Clearcut	Have to use intensive control of hardwood competition after harvest to maintain a pine component.
	Shelterwood	Have to use intensive control of hardwood competition after harvest to maintain a pine component.
	Seed Tree	Have to use intensive control of hardwood competition after harvest to maintain a pine component.
Central & Southern Appalachian Spruce-Fir Forest	Shelterwood	Use if adequate advanced regeneration is not established.

Table C-10. Un-even Aged Silvicultural System Justification for Not Recommended (NR)

Ecological System	Regeneration Method	Reason for Not Recommending
Southern and Central Appalachian Cove Forest (Cove Hardwoods)	Single Tree Selection	Shade intolerant species will not develop satisfactorily under fully stocked stand
Central Appalachian Floodplain	Single Tree Selection	Shade intolerant species will not develop satisfactorily under fully stocked stand
Northeastern Interior Dry-Mesic Oak Forest	Single Tree Selection	Shade intolerant species will not develop satisfactorily under fully stocked stand
Central and Southern Appalachian Montane Oak Forest	Single Tree Selection	Shade intolerant species will not develop satisfactorily under fully stocked stand
Southern Appalachian Montane Pine Forest and Woodland	Single Tree Selection	Shade intolerant species will not develop satisfactorily under fully stocked stand
	Group Selection	Shade intolerant species will not develop satisfactorily; even small openings create too much shade.
	Group Selection	Shade intolerant species will not develop satisfactorily; even small openings create too much shade.
Central Appalachian Dry Oak-Pine	Single Tree Selection	Shade intolerant species will not develop satisfactorily under fully stocked stand

Table C-11. Un-even Aged Silvicultural System Justification for Recommended with Conditions (RC)

Ecological System	Regeneration Method	Conditions for Recommendation
Appalachian (Hemlock)-Northern Hardwood Forest	Single Tree Selection	Use if desirable species are less shade tolerant species and larger openings are required.
	Group Selection	Use if desirable species are shade tolerant species.

Table C-12. Un-even Aged Silvicultural System Justification for Possible (P)

Ecological System	Regeneration Method	Conditions for Recommendation
Southern and Central Appalachian Cove Forest (All)	Group Selection	Species composition will shift to more moderate shade tolerant species.
Southern and Central Appalachian Cove Forest (White Pine))	Single Tree Selection	Species composition will shift to more moderate or exclusively shade tolerant species.
Central Appalachian Floodplain	Group Selection	Species composition will shift to more shade tolerant species.
Northeastern Interior Dry-Mesic Oak Forest	Group Selection	Species composition will shift to more shade tolerant species, oak species would be reduced.
Central and Southern Appalachian Montane Oak Forest	Group Selection	Species composition will shift to more shade tolerant species.
Central Appalachian Dry Oak-Pine	Group Selection	Species composition will shift to more moderate shade tolerant species, oak and yellow pine species would be reduced.
Central & Southern Appalachian Spruce-Fir Forest	Group Selection	Species composition will shift to more moderate shade tolerant species, spruce and fir may be outcompeted.

Table C-13. Two Aged Silvicultural System Justification for Not Recommended (NR)

Ecological System	Regeneration Method	Reason for Not Recommending
Appalachian (Hemlock)-Northern Hardwood Forest	Seed Tree w/ Reserves	Natural seeding ability produces sufficient seedlings for adequate advance reproduction; density of reserve trees is not sufficient to affect proportion of tolerant / intolerant species. Risk of windthrow of residual stems.
Southern and Central Appalachian Cove Forest (All)	Seed Tree w/ Reserves	Risk of windthrow and plentiful seed Is present on the site or will be blown in from adjacent stands. For white pine, Good seed crops only occur infrequently on a 3-10 year cycle; reserve trees subject to windfall
Southern and Central Appalachian Cove Forest (Hemlock)	Clearcut w/ Reserves	Too much sunlight and dry conditions for seedling development.
Southern and Central Appalachian Cove Forest (White Pine)	Coppice w/ Reserves	Pines rarely if ever stump sprout.
Southern and Central Appalachian Cove Forest (Hemlock)	Coppice w/ Reserves	Too much sunlight and dry conditions for seedling development. Conifers rarely if ever stump sprout.
Central Appalachian Floodplain	Seed Tree w/ Reserves	Risk of windthrow and plentiful seed Is present on the site or will be blown in from adjacent stands.
Northeastern Interior Dry-Mesic Oak Forest	Seed Tree w/ Reserves	Heavy seed is poorly distributed and slow growing seedlings are not able to compete with other vegetation; light seeded species have abundant seed on the site or available nearby.
Central and Southern Appalachian Montane Oak Forest	Seed Tree w/ Reserves	Heavy seed is poorly distributed and slow growing seedlings are not able to compete with other vegetation; light seeded species have abundant seed on the site or available.
Southern Appalachian Montane Pine Forest and Woodland	Coppice w/ Reserves	Pines rarely if ever stump sprout.
	Shelterwood w/ Reserves	Does not provide sufficient sunlight to reach forest floor for seed germination, seedling development, and sapling growth.
	Shelterwood w/ Reserves	Does not provide sufficient sunlight to reach forest floor for seed germination, seedling development, and sapling growth.
Central & Southern Appalachian Spruce-Fir Forest	Clearcut w/ Reserves	Too much sunlight and dry conditions for seedling Development. Risk of windthrow.
	Seed Tree w/ Reserves	Too much sunlight and dry conditions for seedling Development. Risk of windthrow.
	Coppice w/ Reserves	Conifers rarely if ever stump sprout.

Table C-14. Two Aged Silvicultural System Justification for Recommended with Conditions (RC)

Ecological System	Regeneration Method	Conditions for Recommendation
Appalachian (Hemlock)-Northern Hardwood Forest	Shelterwood w/ Reserves	Use if adequate advanced reproduction is lacking
	Coppice w/ Reserves	Size of harvest unit will control proportion of tolerant and intolerant species that regenerate; pre-commercial treatments are needed to achieve the desired species composition.
	Clearcut w/ Reserves	Use if adequate advanced reproduction is present.
Southern and Central Appalachian Cove Forest (Cove Hardwoods)	Shelterwood w/ Reserves	Will remove portion of overstory within five years to prevent severe reduction in height and diameter growth
Southern and Central Appalachian Cove Forest (Hemlock)	Shelterwood w/ Reserves	To regenerate hemlock in old stands and/or drier site, lacking sufficient hemlock advanced reproduction; two or three cuts may be required.
Central Appalachian Floodplain	Shelterwood w/ Reserves	Will remove portion of overstory within five years to prevent severe reduction in height and diameter growth
Northeastern Interior Dry-Mesic Oak Forest	Shelterwood w/ Reserves	Use if adequate advanced reproduction is present
	Clearcut w/ Reserves	Use if adequate advanced reproduction is present
Central and Southern Appalachian Montane Oak Forest	Shelterwood w/ Reserves	Use if adequate advanced reproduction is present. Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a pine component
	Clearcut w/ Reserves	Use if adequate advanced reproduction is present. Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a pine component
	Seed Tree w/ Reserves	Use if adequate advanced reproduction is present. Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a pine component
Southern Appalachian Montane Pine Forest and Woodland	Clearcut w/ Reserves	Use when non-serotinous cones are present.
	Seed Tree w/ Reserves	Use when non-serotinous cones are present.
	Seed Tree w/ Reserves	Use when non-serotinous cones are present.
Central Appalachian Dry Oak-Pine	Clearcut w/ Reserves	Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a conifer component
	Seed Tree w/ Reserves	Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a conifer component
	Shelterwood w/ Reserves	Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a conifer component
	Coppice w/ Reserves	Have to use intensive control of hardwood competition after harvest if it is desirable to maintain a conifer component
Central & Southern Appalachian Spruce-Fir Forest	Shelterwood w/ Reserves	Use if adequate advanced reproduction is lacking.