Chapter 3- Affected Environment and Environmental Consequences

Introduction

This chapter describes the Lower Williams Vegetation project area affected environment, including the human elements, and discusses the environmental consequences by resource that may result from implementation of each of the alternatives. It begins with a discussion of those activities not associated with this proposal but having a potential additional impact to the resources when added to the impacts of the proposal. It provides the scientific and analytic basis for the cumulative effects discussions throughout this chapter.

The environmental consequences are described as the direct, indirect, or cumulative effects of carrying out the proposal or alternative actions. Direct effects are caused by an action and occur at the same time and place. Indirect effects are caused by an action, but occur later in time or farther removed in distance. Cumulative effects result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions (40 CFR 1508.7-1508.8).

In accordance with 40 CFR 1502.16, the analysis will also include any adverse environmental effects which cannot be avoided, the relationship between short-term uses and long-term productivity, and any irreversible and irretrievable commitment of resources. It also discloses consistency with the Monongahela Forest Plan. Chapter III describes the existing condition of the resources that may be affected by the implementation of the Lower Williams Vegetation project, according to each of the alternatives. The information presented in this chapter provides a base for understanding how the proposed action and connected actions may change current conditions.

For each resource, a geographic area is described, where potential effects are considered. This area is termed the Affected Area.

National Forest resource management is subject to numerous laws, regulations, policies, and guidelines designed to protect, preserve, and properly manage forest resources. In this chapter, the "Regulatory Framework" associated with specific resources explains how the Proposed Action is designed to meet these requirements. The regulatory framework includes Federal laws, such as the Endangered Species Act and the National Forest Management Act; Forest Service regulation and policy expressed in the Forest Service Manual; and Forest-level guidance described in the Monongahela LRMP.

This chapter also discloses the environmental consequences likely to result from each of the alternatives. The terms environmental consequences, effects, and impacts are used interchangeably. The effects disclosed in this chapter provide the comparison of effects of the two alternatives and will be used by the decision maker in selecting an alternative for implementation.

Three types of effects are considered, including direct effects, indirect effects, and cumulative impacts.

- **Direct effects** are caused by the action and occur at the same time and place (40 CFR 1508.8(a).

- **Indirect effects** are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8(b).

- **Cumulative impact** is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

National Forest lands provide habitat for many forms of plant, wildlife and aquatic species. Analysis of the existing conditions and environmental consequences of the impacts for all existing or potential forms of these species within a planning area is impossible to address. Therefore, in accordance with 36 CFR219.19(a)(1), individual Forest Plans have identified specific species that would be analyzed as representative samples to show the condition of and effects on ecosystems. These are identified as Management Indicator Species (MIS). In addition to the MIS discussed in the appropriate sections, the Endangered Species Act requires an analysis of the existing condition and environmental consequences to species either listed or proposed for listing under this act. Forest Service policy includes the requirement to look at species listed as "sensitive" by the Regional Forester. While species that fell into these categories during the development of the Forest Plan are included as MIS, species added to these lists after approval of the Forest Plan(s) are also analyzed. This document will use these species as the representative samples to analyze the impact to all species within the planning area.

This chapter is organized into the following sections:

Cumulative Effects Consideration Actions

Biological Environment
- Vegetation
- Wildlife

Physical Environment
- Botany/Ecologist
- Soil
- Aquatics

Social Environment
- Heritage
- Recreation
- Scenery/Visual
- Economics
- Safety
- Environmental Justice

Cumulative Effects Consideration Actions

Table 4 displays those activities that will be used in the analysis of the affected environment and the cumulative effects discussions throughout this chapter. The activities listed in the include recreation, watershed improvement, and roads projects within the LWPA that occurred in the past 10 years. The timber sales for the past 20 years are included in Table 4 to accommodate the cumulative effects analysis and effected environment boundary for vegetation.

Table 4. Activities Considered in the Cumulative Effects Discussions

Action	Approximate Miles/Acres	Year
Sawyer Headwaters	162 Acres Timber	1989
Upper Spice Run	83 Acres Timber Sale	1990
Turkey Mountain Timber Sale	865 acres in watershed east of project area in what is now the Tea Creek Mountain area, (Twin Branches, Little Elbow Run, Little Lick Branch areas)	1991
Johnson Run Phase I and II Road Decommissioning.	60 Acres - Fertilized., limed, seeded, and mulched; 16 miles of road decommissioned	2006
Paving of Forest Road 86	1 mile	2006
Johnson Run Timber Sale	449 Acres	2004
Craig Run Timber Sale	583 Acres	1998
Laurel Run Timber Sale	153 Acres	1997
Road Maintenance	FR 86, 82, 101, 234, 735, 787, 133, 239, 272, 425, 429, 733, 920, 920B, 82A, 82B, 101A, 133C, 429A, 429B	Annual maintenance as needed
White Oak Timber Sale	709 Acres	1994
Sawyer Ridge	76 Acres	1989
Sawyer Spice Divide	81 Acres	1989
Upper Sawyer	161 Acres	1989
Bee Laurel Craig	108 Acres	1988
Liming Restoration Project	500 – 1,000 Acres	Foreseeable

Paving of Forest Road 86	2.5 miles	Action Foreseeable
Restoration of Dyer Campsite	Installing ramps for rafts and small open boat	Action Foreseeable Action
Coal Mine Portal Closure	17 mines closed	Recent Past

[1]These acres are related to the analysis boundaries considered in the analysis. Actual acres of these activities may have been higher but did not contribute to the affected environment discussions in the analysis based on the spatial boundaries discussed below. Acres are generated based upon CDS data and only reflect NFS lands.
[2] Acreage was digitized from aerial photographs. None of these acres are on National Forest System lands.
[3] This mine was identified during scoping. It is not expected to have any impacts related to this proposal. (pers. comm. 9/12/05)

Biological Environment

Vegetation

Scope of the Analysis

The scope of the analysis for direct, indirect, and cumulative effects on vegetation is the National Forest land in the Lower Williams project area located in eastern Webster County, West Virginia. This effects boundary was selected because few direct and indirect effects on vegetation are expected outside the area actually harvested, and those effects are discussed in separate sections of this document.

National Forest land in the Project Area itself is the area of focus for attaining the Desired Vegetation Conditions under the Forest Plan: early successional forest habitat, and reduction in the amount of competition between trees for light and water resources in dense, over-crowded stands to provide for sustainable timber and mast production. Approximately 11-13% of the project area would be impacted by the action alternative treatments to implement Forest Plan management direction for 3.0 areas.

Methodology

Data on vegetation and past forest management activities was used from the MNF Geographic Information System and Combine Database System (CDS) databases. Most of the field data in these databases is the result of field work in 2003 and the 1990s. Overstory data was taken using variable radius plots with understory fixed plots. Botany survey results from 2006 and 2007 were examined for the presence of indicator species and species diversity concerns. Aerial photography and visits to the area were also used. Monitoring results were used from the WV Dept. of Agriculture Cooperative Forest Health Protection Surveys (1998-2005), from comparisons of older stand exam data with current data, stocking survey results from within and near the area, and from field observations. Additional background was provided by *Silvics of North America* (USDA, 1990).

Stands were selected for harvest to meet the purpose and need for action according to the Forest Plan, and considering spacing and transportation factors. Treatments were screened for

appropriateness using principles taught at the SILVAH: Oak Ecology and Silviculture workshop (2005), and the Allegheny Hardwood Stocking Guide (Roach, 1977, and Marquis et al. 1992).

Resource Impacts

The following tables summarize vegetation variability within the LWPA. Forest types are variations of the Forest Communities identified in the Forest Plan.

Table 5. Age-Class Distribution

Age – Class	Acres
0*	1,424
1-19	378
20-39	755
40-59	443
60-79	3,900
80-99	6,773
100-119	524
120-139	36
140-159	116
160-206	47
Total acres	**14,396**

*The acres represented by "0" are private lands, water, open and brush.

Table 6. Lower Williams Forest Type Distribution

Forest Type	Acres
Private lands, water, open and brush	1,234
Northern Red Oak –Mixed Oak community	468
Yellow Poplar – White Oak – Northern Red Oak-Mixed Cove Hardwoods community	2,003
Mixed Oak – Mixed Oak community	940
Sugar Maple – Beech – Yellow Birch Northern Hardwoods community	701
Sugar Maple, Basswood – Northern Hardwoods community	451

Black Cherry – White Ash – Yellow Poplar	73
Mixed Cove Hardwoods community	
Sugar Maple – Northern Hardwoods community	74
Mixed Hardwood – Mixed Cove Hardwoods community	8,238
Lowland Brush	79
Open	135
Total acres	**14,398**

There is a high degree of tree species diversity within stands. Ten to fourteen tree species recorded in timber variable plot data are not uncommon. Botany surveys have recorded up to 27 separate tree species in a single stand. Even in stands classified as oak stands, most oak percentages are not much higher than 50%, with the remaining trees made up of several species in much smaller percentages. Black cherry is a species with high timber value that occurs throughout the area, but not in high abundance.

According to survey results from the West Virginia Department of Agriculture, the LWPA is affected by the presence of several important forest pests: gypsy moth, beech bark disease and hemlock wooly adelgid. Field indications are that none of these species has had a massive recent impact on forest tree vegetation overall, partly because of the tree species diversity within the area. Even if all trees died from one of these non-native invasive forest pests, the area would still be forested. Standing dead trees recorded in plot data indicated that recent mortality has not been high (0-5% of trees recorded). These pests could result in high levels of mortality on particular species within the project area: gypsy moth- oaks and basswood; hemlock wooly adelgid- hemlock; and beech bark disease- American beech. Gypsy moth defoliates many other species, but within the area, the oaks and basswood are the species that occur in largest numbers that would be most heavily impacted in an outbreak situation.

Seedling diversity is high in the understory of the units for harvest. Numerous oak seedlings are present. Black cherry seedlings are present, but are not as abundant as oak seedlings. Seedling and shrubs are diverse in recently regenerated areas and wildlife openings of the Johnson Run Timber Sale. Botany surveys have recorded up to 27 species in the seedling layer, along with Indian cucumber, an indicator of low deer impact on vegetation (USDA, 2005). Many stands show the occurrence of up to 3 species of greenbrier, a vine species favored as browse for deer. Sugar maple, white ash and Hercules club are also present in timber seedling data and in botany survey data. Browse lines are not distinct, nor are substantial numbers of browsed stems or large areas dominated by browse-resistant or less-preferred browse species such as beech, striped maple, fern or asters (p. 43 Marquis, Ernst and Stout, 1992). Many areas have been thinned during the past 30 years, but basal area, and crown cover are still high.

Interfering species including striped maple, beech sprouts, witch hazel, and several species of ferns, grasses and sedges are present, but do not dominate the desirable species of advanced

regeneration within any stand to be regenerated. Little cultivated crop land is present. Some areas, particularly in the White Oak and Laurel Run drainages, have substantial acreages of pole-sized stands. Most areas have few regenerating stands close to stands for regeneration.

Heavy deer browsing can have detrimental effects on regenerating timber stands, and on understory vegetation. These effects can include reductions in vegetation diversity or even complete regeneration failure. On the basis of the diversity factors discussed in the last two paragraphs and silviculturist's field visits to the area, a subjective rating of deer browse impacts in most stands proposed for regeneration would be between 2 and 3 on a scale of 1-5, with 1 being the rating within a deer exclosure.

Grape and camphor vines are common within the project area. These species reduce growth of individual trees and can have serious impacts on regenerating timber stands. Heavy weights of sprouting vines in young trees can intensify breakage from ice, snow and wind events. Past treatments to reduce vine numbers have reduced vine numbers. Where grapevines were harvested, the goal was to reduce, but not eliminate such vines. South of the Williams River, treatments in the 1990's only severed camphor vines, not grapevines.

Commercial thinning and other partial harvests have occurred within the area, including small acreage green firewood and pole tree removal near roads. Crop tree release, a non-commercial treatment to girdle or fell small trees in young stands has affected growth and species survival and dominance in some young stands.

This report addresses the impacts that the Lower Williams project would have on the forest vegetation in the area. The impacts of the treatments on both the overstory and understory vegetation will be discussed in this report.

Environmental Consequences Common to all Action Alternatives
All alternatives have similar effects as described below, but the acreage varies. Acreage variation is shown in tables at the end of Chapter II.

Meeting the Purpose and Need for Action for Early Successional Vegetation Conditions
The purpose and need for action for vegetation management in the Lower Williams Project Area was developed site-specifically from a comparison of the existing conditions of the project area with the Desired Vegetation Conditions in Management Prescription 3.0, as shown in the following table. For all the Forest Community Types found in the Lower Williams Project Area, the amount of early successional age class is below the minimum desired.

Table 7. Desired Vegetation Conditions in the Lower Williams Project Area – Management Prescription 3.0 (Forest Plan, p. III-6)

Forest Community	Total Acres	Existing Early Successional		Desired Minimum		Desired Maximum	
		Acres	Percent	Acres	Percent	Acres	Percent
Northern	1226	82	7	147	12	245	20

Hardwoods							
Mixed Cove Hardwoods	10,383	207	2	1246	12	2077	20
Mixed Oak	1408	0	0	169	12	310	22

Early successional forest can develop as a result of natural means by large scale tree blow-down or mortality. It can also occur through natural or prescribed fire or through timber harvest. Prescribed fire was considered to establish some of the age class distribution desired, but was not developed in detail. Northern hardwood and mixed cove hardwood forest communities are not considered to be as adapted to fire as are oak types. The scattered existing condition of the mixed oak sites within the project area, and their relatively high percentage of species other than oaks made it impractical to consider prescribed fire as a tool to develop age class distribution in this project area. Other areas on the forest, with larger contiguous blocks of fire-adapted vegetation, may provide more cost effective opportunities to use prescribed fire. (Fischer, 2007)

Most of the project area is in Fire Regime V, where the historic natural fire regime has long intervals between fires. The Condition Class for these areas is classified as 1, where fire regimes are within the historic range, and the risk of losing key ecosystem components is low. (Thomas-Van Gundy, 2006)

The Monongahela National Forest's GIS data shows 1,095 acres within Fire Regime III condition class 2. These areas are scattered, in 52 separate locations averaging 21 acres. In these areas, fires of mixed severity might have occurred every 35-100 years. Fire regimes have been moderately altered from their historic range, and the risk of losing key ecosystem components is moderate. (Thomas-Van Gundy, 2006) Only regeneration units 4, 5, and 21 are mostly within this regime and condition class. The size and location of most of these areas would make the implementation of a prescribed burn very difficult.

In all action alternatives, early successional forest would be created by regeneration harvests. Thus, shade intolerant tree species would be regenerated, and diversity of forest age classes would be created, to improve the long-term sustainability of timber and increase the quality and growth rate of crop trees and mast producing trees. The acreage of regeneration harvest in each alternative, and it is contribution to meeting the purpose and need is shown below.

Harvesting will take place in all action alternatives for regeneration to meet the purpose and need for action. Pre-harvest vine cutting and manual felling of residual unmerchantable trees concurrent with harvest are included in all regeneration cuts. Vines in thinning areas, including grape vines, may be cut prior to harvest in trees marked for felling. This treatment may enhance safety by weakening the vines connection to adjoining trees in advance of felling.

Most of the regeneration harvests would be clearcuts with residuals. This type of harvest would establish the conditions to permit shade tolerant and intolerant tree species to grow from seedlings already growing on site, from seeds, and from sprouting of cut stumps.

Beech sprouts and seedlings, New York fern, hay scented and other ferns, grass species, and striped maple are present in most of the stands for regeneration. These plants could be expected to outgrow desirable tree species if heavy deer browsing, drought, or other conditions that slow or impede growth of seedlings were present. Established seedlings are more able to resist such impacts and respond to the release provided by timber harvest than are small or seed-origin seedlings. For this reason, the presence of abundant and diverse advance regeneration (seedlings or saplings currently growing in the understory) is a good predictor of successful regeneration. Another advance indicator of potential for successful seedling growth is the observed deer browsing index, a subjective observation of the feeding impact of deer on ground level vegetation. A deer browse impact of 1 indicates the condition expected within a deer exclosure, with no feeding impact by deer. A deer impact of 5 would be the condition if virtually all deer food had been browsed. Although the actual number of deer present in an area would affect the observed deer pressure on vegetation, there are many other variables that affect it. For example, trees can easily outgrow deer pressure during years with good acorn crops or growing conditions, and trees on good sites grow faster than those with less capability for tree growth. All of the sites for harvest, and virtually all the sites in the Lower Williams project area have high site index (a measure of the site capability to grow tall trees). Observations of the deer index indicate current deer impact between 2 and 3. These observations are corroborated by indicator plants recorded in botany surveys, by the high level of understory species diversity found in the stands for harvest, and by the relatively larger number of deer sensitive plants compared to deer resistant plants as recorded in seedling data.

The clearcutting with residual method of harvest was chosen for almost all of the regeneration harvests. This method maximizes the sunlight available for growth of the new stand, and is considered optimum for regenerating a rapidly-growing stand of diverse tree species that will resist changes in deer pressure that could occur over time. In addition, larger units were chosen, in order to reduce the edge effects, since deer pressure can be heavier at the interface between the surrounding forest and the young stand (Campbell, Lasiter et al, 2006).

Because of the current level of diversity in overstory and advance regeneration, the clearcut with residual harvest should result in diverse regeneration of acceptable and desirable tree species. In the resultant young stands, future crop tree release could be used to enhance one or a few species, and to maintain diversity over time. (Such treatments are not considered in this project, since they would be best done 12-15 years after regeneration harvests.)

Pre-harvest vine control and felling of unmerchantable trees and shrubs are considered to be essential to regeneration within the project area.

Vine control will result in cutting few grapevines, since stands with little evidence of vines were selected for harvest. However, some vines are present, and within the vicinity of live mature vines that are not killed before harvest, the sprouting vines can overtop the new seedlings and saplings, causing substantial breakage. Vine cutting is recommended three growing seasons before stands are regenerated, so that shading can kill or substantially weaken the re-sprouting vines before harvest.

Felling of unmerchantable stems (mostly those less than the minimum product size) is required. These mostly small-diameter stems sprout from the roots and provide a source of well-formed regeneration. If not cut, they can develop into poorly formed trees and shrubs that overtop other regeneration.

A shelterwood harvest was chosen for one of the stands to be regenerated. In this stand, the numbers of beech sprouts (Such sprouts are considered undesirable because they are less likely to develop into mast-producing trees, given that beech bark disease is already present in and near the area.), striped maple and ferns was observed to be comparable to the ground level seedlings, although many sugar maple saplings and large seedlings are present. If levels of deer browse impacts increase, this stand could face more risk of desirable tree species being overtopped by undesirable species than the other regeneration units, with some risk of regeneration failure. To minimize that risk, the two cut shelterwood harvest was chosen, with application of herbicide to individual stems of beech and striped maple. The first shelterwood cut will partially increase light on the forest floor with the intended effect of increasing the development of any black cherry or other tree seedlings. If the increased growing space enhances undesirable species more than desirable ones, then hand application of herbicide to the beech and striped maple would be used to reduce their numbers, allowing for successful regeneration to tree species when the second shelterwood harvest is done. If monitoring surveys show that desirable tree species are successfully competing with undesirable and non-tree species, then no herbicide will be applied. Monitoring surveys are done after the first and third complete growing seasons after the first harvest. This series of treatments is appropriate to regenerate this stand.

Triclopyr or glyphosate would be applied to individual seedlings and saplings of striped maple and beech in the shelterwood harvest unit, if stocking surveys after the first cut determine that these species are an impediment to regeneration of desirable species. Two methods may be used for the triclopyr, basal spray or cut surface treatment. For larger understory stems, over two inches in diameter, the cut surface method may be used to apply a solution of triclopyr and water to the cambium of the stem, with up to 0.5 pounds per acre active ingredient being applied by this method. Stems can be cut, or a hand-carried tree injecting tool or hatchet and squirt bottle can be used to apply herbicide by this method. In addition, up to 2 lbs. per acre of active ingredient per acre may be applied to smaller seedlings and saplings less than two inches in diameter by the basal spray method. A back-pack sprayer is used to apply herbicide to the bark or stem of individual trees or seedlings for this method. Glyphosate may be chosen for the basal spray method, instead of triclopyr, with up to 2 lbs. per acre active ingredient.

Pre-harvest vine control, before the first cut, and felling of unmerchantable trees and shrubs along with the second cut are considered to be essential to regeneration in the shelterwood harvest unit.

Table 8. Meeting the Desired Vegetation Conditions in the Lower Williams Project Area – Management Prescription 3.0 (Forest Plan, p. III-6)

Early Successional Age Class Created by Alternative

Forest Community	Total Acres	Alternatives 1		2		3		4		5		6	
		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Northern Hardwoods	1,226	0	0	59	5	59	5	59	5	59	5	59	5
Mixed Cove Hardwoods	10,383	0	0	900	9	830	8	813	8	801	8	780	8
Mixed Oak	1,408	0	0	128	9	87	6	87	6	87	6	87	6

The acreage of early successional age class within the Lower Williams Project Area is shown below as it would exist in 10 years. Within 10 years, all the harvest units are expected to be implemented and regenerated. In addition, 10 years is the temporal boundary for reasonably foreseeable cumulative effects. Because many of the early successional stands within the Lower Williams Project Area are older than age 10, many of them will move into the early-mid successional age class, and so the acreage in early successional forest does not equal the existing condition plus the early successional forest created. No alternative meets the minimum desired vegetation condition for early successional age class. Even if the planned regeneration harvest could all be done in 2007, only the Northern Hardwood Forest Community would meet the minimum desired vegetation condition for early successional age class.

Table 9. Meeting the Desired Vegetation Conditions in the Lower Williams Project Area – Management Prescription 3.0 (Forest Plan, p. III-6)

Early Successional Age Class Created in 10 Years (2017)

Forest Community	Total Acres	Alternatives 1		2		3		4		5		6	
		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Northern Hardwoods	1,226	18	2	76	6	76	6	76	6	76	6	76	6
Mixed Cove	10,383	53	0.5	953	9	882	9	866	8	854	8	833	8

Hardwoods														
Mixed Oak	1,408	0	0	128	9	87	6	87	6	87	6	87	6	

Meeting the Purpose and Need for Action to reduce the amount of competition between trees for light and water resources in dense, over-crowded stands to provide for sustainable timber and mast production

Comparison of basal area data with stocking guides, and field reviews confirm that stands proposed for thinning harvests are over crowded; trees are competing for light, nutrients, and water. Forest Plan Guideline 3009b states "Thinning is a normal practice, especially on better quality sites." The sites proposed for thinning have site indices between 76 and 100, which are considered to be high quality sites. Basal area per acre, a measure of stand density, is between 149 and 209 sq. ft. per acre in all stands proposed for thinning. Their basal areas place them above the 80% relative density level. Above this density, "growth slows, mortality increases, and there is usually sufficient volume. . ." (Marquis et al, 1992).

Site specific guidelines for thinning should emphasize removing trees that have poorer form for timber production, and those at higher risk of mortality or blow down as evidenced by bole, root or crown observations of the individual tree. Dominant and codominant trees should normally be selected to leave, while suppressed or intermediate trees would be cut, if they meet product specifications. The stands to be thinned vary in the current composition of mast producers, and in the number of species present as sawtimber trees. Tree species and diversity are important components to be considered, for sustainable timber and mast production. Maintaining the largest possible diversity of tree species on site provides for greater resilience in times of species-specific insect or disease outbreaks. Since, Webster County is in the infested area for this species, there is a concern for gypsy moth. Basswood and oaks are the species most likely to be seriously impacted by an outbreak. No outbreaks of gypsy moth have been discovered during aerial surveys, but small populations are likely in the area. Beech trees with poor stem quality should be harvested where merchantable since the area is within the beech bark disease advancing front, and rough-stemmed trees are less likely to be resistant to the disease. Because the area is in the advancing front with relatively few dead beech trees, beech resistance is hard to determine. It is possible that infestation and mortality will progress quickly, and more mortality could be present at the time of implementation. If apparently resistant beech trees are found, they should be retained.

Maintaining potential mast producing tree species, such as oak, is one way to help maintain sustainable mast production. Oak trees of the same species can vary greatly in the mast produced. One practical way to recognize a better mast producer is to look for oak seedlings and/or acorns under it. If no seedlings are present then crown canopy quality and size would be the best way to select for potential mast production. Any butternut trees should be left, and released if possible. Black cherry trees should be left if they are dominant or codominant with high potential to survive. Black cherry trees with small crowns, as a result of being suppressed or intermediate, are not potential crop trees and will not respond to thinning. The potential for loss of crown from splitting is also a major factor to use in determining whether to leave or cut a black cherry.

Construction and continued maintenance of roads would remove some acreage of land from the land currently available for tree growth. Skid trails have some of the same effect, but crown closure of adjacent trees over the skid trail surface minimizes the effect on growing space. Since skid trails experience temporary use, the growing space would be occupied by tree species that become established on disturbed soils. Grass seeding that is used to prevent erosion can prevent or delay the establishment of some species. These effects are temporary, because the anticipated growth and development of trees, in thinning, shelterwood, and clearcut with residual harvests will soon result in decrease in the mostly shade-intolerant grass species seeded, allowing for additional establishment of other forest species. Evidence of this process is provided by the many trees currently present on unmaintained roads and skid trails within the area. Some reductions in diversity, numbers and size of trees growing on skid trails is expected.

Creation and maintenance of savannahs, landings, and landings restored for wildlife openings also remove some acreage of land from timber production. If maintenance of these areas is discontinued over time, some reduction of tree diversity, numbers and sizes would be expected on the acreage of landings, wildlife openings and savannahs.

The logging method, whether helicopter logging, or conventional skidding with constructed skid trails, has little direct or indirect impact on the development of forest tree regeneration, other than some reduction in species diversity and growth on the skid trails themselves, as discussed above. Otherwise, the species composition in each harvest unit would be the same for each unit, whether harvested by helicopter or ground based means.

Meeting or complying with Forest Plan Goals, Objectives, Standards or Guidelines

Management Direction for 3.0 – Vegetation Diversity Emphasis
Relevant Management Direction for 3.0 is found on pages III – 7, 8 of the Forest Plan, including 1900-Vegetation, 2410- Timber Resource Management Planning, 2470-Silviultural Systems. Relevant Forest-wide Management Direction is found on pages II-40-41. All regeneration and thinning treatments, and associated practices contribute to the goals and objectives, comply with standards, and are within the guidelines of this section. Some explanation of how project activities relate to these goals, objectives, standards, and guidelines is included.

1900-Vegetation: All the action alternatives contribute to Forest Plan Goal 3001, "Enhance diversity of forest vegetative cover through the dispersion of a variety of species, types, and ages. They also contribute to Objective 3002, "Over the next 10 years regenerate the following amounts of forest vegetation to begin moving toward desired age class conditions for these forest types: Northern hardwoods: 1,000-2,000 acres, Mixed cove hardwoods: 8,000-12,000 acres, and Mixed oak: 3,000-4,000 acres." As shown above in tables, regeneration achieved under any alternative in the LWPA would be less than 10% of the minimum forest-wide 3.0 management prescription objective for Northern Hardwood and Mixed Oak, with the proposed action regeneration of Mixed Cove Hardwoods amounting to about 11% of the minimum objective.

2410-Timber Resource Management Planning: No uneven-aged silviculture was needed on the basis of visual quality, timber products, economics, or site and species capabilities. The high

sites in the project area are appropriate for even-aged management including thinning and regeneration to establish diverse species.

2470-Silvicultural Systems: Even-aged management is used because shade-intolerant vegetation is the species objective, and is needed for accomplishing diversity objectives. Regenerating an intolerant species is appropriate with regard to the existing conditions of the stands for harvest. Shade intolerant, intermediate and tolerant species are present in and near stands for harvest, and advance regeneration is present for a wide range of species. Sugar maple (a desirable shade-tolerant species) is present in many stands, and is part of the species diversity expected to regenerate. A mix of species, similar to the stands being harvested, is an objective. Uneven-aged management was not considered as a fully developed alternative, because reductions in tree species diversity that would be expected under uneven-aged management were not desired, nor part of the purpose and need for action. The maximum percentage of the basal area of sugar maple in any of the stands for regeneration was 49%, in units 37 and 38, however, the percentage of black cherry was also high, at 28%, and would be a desired shade-intolerant component in the regeneration. Hemlock and beech are other shade tolerant tree species that are somewhat desirable, but the presence and expected impacts of hemlock wooly adelgid and beech bark disease make management to enhance or increase the proportions of these species inappropriate at this time. These two non-native forest health problems result in death of many hemlock and beech trees that are infested, and in some stands can kill most trees of these species.

Clearcutting with reserve trees is the normal regeneration cutting method to achieve the objectives of shade-intolerant vegetation and diversity. This is the method used for most regeneration. One shelterwood would be used to ensure regeneration of tree diversity in the presence of inhibiting species that could potentially develop to overtop desirable species. Another objective of this harvest is to increase the percentage of black cherry in the regenerating shelterwood harvested unit.

Standard TR05 Whole-tree yarding will not occur under any alternative.

Standard TR06 No more than 20 percent of the LWPA area will be regenerated under any action alternative, which contributes to compliance with this standard for the entire forest.

Standard TR18 Regeneration harvest units are separated by manageable stands of trees. This spacing requirement applies to regeneration units until regenerated trees have reached 20 percent of the height of the surrounding vegetation. Regeneration unit 32 is about 300 feet at the closest point, from a nearby stand that was regenerated in 2000. A manageable stand separates these two units. Unit 19 is partly adjacent to a stand regenerated in 1998 in alternatives 1, 4, and 5, which may not comply with the Forest Plan, depending on height growth in the older regenerated stand. Other young stands are close to regeneration units, but are already taller than 20 percent of the height of the surrounding vegetation.

Guideline TR23 Treatments are not intended to convert one forest type to another. Oak stands to be regenerated have about 50% of their basal area in oak species, and are expected to regenerate to stands with about 50% oak. Classification of stands with slightly less than 50% oak may change to mixed hardwood, but stands should still have comparable percentages of oak

to the mature stand harvested. Mixed hardwood stands with high numbers of oak seedlings present could potentially regenerate with more than 50% oak, but should still retain some of the diversity that results in their current mixed hardwood classification.

Guideline TR26 Planting of genetically improved American chestnut is part of the project. Trees with some resistance to the chestnut blight are to be interplanted on a total of 10 acres scattered throughout the regenerated area. Native butternut may also be planted.

Goal VE28 and **guideline VE29** Pesticide treatment to achieve management objectives of regeneration would be used in Shelterwood unit 1. Treatment poses little or no risk to humans and the environment (Forest Plan p. II-18). Triclopyr and Glyphosate would be applied to resident populations of native pests to control them to acceptable levels through careful use of pesticides and integrated pest management. The pesticide and method of application was chosen to apply the least pesticide necessary to achieve management objectives. Pesticides would be applied to individual small trees and seedlings rather than broadcast. Although this method would result in no treatment of ferns which may interfere with regeneration, it would reduce the total numbers of interfering plants, and should result in achieving the management objectives of regenerating a diverse stand. Monitoring would be done of regeneration status after the first harvest. If monitoring results indicate that management objectives of regeneration can be met without applying the pesticide, or applying the pesticide only to part of the unit, the use of herbicides would be further reduced.

Direct/Indirect Environmental Consequences by Alternative
Most effects of this alternative on the timber component of the vegetation are described above, in terms of meeting the Purpose and Need for Action developed in order to move towards the Forest Plan desired conditions for the area. Effects of all action alternatives are very similar, with variations in acreage as shown in the table.

Alternative 1 No Action
Under the no action alternative spelling the forest retains a high proportion of mature sawtimber. Early successional forest would continue to decline on national forest land, as young forest stands age. Unpredictable natural events might establish early successional forest, but these events are not foreseeable. Tree seedlings are likely to continue to develop in the understory, but those most likely to survive over time would be the shade tolerant maples.

In overcrowded stands, mortality would continue to occur, mostly in the smaller and more suppressed size classes. Mast trees would not necessarily be the survivors, with any hickory and butternut very likely to decline, because of their relative degree of shade intolerance. Timber volume would not be recovered from trees that die, but a larger snag and down woody component would be produced.

Alternative 2 Proposed Action
Under this alternative, the "Forest provides a dependable source of large-diameter, high-quality sawtimber. Commercial timber harvest is a viable tool for accomplishing vegetation management objectives." (Forest Plan, p. II-40) Helicopter logging is used for 13% of the harvest to accomplish vegetation management objectives.

Alternative 3 and 6
Under these alternatives, helicopter logging would be used for 35% of the harvest to accomplish vegetation management objectives. Commercial timber harvest may still be a viable tool for accomplishing the vegetation management objectives, but the cost appears to be somewhat prohibitive. As described in the economic effects, bidders may not be found to accomplish the vegetation management objectives using the tool of commercial timber harvest.

Alternative 4 and 5
These alternatives would use helicopter logging on 71% and 100% of the harvest to accomplish vegetation management objectives. It would appear that commercial timber harvest would not be a viable tool for accomplishing the vegetation management objectives. As described in the economic effects, bidders may not be found to accomplish the vegetation management objectives using the tool of commercial timber harvest.

Cumulative Impacts

Alternative 1 No Action
The existing condition of the area reflects the cumulative impact of many past actions, including, but not limited to those shown in the table, within the past 10 years. The presence of early successional forest stands reflects cumulative impacts on age classes of clearcut harvests within the past 19 years. Natural processes and disturbances, such as wind, ice, insects, and diseases contributed to the size, age, and forest types that exist in the area now, as well as to the health and vigor of individual trees. Past thinning, including that included in the table of past actions, has had the effect of reducing stocking and strengthening crown development of the trees growing in the area.

Data on dead trees, as well as that for cull and undesirable trees, indicates that current mortality and other effects of insects and diseases amounts to a low percentage of the total number of trees sampled in the area.

Cumulative impacts of forest pest outbreaks in combination with taking no action to regenerate or thin forest stands could occur. Forest pest outbreaks of beech bark disease, hemlock wooly adelgid and gypsy moth are expected, since these pests are present in the area. Mature stands are less resistant to gypsy moth, and more trees are likely to die after outbreaks when more mature trees are present in dense stands. Suppressed and intermediate trees and even codominant trees with small crowns are more likely to die from heavy or repeated gypsy moth outbreaks. The current high level of species diversity and the fact that pure stands of these species don't occur here, damage from these forest pests would not be likely to cause massive mortality resulting in regeneration of any stand.

Cumulative effects of the no action alternative with liming of forest soils could occur. Lime application at the rate of 2-5 tons per acre of dolomitic limestone may have a slight fertilizing effect which could potentially slow the mortality of suppressed trees due to overcrowding. Any effects are unlikely to be identifiable as to cause, given the many factors that enter into such mortality. Because liming of forest stands would affect species differently, cumulative effects of liming with the absence of harvesting could result in slight increases in the relative dominance of

sugar maple and other species that respond to limestone applications. Sugar maple would be expected to increase diameter growth, crown vigor and quantity of seed production from overstory sugar maples, but would not do so for black cherry and beech (Long, Horsley, Lilja, 1997). Increased seed production could result in more sugar maple seedlings in the understory. The continued shading developed under this alternative, would result in greater potential dominance of sugar maples in overstory and understory. Some species in the area, such as yellow poplar, are considered to be less sensitive to soil nutrient status than to soil physical properties. Other species, such as red maple, can occur and grow on a very wide range of soils (Burns and Honkala, 1990). A species of particular interest, butternut, seldom grows on infertile soils. It is adapted even to dry soils of limestone origin (Burns and Honkala, 1990), which would lead to the conclusion that application of small quantities of limestone would not be harmful to any butternuts. Overall, there is some indication that application of limestone to the soil surface would have slight beneficial effects to growth and vigor of some trees, even on dense mid-late successional forest present with this alternative.

Alternative 2 Proposed Action and Alternatives 3, 4 and 5

Cumulative effects of regeneration and thinning harvests, with any outbreaks or increased damage caused by the gypsy moth, hemlock wooly adelgid or beech bark disease would occur, but may not be noticeable in the area, because of the stand tree diversity described above. Since tree species diversity would be similar in thinned areas to that currently occurring, little difference in effects between areas affected by forest pests with and without thinning would occur. Thinning can enhance tree vigor, and depending on the timing of any outbreak of these insects, fewer impacts of outbreaks would occur in thinning areas. Outbreaks of these forest pests are unpredictable, but for all forest pests, impacts can be more severe during droughts.

Regenerating trees are very resilient if defoliated by gypsy moths, and defoliation is generally less severe. Some species shifts could occur, even in regenerating stands, but oaks and basswoods would still be expected to be part of the diversity. In stands with current relatively high percentages of beech (such as unit 9 and 11, with about 40% of the basal area in beech), regeneration before the development of dense layers of beech brush would result in greater levels of diversity, than if partial regeneration occurred as a result of the beech bark scale alone. Beech brush resulting from beech bark scale is also susceptible to the condition, and these trees are unlikely to develop into large forest trees.

Growth could increase with the cumulative addition of lime in thinned areas, and some species would respond more than others, as described above for alternative 1. A combination of thinning and liming has been found to increase yellow birch growth (Burns and Honkala, 1990).

In regenerating areas, little cumulative impact of limestone application and harvest activity is expected. Past experience has shown that wildlife openings and skid trails that are not mowed or maintained are very likely to become young stands, or develop tree seedlings in them. These sites generally are treated with about 2 tons per acre of lime, similar to that expected in the limestone treatment. Some variation in species composition may occur, as described above. Sugar maple, and other species that respond to lime applications may become more dominant, but monocultures of sugar maple are not expected. Black cherry is a valuable species, for timber and mast, and is highly desirable as a component of regenerating stands. It does not respond to

lime application. It is uncertain whether black cherry would decline in regenerating stands as sugar maple and other trees that may respond to lime grow more vigorously. Because of the normal fast growth of advance regeneration and sprouts of black cherry, any black cherry may survive and compete well. However, there is a relatively small amount of this species in most of the stands for regeneration.

Unavoidable Adverse Impacts

No overall unavoidable adverse impacts on vegetation are expected. Some logging damage to individual trees in and near harvest areas is expected, and damage to residuals in clearcuts with residuals will also occur. These events are not entirely adverse, since they can result in additional habitat, if left. In addition, the removal of such trees during normal timber sale administration would result in additional revenue of the timber harvest. The numbers of damaged trees would not be sufficient to prevent accomplishment of management objectives of thinning, clearcutting and shelterwood harvest.

Irreversible of Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of vegetative resources would occur from any of the alternatives. As discussed above, early successional vegetation is expected to grow into the later successional stages, and over time, mature forest is again expected to occupy the stands regenerated at this time. Species composition in the regenerated and thinned stands would be expected to vary from the current condition of these stands, but overall there would not be substantial change in the forest types, or the diversity of tree species in the area.

Some land in each alternative would be removed from timber production to become roads or wildlife openings. These actions are part of the management objectives for the area, and thus are not adverse. Some changes in the site quality and species composition would be expected if these areas were allowed to revert to timber lands, but regrowth of trees on such lands is relatively rapid in this area.

Consistency with Laws, Regulations

All alternatives are consistent with Forest Service Handbook (FSH 2409.17) direction, and with the Multiple Use Sustained Yield Act of 1960 and the National Forest Management Act of 1976.

Consistency with the Forest Plan

Alternative 1 No Action

This alternative is consistent with the Forest Plan, in that the Forest Plan does not require action in any particular area. However, it would not move the area towards the desired conditions from the Forest Plan.

Alternatives 2, 3, 4, 5, and 6

These alternatives move the area towards the desired conditions described in the Forest Plan as described above in terms of meeting the Purpose and Need for Action for Early Successional Vegetation Conditions, which was developed site-specifically from a comparison of the existing conditions of the project area with the Forest Plan desired conditions for vegetation.

In Alternatives 2, 4, and 5, one unit, Regeneration Unit 19, would touch another young stand which may not achieve the height requirement of Standard TR 18 at the time of harvest. Height of the nearby stand could be measured when the sale is prepared for implementation, to determine compliance. The regeneration area is on a ridge above the young stand and only touches it at one point. If growth has not resulted in compliance, then part of the regeneration harvest could be dropped in order to comply with this standard.

Wildlife

This section of the document discusses how the Lower Williams alternatives may change terrestrial wildlife habitat, influence availability of mast and other food resources, and affect wildlife resources and Management Indicator species. Refer to Chapters 1 and 2 of the Lower Williams Environmental Impact Statement and the Biological Evaluation for descriptions of the project area, proposed action, and alternatives.

Scope of the Analysis

The spatial boundary to analyze **direct, indirect and cumulative** consequences for this project was the project area. This was determined to be an adequate approach because the species considered are either wide ranging or habitat specialists. For wide ranging species, the project area is adequate for this analysis because the project area makes up a relatively small part of the species range. For habitat specialists, determining suitable habitat in the project area is adequate to disclose potential impacts to those species. This determination was also based on review of the project area, current information, and best professional judgment. **Direct and indirect** effects to wildlife resources are not expected to last beyond the expected harvest periods because once the harvest is complete it is anticipated the affected resource discussed will remain in the suitable habitat near harvest units in the project area. The temporal boundary used to assess **cumulative** impacts was about 25 years because it is anticipated that the harvest units will regenerate and trend toward maturity and start producing mast by that time.

Methodology

Original determinations for the Lower Williams project were made based on review of the following: 1) species specific literature as cited; 2) internal agency information (e.g., ArcGIS information); and 3) field review. ArcGIS information is a compilation of wildlife survey and sightings collected over many years. Field visits were conducted by the District Wildlife Biologist and/or by Biological Technicians from spring 2006 through spring 2007.

Digital orthographic quadrangle (DOQ) photos were examined and open and regenerating areas digitized in ArcInfo for private lands in the watershed. This information was then delineated by the project boundary to analyze fragmentation. Stand data were used to determine cover and age on national forest ownership. Calculations of open, forested, and regenerating land are used to determine existing forest fragmentation in the project area. The totals are given in Table 13.

Affected Environment

Management Prescription Direction

All of the project area is managed under Management Prescription 3.0 direction, which emphasizes wildlife tolerant of disturbance, such as white-tailed deer, gray squirrel, ruffed grouse, and associated species.

The Forest Plan standards and guidelines for management in MP 3.0 emphasize the even-aged system of silviculture when shade intolerant species such as oaks are the species objective (p. III-8). The Forest Plan recommends a mosaic of hardwood stands varying in size, structure, and species composition to provide habitat for a variety of wildlife species (p. III-7). Other habitat components called for in the Forest Plan for this prescription include maintaining 3-8% of the area in permanent wildlife openings and retention or creation of permanent water sources (Forest Plan, p. III-7-8).

A challenge in managing for multiple wildlife species is to maintain sufficient habitat for species that need mature forest while providing for the needs of desired edge and early successional species. Management Prescription 3.0 direction seeks to maintain canopied stands of a sufficient size, interspersed with younger stands throughout the landscape, which would provide habitats for a variety of wildlife species requiring different seral stages and habitat types. The proposed Lower Williams activities would serve as a means of attaining diverse tree stands, early successional stages/openings, and open understory conditions, which have been noted to provide benefits for wild turkey and black bear (Bailey and Rinell, 1968; Miller, 1975; Rieffenberger et al., 1981; Wunz, 1989; Wunz, 1990). Deer and other species associates could benefit from the additional food, cover, and nest sites provided by tree seedlings and saplings, forbs, grasses, blackberries, etc. in even-aged regeneration areas (Robinson and Bolen, 1984). These activities would affect mature forest to some extent, which would affect species like the wood thrush, a forest interior species that requires larger areas of mature forest. Robbins (1979) estimates that 250 acres is the minimum forest area required to sustain viable breeding populations of this thrush.

Different wildlife species use different vegetative stages/ages. As documented in the "Vegetation" section of this EIS, about one percent of the National Forest System lands in the project area provide openings and brush, habitat that is used by species like white-tail deer, cottontail rabbits, and wild turkey. National Forest lands within the project area have about 4% of forest stands in the 0-19 year age class which are early successional stands, and about 6% in the 20-39 year age class. Thirty three percent of forest stands within the project area are in the 40-79 year age class, while about 55% of National Forest stands within the project area are between 80 and 119 years old and about 2% within the 120+ year age class. This forested habitat provides habitat for a variety of species such as gray and red foxes, bobcat, southern flying squirrel, woodpeckers, owls, songbirds, various amphibians, gray squirrel, black bear, and turkey. The primary Forest Community Types found within the project area are Mixed Cove Hardwoods 78%, Northern Hardwoods 9%, and Mixed Oak 2%. These forest types provide a wide variety of soft and hard mast for many of the wildlife species within the project area.

Management Indicator and Other Species

The Monongahela National Forest Land Management Plan (Forest Plan) contains a list of MIS for use in monitoring because their population changes are believed to indicate the effects of management activities on habitats. Table D-1 found in Appendix D of the updated Forest Plan provides a revised list of MIS in the 2006 Forest Plan; Table D-2 provides a 'disposition of MIS from the 1986 Forest Plan'. The following species are now considered MIS: Wild (naturally reproducing) brook trout, *Salvelinus fontinalis*; Cerulean warbler, *Dendroica cerulea*; Wild Turkey, *Meleagris gallopavo*; and the West Virginia northern flying squirrel (WVNFS), *Glaucomys sabrinus fuscus*. Potential impacts to the brook trout are analyzed in the specialist report for "Aquatic Resources". The WVNFS will be analyzed in the Threatened and Endangered species section of this report. Table 10 summarizes the habitat objectives for the MIS considered within this section (Cerulean warbler and Wild turkey).

Table 10. Forest-wide Management Indicator Species pertinent to this analysis

Species	Reasons for Seclection	Habitat Objective
Cerulean warbler	High-interest non-game species. Associated with large trees, gaps, and complex canopy layering characteristic of old-growth forests. A forest interior species that is believed to be sensitive to fragmentation. The Forest and WV DNR are cooperating on an ongoing songbird point count monitoring program that is expected to provide Forest-wide data on this species.	Maintain at least 50,000 acres of midlate and late successional (>80 years old) mixed mesophytic and cove forest to meet habitat needs for cerulean warbler, a MIS.
Wild turkey	High-interest game species. In the Appalachians, strongly associated with oak mast. Requires herbaceous openings for brood range and is expected to reflect the effectiveness of the cooperative Forest-WV DNR wildlife opening management effort. Uses shrub/sapling stands for nest sites. Ongoing harvest data collected by WV DNR provides a Forest-wide population index.	Maintain at least 150,000 acres of 50-150 year old oak and pine-oak forest in MPs 3.0 and 6.1 to meet habitat needs for wild turkey, a MIS.

The following pages describe existing habitat conditions for MIS within the project area. The Forest has monitored MIS species and their habitat since 1986 using a variety of techniques.

Habitat and population trends on the Forest and in the project area are discussed where information is available. Wildlife monitoring data collected, including changes in available habitat, are summarized in annual Forest and Fish and Wildlife Monitoring Reports. Information from these published reports, as well as on-going or unpublished monitoring data, is incorporated

here by reference.

Cerulean warbler *(Dendroica cerulea)* -Typically associated with large trees, gaps, and complex canopy layering characteristic of old-growth forests. A forest interior species that is believed to be sensitive to fragmentation. Breeding bird surveys have shown that the species is common and broadly distributed across West Virginia (Buchelew and Hall, 115). Breeding has been confirmed near, but not within the project area, in Nicholas, Webster and Greenbrier counties. Effects to this forest interior species are closely tied to the Fagmentation section of this document.

WildTurkey *(Meleagris gallopavo)* - Typically associated with grassy openings, thickets of dense cover, scattered clumps of conifers and extensive tracts of mature/late-successional forests. They can be found throughout the project area.

Eastern wild turkey and their young use grass/forb habitat to forage for insects in the late spring and summer months. While acorns are the primary food of wild turkey in fall, winter and into spring, their prominence in the diet declines to less than 5 percent in summer (Dickson 1990). Insects, herbaceous material and grass seed dominate the summer diet. The project area provides very few grass forb openings on National Forest lands. This habitat type is usually associated with agricultural lands which are found in and around the Western Cherry watershed area.

Mature mixed hardwood forest types cover the majority of the project area. Eastern wild turkeys eat a variety of plant and animal matter as it is available but important fall and winter foods are the fruits, seed, or nuts from wild grape, oaks, beech, dogwood, yellow popular, and black cherry. The project area provides hard mast in the form of acorns, hickory nuts, beechnuts, and black cherry. Flowering dogwood are locally common but are not abundant throughout the project area. Dense rhododendron thickets along drainages provide security cover during hunting seasons and shelter. The project area also contains some conifers that provide roost cover during severe winter weather.

Turkeys need a daily water source and water is available throughout 90 % of the project area in the form of seeps, springs, streams and created waterholes.

WVDNR Big Game bulletins, track spring and fall turkey harvest numbers by county and National Forest wildlife management areas. Population estimates are based on the premise that the number of spring gobblers harvested represents 10% of the turkey population in an area. The Lower Williams Project Area is within the 461 square miles Cranberry Wildlife Management Area (CWMA).

Table 11. Estimated Turkey Populations, Based on Harvest Numbers

Year	2000	2001	2002	2003	2004	2005	2006
Spring gobbler Harvest	45	60	29	37	26	15	20
Established Population CWMA	450	600	290	370	260	150	200
Established turkey/square mile CWMA	1	1.3	0.6	0.8	0.6	0.3	0.4

According to the WVDNR, the suspected reasons for the tremendous decline in the number of birds harvested statewide in the spring of 2002 were not due to an actual reduction in the turkey

population but were due to (1) the adverse weather conditions during the hunting season that affected hunter participation and success, (2) fewer naive young gobblers in the population that are easier to kill, and (3) gobblers were more difficult to call in because of male-female social interactions that year (WVDNR 2002). In contrast, the continued harvest rate decline in the spring of 2003 is believed to at least partially reflect a decline in the turkey population in some areas due to the severe winter weather that killed many birds. The spring 2003 harvest decline probably was exacerbated by the poor weather during the spring gobbler season, which may have reduced hunter participation (WVDNR 2003). Mast failure has occurred for 4 of the last five years in various areas of the Forest and has contributed to a general decline in turkey numbers and distribution throughout the Forest.

Scope of the Analysis

The area considered for direct, indirect, and cumulative effects to MIS wildlife is the Lower Williams project area, which is surrounded by a number of natural and man-made fragmenting features. Direct and indirect effects will be limited to the project area in the vicinity of management activities. The partial isolation of the project area by fragmenting features will tend to limit the spatial extent of the project's contribution to cumulative effects on wildlife. The temporal boundary used for assessing effects varies depending on the effects considered (as explained in the effects discussion that follows). For example, regeneration harvests reset succession and can affect certain habitat characteristics (e.g., mast production) for a century or more.

Methodology

The effects analysis was based on review of literature and scientific knowledge concerning the effects of timber harvest and road construction on habitat structure, mast production, and disturbance of wildlife. A wildlife biologist visited the project area to assess wildlife habitat conditions and evidence of species present in the harvest units. Available population information for MIS was considered.

No Action

In this alternative, trees would not be harvested, no roads or landings would be constructed, reconstructed, improved, or abandoned. Little early successional habitat would occur other than in openings created by natural disturbances, such as fire, windthrow, severe ice damage, and insect damage. Early successional habitat in the project area likely would decline as early successional forest in previously harvested areas matures.

If large-scale natural disturbances occur, they could offset this trend, but the timing and duration of natural disturbances cannot be predicted. Timber harvest on private land is not likely to provide much early successional habitat because such harvest typically is selection or diameter limit cutting. Early successional species would find habitat located in small patches scattered throughout the area. Some species that are limited to this habitat or require it as a component of their habitat would probably decline as the previously harvested units continue to mature. Woodpeckers and cavity nesters would be maintained at current levels or possibly increase as more snags and dying trees become available. Availability of den trees for bears may increase as trees grow larger and become more susceptible to diseases and injuries that create hollows. Species requiring larger expanses of mature forest would be maintained at current levels or possibly increase as existing early successional forest matures, unless natural catastrophic events affect large areas.

With no habitat management to enhanced browse or mast availability, management activities would not impact deer populations in the short term. However, over the long term, lack of management actions on National Forest System lands in the project area may result in less browse being available to deer populations, which could affect their populations.

No trees currently producing mast would be removed; however, no mast trees would be regenerated for future sustainable yields. Cherry, oak, and hickory would not regenerate over wide areas unless there were a natural disturbance in the area, such as fire, windthrow, or insect damage. Mast production of black cherry, oak, and hickory could decrease in perhaps 40-50 years when existing mast trees begin to decline in mast production and are not replaced by younger trees. Over the long term, squirrel, deer, turkey, bear, and other wildlife populations that depend on mast could be adversely affected by the reduction in mast production across the area. However, some mast production likely would continue, and any population declines would not noticeably affect Forest-wide species viability.

Mast producing shrubs would remain in the understory but would not produce as much mast as in a managed forest where light conditions in the understory would be increased by management actions such as thinning and two-age harvests. Natural breaks in the canopy due to overstory tree mortality would allow additional sunlight to reach mast producing shrubs. Affects on wildlife from human activities in the project area would remain static. Wildlife would not experience increased disturbance or other effects from equipment use, road compaction, soil disturbance, human presence, or vehicle traffic since this alternative would not include those activities. Access and use of the area would remain at current levels with no expectation of any increased use of the area.

Action Alternatives

All action alternatives involve thinning and regeneration harvests. Effects due to harvest would be the same in all action alternatives, however, effects may differ when conventionally logged versus helicopter logged.

Thinning harvests would remove lower quality trees and release healthy trees, including mast producing trees such as oaks and hickories. Wildlife species requiring closed canopy forests may be adversely affected by the thinnings in the short term, as the thinnings would create gaps in the forest canopy. However, these gaps may allow understory vegetation to flourish from the temporary increase of sunlight reaching the forest floor. A variety of wildlife species, including deer, bears, and shrub-nesting birds, would capitalize on the new growth of understory vegetation. This vegetation would provide increased structural diversity that could attract songbirds such as hooded and Kentucky warblers (Smith 1988) and nesting wild turkeys. Hawks, owls, and other predators that prefer a more open understory may have reduced hunting success in the dense understory vegetation. Some mast-producing trees would be removed, but residual mast producing species of trees and shrubs would experience less competition and probably would produce more mast. The thinnings would leave an abundance of healthy trees whose canopies would soon expand to fill the gaps, so some of the beneficial and adverse effects of reducing canopy cover would be temporary (5-10 years). Thinning harvests could have a somewhat longer term effect by reducing competition for resources among overstory trees. This

in turn could result in more vigorous trees and increased mast production, which would benefit a variety of wildlife species, including deer, bear, squirrels, and turkeys.

Direct effects of harvest on birds, gray squirrels, and other tree-nesting species could result from loss of eggs, young, and/or adults during tree felling and skidding, primarily if these activities are conducted during the nesting season. Indirect effects could include loss of nests, nest cavity sites, and roosting sites. Bats roost under shredding bark of old trees and snags, so they could also experience loss of roosting sites and mortality during felling operations. Other cavity users, such as mice, squirrels, and raccoons, could be adversely affected by loss of cavities. Such effects could occur due to the harvest included in the action alternatives. The effects would be similar in all action alternatives. These effects would be minimized by standards and guidelines in the Forest Plan that call for the retention of snags and den trees in cutting units (Forest Plan, p. II-24).

Salamanders could experience local population declines in the regeneration harvest units proposed and possibly in thinned stands. Pauley (1997) noted that in sections of clearcuts where sunlight reaches the soil, the surface is hardened and prevents salamanders from reaching the surface to feed. Where slash and surface litter is left and soils retain moisture, salamanders are still able to reach the surface. The alternatives will include regeneration harvest and thinning harvests where the canopy has been opened. The effects would be similar in nature in the action alternatives, but would occur to a greater extent in the alternative with more conventional logging due to the skidding and yarding associated with this type of operation. Effects would be limited by leaving tree tops and other slash scattered through harvest units. Pauley (1997) has noted that in West Virginia, red-backed salamanders would return to pre-clearcut populations within 22 years. Populations of mountain dusky salamanders would return and would be abundant, but would not equal pre-clearcut populations as quickly as the red-backed salamanders.

The skid roads needed to remove timber from the conventional harvest units may provide travel lanes for some species, such as deer and bear. Skid roads may temporarily isolate some small species such as salamanders that are associated with leaf litter and other forest floor organic matter, since their movements may be restricted by areas of bare soil. Some action alternatives include several miles of road improvements, construction and reconstruction. In general, the reconstruction of existing roads would have minor effects on wildlife. Road reconstruction would result in the removal of vines, tree limbs, brush, and other vegetation that have encroached onto the roadways in the last several years. The reestablishment of the road corridor may benefit certain bat species that forage in linear openings. Road reconstruction would also remove any herbaceous vegetation that has grown on the road surface. Species such as deer, turkeys, grouse, cottontails, and songbirds would lose the clover and other preferred plant species that presently occur on the roadway. However, these resources should still be available to a lesser extent on the roadsides and in other open areas. Effects of log landing construction would be similar, since most landings would be constructed in existing openings that are dominated by herbaceous plants. Effects due to log landings would be temporary since the landings would be revegetated after use.

The new road construction and the sections of road reconstruction that would occur outside of the existing road beds would result in the removal of linear strips of trees, other woody and herbaceous vegetation, topsoil, leaf litter and other organic material used by wildlife. Soil and ground disturbance from road construction could directly affect ground-nesting species by destroying ground nests and burrows, with possible loss of adults and young (salamanders, rabbits, mice, chipmunks, and ground-nesting birds such as juncos and ovenbirds). Soil compaction on roads, skid roads, and log landings would be detrimental for burrowing animals on those specific sites, but adjacent to the roads and landings would be largely unaffected by soil compaction. By creating new edge habitat, road construction may benefit species like deer and eastern towhees (*Pipilo erythrophthalmus*).

Many species are considered to be tolerant of human disturbance to some degree. However, some species such as bears and turkeys are believed to be sensitive to disturbance, particularly during critical life stages like nesting, denning and brood rearing. Short-term direct and indirect disturbance to wildlife may occur during project implementation from (1) physical harm or mortality of individual animals from equipment use, tree felling, and skidding; (2) disturbance or destruction of nesting and roosting sites, cover vegetation, or food sources; (3) noise disturbance from equipment use and vehicle traffic; (4) visual disturbance from increased human activities in the area; and (5) soil disturbance and compaction during road construction and skidding. Some animals may become roadkill victims due to the increase in log truck and other vehicle traffic in the project area during project activities.

Long-term disturbance could occur after project completion if new roads or road improvements facilitate human access into the area. However, none of the alternatives would open any additional road mileage to public vehicular use, therefore sources of additional disturbance due to improved access would be limited to increased foot travel, bicycle travel, and unauthorized motor vehicle use (i.e., ATVs). Noise from equipment and human activity could cause some species, such as bears, bobcats, and turkeys, to change their normal activity patterns to avoid some locations.

Helicopter operations require less road construction and no skid trails. Therefore, long term effects to ground conditions are less than with ground-based systems. Less time is required to harvest a unit using helicopter logging as well. Helicopter logging is done in the leaf off period, normally October through May, which reduces effects to wildlife. This timing would avoid disturbance to nesting and brooding turkeys, but could cause disturbance of denning bears if any are present in the harvest units during harvest. There may be some effects of helicopter noise on wildlife that inhabit caves but this affect is most likely not significant as most animals adapt to "predictable" noises over short periods of time.

Fewer animals will be displaced in an equal sized unit with helicopter logging versus ground based logging because ground conditions are not disturbed and many animals will habitualize to the noise and will not disperse from the area or will disperse only a short distance and return when operations are completed. Most reptiles and amphibians, for instance, will be burrowed underground for some of this time of year and will not be affected by the noise but would be active during the warmer months and could be extremely disturbed by skidders and other heavy equipment.

Direct/Indirect Environmental Consequences

No Action
The No Alternative would not involve any new activity, and therefore would not add to existing fragmentation. Fragmentation would decline over time as recent timber harvests mature and cease to produce edge effects, unless natural events or future timber harvests produce new edge to offset the decline.

Action Alternatives
The action alternatives may change approximately 949 acres (Alternative 6) to 1,144 acres (Alternative 2) of the project area from closed canopy forest to openings (through regeneration harvesting or savanna construction); this would temporarily increase the total area of openings from approximately 135 acres to 1082-1279 acres. The increased open area due to regeneration harvesting would last about 20 years until the canopy closes again, while the new openings due to savannah creation would persist as long as these areas are maintained as openings. Because existing timber harvest openings would close during this time, the actual area of openings at the end of 20 years could be more or less than current levels, depending on other activities in the project area.

The creation of two 35 acre savannah openings (under alternative 2) or one 35 acre savannah (under alternatives 3 and 6), along with landings and skid roads would provide nesting, dusting, and foraging sites dispersed throughout the area for all species using grassy, open areas. The openings would also create habitat for those species using a grassy open understory with moderate canopy cover. Turkeys and grouse would use the open areas as brood range, and for fall feeding. Hawks, owls, and bats could benefit from increased open foraging/hunting area. These openings could attract more predators, such as the great-horned owl and crows, possibly changing the predator/prey ratio of those areas.

Salamanders would experience population declines in the regeneration units, and openings. Pauley (1997) noted that in sections of clearcuts where sunlight reaches the soil, the surface is hardened and prevents salamanders from reaching the surface to feed. Where slash/surface litter is left and soils retain moisture, salamanders are still able to reach the surface. Pauley has also noted that in WV, red-backed salamanders will return to pre-clearcut populations within 22 years. Populations of mountain dusky salamanders will return and will be abundant, but will not equal pre-clearcut populations as quickly as the red-backed salamanders. Effects would be minimized by leaving all topwood and other slash scattered through regen units.

Direct effects on birds could result from loss of nestlings and/or adults during tree-felling and skidding. Indirect effects could include loss of nests, nest cavity sites, and roosting sites. Bats roost under loose bark of shagbark hickory, and older or dead trees, and could also lose roosting sites. Other cavity users, such as mice and squirrels, could be adversely affected by loss of cavities. These effects are minimized by guidelines in the Forest Plan as amended which leave shagbark hickory, snags and den trees in thinning and other cutting units.

Deer populations within this project area and adjoining areas had been increasing slowly over the past decades. In addition to mast, deer browse on the twigs, buds and leaves of many plant species. Currently the deer population and their browsing has a non significant impact on the

under story vegetation, however, with a growing population browsing would increase and eventually reach a level where it could reduce or eliminate under story vegetation, thus decreasing nesting sites and cover for songbirds and small mammals (deCalesta, 1994; McShea and Rappole, 1994).

Regeneration harvests, and wildlife openings would create ground level vegetation available for browse, nesting and cover. In addition, slash when left in clear cuts, would make it harder for deer to move around within these stands, minimizing browsing and allowing regeneration of the forest trees.

The thinning would temporarily open the overstory canopy allowing sunlight to reach the forest floor. Understory vegetation would flourish, producing additional browse, forage, and cover for deer and small mammals. This vegetation would provide increased structural diversity which could attract songbirds, such as the hooded and Kentucky warblers (Smith, 1988). It could detract from the hunting ease of hawks and owls, which need a more open understory to hunt. The skid roads needed to remove timber from the harvest units could provide travel lanes for some species. Bare skid roads, however, could temporarily isolate some species such as salamanders, which are limited in travel where there is no leaf litter cover.

The Action Alternatives would provide for regeneration harvest where some mast-producing species such as oak, black cherry, and hickory would regenerate. In the short term, this would remove these acres from current mast production; however, the stands created would provide mast in the future when some of the older stands may be declining in mast production. During the initial 10 to 15 years following clearcutting, these sites would provide blackberries, forbs and grasses for a varied food source for many animals. This increased food source would benefit black bear, squirrel, wild turkey, blue jay, tufted titmouse, fox, raccoon, chipmunk, deer, mice, hermit and wood thrush, towhee, and woodpecker, among others. Mast tree/shrubs, such as dogwood, hawthorn, etc. when released in the under story after thinning opens the canopy would provide additional seasonal food sources.

Habitat disturbance during project implementation would occur from (1) soil disturbance and compaction during road construction, wildlife opening creation, tree felling, and skidding; (2) noise, equipment use, and vehicle traffic; and (3) increased human activities in the area.

Soil and ground disturbance from road construction could directly affect ground-nesting species by destroying burrows, with possible loss of adults and young (salamanders; rabbits; mice; chipmunks; ground-nesting birds, such as juncos and ovenbirds). Soil compaction on roads/skid roads would be detrimental for burrowing animals on those specific sites, but other habitat is available next to roads and in other stands not being harvested. Tree-felling could directly affect species, such as birds, bats, and squirrels if they were located in the tree at the time of felling. Noise from equipment and human activity could cause some species, such as bears and bobcats, to change their normal range patterns to avoid certain sites. Some of these animals could be lost to mortality on roads from vehicle use during project activities.

Bulldozing to clear wildlife openings could disturb nests in slash piles, and ground burrows. Effects would be greatest in the spring when the majority of young are being born and raised,

and late fall and winter when disruption could expose animals to harsh weather and remove their cache of winter food supplies. Long-term disturbance would not change much from the existing condition as no more than 3.5 miles of new road will be built onto the existing road system.

Effects of Herbicide

The action alternatives would utilize herbicides to reduce competitive species of plants in the project area. The purpose is to improve the regeneration success for mast producing tree species. Herbicides will also be used as a mitigation to reduce non-native invasive plant species within the project area. A risk assessment was performed to determine the potential toxic effects to wildlife. The assessment calculates the potential toxicity for biological organisms of differing size and mass based on the intended application rate of the herbicide (SERA 2003a, b, c, d). The risk assessment provides a hazard quotient (HQ) that is the ratio of the applied dose/chronic dose. The HQ provides a basis for analyzing the effects of the herbicide on non-target species. Herbicide would either be applied directly to the target plant or broadcast sprayed. Direct application of herbicide is not expected to have any direct or indirect effects to wildlife species. Direct application would ensure the herbicide will achieve the desired effect and greatly minimize impacts to wildlife resources.

Broadcast application of herbicide is more apt to affect non-target species through either direct contact or ingestion of spayed vegetation. Additionally, non-target species could ingest prey species that were directly sprayed by the herbicide, but the effects to wildlife species also relates to the toxicity of the herbicide being used. Of the three herbicides that will be broadcast applied, the HQs for glyphosate ranged as high as 1.1 for acute/accidental exposure for a small mammal consuming contaminated insects and chronic/longer term exposures for large birds consuming contaminated vegetation. Data for a single toxic dose (LD_{50}) classify glyphosate as Practically Nontoxic to tested insects and birds. Data for multiple dietary doses classify glyphosate as no more than Slightly Toxic to birds (US EPA 1993). The use of glyphosate has shown to be a compatible tool in managing for mosaics at a landscape scale (Sullivan and Sullivan, 2003). Sullivan (et al. 1998) found no difference in small mammal abundance and species richness between treated and untreated plots. Response from specific species to glyphosate treatments may be a result of changes in micro climate (changes in cover, forage, forest floor humidity), but not a result of direct toxicity (Sullivan and Sullivan, 2003; Vreeland et al., 1998)

Cumulative Impacts

No Action

The No Action Alternative would not involve any management activity in addition to ongoing activities and maintenance. Therefore, the No Action Alternative would not contribute to the cumulative effects of past, present and reasonable foreseeable future actions.

Action Alternatives

Cumulative effects related to wildlife, are evaluated by looking at past, present and foreseeable future effects, which are most likely to result in a change in wildlife habitat conditions and wildlife distribution and use when considered cumulatively.

When considering the effects to wildlife over time, and based on past and anticipated future disturbances within the project area, the primary factors of change affecting wildlife and wildlife habitat in the planning area and surrounding landscape include activities such as timber harvests on Forest Service and private land, wildlife habitat improvements such as new permanent openings and waterholes, maintenance of existing Forest and State roads, maintenance and operation of existing gas wells and pipelines, construction and/or decommissioning of strip coal, and possible residential and agricultural developments.

In general, these activities tend to maintain or create permanent openings, early successional forest habitat, edge habitat and tend to reduce and fragment mature forest habitat. As described previously, even-aged partial harvest treatments result in short-term effects to wildlife habitat and use, and for this reason, partial harvest activities are not included in the cumulative effects analysis. Since there have been no major naturally-occurring disturbances or changes within the project area within the last 10 years, potential cumulative effects were identified by looking at the predominant, human-caused disturbances which have occurred within the project area over time. For the purpose of this analysis, the geographic scope or cumulative effects analysis boundary used to evaluate effects to the wildlife resource, includes all private and National Forest System lands within the Lower Williams project area. The following rationale was used to identify the cumulative effects analysis area for wildlife. The planning area is characteristic of the surrounding landscape, in that the area is predominantly forested and surrounding lands are similarly forested. Also the level of past and anticipated future activity in adjacent watersheds surrounding the project area is comparable to that of the Williams area.

The regeneration and road reconstruction proposed in the Action Alternatives would contribute to the cumulative effects of other actions that replace mature forest habitat with early successional forests, permanent openings, and edge. The regeneration harvests would also contribute to the long-term maintenance of mast production in future mature forest habitat, assuming regeneration of mast producing species is successful.

The thinning harvests included in all alternatives would not remove the forest canopy, and thus would not contribute to cumulative effects related to openings. However, thinning would stimulate understory growth and would make a very short-term contribution to some components of early successional and edge habitats. The action alternatives contribution to cumulative effects would last about 5-10 years, at which time canopy closure of the regeneration harvest units would return these areas to forest habitat. However, road reconstruction contributions would persist indefinitely as long as they are maintained. The contribution to sustainable mast production would begin when the regenerated trees reach optimal mast production several decades after the harvest, and would continue until the trees begin to senesce around a century after the harvest.

Species in the project area limited to mature forests, such as wood thrush and some salamander species, would experience population declines due to these cumulative effects. However, despite these effects, mature forests and the species that inhabit them are expected to continue to dominate the majority of the project area. The Action Alternatives would not adversely affect maintenance of species viability at the Forest-wide scale.

Unavoidable Adverse Impacts

The adverse impacts identified above for the action alternatives are unavoidable because they are associated with activities that would occur if the alternatives are implemented. The impacts identified for salamanders due to drying and hardening of the soil surface may be partly mitigated by retention of slash, but they are not completely avoidable. The adverse impacts identified for the no action alternative are also unavoidable because they would occur naturally in the absence of management activity.

Irreversible or Irretrievable Commitment of Resources

The no action alternative does not involve new action, thus it would not commit any wildlife resources. The early successional habitat that would be lost gradually under the no action alternative is retrievable through future management actions. The action alternatives would each result in the conversion of some mature forest habitat to early successional habitat. These commitments of habitat resources would not be irreversible because the harvested areas eventually would return to mature, closed-canopy forests. The action alternatives would cause a temporary irretrievable commitment of forested and herbaceous habitat associated with the construction and reconstruction of roads and landings. These commitments are not irreversible because the roads and landings could be decommissioned and re-vegetated.

Consistency with the Forest Plan

All alternatives would be consistent with Forest-wide standards and guidelines for Wildlife species (Forest Plan, II – 29-31).

Fragmentation

This section addresses adverse effects of increasing fragmentation of forested habitat. This analysis addresses not only the effect of increased area of temporary and permanent openings, but also the fragmentation and degradation of remaining forest due to the edge effect. Edge effect varies depending on the shape and arrangement of openings, as well as the size of the openings (Franklin and Forman 1987). Particular discussion is given to fragmentation effects as they relate to neotropical migratory birds because many of them require interior forest conditions (Forman and Godron 1986). Fragmentation is evaluated in terms of amount of forest and openings, interior to edge ratio, and percent core area. Core area is the interior forest that is left after the edge effect of the openings is subtracted from the total forested area; it is expressed as a percentage of the project area (all land ownerships). Interior to edge ratio is the ratio of interior forest to forest that is included in the edge effect of adjacent openings. Edge effects were calculated using a 49-feet-wide edge and a 328-feet-wide edge. The 49-foot edge width is based on the typical penetration of sunlight in eastern forests (Ranney et at. 1981) and represents the impact of the edge on forest structure. The 328-feet edge width is based on habitat needs of neotropical migratory birds in the eastern U.S. (Temple 1984) and represents the impact of fragmentation on forest interior wildlife. Percent core area and interior to edge ratio analyses focus on the 328-feet edge width to assess habitat for neotropical migratory birds, which represents a "worst case" effects scenario.

Landscape ecology studies suggest that the interior to edge ratio is a meaningful parameter in assessing forest fragmentation and viability of interior species (Forman and Godron 1986, Laurence and Yenson 1991, Chen 1991). When the interior to edge ratio is 2:1 or greater, an area is presumed to provide adequate interior habitat. Ratios less than 1.5:1 are approaching a level of concern. As the interior to edge ratio reaches 1:1, the amount of interior equals the

amount of edge. This is considered an important threshold because the remaining interior patches are generally small, isolated, and unlikely to support interior species over time. The relationship of percent core area to fragmentation effects on songbirds has been investigated on the MNF. Across landscapes with 42% to 81% forested core area on the MNF, fragmentation effects on songbirds were only apparent at localized scales within 75-100 feet of edge, with no pervasive landscape-scale effects noted (DeMeo 1999). In a different study, Donovan et al. (1995) hypothesized that 40% core area represents a minimum threshold where there is no difference between source and sink habitats for neotropical migratory birds in the landscape.

Affected Environment

To assess the areas existing condition and the effects of each alternative, a coarse analysis was performed. This analysis permits a quantitative display of fragmentation effects, in addition to qualitative discussion. The total existing edge of openings in Lower Williams analysis area was determined using ArcView/ArcGis. The Williams River and Forest Road (FR) 86 runs east-west through the planning area with FR 735 running along portions of the north western boundary and Forest Roads 82 and 272 forming portions of the southern boundary. A polygon created by a 30' road width and its length was used to determine edge area amounts for roads and utility right of ways. The interior roads perimeter length was doubled to include the total edge area for road effects to be included in this analysis.

Throughout the project area, open fields/pasture/croplands on private properties, old and newer clearcuts, brushlands, and wildlife openings were measured. Where roads intersected existing openings, the perimeter was placed around the units only and did not count the road length going through existing openings.

Based on an edge width of 49 feet, the forest acreage within the project area is divided into approximately 12,470 acres of interior forest and approximately 899 acres of edges. Using a 328-feet edge width, the project area contains approximately 8,419 acres of interior forest and approximately 4950 acres of edges. This translates to an interior to edge ratio of about 1.7:1; percent core area is about 58 percent. This area is presumed to provide adequate interior habitat with an interior to edge ratio. The percent core area suggests that current levels of fragmentation are not a problem for forest interior birds. Current levels of fragmentation reflect the intensity of management on both National Forest and private land in the project area. Management Prescription 3.0 emphasizes a variety of activities including vegetation management to produce forest products. It does not focus on maintaining remote undisturbed habitat as some other management prescriptions do.

Scope of the Analysis

The area considered for direct, indirect, and cumulative effects of fragmentation is the Lower Williams project area. Direct and indirect effects would be limited to the project area in the vicinity of management activities. The temporal boundary for most effects is approximately 20 years, which is about the time it takes for regenerated areas to return to forested conditions. However, impacts due to roads may last longer if the roads are maintained beyond that time period.

Methodology

Fragmentation was assessed through a GIS analysis of the project area. Polygons representing existing openings were digitized from digital orthophoto quarter quads (DOQQs) covering the project area. All features that appeared to represent a substantial break in the tree canopy were digitized, including roads, agricultural land, wildlife openings, residential sites, recent even-aged timber harvests, and anything else that appeared to be a substantial opening. These features were digitized without regard to land ownership. Thinning harvests were not included for either alternative. While thinning creates small gaps in the tree canopy and may alter habitat characteristics for some species, it does not create non-forested habitat and edge effects. Therefore, for this analysis, we did not consider thinning to be a fragmenting event.
For the existing condition and each action alternative, the area of openings was calculated from the digitized polygons. For the two edge width scenarios, the area of edge was calculated by buffering the openings polygons by 49 and 328 feet. Total forest area was calculated as the total area of the project area minus the area of openings. Interior forest area was calculated by subtracting the area of edge from the total forest area. The interior to edge ratio was calculated as interior forest area divided by edge area. Percent core area was calculated as interior forest area divided by the total area of the project area, with the result expressed as a percentage.

Direct/Indirect Environmental Consequences

No Action

The No Action Alternative would not involve any new activity, and therefore would not add to existing fragmentation. Fragmentation would decline over time as recent timber harvests mature and cease to produce edge effects, unless natural events or future timber harvests produce new edge to offset the decline.

Proposed Action

The Proposed Action may change approximately 1,172 acres of the project area from forest to openings (this includes new openings created by proposed road construction, reconstruction, and landings); this would temporarily increase the total area of openings from approximately 1,027 acres to approximately 2,199 acres. Approximately 1,049 acres of new openings come from regeneration harvesting; the remaining acres come from road construction/reconstruction and expansion/creation of openings for landings and wildlife openings.

The increased open area due to regeneration harvesting would last about 20 years until the canopy closes again, while the new openings due to roads and landings would persist as long as these areas are maintained as openings. Because existing timber harvest openings would close during this time, the actual area of openings at the end of 20 years could be more or less than current levels, depending on other activities in the project area.

Based on a 49-foot edge width, the Proposed Action would create approximately 231 acres of new edge, temporarily raising the amount of 49-foot-wide edge from approximately 899 acres to approximately 1,130 acres. The proposed action would create approximately 1,139 acres of new 328-foot-wide edge, raising the total amount from approximately 4,950 acres to approximately 6,089 acres for up to 20 years; edge effects would decline gradually during this time as existing timber harvest openings close. Immediately after harvest, the interior to edge ratio would decrease from about 1.7:1 to about 1:1, which is still above the threshold where interior species are believed to have difficulty persisting over the long term. Percent core area would decline

from about 58 percent to about 42, which is just above the hypothesized 40 percent threshold where fragments are believed to begin acting as population sinks.

Most of the increases in edge habitat and associated fragmentation effects would last about 20 years until the tree canopy closes over the regeneration areas. Slight additional fragmentation would persist due to the roads and helicopter landings for as long as these areas are maintained as openings. The interior to edge ratio and percent core area presented here represent the worst-case scenario that would exist immediately after implementation of the project. Because existing timber harvest openings would close some time after project implementation, the actual degree of fragmentation at the end of 20 years could be more or less than current levels, depending on other activities in the project area. Any such effects are not expected to impact viability at the Forest-wide scale because large areas of the Forest are managed to maintain forest interior characteristics (e.g. wilderness, remote backcountry). Approximately 20 percent (approximately 176,200 acres) of National Forest land is centered in wilderness areas and remote backcountry.

Other Action Alternatives

Among all of the action alternatives (Alternatives 2, 3, 4, 5, and 6), alternative 5 would have the least amount of increase to open area. The proposed action (alternative 2) would have the largest increase in open area. Because of this, alternatives 2 and 5 will be compared. Alternative 5 would change approximately 945 acres of the project area from forest to openings, increasing the total area of openings from approximately 1,027 acres to approximately 1,972 acres. Alternative 5 includes 909 acres of regeneration harvest. This analysis, also includes the increase in open area due expansion/creation of openings for helicopter landings. These openings would persist as long as they are maintained as openings. Because existing timber harvest openings would continue to close, the area of openings would begin declining after project implementation, and the future amount of openings would depend on the extent of future activities.

Based on a 49-feet edge width, Alternative 5 would create approximately 171 acres of new edge, raising the amount of 49-feet-wide edge from approximately 899 acres to approximately 1,070 acres. Alternative 5 would create approximately 830 acres of new 328-feet-wide edge, raising the total amount from approximately 4,950 acres to approximately 5,780 acres. This would cause the same amount of decrease in the interior to edge ratio from about 1:7:1 to about 1:1 as alternative 2. However, percent core area would also show a slightly smaller decline, from about 58 percent to about 46 percent. The increases in edge habitat and associated fragmentation effects would persist as long as the helicopter landings are maintained as openings. The interior to edge ratio and percent core area presented here represent the worst-case scenario that would exist immediately after implementation of the project. Because existing timber harvest openings would continue to close, the area of openings and edge would begin declining after project implementation and the future amount of openings and edge would depend on the extent of future activities.

Table 12. Forest Fragmentation Impacts by Alternative.

	Existing Condition (No Action)	Alternative 2 (PA)	Alternative 5

Table 12. Forest Fragmentation Impacts by Alternative.			
Total Project area size (estimated acres)	14,398	14,398	14,398
Open area (estimated acres)	1,027	2,199	1,972
Forested area (estimated area)	13,371	12,199	12,426
Based on 49-foot Edge Width			
Edge area (acres)	899	1,130	1,070
Interior area (acres)	12,470	11,069	11,356
Based on a 328-foot Edge Width			
Edge area (acres)	4,950	6,089	5,780
Interior area (acres)	8,419	6,110	6,646
Change in interior (%)	NA	-27	-21
Interior: edge ratio	1.7:1	1:1	1:1
Percent core area	58	42	46

Cumulative Impacts

No Action

The No Action Alternative would involve no new action, and therefore would not contribute to the cumulative effects of past, present, and reasonably foreseeable future actions.

Action Alternatives

The past, present, and reasonably foreseeable actions outlined in Table 4 that are within the project area tend to create or maintain temporary or permanent fragmentation of forested habitat. The fragmentation effects outlined above for the Proposed Action would contribute to the cumulative effects of these fragmenting activities. Most of the fragmentation contributed by the proposed action would last about 20 years until the canopy closes in the regeneration harvest units. The fragmentation due to the roads and landings would persist as long as these features are maintained as openings. The cumulative effects of fragmentation would further reduce percent core area and the interior to edge ratio. The amount of the additional fragmentation cannot be predicted due to uncertainty over actions on private land. This cumulative fragmentation could negatively affect populations of forest interior species. However, Forest-wide viability will not be affected because approximately 20 percent of the National Forest land is managed as wilderness and remote backcountry, which provides forest interior habitat.

Unavoidable Adverse Impacts

The fragmenting effects identified above would occur if regeneration harvesting and construction of roads and landings is implemented. The adverse effects identified for each alternative are unavoidable if the alternatives are implemented.

Irreversible or Irretrievable Commitment of Resources

The action alternatives would cause irretrievable fragmentation of forested habitat due to regeneration harvesting and construction of roads and landings. However, these effects are not irreversible because the harvested areas would grow back and the roads and landings could be decommissioned and returned to forested habitat.

Consistency with the Forest Plan

The Forest Plan does not contain specific direction addressing fragmentation of forested habitat. The fragmentation that would occur under the action alternatives is consistent with the overall management emphasis in Management Prescription 3.0, which calls for a variety of intensive uses (Forest Plan, III-7).

Birds of Conservation Concern (BCC)

Scope of the Analysis

The spatial boundary to analyze **direct, indirect and cumulative** consequences for this project is the project area. This approach is adequate because the Birds of Conservation Concern are migratory and have habitat requirements that can be evaluated to determine if analysis of the project area adequately addresses potential impacts to those species.

Direct and indirect effects to birds of conservation concern are not expected to last beyond the expected harvest periods. Once the harvest is complete it is anticipated the species discussed would remain in the suitable habitat near harvest units in the project area. The temporal boundary used to assess **cumulative** impacts was about 20 years because it is anticipated that the harvest units would regenerate and trend toward maturity and start producing mast by that time.

Methodology

This section of the EIS has been prepared in response to the President's Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds" of January 10, 2001.

Based on the document "Birds of Conservation Concern 2002" (USFWS, December 2002) the Monongahela National Forest and the state of West Virginia occur within the Appalachian Mountain Bird Conservation Region, (BCR) 28. There are 27 species of birds that are listed as birds of conservation concern for the Appalachian Mountain Bird Conservation Region.

To simplify a discussion of the effects of the alternatives, these species have been grouped by the type of habitat they use (species using forested habitat, species using non-forested habitat or young forest/brushy habitat, and species using both forested and non-forested habitat). A description of each of these species and its habitat is provided below.

Species using forested habitat

Kentucky Warbler – dense under story of mature, humid deciduous forest, wooded ravines, oak-pine or northern hardwood forest.
Louisiana Waterthrush – along streams flowing though heavily wooded valleys, deciduous forest, some hemlock, northern hardwoods.
Swainson's Warbler – dense under story under an older forest, rhododendron or mountain laurel thickets in woods, mostly found in the south and west part of the state.

Worm-eating Warbler – mature deciduous woodland that lacks dense ground cover, mature beech-maple or oak-pine forest.
Cerulean Warbler – mature forest, mixed mesophytic and oak forest below 600 meters in elevation, common in the west part of the state, sparse in the mountains.
Wood Thrush – mature or near mature deciduous forest, prefers dense shade on forest floor.
Acadian Flycatcher – mature mixed deciduous forest dissected by small streams and ravines; lower elevations; not in spruce, oak or pine forest; nests over water; more common in the west side of the state.
Yellow–bellied Sapsucker (breeding populations only) – upland black cherry forest, cut over mature hardwoods, spruce-hardwoods.
Whip-poor-will – mixed deciduous woods, upland oak-hickory forest, not in spruce, hardwood-pine or hardwood-hemlock, few in northern hardwoods, rare in dense forest. Potential habitat could occur.
Northern Saw-whet owl (breeding populations only) – spruce and mixed spruce-hardwoods, swampy areas in coniferous forest, high elevations.
Black-billed Cuckoo – northern hardwoods, cove hardwoods, oak-hickory forest.
Prothonotary Warbler – swamps (wooded wetlands) and large streams, not in the highlands.
Red-headed Woodpecker – open oak groves with little understory, groves of oaks and grazing lands, Ohio River valley and low elevations in the Allegheny Mountains.

Species using non-forested habitat (grassland or other permanent openings)
Upland Sandpiper – grass, old field habitat, grassy mountain tops and reclaimed surface mines, pastures, airports, golf courses.
Buff-breasted Sandpiper – short grass, not listed in the WV breeding bird atlas, accidental/hypothetical to WV. Nests in the arctic shores of Alaska and Canada. Winters in the pampas of Argentina. Migrates up the Mississippi Valley and to the west.
Short-eared Owl – extensive open grassland, meadows, prairies, plains, marshes, dunes, tundra, not listed in the WV breeding bird atlas.
Sedge Wren – wet grass and sedge meadows, nests near surface of water, needs wetlands, grassy marshes.
Henslow's Sparrow – grassy, weed filled fields, fields of broom sedge and weeds, early years of plant succession.

Species using young forest/brushy habitat
Olive-sided Flycatcher – in openings in northern spruce forests, such as bogs, old beaver ponds, burned over slash from lumber operations with scattered snags and trees for perches.
Bachman's Sparrow – brushy overgrown fields, abandoned pastures growing up in shrubs, often in erosion gullies in steep hill sides, much un-used habitat remains.
Bewick's Wren – dry open country in valleys east of the mountains, in small clearings in spruce at high elevations, brushy thickets, favors old farm buildings, old farmsteads, very local or extirpated.
Prairie Warbler – young pine forests and brushy scrub, young second growth hardwoods, overgrown pastures, Christmas tree plantations.
Golden-winged Warbler – low, brushy second growth forest and open woodland, especially powerline rights of way, higher elevations, not in spruce.

Species using both forest and non-forest habitat
Peregrine Falcon – nests in cliffs, bridges over water, or high rise buildings in urban areas. Feeds over fields, forest, or urban areas by catching birds during flight.

Species not applicable to the MNF
Red Crossbill (southern Appalachian populations only) – not applicable to WV or the MNF

Black-capped Chickadee (southern Blue Ridge populations only) – not applicable to WV or the MNF

Chuck-will's-widow – No nest records from the state, mostly found in western hills portion of the state. The MNF is outside the known breeding range of this species.

Of the 24 species of birds of conservation concern in the Appalachian Bird Conservation Region that are applicable to the MNF, 13 (54%) use primarily mature forest habitats. Permanent herbaceous openings and young forest/brushy habitat are each used by 5 species (21%). One species (4%) has very specific nest site requirements, but forages over a broad variety of habitats.

Direct, Indirect, and Cumulative Effects
No Action
Under Alternative 1, no timber harvest or road construction/reconstruction would occur, so there would be no direct effects on Birds of Conservation Concern. Indirectly, natural succession would continue, and the project area would trend toward older forest conditions. This trend generally would have no effects or beneficial effects on species that use forested habitats. Species using non-forest habitats would not be affected, because no new permanent openings would be created and existing openings would continue to be maintained. Habitat for species using young forest/brushy areas would decline as young forests in previously harvested areas mature. However, some young forest/brushy habitat would be provided by natural disturbances. Lack of management under Alternative A would not contribute to the cumulative effects of past, present, and reasonably foreseeable future management actions.

Action Alternatives

Species using forested habitat: In the short term, the regeneration harvests in the action alternatives would temporarily remove or adversely alter between 949 to 1,144 acres of habitat for species that use forested habitats. Construction of new roads and landings would add a small amount of permanent or semi-permanent openings. Some individuals could be subject to direct mortality during harvest operations, particularly if harvesting occurs during the nesting season (generally May through August for these species). Some of these species would cease to use the harvested areas, while others would persist at lower densities due to the retained basal areas. Two of the species that use forested habitats, red-headed woodpecker and whip-poor-will, prefer open forests and could benefit from the broken-canopy conditions provided by the two-age harvests. These effects would persist for a period of 15 to 20 years until the canopy closes. The thinning harvests included in the action alternatives would have short-term effects until the canopy closes again in a few years. These effects would be detrimental to those forest species that prefer a closed canopy, but beneficial to those that use dense understory vegetation.

Thinning might provide a short-term benefit to red-headed woodpecker and whip-poor-will. The very minimal effects from the new roads and landings would persist as long as these openings are maintained. All of these effects would contribute to the cumulative effects of temporary and permanent removal of forest habitat due to past, present, and reasonably foreseeable future actions such as other timber harvests, agricultural and residential development, gas well/pipeline development, and road/highway construction. Most of the project's contribution to these effects would cease when the regeneration harvest units achieve canopy closure. Minimal cumulative effects due to the new road and landings would persist as long as these openings are maintained. Despite the cumulative effects of all of these actions, the project area and watershed are expected to remain dominated by mature forests. While populations of species that use forested habitat are likely to decline somewhat over time, these effects are not expected to extirpate any species from the project area or watershed.

Species using non-forested habitat: Species using non-forest habitats are unlikely to be affected by the proposed project. Although they are not known to occur in the project area now, some of these species may benefit from the creation of the savannah habit in alternative 2 (70 acres) and 3 (35 acres). The non-forest habitats created by the new road and landings likely would not be large enough to provide habitat for any of these species.

Species using young forest/brushy habitat: Species that use young forest/brushy habitat likely would not suffer direct mortality from the proposed action because they would not be present in mature forested areas when harvesting would occur. Indirectly, these species would benefit from the brushy habitat created by the regeneration harvest and the edge conditions created along the savannahs, road and landings. These effects would persist for 15 to 20 years until the forest canopy closes again and shades out the brushy habitat. Minimal benefits due to edge along the new savannah habitat, road miles and landings would persist as long as these openings are maintained. Thinning harvests are unlikely to affect these species because they will not create the type of open-canopy brushy habitat that these species prefer. Effects from the harvests, road, and landings would contribute to the cumulative effects of creation of temporary and permanent young forest/brushy habitat due to past, present, and reasonably foreseeable future actions such as other timber harvests, agricultural and residential development, gas well/pipeline Development, and road/highway construction. Most of the proposed project's contribution to these effects would cease when the regeneration harvest units achieve canopy closure. Minimal cumulative effects due to the savannahs, new road and landings would persist as long as these openings are maintained. Cumulative effects of all of these actions could result in larger populations of these species in the project area and watershed.

Species using both forest and non-forest habitat: Suitable nesting habitat for the peregrine falcon is not known to occur near the project area, so the proposed project would not affect this species.

Consistency with the Forest Plan

All alternatives would be consistent with Forest-wide standards and guidelines for Birds of conservation concern (Forest Plan, II – 29-31).

Terrestrial Threatened, Endangered and Sensitive Animals

Resource Impacts Addressed

The Lower Williams' project specific Likelihood of occurrence Table (project file) displays the status of all Federally Endangered, Threatened, and regionally Sensitive species (TES) found on the Monongahela National Forest. It also identifies if habitat can be found within the Lower Williams area. Eastern cougar and Gray wolf are not addressed further as they are considered extirpated in West Virginia. Plant species are covered in the Threatened, Endangered and Sensitive Plant section and fish species are covered in the aquatic section of this document.

Field surveys, GIS layers pertaining to wildlife, layers specific to federally listed, or Regional Forester Sensitive Species (RFSS), as well as layers pertaining to unique habitat features such as soils and rock outcrops were reviewed. A Likelihood of Occurrence (LOO) table was created to aid in this analysis. Through this analysis, it was determined that the planning area is considered occupied habitat for 6 TES terrestrial animal species (Indiana bat, eastern small-footed bat, Allegheny woodrat, timber rattlesnake, green salamander and hellbender) and may provide suitable habitat for 10 additional TES terrestrial animal species. Specific information regarding TES species can be found in the project Biological Evaluation.

Although it is very unlikely that the project area includes occupied habitat, Cheat Mountain salamander, and Northern Goshawk, are addressed below because further explanation of their analysis seemed appropriate due the importance of documenting survey efforts or due to their transient nature.

The project area includes potential habitat for several other MNF R9 sensitive species in which presence cannot be discounted. Southern water shrew, Diana fritillary, columbine duskywing, a noctuid moth (*Hadena ectypa*), the cobweb skipper and two tiger beetles (*Cincindela ancocisconensis and* Barren's tiger beetle *C. patruela*) are associated with habitats that either are known to exist in the project area or, due to the general habitat description and lack of survey data, potential presence cannot be discounted.

There is a high potential for occurrence for three of the lepidopterans (Diana fritillary, columbine duskywing and the noctuid moth) because their obligate plants (columbine and starry campion) are thought to be ubiquitous across the forest and assumed to occur in the project area. Although it is not know to occur within the project area the tiger beetle (*Cincindela ancocisconensis*) is assumed to occur there due to the potential habitat along the Williams River. While the potential for occurrence of the southern water shrew, Barren's tiger beetle and cobweb skipper is difficult to assess due to the difficulty for surveying or lack of knowledge about preferred habitats, presence is also assumed.

Threatened and Endangered Animal Species

Indiana bat (*Myotis sodalis*)
The Indiana bat is distributed throughout the eastern US, from Oklahoma, Iowa, and Wisconsin, east to Vermont and south to northwestern Florida (Romme et al. 1995). During winter, Indiana bats restrict themselves primarily to karst (limestone geology) areas of the east-central U.S.

During summer, Indiana bats forage nightly for terrestrial moths and aquatic insects in riparian as well as upland forests.

The area of influence for Indiana bats is recognized as four distinct areas;

1. Hibernacula (200-foot radius)
2. Maternity sites (2 mile radius)
3. Primary range (primary foraging, summer roosting and fall swarming – 5 mile radius around hibernacula)
4. Key areas (150 acres within 5 miles of each hibernacula).

Hibernacula

Indiana bats typically hibernate predominately in karst caves between October and April; the precise dates vary depending upon local weather conditions. During a recent decade, West Virginia saw a 45% increase in the number of hibernating Indiana bats (Wallace pers. comm. 1999), with a total statewide population of approximately 10,770 (Stihler and Wallace 2004).

In most years, approximately 26 West Virginia caves provide adequate Indiana bat winter hibernacula. Eleven hibernacula are within the MNF Proclamation Boundary, but only three (Big Springs Cave, Cave Hollow/Arbogast Cave, and Two-Lick Run Cave (all over 50 miles from Lower Williams) have all or most of their entrances on MNF land.

Hellhole cave, a privately owned cave in Pendleton County, is the only WV cave currently designated as Critical Habitat for the Indiana bat (Priority II) (USFWS 1996); it lies within the MNF proclamation boundary, but on private land approximately one mile from national forest land. Hellhole cave is located approximately 60 miles from the project area. There are no Indiana bat caves in the Lower Williams watershed area. The nearest caves which have Indiana bats are Lobelia Saltpeter and Tub Cave, both just over 14 miles south-east and located on private lands.

Maternity sites

Female Indiana bats depart hibernacula before males and arrive at summer maternity roosts in mid-May. Some males can remain near the hibernacula year-round (Stihler 1996). Females form small maternity colonies containing up to 100 adults and their young. A single offspring per female is born during June and is raised at the maternity site, usually under loose tree bark (Harvey et al. 1999). Maternity colonies typically use multiple roosts – at least one primary roost used by most bats during summer, and a number of secondary roosts used intermittently and by fewer bats. Thus, some Indiana bat maternity colonies may use more than a dozen roosts (USFWS 1996).

Romme et al. (1995) presented five variables that determine roosting habitat and described the values of these variables that make the most suitable Indiana bat habitat. The optimal forest canopy cover for roosting Indiana bats is 60-80%. The higher the mean diameter of overstory trees, the more suitable the area is for roosting. The abundance of snags indicates current roosting value, so the more snags the better. Percent understory cover indicates how accessible the roost trees are to the bats. A lower percentage means better access to roost sites. Tree structure, specifically the availability of exfoliating bark with roost space underneath, is a critical characteristic for roost trees. Potential roosting habitat, both maternity and non-maternity, is widely available as the MNF is 96 percent forested, with 63 percent of the forested land being

more than 60 years old. Trees exhibiting roosting characteristics, such as shagbark and bitternut hickory, red and white oak, sugar maple, white and green ash, and sassafras, are plentiful throughout the Forest and many are found in the project area. Forest Service land within the project area is almost all forested, with nearly 90 percent being greater than 60 years old, indicating abundant potential roosting habitat.

West Virginia is within the Indiana bat's eastern maternity range, but not within the core range. Prior to summer 2003, maternity colonies in WV had not been confirmed. Despite extensive summer surveys throughout West Virginia, especially in and around the MNF, Indiana bat maternity roosts had not been found. Presumably, reproductive female bats are more constrained by thermoregulatory and energy needs than are males and non-reproductive females (Cryan 2000). Night temperatures on most of the Forest are thought to be too cold to support maternity colonies (Stihler and Tolin, pers. comm. 1999).

Additionally, in survey efforts conducted in 2004 on the MNF, a confirmed maternity colony was located in the Lower Glady area. This capture site is over 50 miles from Lower Williams project area. A radio transmitter was placed on the female bat and roosting habits were documented through monitoring efforts until the transmitter fell off the bat. Evening emergence counts were conducted at two identified roost sites. Both roost sites were either on or very near Forest Service lands and within ½ mile from the original capture site. Generally, the area in which this maternity colony is located is a mixture of forested areas, forest edges, and early successional areas. The maternity roost tree is located in an area that has experienced recent (≈ 5 years) partial timber harvest and has been burned over creating a generous number of larger snags with sloughing bark. Protections as provided in the Forest Plan have been implemented with regard to this maternity roost site. These protections include establishing a 2-mile radius buffer ("area of influence") around the maternity site. Thus, the maternity site area of influence falls well outside of the Lower Williams project area boundary.

Primary Range

From May to October, Indiana bats forage nightly for terrestrial moths and aquatic insects, primarily in upland forests and riparian woodlands. Prey selection reflects the available foraging environment (Romme et al. 1995). While summer needs are not well understood (USFWS 1997), Indiana bats prefer to forage within upper forest canopy layers where overstory canopy cover ranges from 50-70% (Romme et al. 1995). Indiana bats are known to forage along forest edges, in early successional areas, and along strips of trees extending into more open habitat, but drinking water must be available near foraging areas (Romme et. al. 1995). Large open pastures or croplands, large areas with <10% canopy cover, and stands with large unbroken expanses of young (2-5-in dbh), even-aged forests are avoided or are rarely used for Indiana bat foraging (Romme et al. 1995). Field observations suggest that a large amount of the Forest is above optimal canopy closure for Indiana bat foraging habitat (USFS 2001), but the majority of forested conditions (63% greater than 60 years old) make most of the Forest, including the project area, potential habitat.

Indiana bats begin swarming in preparation for hibernation as early as August and continue through October or November, depending upon local weather conditions. Swarming entails congregating around and flying into and out of cave entrances from dusk to dawn, prior to

hibernation (Kiser and Elliot 1996). The MNF provides approximately 203,235 acres of swarming habitat within 5 miles of known hibernacula. Swarming activity is believed to be concentrated within 5-mile radii around hibernacula, but Indiana bats may also swarm around cave entrances not necessarily used as hibernacula. There are no non-hibernacula caves within the Western Lower Williams project area. Strip coalmine areas adjacent to the project area are potential non-hibernacula caves.

On the MNF, foraging, roosting, and swarming are believed to be concentrated within 5 miles of hibernacula, although individual bats can occur outside this area (USFS 2001). Therefore, the Forest Plan has designated areas within 5 miles of hibernacula as Primary Range. Within these areas, vegetation greater than 5 inches dbh may be managed only for the benefit of the Indiana bat, for other threatened, endangered or sensitive species habitat, achieve research objectives or for public safety (Forest Plan, p. II - 24). Emphasis will focus on management of tree species to provide a continuous supply of suitable roost trees and preferred foraging habitat for Indiana bats.

Key Area

The Forest Plan also calls for the designation of a Key Area within the 5-mile radius primary range around each hibernacula. A Key Area consists of a group of mature stands, totaling at least 150 acres, located as close as practical to the hibernacula. This area should include 20 acres of old growth forest or potential old growth and an additional 130 acres of mature forest (Forest Plan p. II – 26). As appropriate, the area should include the area around the cave entrance, area above the cave entrance, foraging corridor and ridge tops/side slopes around the cave. There are no key areas acres located in areas proposed for timber harvest or road work within the Lower Williams project area. A total of 17 sites within the Lower Williams Watershed area have been mist-net surveyed in 2000, 2002, 2004, 2005 and 2006. A total of 479 bats were captured during these efforts and no Indiana bats were captured.

Virginia big-eared bat (*Corynorhinus townsendii virginianus*) – The area of influence for this species is six miles from maternity/hibernacula. This is consistent with the Biological Opinion for the Forest Plan (USFWS. 2006). The Virginia big-eared bat is a geographically isolated and sporadically distributed cave obligate species that feeds predominantly on moths (Dalton et al. 1986, Sample and Whitmore 1993). Virginia big-eared bats begin to return to hibernacula in September, but continue feeding during warm evenings. By December, they hibernate in dense clusters on cave ceilings. Nine West Virginia caves are monitored as Virginia big-eared bat hibernacula. Three caves are found on the MNF and harbor approximately 7 percent of all hibernating Virginia big-eared bats in West Virginia. Hibernacula caves, as well as 200-foot buffers around them, are considered part of the areas of influence for Virginia big-eared bats. The closest hibernacula to the Lower Williams project area are Stewart Run Cave, which is over 20 miles North and East of the watershed. Female maternity colonies generally utilize warm caves, though some may use cold caves. Nocturnal activities in maternity colonies vary as the maternity season progresses. During May and most of June, when females are pregnant, the colony remains outside the cave most of the night. After birth in late June and July, nightly emergent behavior of the mother depends on the needs of her young. Male Virginia big-eared bats also roost together in bachelor colonies during the non-hibernation season, although they inhabit different areas of the cave than the females (USFS 2001 and references therein).

Virginia big-eared bats are also known to use mine adits and abandoned buildings as summer maternity colonies and bachelor roosts. Identified summer colonies, including both maternity and bachelor sites, are included within the area of influence for Virginia big-eared bats. Eleven caves in West Virginia are monitored by the West Virginia Department of Natural Resources for summer Virginia big-eared bat use. Three of these are on MNF land. The closest gated and fenced summer colony (a maternity cave) is Minor Rexrode cave is located over 50 miles from Lower Williams project area. Two other caves (Keys and Izaak Walton caves) have harbored VBEB's in the past, however according to WVDNR they are not used as consistently as other caves.

Observational research shows Virginia big-eared bats forage only after dark. Virginia big-eared bats forage near their caves. In general, distances from roosts to centers of foraging areas do not differ between males and females (Adam et al. 1994), though foraging area size for females may increase during the summer. The maximum distance a male bat has been found from its roost was 5.04 miles (8.4 km). Maximum distance a female was found from the maternity colony was 2.19 miles (3.65 km) (Adam et al 1994).

Late summer telemetry studies (August) indicate that VBEB on the MNF are using similar habitats for foraging as documented for early summer with the exception that agricultural fields were used during this session and not earlier (Stihler, 1999). VBEB appear to move readily from summer roost caves to other caves for winter hibernacula. VBEB banded during summers were located at several different caves during winter surveys. WVEB banded at Elkhorn Cave were found at Cliff Cave, approximately 114 miles away. VBEB were also observed in Hellhole up to 20 miles from where they were originally banded at Cave Mountain cave, Elkhorn Cave, Minor Rexrode Cave and Sinnitt Cave (Shihler, et al 1997).

Based on information that Virginia big-eared bats travel up to 6 miles from their caves to forage (Stihler 1995), areas 6 miles in radius from hibernacula and summer colonies are included within the area of influence for Virginia big-eared bats. Other than the 200-foot buffer around hibernacula and summer colonies, there is no specific management prescription or opportunity area designation for roosting and foraging areas within this 6-mile radius circle. Within the 6-mile radii surrounding the eleven monitored Virginia big-eared bat maternity/bachelor caves, 76 percent of the land is privately owned, and the majority is in agricultural use. Of the less than 25 percent that is National Forest land, more than 95% is forested habitat over 60 years old. There are no areas of influence for Virginia big-eared bat within the Lower Williams watershed area.

There are no known Virginia big-eared bat hibernacula or maternity caves / mines within the planning area or within a 6.5 mile radius of the area.

Cheat Mountain salamander (*Plethodon nettingi*) – Due to the small home range of these species, individual impacts to potential habitat were used to analyze the effects to this species. This small woodland salamander is found in red spruce and mixed deciduous forests above 2,700' in microhabitats that have relatively high humidity, moist soils and cool temperatures. In 2001, Dr. Pauley provided the Monongahela National Forest maps identifying high and low potential habitat, known population locations and areas surveyed. There is one small area of low potential Cheat Mountain salamander habitat identified in the Lower Williams project area, however no Cheat Mountain salamanders were discovered within the area during surveys by the Gauley District Wildlife Biologist in 2006 and 2007. There are no activities identified within

this area in any of the Alternatives. There is no high potential CMS habitat within the planning area.

West Virginia Northern flying squirrel (*Glaucomys sabrinus fuscus*) – The analysis for this species focused primarily on impacts to suitable habitat within or adjacent to the planning area. Cumulative effects encompassed primarily the forest boundary due to the available reliable data. On July 31, 1985, USFWS listed Virginia Northern Flying Squirrel (VNFS) *Glaucomys sabrinus fuscus* as endangered (50 CFR Part 17). The USFWS released the Appalachian Northern Flying Squirrel (*Glaucomys sabrinus fuscus) (Glaucomys sabrinus coloratus)* Recovery Plan on September 24, 1990 (USFWS 1990). A Recovery Plan Update was signed on September 6, 2001 which includes an Amendment to Appendix A; Guidelines for Habitat Identification and Management for *Glaucomys sabrinus fuscus* (USFWS 2001).

The amended guidelines stipulate two basic types of WVNFS habitat, suitable and unsuitable. Suitable WVNFS habitat is defined as areas that have habitat characteristics required by the squirrel as indicated by known capture locations. All mapped suitable habitat, as defined and displayed in the most recently reviewed map, is assumed potentially occupied by WVNFS, and emphasis will be placed on protecting this habitat. No projects or activities that would adversely affect suitable habitat on the MNF will be allowed unless authorized under Section 7 or, in the case of scientific permits, Section 10(a)(1)(A) (USFWS 2001). Unsuitable habitat does not currently have habitat components preferred by the WVNFS and must, therefore, be assumed to be unoccupied by WVNFS. Consequently, management activities planned in unsuitable habitat will not affect the WVNFS and will not require consultation or permits pursuant to the ESA (USFWS 2001). The nearest proposed activities are a half mile from any identified suitable habitat.

Scope of the Analysis

The spatial boundary used for the assessment of direct, indirect and cumulative effects to TE and S species varies for individual species. Species that have wide home ranges will have larger areas analyzed versus species with narrower home ranges. The time period considered for direct effects is the duration of the road building, harvest, and yarding activities. The time period of analysis of indirect and cumulative effects is approximately 10-20 years post-harvest, when tree canopies of regenerated stands likely will be closed. Temporal considerations beyond these timelines would be speculative and irrelevant to this analysis.

Methodology

The likelihood of occurrence of each threatened and endangered species and its potential habitat was determined for the Lower Williams project area. Likelihood of occurrence was based on habitat requirements, district files, Natural Heritage Section of the West Virginia Division of Natural Resources (WVDNR) records, research literature, various field surveys, and personal communication with species specialists. Conclusions drawn from the likelihood of occurrence table dictated the level of analysis needed for each threatened and endangered species (see information in the Affected Environment section). The potential effects of each alternative on species and their habitats were evaluated. Also considered was information presented in the programmatic Biological Assessment for the Monongahela National Forest Plan (USFS 2006)

and the corresponding Biological Opinion from the U.S. Fish and Wildlife Service (USFWS 2006).

Direct/Indirect Environmental Consequences

No Action Alternative
Indiana Bat: With the No Action Alternative, no potential habitat would be harvested or otherwise disturbed. Usual road maintenance and wildlife opening mowing activities would continue unchanged. Therefore, implementation of the No Action Alternative would have no direct or indirect effects on Indiana bat habitat. Indirectly, beech bark disease could create additional snag and cull trees used for roosts. Because no tree felling or other activity would occur, the No Action Alternative would have no impact on the Indiana bat.

Virginia Big-Eared Bat: There are no known hibernacula within the watershed and no reason to presume that Virginia big-eared bats would travel the 40+ miles to forage within the project area. As a result, there are no adverse effects anticipated to this species under the No Action Alternative.

Cheat Mountain salamander: There would be no direct effect to Cheat Mountain salamander with the No Action Alternative.

West Virginia northern flying squirrel: There would be no direct effect to West Virginia northern flying squirrel with the No Action Alternative.

Action Alternatives

Indiana Bat – Hibernacula, Key Areas, Maternity sites and Primary Range - There would be no direct, indirect or cumulative affects to Indiana bat hibernacula, key areas, or maternity sites with implementation of any activities identified in the Action alternatives because there are no hibernacula, maternity, or key sites within the Lower Williams watershed.

Project Area - Because tree felling activities would have the potential for take, whether they occur inside or outside the primary range, there is potential for direct effects from the activities proposed in the action alternatives. Any tree removal during the non-hibernation period (April 1 – November 14) may result in mortality (take) of an individual roosting Indiana bat if a tree containing that bat is removed intentionally or felled accidentally. If a bat using the said felled and removed roost tree is not killed by the felling action, the roosting bat would be forced to find an alternative roost trees, potentially expending energy and making the bat vulnerable to predation. This action would result in harm or harassment to the bat and constitutes take. All activities fall within the scale and scope addressed in the Biological Opinion and within the level of take identified in the Incidental Take permit (USFWS 2006). Except for removing potential roost trees, commercial thinning may indirectly benefit Indiana bats by reducing canopy closure to a more optimal level for Indiana bat foraging. Opening up canopy cover improves foraging as well as roosting conditions. These effects are short-term, because canopy closure occurs in approximately 5-10 years after thinning occurs. A more long-term effect of thinning is increased residual growth on the remaining trees, creating larger diameter and more suitable roost trees. Damage to residual trees during felling can also improve roosting quality and quantity as damage

areas turn to cavities and crevices are more likely to develop due to resulting pathogen and insect attack at the injury point.

No detrimental effects to Indiana bat are anticipated from herbicide use in the project area (see Wildlife/MIS report on herbicide toxicity). The hazard quotients for glyphosate represents a slight toxicity and this, combined with the project area not lying within 5 miles of known hibernacula, minimizes the potential effects from herbicide on Indiana bats.

Virginia big-eared bat: Implementation of any of the action alternatives will not directly affect Virginia big-eared bats. There are no known hibernacula within the watershed and no reason to presume that Virginia big-eared bats would travel the 40+ miles to forage within the project area. As a result, there are no adverse effects anticipated to this species under any Action Alternative.

Cheat Mountain salamander – There are no harvest activities planned in potential CMS habitat within Lower Williams watershed area.

West Virginia northern flying squirrel: There are no timber harvest activities planned within suitable squirrel habitat. As a result, there are no adverse effects anticipated to this species under any Action Alternative.

Cumulative Effects

No Action Alternative
The No Action Alternative would involve no action in addition to currently ongoing activities, so it would not contribute to the cumulative effects of past, present and reasonably foreseeable future actions.

Action Alternatives
Approximately 88% of CMS populations within the MNF boundary, timber harvesting and other activities outside the MNF will have limited cumulative effects on CMS populations. Because most ground disturbing activities are avoided in occupied and high potential CMS habitat there should be no cumulative effects on this species within the Forest boundaries due to implementation of any action alternatives chosen.

Suitable Indiana bat roosting and foraging habitat would continue to predominate throughout the project area. On National Forest land, potential future actions include thinning and regeneration harvests to benefit the Indiana bat and to create age class diversity, although no such harvests have been proposed yet. Future activities may also include creation and maintenance of wildlife openings and water sources. On private land within the foraging circle, forest management is likely to continue to be the dominant land use, with scattered agricultural and residential development. The effects of these activities would vary. Some timber harvesting, both on National Forest and private land, could have beneficial effects on Indiana bat if it reduces canopy cover to the optimal range for foraging or roosting. Other timber harvesting could have adverse impacts by reducing canopy cover below the optimal range or by reducing the availability of potential roost trees. The magnitude of the impacts of these actions cannot be assessed because specific actions have not been proposed. The proposed action as proposed would make a minor contribution to the cumulative effects of regeneration harvesting. Cumulative effects of

incidental take associated with the action alternatives are within the scale and scope addressed in the Biological Opinion and Incidental Take permit (USFWS 2006).

Forest wide, the majority of Virginia big-eared bat foraging habitat is on private lands and is in mixed habitats consisting of forests, pastures, and other agricultural uses. This habitat provides a variety of foraging opportunities for this species. Most activities that add to or maintain this habitat diversity would have a somewhat beneficial effect on Virginia big-eared bats. The contribution of the proposed action to cumulative effects at the forest wide scale is not measurable in Lower Williams. Cumulative impacts on Virginia big-eared bat should be viewed in the context of the 6 mile radius area of influence; the closest area of influence to Lower Williams is located over 20 miles away (Stewart Run cave). Because of this distance, cumulative effects associated with all Alternatives would not be measurable.
Because there will be no suitable habitat within the project are, the action alternatives will not reduce available West Virginia northern flying squirrel suitable habitat.

Unavoidable Adverse Impacts

All alternatives result in expected impacts to wildlife as discussed above. While some of the activities are expected to result in improvements to wildlife habitat, adverse impacts to individual species and/or species habitat are expected to occur as discussed above. These impacts have been minimized through project development and design to reduce the impacts but have not been eliminated.

Irreversible or Irretrievable Commitment of Resources

While individual potential roost trees may be removed from the planning area, management of the area will still consider and, where appropriate, be designed to manage for those species dependent upon the habitat. There will be no reallocation of primary uses within the planning area. Therefore, there will be no irreversible or irretrievable commitment of resources.

Consistency with the Forest Plan

All alternatives would be consistent with Forest-wide standards and guidelines for threatened and endangered species (Forest Plan, II – 22-28).

Sensitive Species – Terrestrial Animals

Resource Impacts Addressed

A Biological Evaluation (BE) was completed to determine the effects of the alternatives on Regional Forester's Sensitive Species (RFSS) for the Monongahela National Forest. This effects section summarizes the data on terrestrial animals. Aquatic animals are covered in the Aquatic resources section; terrestrial plants are covered in the plant section. Several terrestrial RFSS animals are known to occur within the project area, but surveys have not been conducted for all species on the RFSS list. Sensitive species have been grouped into habitat types for effects analysis.

Northern Goshawk: Considered a habitat generalist at range-wide spatial scales, the goshawk is more specialized in its choice of nesting and foraging habitat at the local scale. Landscape features and vegetation structure and composition among goshawk home ranges vary with the location and forest type. In general, the goshawk uses mature forest conditions for nesting and

foraging purposes. The age, at which, forest stands express "mature" characteristics and become suitable for goshawk use varies based upon forest type and site capability.

Historic goshawk nesting has been observed within the higher elevations of the eastern portions of the Williams River watershed (outside of the project area) but no active nesting has been observed in the last 6 years. Goshawk Call Surveys were completed within the proposed action areas in the spring of 2006 with no responses.

Riparian/Stream Species

There is a variety of riparian habitat within the various sub-watersheds created by numerous perennial, intermittent and ephemeral streams within the project area. Riparian ecosystems are productive areas with great physical and biological diversity. Refer to the Water/Hydrology and Aquatic Resources sections for more detailed resource condition discussions. The aquatic/riparian zones in the project area provide potential habitat for the following sensitive terrestrial species:

Species	Limiting Factor
Cicindela ancocisconensis	Disturbance to individuals or habitat
Hellbender	Disturbance to water quality
Southern water shrew	Disturbance to individuals or habitat

Hellbender: The hellbender, (*Cryptobranchus allegeniensis*), is found from southern NY, through PA, southeastern OH, WV, and KY to northern GA and AL (Green and Pauley 1987, Petranka 1998). Hellbenders inhabit cool, clear, fast-flowing permanent streams below 2500 ft. in elevation. These salamanders spend much of their time under large, flat rocks and logs in streambeds and emerge at night to forage along river and stream bottoms (Green and Pauley 1987, Petranka 1998).

Crayfish make up a majority of the hellbenders diet, with fish, aquatic insects, other salamanders, and earthworms being of secondary importance (Green and Pauley 1987, Wilson 1995, Petranka 1998). Extraneous matter such as leaves, pebbles, and sticks may occur in stomach contents of hellbender, perhaps due to the fact these salamanders forage along stream and river bottoms (Green and Pauley 1987).

Hellbenders do not reach sexual maturity until they are 4-8 years old (Wilson 1995, Petranka 1998). Breeding season for hellbenders begins in August and continues into September. Egg lying occurs from late August to early November. The males excavate a nest under a flat rock or log in the stream, where the female lays more than 400 eggs (Green and Pauley 1987). The eggs are guarded by the male, and hatch in approximately 6 weeks.

Hellbenders are rare range-wide, but can be locally common in some streams. Hellbenders cannot reproduce successfully in streams experiencing siltation or general pollution. Excessive, long-term sedimentation covers the loose rock and gravel, thereby destroying nest sites, protective cover, and food sources for the hellbender. Streams become unsuitable for hellbenders if the water temperature rises above 20º C (68º F). There have been no specific

hellbender surveys conducted within the watershed, however hellbenders do occur within the portions of the project area.

Southern Water Shrew: Water shrews are typical animals of northern forests, or of Canadian and Hudsonian life-zone montane forests to the south. Specifically, southern water shrews range from the Appalachian Mountains of southern Pennsylvania to just north of Georgia. They most commonly occur along the edge of slow or swift flowing streams with rocks, crevices, and over hanging banks, with boulders, rocks, and woody debris present in the stream and streambed. The species inhabits both perennial and ephemeral streams (Beneski and Stinson 1987, Pagels et al. 1998).

The riparian areas are typically in or near northern hardwood forests, often with the dominant trees being yellow and black birch, sugar maple, red maple, black cherry, American beech, and eastern hemlock (Pagels et al 1998). Water shrews have also been captured in sphagnum swamps, beaver pond meadows and grass/sedge marshes. Water shrews are seldom found far from water and feed extensively on immature stages of aquatic insects. Southern water shrews are difficult to capture, which has made this a difficult species to monitor. It may be more abundant within its range than records indicate. Riparian areas in the Lower Williams project area provide potential habitat for southern water shrew, though specific surveys for southern water shrew were not conducted.

Direct/Indirect/Cumulative Effects

Soil disturbing activity can have direct, indirect, and cumulative effects on aquatic and riparian resources and these effects can be variable in terms of the extent and duration. Activities that disturb soils can increase stream sedimentation and lead to various forms of aquatic habitat degradation. Soil disturbing activities associated with the Action Alternatives include reconstruction, maintenance, and use of roads (system, temporary, and skid roads) and landings (log and helicopter landing sites) and to a limited extent, timber harvests.

Roads within riparian areas and floodplains can inhibit stream and floodplain function and physically occupy riparian habitat. Roads that cross stream channels can disconnect aquatic habitat, change stream channel dynamics in the vicinity of the crossing, and contribute toward channel instability. All these effects can alter the quality of habitat for many terrestrial and aquatic species that inhabit these areas.

Timber harvesting can affect watershed processes that are important to maintaining the health of many aquatic and riparian dependent communities. Extensive timber harvesting and associated activity throughout a watershed can affect stream flow conditions, particularly storm flow and peak flow characteristics during the growing season.

Mature Forest Species

The age class distribution in the project area is somewhat typical of the entire MNF in that more than half of the area is in stands between 70-100 years old. The mature forest in the project area provides potential habitat for the following sensitive terrestrial animals:

Species	Limiting factor

Diana fritillary	Insecticide / Herbicide application
Green salamander	Disturbance to habitat
A noctid moth	Disturbance to habitat
Timber rattlesnake	Disturbance during hibernation and direct killing of individuals
Eastern small footed bat	Disturbance during roosting and hibernation

Diana Fritillary: The Diana fritillary is a southern Appalachian species that ranges from Virginia and West Virginia south to northern Georgia and Alabama. The Diana is found in West Virginia in the southern third of the state, south from lower Pocahontas County and west to Kanawha and Lincoln Counties.

The species may also occur occasionally in other surrounding counties, as well as the southern counties, with no records to date. The Diana fritillary is a forest species inhabiting mountainous areas in West Virginia. It prefers moist and well-shaded forest covers with rich soils. The butterfly uses small openings and roadsides in search of nectar plants but will not stray far from the woods (Allen 1997). Milkweeds and thistles are the preferred nectar plants. They will also use butterfly weed and swamp milkweed. Later in the season, wild bergamot, Joe-pye weed and ironweed are the common plants selected. As with other *Speyeria*, woodland violets serve as host plants for Diana in West Virginia (Allen 1997). This species is known to occur within Pocahontas and Greenbrier Counties and the plant species listed as nectar sources and host plants do occur within Lower Williams project area.

Green Salamander: The range of the green salamander extends from southwestern Pennsylvania, western Maryland, and southern Ohio to central Alabama and northeastern Mississippi. Preferred habitat for the Green salamander is crevices in well shaded and moist, but not wet, rock faces in mesophytic forests. Because of their microhabitat preferences, green salamanders probably do not compete with other salamanders that restrict their activity to the forest floor. Green salamanders can occasionally be found under logs and loose bark on trees in the absence of suitable rock formations (Green and Pauley 1987, Petranka 1998, Wilson, 1995). Green salamanders have also been found in upland pine forests (Virginia pine, white pine and eastern hemlock) with a mountain laurel understory (Wilson 1995). This unique habitat of the green salamander may be the limiting factor for this species. Suitable habitat is patchily distributed; therefore the salamander is generally uncommon throughout its range (Petranka 1998). Timbering in the immediate vicinity of rock outcrops dries crevices used for foraging and nesting and can lead to the extinction of local populations.

There is a substantial amount of rock formations within the Lower Williams project area. Green salamanders are also known to occur under rotting bark and logs. Both these habitat types can be found within the project area. Green salamander surveys were conducted in the project area and several individuals were discovered within the project area. One-hundred and fifty foot buffers were placed around all known locations within the regeneration units of the action alternatives.

Timber Rattlesnake: The timber rattlesnake was once widespread, but due to hunting and disturbance of winter dens, remaining populations are restricted primarily to mountainous areas that have suitable denning areas for winter hibernation, and rocky ledges on south facing slopes for basking and nursery areas. Forested areas consisting of second-growth deciduous or coniferous forests with high rodent populations provide excellent habitat for this species and

rocky areas with southern exposure allow maximum exposure to the sun during the spring and fall (Green and Pauley 1987). Timber rattlesnakes return to the same den site each year during October. After emergence in the spring (April-May), rattlesnakes remain close to the den until after shedding. Brown (1993) recognized the importance of "transient habitat", a habitat that is distinct from the den and summer-range habitat. This habitat is usually within 650 ft. of the den site, and largely consists of more open, grassy woodlands with numerous rocky surfaces. Gravid females preferred forested sites with approximately 25% canopy cover, equal amounts of leaf litter and vegetation covering the ground surface, large amounts of coarse woody debris, and overall warmer microclimate then males and non-gravid females (Reinert and Zappalorti 1988). Male timber rattlesnakes have large home ranges and may travel over two miles from the den in the summer, although most timber rattlesnakes travel no further then a mile from the den during the summer. Outside of the winter den, males and non-gravid females prefer forested habitat with >50% canopy closure, thick ground and shrub vegetation (approximately 75%), and low coarse woody debris cover (Reinert and Zappalorti 1988).

The diet of the timber rattlesnake primarily consists of small mammals such as mice and voles, squirrels, chipmunks, rabbits, bats, songbirds, frogs, and other snakes. In the Appalachian Mountains, mating occurs in the late summer (August-September), and ovulation takes place in late May and early July the following year. The gestation period is 5½ to 6 months, and 6 to 17 young are born in late August- October (Brown 1993). Timber rattlesnakes in the Appalachian Mountains do not reproduce every year, rather reproductive intervals ranged from 2-4 years with the proportion of reproductive females varying from 31-80% annually (Martin 1992, Brown 1993). Timber rattlesnake reproduction is highly dependent on the fat store of the females. Low reproduction may occur in years with low temperatures, high cloud cover, or low small mammal populations.

The primary causes of timber rattlesnake population declines are snake hunting resulting in the destruction of den sites and removal of timber rattlesnakes from winter dens by humans. Martin (1992) states that summer time snake hunting is by far the biggest factor in the extirpation and reduction of timber rattlesnake populations. Additionally, the prolonged mate searching by male rattlesnakes' results in increased movements and thus greater exposure to predators and vehicles during the late summer mating season, leading to higher mortality during these months. Specific timber rattlesnake surveys were not conducted. There are no known den sites located within the Lower Williams project area, but rattlesnakes can be found almost anywhere within the Monongahela National Forest. Suitable timber rattlesnake habitat exists within the project area.

Eastern Small-footed Bat: Eastern small-footed bats occur from Maine, Quebec, and Ontario southwestward through the Appalachian region to Arkansas and eastern Oklahoma. Eastern small-footed bats may hibernate close to summer roosting and maternity habitat (Whitaker and Hamilton 1999). Very little is known about their summer ecology. During this time, these bats are sometimes found in unusual roost sites such as under rocks on exposed ridges, in cracks in rock faces and outcrops, in bridge expansion joints, abandoned mines, buildings, and behind loose bark (Erdle and Hobson 2001). Eastern small-footed bats forage over land and bodies of water (Wilson and Ruff 1999). Their diet includes flies and mosquitoes, true bugs, beetles, bees, wasps, ants and other insects (Harvey et al. 1999). They forage in and along wooded areas at and below canopy height, over streams and ponds and along cliffs and ledges (Erdle and Hobson 2001).

Little is known about their reproductive ecology. Available data suggests that females form small maternity colonies, and proximity to water may be a factor in selecting nursery sites (Erdle and Hobson 2001). The greatest threats to this bat are human disturbance and vandalism at maternity and hibernating sites. Other possible causes of bat population declines include natural disasters, loss of roosting sites due to sealing mine entrances, cave commercialism, chemical contamination, and loss of foraging habitat.

There are rock ledges and bridges on National Forest lands in the Lower Williams project area that would provide roosting sites for eastern small-footed bats. Riparian and woodland habitat is used for foraging. A total of 17 sites within the Lower Williams Watershed area have been mist-net surveyed in 2000, 2002, 2004, 2005 and 2006. A total of 479 bats were captured during these efforts. Only one Myotis leibii, was captured during these surveys within the Lower Williams watershed.

Direct/Indirect/Cumulative Effects

Direct effects due to timber harvest activity on many of the R9SS include directly crushing individuals, collisions with vehicles or purposefully killing an individual (timber rattlesnake in particular) microclimate changes to habitat or permanently removing their territories. Indirect effects on Diana fritillary, green salamander, would be similar. Timber harvesting would remove canopy, potentially changing forest floor microclimate. Decreasing soil moisture may deem those harvest units unsuitable to all these species.

Timber harvesting from April thru October would have the greatest probability of directly affecting rattlesnakes. During timber harvesting, falling trees may crush rattlesnakes. There would also be increased probability of threat to snakes due to increase human activity in the area while harvesting. Timber harvesters do not generally tolerate rattlesnakes in the area where they are working. Indirectly, timber harvesting may benefit rattlesnakes by increasing food resources. Small mammal populations are higher in open wooded areas with an abundance of forest floor vegetation. In addition, increases in coarse woody debris on the forest floor provides good habitat for both timber rattlesnake and their prey species.

Timber cutting may improve eastern small-footed bat foraging areas as the canopy opens and allows the bats to forage more easily. Additionally this would create more edge habitat suitable for summer foraging. Direct effects due to road management activity on Diana fritillary, green salamander, include crushing individuals with equipment, collisions with vehicles or purposefully killing an individual (timber rattlesnake in particular) or permanently removing their territories.

Indirectly, road management may benefit Diana fritillary as they tend to utilize roadsides in search on nectar bearing plants. Indirectly, roads create barriers to salamander movement and dispersal (DeMaynadier and Hunter 1995), and prevent genetic exchange between fragmented populations. Green salamanders do occur within the project area but not within any proposed units. Road management activities may have both adverse and beneficial affects to area rattlesnakes. Reconstruction activities may directly affect individuals if they are present during heavy equipment use. Effects may be due to equipment or equipment operators directly killing a snake if they see it. On the other hand, roads act as travel lanes for small mammals, providing

snakes with additional hunting areas. Snakes may also use roads to sun themselves during the day.

Road construction/reconstruction requires some timber removal; however this activity would have no direct effect on eastern small-footed bats. These bats roost in rock crevices and caves during daylight hours when road construction and road use take place. Indirectly, roads within the project areas provide travel corridors and the increased edge provides foraging areas for bats. Bats would also take advantage of standing water found in road ruts. Overall the effects of the Action Alternatives on mature habitats and populations due to timber harvest would be extremely negligible and short-term. Mature community viability would be maintained and no adverse effects on sensitive species would be expected. The action alternatives may impact individuals but are not likely to cause a trend toward federal listing or a loss of viability for the sensitive species inhabiting mature habitat.

Disturbed Habitat Species

Disturbed habitats within the project area include young timber stands, landings and roadsides that provide either exposed soils, grass/forbs or seedling/sapling seral stages that allow more light to reach the under-story than does a forested stand. Disturbed areas in the Lower Williams project area provide potential habitat for the following sensitive species:

Species	Limiting factor
Coumbine duskywing	Disturbance to individuals or lack of suitable habitat
Cobweb skipper	Disturbance to individuals or lack of suitable habitat
Barren's Tiger beetle	Disturbance to individuals or lack of suitable habitat

Barren's Tiger Beetle: This species has a two-year life cycle, over-wintering the first year as a mature larva and the second year as an adult. Adults emerge in September and can be encountered for a short time in the fall before hibernation. The following spring they are usually more abundant when they emerge to feed and reproduce. Adults die during early summer, following reproduction. Adults occur on dry sandy soils with sparse vegetation, such as mosses, lichens and low forbs where sandstone strata create natural forest openings. They can also be found in open areas of sparse vegetation in a variety of woodland habitats consisting of trails, along woodland roads, gas well sites, power and gas line rights-of-way, road banks, and at the edges of abandoned sandstone quarries. This species ranges across the northern portions of the central and eastern US southward into Georgia (Allen and Acciavatti 2002). Woodland habitat, roads, road banks and openings can be found within Lower Williams project area.

Direct/Indirect/Cumulative Effects

Direct effects due to timber harvest activity and road management activities on these insect species include direct crushing of individuals, collisions with vehicles, or permanent removal of territories while management activities are taking place. Indirectly, timber harvesting would remove canopy, creating more suitable "disturbed" or open areas. This habitat is temporary, usually lasting about 10 years until the canopy is closed and forest litter or vegetation covers exposed soils. Regeneration harvests would create more and longer lasting disturbed habitat than thinning harvests.

Road construction disturbs ground and opens up the forest canopy creating a permanent edge affect along the road perimeter. This will indirectly benefit species associated with disturbed habitats.

None of the action alternatives will result in loss of viability for any species associated with disturbed habitat types.

Rocky Habitat Species
There are several stands with rock outcrops and ledges. A field review of several of these stands found that these rock ledges follow contours through the project area, creating a severe slope break. The rock material has many holes and crevices that provide potential habitat for the following species:

Allegheny woodrat	Disturbance to habitat
Timber rattlesnake	Disturbance to habitat and individuals
Green salamander	Disturbance to habitat

Allegheny woodrat: Allegheny woodrats live almost exclusively in rocky areas such as caves, deep crevices, and large boulder fields. Most woodrat dwellings are located in or around hardwood forests that have an abundance of oaks and other mast-bearing trees. The woodrat is also known to occur in northern hardwood (beech, birch, maple) and oak-pine forests. Woodrats are seldom found in agricultural or residential areas. Woodrats are herbivores: they rely almost exclusively on plant materials for their food. Among their favorite foods are acorns and other nuts, berries, twigs, leaves and fungi. Occasionally they may feed on snails, insects or other invertebrates. In Autumn woodrats habitually cache (store) large quantities of acorns, twigs, leaves, and other edible vegetation to ensure a constant food supply throughout the winter months

Scientists have identified several factors that may be contributing to the decline of the Allegheny woodrat. Some cite the gypsy moth, which has been spreading south into the oak forests where woodrats. Defoliation by gypsy moth larvae can severely weaken oak trees, reducing the acorn crops on which woodrats rely for food in the winter. A second threat to the woodrat is a parasite, the raccoon roundworm (Baylisascaris procyonis), that is carried by raccoons. The raccoon roundworm, which does not severely harm raccoons, causes death in woodrats by attacking their central nervous systems. With their tendency to collect debris, including the scats of other animals, woodrats are especially susceptible to contracting this disease from raccoon feces. Habitat degradation and fragmentation may also be playing a role in the woodrat's decline throughout much of its range. Because of their tendency to inhabit remote places, woodrats generally have not been severely impacted by human activities. Allegheny woodrats are found within the Lower Williams Watershed. Allegheny woodrat signs (potential droppings and tracks) were observed in rock outcroppings above during field surveys of the project area. All known locations within the project area were avoided during project development by buffering from proposed regeneration units.

Direct/Indirect/Cumulative Effects
Timber harvesting could cause direct disturbance as the removal of trees on or near outcrops increases sunlight and winds, changing the microclimate of the rocky areas. This would cause an

increase in ground vegetation and a general drying effect. Direct effects due to timber harvest activity and road management activities on Allegheny woodrat, timber rattlesnake and green salamander include direct crushing of individuals, collisions with vehicles, or permanent removal of territories while management activities are taking place.

Indirectly some species associated with rock habitats are found in other areas in the forested landscape and are sensitive to changes in micro site conditions such as opening of the canopy, increasing allowable light and change in species composition with changes in ability to compete. None of the Action Alternatives will result in loss of viability for any species associated with Rocky habitat types.

Consistency with the Forest Plan

All alternatives would be consistent with Forest-wide standards and guidelines for Monongahela National Forest Regional Forester's Sensitive Species (Forest Plan, II – 29-31).

Botany/Ecology

Introduction

This report discloses expected direct, indirect, and cumulative effects of the Lower Williams Vegetation Management project on terrestrial ecosystems and botanical resources. Each of the action alternatives under consideration would involve various types of timber harvest. These harvest activities would include clear cuts with reserve trees, shelterwood harvests, and thinning harvests. The amount of harvesting, methods of yarding the logs, and site preparation activities would vary by alternative. The silviculturist's report and Chapter 2 of the Environmental Impact Statement give detailed descriptions of the proposed action and alternatives.

This report is divided into three sections that cover three groups of terrestrial ecological and botanical resource issues: terrestrial ecosystems; threatened, endangered, and sensitive plants; and non-native invasive plants.

TERRESTRIAL ECOSYSTEMS

Scope of the Analysis

This section addresses effects to terrestrial ecosystems including natural disturbance regimes, forest development stage distribution, rare communities, old growth, and ecological reserves. Indicators used include the following:

- Amount and intensity of effects to old growth.
- Amount and intensity of effects to ecological reserves.
- Amount and intensity of effects to rare communities.

Spatial Boundary

For direct and indirect effects, the spatial boundary of the analysis is a slightly modified version of the project area boundary (Figure 1). The project area boundary is based on the watershed boundary for the lower Williams River, and excludes a proposed new road and log landing just outside the northwestern part of the watershed. Therefore, for this analysis, the boundary has been expanded to include the proposed road and landing. This expanded boundary includes all activities proposed in all alternatives; therefore, it is an appropriate boundary for analyzing direct

and indirect effects of the activities. The direct and indirect effects boundary includes 13,524 acres of National Forest land and 1,174 acres of private land.

For cumulative effects, the spatial boundary of the analysis includes the terrestrial ecosystem within which the effects of the project will occur: the low to mid-elevation mountain ridges that surround the lower Williams River. This boundary includes land between the Gauley River and Cranberry River, eastward to the beginning of the high elevation ecosystems east of Three Forks of Williams River. The large rivers and the transition to the high elevation spruce-northern hardwood ecosystem form natural boundaries that contain the mixed mesophytic hardwood ecosystem within which project effects will occur. Also, the most intensive action alternative would implement harvest activities on 1,911 acres, which constitutes eight percent of the National Forest land in the cumulative effects boundary and 6 percent of all land within the cumulative effects boundary. Therefore, it is likely that a larger cumulative effects boundary would dilute the effects of the project to the point that any contribution to cumulative effects would not be measurable. The cumulative effects boundary includes 23,620 acres of National Forest land and 9,023 acres of private land.

Temporal Boundary

The temporal boundary for direct and indirect effects is the period of time for which forest age classes would be affected by the harvest activities. In the mixed mesophytic forests that characterize the project area, the even-aged stand structure created by regeneration harvesting begins breaking down at around 120 years after stand initiation, and the regenerated stands become difficult to distinguish from stands that have not been harvested. Therefore, 120 years is the temporal boundary used for this analysis. This temporal boundary is also used for the cumulative effects analysis because the contribution to cumulative effects ends when the direct and indirect effects no longer exist.

Affected Environment

Ecological Setting

The Lower Williams project area and surrounding lands (including all land in the cumulative effects boundary) lie within ecological section M22B (Allegheny Mountains), subsection M221Bc (Southern High Allegheny Mountains), and Land Type Association (LTA) Bc01 (Allegheny Plateau). The Southern High Allegheny Mountains subsection consists of a deeply dissected high plateau that is characterized by sandstone and shale geology, generally fine-textured soils, a cool, moist climate, and mesophytic vegetation associations (USDA Forest Service 2002). Section and subsection classifications are taken from the U.S. Forest Service publication *Ecological Units of the Eastern United States* (Keys et al. 1995). LTA classification follows the Monongahela's draft ecological classification (USDA Forest Service 2002), which is a sub-section level refinement of the larger Forest Service classification.

According to the MNF's ecological classification, the potential natural vegetation of about 75 percent of the land in the cumulative effects boundary is mixed mesophytic hardwoods, with the remainder consisting of spruce, hemlock and oaks. Mixed mesophytic hardwoods are dominated by a variety of hardwood tree species, but typically lack the strong yellow birch component that characterizes northern hardwoods and the strong dry-site oak component that characterizes oak forests. Stand data for the project area and vicinity show that the existing vegetation tracks the

potential natural vegetation closely, with mixed mesophytic hardwoods occupying about 71 percent of the National Forest land in the cumulative effects boundary. The cumulative effects boundary for this project includes low to middle elevations of the ecological subsection, typically between 2,200 and 3,600 feet. The generally low elevations account for the small amount of spruce forest, and the moist climate favors mixed mesophytic forests over oaks.

Historically, this mixed mesophytic ecosystem likely was subject to primarily small-scale natural disturbances, such as the felling of individual trees or small groups of trees through wind throw, ice damage, and insect and disease damage. Fire and other large disturbances likely were an infrequent part of the natural disturbance regime of this ecosystem. Fire regime modeling conducted by the MNF suggests that the average presettlement return interval for fire in this area would have been greater than 200 years (Thomas-VanGundy 2005). Return intervals for stand-replacing disturbances in similar landscapes in the northeast have been estimated at 500 to over 1,300 years (Lorimer and White 2003). Such long return intervals would have resulted in old stands occupying approximately 80 to 90 percent of the landscape and young stands (<40 years old) occupying 3 to 8 percent of the landscape, on average (USDA Forest Service 2006a). However, at smaller scales, openings and young forests could have occupied a substantial part of the landscape for several decades following rare catastrophic disturbances.

Currently, the forest development stage distribution in the Lower Williams vicinity is dominated by even-aged stands that originated during landscape-scale logging that occurred 80 to 120 years ago, before the land was part of the MNF. Sixty-four percent of National Forest land in the cumulative effects boundary is occupied by mature, even-aged stands (80-119 years old), and 27 percent is occupied by mid-developmental even-aged stands (40-79 years old). Young stands (<40 years old) comprise 3 percent of the landscape, and old stands (>120 years old) occupy only 1 percent. The forest development stage breakdown on National Forest land within the direct and indirect effects boundary is similar. The development stage breakdown on private land in the Lower Williams vicinity is not known due to lack of available stand information. It is not believed to be greatly different from conditions on National Forest land because all land in the area, regardless of current ownership, was cut over during the landscape-scale logging that occurred around the turn of the 20th Century. However, much of the private land in the cumulative effects boundary is owned by forest products companies that typically manage their lands more intensively than the MNF manages National Forest lands. Therefore, there may be greater representation of the younger age classes on private land.

Old Growth

Given the development stage distributions outlined above, it is obvious that there is essentially no existing old growth in the Lower Williams vicinity. No true virgin stands are known to exist, and it is likely that the one percent of stands in the "old" category either were cut very early in the landscape-scale logging period, or were aged based on old cull trees.

Ecological Reserves

Conservation planners use the term "minimum dynamic area" (MDA) to describe the minimum size necessary for an ecological reserve to absorb natural disturbances and still maintain representative natural amounts of ecological communities and development stages over the long term (Haney et al. 2000). The MNF relies on the MDA reserve concept as a strategy for

providing future old growth and preserving native biodiversity under natural regimes of disturbance and re-growth (USDA Forest Service 2006a). This is achieved through Forest Plan allocations of land to a number of management prescriptions that emphasize passive management. Taken together, these management prescription allocations in many areas coalesce to form large blocks of land where vegetative composition and structure is shaped primarily by natural processes. On the MNF, blocks that are larger than 10,000 acres are considered large enough to perform MDA reserve functions.

One MDA reserve exists in the Lower Williams vicinity. This reserve is centered around the Cranberry Wilderness and the backcountry areas on Turkey Mountain, Tea Creek Mountain, and Gauley Mountain. It also includes adjacent land in Management Prescription 4.1 (spruce restoration), MP 5.1 (recommended wilderness), endangered species habitat (WV northern flying squirrel), and other stands that have been classified as tentatively unsuitable for timber production for other reasons. This reserve covers approximately 120,000 acres in parts of the Gauley and Marlinton-White Sulphur districts (see map packet in the Forest Plan EIS, USDA Forest Service 2006a). The cumulative effects boundary for the Lower Williams project contains 2,956 acres of this MDA reserve. The direct and indirect effects boundary contains 97 acres along the western edge of the reserve. Approximately 40 acres consists of a few stands that are disjunct from the main body of the reserve, but were included when the reserve was mapped at the programmatic level because they were classified as tentatively unsuitable and they lie within 300 meters of the main body of the reserve. The remaining acreage lies along the edge of the main body of the reserve.

Rare Communities

The programmatic analysis for the Forest Plan identified 11 rare ecological communities that provide important habitat components for terrestrial species that may have viability concerns:

Bogs, fens, seeps, and seasonal ponds
Open wetlands
Stream channels
Glades and barrens
Rock outcrops and cliffs
High elevation grassland
Shrub balds
Caves and mines
Woodlands, savannas, and grasslands
Remote habitat
Lakes and ponds

Stream channels and lakes/ponds, primarily aquatic habitats, are covered in the aquatics analysis and will not be covered further in this report. Also, caves/mines and remote habitat function primarily as habitats for certain threatened, endangered, and sensitive animals will not be covered in this report. These habitats are covered in the wildlife analysis. In this part of the Forest, high elevation grasslands and woodlands, savannas, and grasslands communities do not occur naturally. Occurrences on National Forest land generally are associated with wildlife habitat management efforts; therefore, these communities are covered in the wildlife analysis.

Based on programmatic (Forest-wide) mapping of rare communities and field experience, the glades/barrens and shrub balds communities are not known to occur in the Lower Williams vicinity. Therefore, these communities also will not be addressed further in this analysis.

Bogs, Fens, Seeps, and Seasonal Ponds

Bogs, fens, seeps, and seasonal ponds consist of non-riverine wetlands characterized by saturated or seasonally wet soil. On a Forest-wide basis, these wetland types provide habitat for a number of plants on the Regional Forester's Sensitive Species list (see Threatened, Endangered, and Sensitive Plants analysis later in this document).

Programmatic (Forest-wide) mapping based primarily on a combination of remote sensing data sources (USDA Forest Service 2006a) identified only 9 acres of this community within the Lower Williams cumulative effects boundary. These areas lie in the floodplain of the Williams and Gauley Rivers. Based on field experience in the area, there are numerous small seeps located along large and small streams and in moist coves. These features were missed by the remote sensing data that was used to construct the programmatic mapping. These small wetlands are scattered throughout the project area and cumulative effects area, but cannot be quantified based on existing data.

Open Wetlands

Open wetlands include marshes and shallow areas of open water. Programmatic mapping based primarily on a combination of remote sensing data sources (USDA Forest Service 2006a) identified 11 acres of this community within the Lower Williams cumulative effects boundary. Most of the features identified appear to be associated with strip mine disturbance or man-made ponds. Almost all of the acreage lies on private land.

Rock Outcrops and Cliffs

A partial site-level inventory of rock outcrops was conducted in the Lower Williams project area as part of the archaeology surveys that were conducted for this project. Although the inventory did record rock features outside of proposed unit boundaries, it focused on the units and adjacent areas. Therefore, it should not be considered a complete inventory of rock outcrops in the project area. The surveys identified 34 outcrop areas ranging in size from 0.5 acre to 10 acres. A total of 107 acres of outcrops was identified.

Desired Conditions

Old Growth

The Forest Plan does not contain specific Forest-wide or MP 3.0 desired conditions for old growth. However, the concept of providing for old growth is included in the desired conditions for forest development stage distribution, which include old stands in the desired range of age classes.

Forest-wide direction in the Forest Plan calls for a range of forest development stages from maintained openings to a network of late successional stands (USDA Forest Service 2006b, p. II-17). Where management prescriptions emphasize allowing forest succession to occur, the desired condition calls for increases in late successional species composition and canopy structure.

All of the National Forest land that could be directly affected by the Lower Williams project is contained within Management Prescription 3.0. The desired conditions for forest development stages in MP 3.0 call for a mosaic of hardwood stands of varying size, shape, height, and species (USDA Forest Service 2006b, pp. III-6 and III-7). Desired development stages range from young to old stands, but emphasize the mid-development and mature stages (40-79 years old and 80-120 years old).

Ecological Reserves

While the Forest Plan does not contain desired conditions that specifically mention MDA reserves, the concept is included in the Forest Integrated Desired Conditions (USDA Forest Service 2006b, p. II-6). Desired conditions that address the MDA reserve concept include:

- Integrity of ecosystems and watersheds that have a viable combination of all the diverse elements and processes needed to sustain systems and to perform desired functions
- Ecosystems that are dynamic in nature and resilient to disturbances
- Vegetation forms a diverse network of habitats and connective corridors for wildlife, and provides snags, coarse woody material, and soil organic matter

Rare Communities

Desired conditions for rare communities are addressed in Forest-wide direction. The Forest Integrated Desired Conditions (USDA Forest Service 2006b, p. II-6) includes an emphasis on maintaining rare plant communities. The Forest-wide desired conditions for vegetation call for protection of rare communities through the designation of botanical areas and through the protection of habitats for Regional Forester's Sensitive Species. MP 3.0 does not include additional desired conditions for rare communities.

Environmental Consequences

Direct and Indirect Effects – Old Growth

Because no old growth is currently known to exist within the Lower Williams direct and indirect effects boundary, none of the alternatives would affect existing old growth.

However, each of the alternatives could affect the potential for development of old growth in the future.

The No Action Alternative 1 does not include any regeneration harvesting. Therefore, the only effects on forest development stage distribution would be due to the continued natural aging of stands. Given the very long average return intervals for catastrophic natural disturbance in this ecosystem, it is unlikely that natural disturbances would reset stand development during the 120-year time span of this analysis. However, if such a disturbance did occur, substantial amounts of young forest could be created. In the absence of such a disturbance, the large proportion of stands that are now in the mature (80-119 years old) development stage would begin moving into the old (>120 years old) development stage. While a stand does not automatically become old growth when it reaches 120 years of age, over time these stands would begin acquiring old growth characteristics, such as an uneven-aged stand structure, scattered large-diameter trees, and increased amounts of snags and large woody debris. Forward projection of the existing age class distribution on National Forest land in the direct and indirect effects boundary shows that the proportion of stands in the old development stage would increase from the current 2 percent to 19 percent 30 years from now, 88 percent 50 years from now, and 97 percent in 90 years.

The action alternatives would reset forest development (through regeneration harvesting or savanna construction) on 925 acres (Alternative 6) to 1,092 acres (Alternative 2). Permanent openings would be created on 32 (Alternative 4) to 90 acres (Alternative 2), such that the total conversion of closed canopy forest to open canopy would range from 987 acres under Alternative 6 to 1,182 acres under Alternative 2. This constitutes 7.3 to 8.7 percent of National Forest land in the direct and indirect effects boundary. Therefore, under the action alternatives the proportion of stands reaching the old development stage in 90 years would be reduced from 97 percent to between 88 (Alternative 2) and 90 percent (Alternative 6). The effects of Alternatives 4 and 5 would be essentially the same as Alternative 6, whereas the effects of Alternative 3 would be intermediate to the effects of Alternatives 2 and 6 (Table 13).

Table 13. Summary of effects to potential old growth for the Lower Williams Vegetation Management Project.

	Alternatives – Estimated Acres					
	No Action	**Proposed Action**	**3**	**4**	**5**	**6**
Acres of regeneration harvesting plus openings	0	1,182	1,041	991	989	987
Percentage of project area reaching 120 year stand age 90 years from now	97	88	89	90	90	90

The action alternatives also would implement between 670 acres (Alternatives 3, 4, 5, and 6) and 750 acres (Alternative 2) of thinning harvest. Because thinning leaves most of the canopy in place, it would not reset the forest development stage, and therefore would not affect the timing of stands reaching the old stage. Instead, it would tend to mimic the type of low-intensity natural disturbance that characterizes this ecosystem. This could have the effect of enhancing the development of certain old growth characteristics, such as vertical layering of vegetation and large-diameter trees. However, because thinning tends to preferentially remove defective trees, it could hamper the development of other old growth characteristics like snags and large woody debris.

Cumulative Effects

Because none of the alternatives would have direct or indirect effects on existing old growth, they would not contribute to any cumulative effects on existing old growth.

All of the action alternatives could contribute to cumulative effects on the development of future old growth. However, assessing the contribution is difficult due to uncertainty over the types and amounts of actions that could occur within the cumulative effects boundary, especially on private land. In the absence of past harvesting, the current forest development stage distribution would be heavily dominated by old growth, so the proposed harvesting could be viewed as contributing to the cumulative effects of past harvesting by delaying the recovery of old growth. The areas to be regenerated or converted to openings comprise between 3.0 percent (Alternatives 4, 5, and 6) and 3.6 percent (Alternative 2) of the total land in the cumulative effects boundary. Therefore, the contribution to the cumulative delay in old growth recovery would be minimal.

It should be noted that if current land management direction and policies are followed, future actions are likely to prevent large scale re-development of old growth within the cumulative effects boundary. The large majority of the National Forest land in the cumulative effects boundary is in MP 3.0. For the forest types that predominate within the boundary, desired conditions for MP 3.0 call for only 5 to 10 percent of the landscape in old stands (>120 years). While these desired conditions may not be achieved due to budget and personnel constraints, it is reasonable to assume that future Forest Service

actions will tend to prevent large-scale redevelopment of old growth on National Forest land. Most of the private land in the cumulative effects boundary is owned by forest products companies, who presumably will continue to manage their land using even-aged silviculture. Therefore, large scale redevelopment of old growth on private land is not anticipated. The regeneration harvesting proposed under the action alternatives will make a small incremental contribution toward the overall trend of retarding the redevelopment of old growth. This overall cumulative trend, while it does not move the land back toward the natural forest development stage distribution, is in accord with desired conditions, goals, and objectives set for this area by the MNF and adjacent private landowners.

Direct and Indirect Effects – Ecological Reserves

The No Action Alternative 1 would not implement any new activities, therefore it would have no direct or indirect effects on ecological reserves.

All of the action alternatives would place an approximate two acres helicopter log landing in a 35-acre stand that is mapped as part of the Cranberry-Gauley Mountain MDA reserve. This stand is disjunct from the main body of the reserve, but was included with it when the reserve was mapped at the programmatic level because it is classified as tentatively unsuitable for timber production and it is located within 300 meters of the main body of the reserve. The estimated two acres impact to this small disjunct stand is not expected to cause a measurable effect on the ecological function of the 120,000 acres reserve.

Cumulative Effects

The No Action Alternative 1 would not have any direct or indirect impacts, nor would it contribute to any cumulative effects on ecological reserves.

No reasonably foreseeable actions that would affect the portion of the reserve within the cumulative effects boundary are known at this time. Also, the direct and indirect effects of the action alternatives are not expected to be measurable. Therefore, the action alternatives are not expected to contribute to any cumulative effects on ecological reserves.

Rare Communities

Direct and Indirect Effects – No Action (Alternative 1) – Rare Communities

The no action alternative (Alternative 1) would not implement any new activities, therefore it would not directly affect rare communities. The effects of natural vegetation development would continue as the forest communities in which the rare communities are embedded continue to age. As the majority of stands on the landscape begin reaching the old stage four to five decades from now, canopy gaps would become more common and could increase the amount of light reaching the rare communities. This could shift the plant species mix toward species that are less tolerant of deep shade.

Direct and Indirect Effects – Action Alternatives

Bogs, Fens, Seeps, Seasonal Ponds – Each of the action alternatives likely would affect seeps. Small seeps are common on the landscape, so it is likely that seeps are included in some of the harvest units in each action alternative. The magnitude of effects cannot be quantified because seeps have not been inventoried. However, two factors are likely to limit effects on seeps. First, seeps tend to be concentrated near streams, so it is likely that some seeps will be contained within the stream channel buffers that are required by Forest Plan direction. Second, seeps themselves are protected by Forest Plan direction (USDA Forest Service 2006b, guideline SW51, p. II-13). This guideline calls for maintaining 60 to 100 percent canopy cover over seeps, avoiding overland skidding through seeps, and limiting skid trails and roads to essential crossings that are designed to minimize disturbance. Therefore, the likely effects on seeps include reduction of the tree canopy cover to around 60 percent, and limited crossings of seeps by skid trails and new road construction.

Open Wetlands – The action alternatives likely would have no effects on open wetlands because none are known to exist in any of the proposed activity areas.

Rock Outcrops and Cliffs – Each of the action alternatives would include some rock outcrop areas in harvest units (Table 14). Alternative 2 would include the greatest number and acreage of rock outcrops in harvest units. Effects of harvest activities could include changing the plant species composition of the outcrops by increasing the amount of light reaching the outcrops. This effect would be most pronounced in regeneration and savanna units. Alternative 2 would include about twice as much inventoried rock outcrop acreage in regeneration and savanna units as the other alternatives. All action alternatives would contain the same amount of rock outcrop acreage in thinning units.

Alternatives 2, 3, 4, and 6 also could cause skidding impacts to outcrops. Alternative 2 would have the greatest potential for skidding impacts, with conventionally-yarded units containing 54 acres of inventoried rock outcrops. Alternative 4, which would yard many units by helicopter, would contain only 5 acres of inventoried outcrops in conventional units. Alternatives 3 and 6 would be intermediate in potential skidding impacts with 19 acres of inventoried outcrops in conventionally-yarded units. A mitigating factor that may limit skidding impacts is the excavation difficulties associated with outcrops. It is likely that loggers would choose to shift skid trail layouts to avoid large outcrops. None of the action alternatives include inventoried rock outcrops in new road construction areas.

Table 14. Direct Effects to Rock Outcrop Communities, by Alternative.

	Alternatives – Estimated Acres					
	No Action	Proposed Action	3	4	5	6

Number of outcrop areas affected	0	21	15	15	15	15
Acres of outcrops in regeneration units	0	41	19	19	19	19
Acres of outcrops in thinning units	0	13	13	13	13	13
Total acres of outcrops in all harvest units	0	54	32	32	32	32
Acres of outcrops in conventionally yarded units	0	54	19	5	0	19

Cumulative Effects – No Action (Alternative 1)
Continued natural development of vegetation under the no action alternative could contribute to the cumulative effects that aging forests have on rare communities (increased sunlight due to canopy gaps, increased large woody debris). However, these effects cannot be quantified due to lack of information on future activities that will govern the amount of old forest that develops on National Forest and private land within the cumulative effects boundary.

Cumulative Effects – Action Alternatives
The action alternatives could contribute to cumulative effects on seeps and outcrops. To the extent that other activities damage these communities, the effects of skid trails from the action alternatives will add to the cumulative damage. Because these features have not been fully inventoried in the cumulative effects boundary, and due to lack of information on future activities, the overall cumulative effects cannot be quantified.

Threatened, Endangered, and Sensitive Plants

Scope of the Analysis
This analysis addresses effects to plant species that are federally listed as threatened or endangered, and also those plant species that are listed as Regional Forester's Sensitive Species (RFSS) on the Monongahela National Forest. Threatened, endangered, and sensitive species are collectively referred to as TES species.

Spatial Boundary
The spatial boundary for direct and indirect effects on TES species is the same as the direct and indirect effects boundary used for the terrestrial ecosystems analysis (see Figure 1 above). This boundary contains all proposed project activities and is the boundary within which all direct and indirect effects will occur. The spatial boundary for cumulative effects on TES species is the Proclamation and Purchase Unit boundary for the Monongahela National Forest. This is the boundary to which the National Forest Management Act viability requirement applies.

Temporal Boundary

The temporal boundary for direct and indirect effects on TES species is 120 years from the beginning of project implementation. This is the time frame within which effects to forested habitat will persist. While effects to each individual species may not persist that long, successional changes set in motion by regeneration harvesting will continue for at least that long, potentially affecting some species that occur in forested habitats. This temporal boundary is also used for the cumulative effects analysis because the contribution to cumulative effects ends when the direct and indirect effects no longer exist.

Affected Environment

Four federally-listed threatened and endangered plant species are known to occur on the Monongahela National Forest: running buffalo clover (*Trifolium stoloniferum*), shale barren rockcress (*Arabis serotina*), Virginia spirea (*Spiraea virginiana*), and small whorled pogonia (*Isotria medeoloides*). Fifty-four plant species are listed as Regional Forester's Sensitive Species on the Monongahela National Forest. The likelihood of occurrence for each TES species is assessed in the Likelihood of Occurrence document, which is filed in the project record. Likelihood of occurrence is based on field surveys of the proposed activity areas, historic records, and the presence of potential habitat in the project area.

Threatened and Endangered Plants

Based on field surveys of proposed activity areas and existing records, one of the four threatened and endangered species is known to occur within the direct and indirect effects boundary for the Lower Williams project. Potential habitat may occur for two other species.

Virginia Spirea

Virginia spirea is a clonal shrub found on damp, rocky banks of large, high-gradient streams (USFWS 1992a). Within the Lower Williams direct and indirect effects boundary, potential habitat for Virginia spirea is limited to the channels and banks of large streams such as the Williams River. Potential habitat does not occur within any of the proposed harvest units, road construction areas, landings, skid trails, etc. in any of the alternatives.

Running Buffalo Clover

Potential habitat for running buffalo clover typically exists in lightly disturbed forests and woodlands on soils derived from circumneutral geologic features (NatureServe 2006a, USFWS 2007). The Monongahela National Forest is a stronghold for running buffalo clover, with the largest and highest quality populations range-wide occurring on the Forest (USFWS 2007). Most of the Forest's populations are associated with old skid trails, lightly used roads, or other features that cause moderate soil disturbance.

Botanical field surveys covered all proposed harvest units, skid trails, landings, and new roads. Existing roads that will be used as haul roads were not covered completely,

although they received some survey effort through travel along the roads and in conjunction with surveys of proposed harvest units adjacent to roads.

Although potential habitat for running buffalo clover would appear to be limited in the Lower Williams area due to a lack of favorable geology, field surveys discovered an occurrence of running buffalo clover in the northeastern part of the project area, along a Forest Service system road. Follow-up surveys confirmed that running buffalo clover occurs scattered along the entire length of the road. Follow-up surveys were also conducted on two nearby roads in a similar topographic and geologic setting, but no running buffalo clover was found on these roads.

The Lower Williams running buffalo clover population appears to be large and healthy. It is estimated to contain over 2,000 rooted crowns (USDA Forest Service unpublished data). By comparison to population information in the recovery plan (USFWS 2007), the Lower Williams population appears to be the third largest population in West Virginia and the fourth largest population in the entire range of the species. A substantial amount of flowering and fruiting was observed during the summer of 2007. The clover occupies the lightly-disturbed shoulders and drainage ditch along the roadside. Most plants are concentrated within a few feet of the travel surface, but plants do not occur on the travel surface itself. No running buffalo clover was found in the forest adjacent to the road.

Small Whorled Pogonia
Habitat preferences for small whorled pogonia are poorly known, but could include a variety of forested habitats. The available literature indicates occurrence in mixed deciduous and pine-hardwood habitats of a variety of ages, often near partial canopy openings (USFWS 1992b). Likelihood of occurrence for small whorled pogonia is considered low because it is not known to occur near the Lower Williams vicinity, and site-specific surveys have not located it. However, potential occurrence cannot be completely ruled out based on habitat preferences and due to the difficulty of locating this species using conventional survey techniques.

Shale barren Rockcress
Shale barren rockcress is not likely to occur in or near the Lower Williams vicinity due to lack of shale barren habitat. Shale barrens are limited to the drier areas on the eastern side of the Forest.

Regional Forester's Sensitive Plants

Based on field surveys and existing records, two of the 54 RFSS plants are known to occur within the direct and indirect effects boundary: long-stalked holly (*Ilex collina*) and nodding pogonia (*Triphora trianthophora*). Long stalked-holly is known from five locations in or immediately adjacent to the direct and indirect effects boundary. Nodding pogonia is known from two locations within the direct and indirect effects boundary.

Based on the Likelihood of Occurrence assessment, potential habitat could occur for 26 additional RFSS plants. However, given the lack of known occurrences despite site

surveys, it is unlikely that the activity areas support substantial populations that are crucial for the continued viability of the species on the MNF.

The total for potential and known RFSS plants in the Lower Williams direct and indirect effects boundary is 28 species. To facilitate analysis, RFSS plants have been grouped according to their primary habitat (Tables 15-17). The three habitat groupings are wetland/riparian habitat, mesic/cove forest, and rocky habitat.

Table 15. Wetland and riparian habitat RFSS plants that could occur in the Lower Williams vicinity.

Scientific Name	Common Name	Habitat Comments
Baptisia australis var. *australis*	Blue wild indigo	Primarily early successional wetlands
Botrychium oneidense	Blunt-lobed grapefern	Wooded wetlands
Euphorbia purpurea	Darlington's spurge	Open or closed canopy
Hasteola suaveolens	Sweet-scented Indian plantain	Riverbanks and disturbed wetlands
Hypericum mitchellianum	Blue Ridge St. John's wort	Riverbanks and disturbed wetlands
Ilex collina	Long-stalked holly	Open or closed canopy
Marshallia grandiflora	Large-flowered Barbara's buttons	Flood-scoured stream banks in full sun
Pedicularis lanceolata	Swamp lousewort	May prefer circumneutral soil
Poa paludigena	Bog bluegrass	Sun to partial shade
Potamogeton tennesseensis	Tennessee pondweed	Standing or slow-flowing water
Taxus canadensis	Canada yew	Also occurs in spruce forests. In the Lower Williams vicinity, likely to be limited to wetlands and riparian zones.
Vitis rupestris	Sand grape	River banks and washes
Woodwardia areolata	Netted chain fern	Swamps and wet woods

Table 16. Mesic forest and cove habitat RFSS plants that could occur in the Lower

Williams vicinity.		
Scientific Name	**Common Name**	**Habitat Comments**
Botrychium lanceolatum var. *angustisegmentum*	Lance-leaf grapefern	Moist, shady woods and swamp margins
Corallorhiza bentleyi	Bentley's coral root	Habitat preferences poorly understood
Cypripedium parviflorum var. *parviflorum*	Small yellow lady's slipper	Moist to wet sites
Cypripedium reginae	Showy lady's slipper	Swamps and woods
Juglans cinerea	Butternut	Most likely in rich alluvial soil, but could occur elsewhere
Triphora trianthophora	Nodding pogonia	Deep leaf litter or humus
Viola appalachiensis	Appalachian blue violet	Often in riparian areas, but can occur in other mesic situations

Table 17. Rocky habitat RFSS plants that could occur in the Lower Williams vicinity.

Scientific Name	Common Name	Habitat Comments
Cornus rugosa	Roundleaf dogwood	Rocky areas within forests
Gymnocarpium appalachianum	Appalachian oak fern	Rocky woods
Heuchera alba	White alumroot	Most likely in dry microsites
Juncus trifidus	Highland rush	Rock crevices
Pycnanthemum beadlei	Beadle's mountainmint	Open canopy over rocks
Scutellaria saxatilis	Rock skullcap	Rocky areas within forests
Syntrichia ammonsiana	Ammon's tortula	Wet, cool microsites
Trichomanes boschianum	Appalachian bristle fern	Dripping rocks

Of these 28 RFSS plants, one species is unlikely to occur within any of the areas proposed for harvest, road construction, landings, etc. Potential habitat for large-flowered Barbara's buttons (*Marshallia grandiflora*) is limited to the flood-scoured banks of large streams and rivers, which are not included in any of the proposed activity sites.

Desired Conditions

The Forest Plan addresses TES species at several places in the Forest-wide direction.

The Forest Integrated Desired Conditions (USDA Forest Service 2006b, p. II-6) call for maintaining habitats that support populations of TES species. Desired conditions for vegetation (p. II-17) emphasize protection and enhancement of rare plants and their habitats. Desired conditions for threatened and endangered species (p. II-22) call for managing habitats to maintain or enhance populations consistent with recovery plans, and for keeping adverse effects at levels that do not threaten population persistence.

Threatened and Endangered Plants Environmental Consequences

Direct and Indirect Effects

Virginia Spirea – Proposed activity areas for all alternatives avoid potential habitat for Virginia spirea. Therefore, no alternative has any potential to affect Virginia spiraea.

Running Buffalo Clover – The known occurrence of running buffalo clover would be protected from ground-disturbing activities under each of the action alternatives. Therefore, the potential for adverse effects under the action alternatives is discountable.

Alternative 1 (No Action) would not involve any new ground or vegetation disturbing activities, therefore Alternative 1 would have no effect on running buffalo clover.

Small Whorled Pogonia – The potential for affecting small whorled pogonia is very low because of its low likelihood of occurrence. Also, harvest activities under all action alternatives would affect a small proportion of land in the direct and indirect effects boundary, ranging from 7 percent under Alternative 5 to 8.6 percent under Alternative 2. Due to the low likelihood of occurrence and the limited extent of site-disturbing activities, the potential for adverse effects is discountable.

Alternative 1 (No Action) would not involve any new ground or vegetation disturbing activities, therefore Alternative 1 would have no effect on small whorled pogonia.

Shale Barren Rockcress – Because shale barren rockcress has no potential to occur in the Lower Williams vicinity, no alternative would affect this species.

Cumulative Effects

Because the potential for direct effects is either discountable or nonexistent for all four species under all alternatives, no alternative would contribute to cumulative effects on threatened and endangered plants.

Virginia Spirea – Proposed activity areas for all alternatives avoid potential habitat for Virginia spirea. Therefore, no alternative has any potential to affect Virginia spirea.

Running Buffalo Clover – Alternatives 2, 3, 4, and 5 would haul timber on the road that supports the running buffalo clover population. Activities on the road would include blading, adding gravel, and heavy traffic by log trucks. It is likely that these activities would extend beyond the current travel surface, which is not wide enough to accommodate log trucks. Therefore, maintenance and hauling activities would be expected to destroy most or all of the running buffalo clover population. In addition,

each of these four alternatives would clear cut timber in a stand that surrounds the largest part of the population. This timber harvest would change the light regime from the current mostly shady situation to full sunlight, rendering the habitat unsuitable for running buffalo clover. Therefore, Alternatives 2, 3, 4, and 5 likely would cause the extirpation of the Lower Williams running buffalo clover population.

The known occurrence of running buffalo clover would be protected from ground-disturbing activities under Alternative 6. The road that provides habitat would not be used for hauling and would not receive any maintenance, hardening, reconstruction, etc. in association with this project. No harvesting would occur near the population, so the light regime would not be changed. The areas of occupied running buffalo clover habitat impacted by action alternatives 2, 3, 4, and 5 are the same at 3.9 acres. There would be zero acres of occupied running buffalo clover habitat impacted by Alternatives 1 (No Action) and 6.

If undiscovered occurrences of running buffalo clover exist in any of the activity areas under any of the action alternatives, effects could occur. If running buffalo clover exists along roads to be used as haul roads, maintenance, hardening, and hauling could harm or destroy these occurrences. Likewise, if undiscovered occurrences exist within proposed harvest units or landing sites, they could be harmed or destroyed by skidding and landing construction. The open canopy created in clear cut units likely would lead to running buffalo clover being out-competed by sun-loving herbs, shrubs, and saplings. Beneficial effects could occur in thinning or shelterwood units due to partial opening of the canopy. In conventionally-yarded thinning and shelterwood units, the soil disturbance due to skidding would be an additional benefit by providing suitable substrate for running buffalo clover to colonize. Road construction proposed under each of the action alternatives could create additional habitat for running buffalo clover, provided post-project use and maintenance of the road maintains the proper conditions of slight disturbance.

The possible effects outlined in the preceding paragraph are considered extremely unlikely due to the low probability that undiscovered occurrences of running buffalo clover exist. All proposed harvest units, skid trails, landings, and road construction corridors in the preferred alternative were surveyed by a competent botanist, and no running buffalo clover was found within these activity areas. Existing roads proposed for hauling near the known population also were surveyed with negative results. Other proposed haul routes in the project area received some coverage in representative sections near the harvest units, also with negative results.

Alternative 1 (No Action) would not involve any new ground or vegetation disturbing activities, therefore Alternative 1 would have no effect on running buffalo clover.

Small Whorled Pogonia – The potential for affecting small whorled pogonia is very low because of its low likelihood of occurrence. Also, harvest activities under all action alternatives would affect a small proportion of land in the direct and indirect effects boundary, ranging from 11 percent under Alternative 6 to 13 percent under Alternative 2.

Due to the low likelihood of occurrence and the limited extent of site-disturbing activities, the potential for adverse effects is discountable.

Alternative 1 (No Action) would not involve any new ground or vegetation disturbing activities, therefore Alternative 1 would have no effect on small whorled pogonia.

Shale Barren Rockcress – Because shale barren rockcress has no potential to occur in the Lower Williams vicinity, no alternative would affect this species.

Cumulative Effects

Because Alternatives 2, 3, 4, and 5 would impact an important population of running buffalo clover, these alternatives would have the potential to make a substantial contribution to cumulative negative effects on this species. No other ongoing or reasonably foreseeable future activities on National Forest land would affect running buffalo clover, but even without the combined effects of other projects, the direct and indirect effects from Alternatives 2, 3, 4, and 5 would have a substantial effect on the overall recovery potential of the species. Impacts due to activities on private land could add to the cumulative effect, although the information necessary to quantify effects on private land generally is lacking.

The potential for direct and indirect effects on running buffalo clover is nonexistent under Alternative 1 (No Action) and discountable under Alternative 6, so these alternatives would not contribute to the cumulative effects of other past, present, and reasonably foreseeable future actions.

For the other three threatened and endangered plant species (Virginia spirea, small whorled pogonia, and shale barren rockcress), the potential for direct effects is either discountable or nonexistent under all alternatives. Therefore, no alternative would contribute to cumulative effects on these three threatened and endangered plants.

Direct and Indirect Effects – Regional Forester's Sensitive Plants

Wetland/Riparian Plants – Forest Plan direction that protects stream channel corridors and wetlands would limit potential effects on RFSS plants that occur in wetland and riparian habitats. Forest Plan direction requires stream channel buffers that exclude most timber harvest, road building, skidding, and landings (Standards SW34, SW37, SW40, SW44, and SW55). Programmed timber harvest is not allowed in stream channel buffers, and roads, skid trails and landings are allowed only at essential crossings. Standard SW51 provides similar protection for seeps and other wetlands, with ground disturbance limited to essential crossings. The known locations of long-stalked holly would be protected by the stream channel buffers and project design criteria that include a 75-foot buffer around known RFSS plant locations.

Because of the allowance for essential crossings, action alternatives 2, 3, 4, and 6 would have some potential to impact wetland and riparian RFSS plants where skid trails and new roads cross streams and wetlands. The potential for impacts is considered low because only long-stalked holly is known to occur in the project area, and these known

locations would be protected. However, surveys may have missed RFSS, so the potential for impacts cannot be completely ruled out. Alternative 2 (Proposed Action) includes 5 perennial stream crossings by skid trails, Alternative 3 includes 1, and Alternatives 4 and 6 include none. Alternatives 2, 3, 4, and 6 undoubtedly also include skid trail crossings of seeps and intermittent streams; however, these features have not been inventoried, so the impacts cannot be quantified. Alternative 2 would have the greatest potential for impacts, followed by Alternatives 3, 6, and 4. Alternatives 2, 3 and 6 also probably include new road crossing impacts to seeps and intermittent streams, whereas Alternative 4 does not contain any new road construction. Alternative 5 would be unlikely to affect riparian and wetland plants because it does not include any skid trails or road construction. Table 18 summarizes potential effects on wetland and riparian RFSS plants.

Table 18. Effects to wetland and riparian RFSS plants as measured by perennial stream crossings and miles of skid trails and roads.

Indicator	Alternatives					
	No Action	**Proposed Action**	**3**	**4**	**5**	**6**
Perennial stream crossings – skid trails	0	5	1	0	0	0
Perennial stream crossings – new roads	0	0	0	0	0	0
Miles of skid trails	0	64.0	50.1	18.6	0	42
Miles of new roads	0	3.26	2.1	0	0	2

In contrast to the negative impacts of road and skid trail crossings, habitat adjacent to the crossings could be improved for species that prefer an open or partially open canopy (blue wild indigo, sweet-scented Indian plantain, Blue Ridge St. John's wort, and bog bluegrass). The extent to which the habitat improvement might offset the potential loss of individuals and habitat from the footprint of the crossing is not known.

Each of the action alternatives proposes to apply herbicide for site preparation in the 38-acre shelterwood harvest unit. Herbicide would not be applied in stream channel buffers, and thus would not impact wetland and riparian plants near streams. Herbicide could be applied in or adjacent to small seeps, potentially killing any wetland or riparian RFSS that might exist in these seeps. Known locations of RFSS plants would be buffered, so such effects would be limited to any occurrences that were missed by the botany surveys.

Herbicide application for non-native invasive plant control would occur under all of the action alternatives. Current NNIS populations are concentrated along roadsides, old skid trails, and old landings, which are unlikely to support RFSS plants. Therefore, herbicide

applications for NNIS would have little or no potential to affect wetland and riparian RFSS.

The potential effects listed above apply to all of the wetland/riparian RFSS plants except large-flowered Barbara's buttons. Because habitat for this plant does not occur in any of the areas proposed for activity under all of the alternatives, no alternative would have direct and indirect effects on this species.

Alternative 1 (No Action) would have no direct or indirect effects on wetland and riparian habitat RFSS plants. The detrimental and beneficial effects noted above for the action alternatives would not occur.

Mesic Forest/Cove Plants: Nodding Pogonia – Alternatives 2 and 3 would clear cut the proposed harvest unit that contains the largest known population of nodding pogonia on the Forest. Experimental data on effects of timber harvest are lacking, although anecdotal information suggests that canopy gaps such as those created by selective harvesting may not be harmful, and may even be beneficial. Clearcut logging, however, is generally viewed as detrimental due to the wholesale change in light regime and disturbance of the soil and leaf litter (Ramstetter undated). The ground-based skidding included in Alternatives 2 and 3 would be an additional impact. Therefore, the worst-case scenario is that Alternatives 2 and 3 would result in the loss of this nodding pogonia population.

Alternatives 4, 5, and 6 would not harvest the unit that contains the large nodding pogonia population. Therefore, these alternatives would not affect this population. If undiscovered occurrences exist elsewhere, effects could occur similar to those outlined below for other mesic forest/cove RFSS plants. Under action alternatives 4, 5, and 6, there would be no possible impacts to acres of occupied nodding pogonia habitat. However, there would be approximately 17.4 acres of occupied nodding pogonia habitat impacted under Alternatives 2 and 3. Table 8 summarizes effects to known occupied habitat by alternative.

Alternative 1 (no action) would not implement any activities, therefore it would have no direct or indirect effects on nodding pogonia.

Mesic Forest/Cove Plants: Other Species – All of the action alternatives include regeneration harvesting that has the potential for negative effects on all but one of the other mesic forest RFSS plants (lance-leaf grapefern, Bentley's coral root, small yellow lady's slipper, showy lady's slipper, Appalachian blue violet). These forest-dwelling species are not known to be adapted to the full sunlight environment that would be created by regeneration harvesting. Therefore, any individuals that may be present are likely to be outcompeted by sun-adapted vegetation. The remaining species, butternut, likely would benefit from regeneration harvesting because it is shade intolerant and cannot reproduce without a disturbance to remove the canopy. Any existing butternut trees would be protected from cutting during sale layout, and up to 20 native butternut trees per acre may be planted in regeneration units. The likelihood of effects occurring is

low, given that these species are not known to occur in the direct and indirect effects boundary. However, surveys could have missed individual plants, so the potential for effects cannot be ruled out entirely. Among the action alternatives, the potential for effects would be highest under Alternative 2 (Proposed Action) and lowest under Alternative 6 (see Table 2 in EIS Chapter 2 for a comparison of regeneration harvesting amounts by alternative).

Thinning harvests in all of the action alternatives would have uncertain effects on lance-leaf grapefern, Bentley's coral root, small yellow lady's slipper, showy lady's slipper, and nodding pogonia. These species occur in forested environments, but information is lacking on the effects of partial canopy openings. Thinning likely would benefit Appalachian blue violet because it prefers partial sunlight over deep shade. Likewise, thinning could benefit butternut by releasing established individuals from competition. Again, the probability of effects occurring is low due to lack of known occurrences of species other than nodding pogonia, but effects could occur if surveys missed individual plants. Among the action alternatives, Alternative 2 (Proposed Action) would have a greater potential for effects than the other alternatives (see Table 2 in EIS Chapter 2 for a comparison of thinning amounts by alternative).

Action Alternatives 2, 3, 4, and 6 would involve construction of skid trails and dragging of logs over the ground. If any unidentified occurrences of these plants exist along skid trail routes, skid trail construction would obliterate the occurrences. Dragging logs over the ground could damage occurrences. However, log-dragging and skid trail construction could benefit Appalachian blue violet by creating soil disturbance. Appalachian blue violet often is associated with small areas of soil disturbance (NatureServe 2006b). This beneficial effect would be most likely to occur in thinning units, which would also create the partial canopy openings preferred by this species. Among the action alternatives that include conventional yarding, potential effects associated with skidding and log dragging would be greatest under Alternative 2 and least under Alternative 4. Alternative 5 would not cause any skidding-related impacts because all yarding would be done via helicopter. However, Alternative 5 could still impact plants by dragging logs for short distances as they are picked up by the helicopter. See Table 6 above for a comparison of skid trail mileage by alternative.

Road construction under the action alternatives also has the potential to destroy occurrences of mesic forest RFSS, should any undiscovered occurrences exist. Impacts would be most likely under Alternative 2 (Proposed Action), which would involve 3 miles of new road construction. Impacts would be somewhat less likely under Alternatives 3 and 6, which would include up to 2 miles of new construction. Alternatives 4 and 5 would not include new road construction. Road reconstruction could also impact mesic forest RFSS in areas where road beds has revegetated. Appalachian blue violet would be the species most likely to be affected because it can occur on old road beds (NatureServe 2006b). The potential for effects would be highest under Alternatives 2, 3, and 6 (2 miles of reconstruction), low under Alternative 4 (0.5 miles of reconstruction), and zero under Alternative 5 (no reconstruction). Other road activities such as hardening and maintenance likely would not affect mesic forest RFSS plants

because these activities generally occur on roads that have not been revegetated to the point that they could be colonized by these species.

Foliar herbicide application for site preparation would likely extirpate any undiscovered mesic forest RFSS occurrences in the area where herbicides are applied. Site prep herbicide applications would be limited to the 38-acre shelterwood regeneration unit under all of the action alternatives, so the probability of any effects is low.

Herbicide application for non-native invasive species control would have the potential to extirpate any undiscovered occurrences of Appalachian blue violet and possibly butternut in the areas to be treated. Effects to the other mesic forest RFSS probably would not occur because these species typically do not grow on the roadsides, old skid trails, and landings that would be targeted for control efforts. Each action alternative would include up to 21 acres of non-native invasive species herbicide treatment.

Alternative 1 (No Action) would have no direct or indirect effects on mesic habitat RFSS plants. The detrimental and beneficial effects noted above for the action alternatives would not occur.

Rocky Habitat Plants – The effects of regeneration harvesting on rocky habitat RFSS plants are likely to vary by species. The probability of any effects occurring is low because none of these species has been found within the direct and indirect effects boundary; however, effects could occur if the surveys missed occurrences of these species. Beadle's mountainmint, which prefers an open canopy (NatureServe 2002), could benefit from the open canopy created by regeneration harvesting. Ammon's tortula and Appalachian bristle fern, on the other hand, prefer moist to wet microsites and likely would be harmed by increased sunlight that could cause such sites to dry out. The remaining species could also be harmed by opening the canopy, given that they all prefer forested habitats. However, information on effects of harvesting is not available, so it is not certain that occurrences would be eliminated by regeneration harvesting. Among the action alternatives, Alternative 2 (Proposed Action) would include about twice as much rocky habitat in regeneration units as the other three action alternatives (see Table 2 in the Terrestrial Ecosystems section above).

Thinning likely also would have positive effects on Beadle's mountainmint, should this species occur in the thinning units. Thinning could also harm Ammon's tortula and Appalachian bristle fern, though the potential for harm probably would not be as great as with regeneration harvesting. The potential effects of thinning on the other rocky habitat species are uncertain due to lack of information on the precise canopy closure preferences of these species. Effects would be the same across all of the action alternatives because each action alternative would include 13 acres of inventoried rocky habitat in thinning units.

Effects to rocky habitat RFSS plants due to construction of skid trails and roads would parallel the effects to the rock outcrops community, as detailed above in the Terrestrial Ecosystems section.

Herbicide application for site preparation and non-native invasive plant control could extirpate occurrences of rocky habitat RFSS plants if any exist in the application areas. However, in all of the action alternatives, site prep herbicide applications would be limited to the single shelterwood unit. This unit does not contain any inventoried rock outcrops. Likewise, inventoried rock outcrops do not occur in areas proposed for herbicide treatment to control non-native invasive plants. Therefore, the potential for effects on rocky habitat RFSS from herbicide applications is low.

Alternative 1 (No Action) would have no direct or indirect effects on rocky habitat RFSS plants. The detrimental and beneficial effects noted above for the action alternatives would not occur.

Cumulative Effects

The major potential negative effect of the Lower Williams project on all RFSS plants is the potential for extirpation of occurrences, if any were missed by the surveys. This effect would add to the effects of past activities that may have caused extirpation of occurrences. Examples of such past activities include widespread timber harvest, soil erosion, and fires between the years 1880 and 1930, Forest service timber sales and road building in more recent years (see Table 4 in EIS Chapter 3), historic strip mining on private land and what is now National Forest land, recent timber harvests and road building on private land, and small amounts of residential and agricultural development. Specific information on the effects of these past activities on RFSS plants is not available.

Any effects of the Lower Williams project also would be additive to the effects of ongoing and future activities within the Monongahela National Forest boundary. On National Forest land, ongoing and proposed future activities include outfitter guide permits, special use permits, several road and utility right-of-way proposals, construction and renovation of recreation facilities, wildlife habitat developments, grazing allotment management, watershed improvement, liming to improve soil productivity in the Lower Williams watershed, and several major timber sales. Harvest activities and related road construction are ongoing or will begin in the next year on the Upper Williams (Marlinton-White Sulphur District), Desert Branch (Gauley District), Cherry River (Gauley), Lower Clover (Cheat-Potomac District), and Little Beech Mountain (Greenbrier District) timber projects. Timber projects are proposed in future years in the Hogback (Cheat-Potomac District) and Ramshorn (Greenbrier District) project areas.

At the current stage of implementation and analysis, the only known effects to RFSS plants from any of these ongoing and proposed projects would involve Appalachian blue violet and rock skullcap. The Upper Williams timber project, Upper Williams wildlife habitat improvement project, the Upper Williams watershed improvement project, the Hogback timber project, and the Nine gas pipeline project may impact Appalachian blue violet. These activities may impact individuals, but because Appalachian blue violet is a disturbance-adapted species, the occurrences are not expected to be extirpated. Because

the Lower Williams project has a low probability of affecting Appalachian blue violet, a measurable contribution to cumulative effects on this species is not expected.

The Ramshorn project would impact an as yet undetermined number of occurrences of rock skullcap. Project alternatives, design criteria, and mitigation are still being developed, so it is not currently known how many, if any, of the occurrences would be extirpated by this project. However, as with Appalachian blue violet, the Lower Williams project has a low probability of affecting rock skullcap, so a measurable contribution to cumulative effects is not expected.

In the other project areas, RFSS plants either are not known to occur or will be avoided by project activities. Thus, as is the case with most RFSS plants in the Lower Williams project area, impacts from these projects would only occur if plants were missed by the pre-project surveys. Activities on other land ownerships within the Forest boundary undoubtedly have the potential to extirpate RFSS occurrences; however, information on the effects of such activities is difficult to obtain because other land owners do not have to consider effects to RFSS.

The only substantial contribution of the Lower Williams project to cumulative effects on RFSS plants would involve nodding pogonia. As noted above in the direct and indirect effects section, Alternatives 2 and 3 could extirpate the largest known population on the Forest. Although no other ongoing or future projects on the Forest are likely to affect this species, and information is not available on impacts of private activities, the effects of Alternatives 2 and 3 by themselves are enough to cause a substantial impact to viability of this species on the Forest. Only four other small populations are known to exist on the Forest. All but one of these populations is in the Gauley District, so the species is not well-distributed on the Forest. Loss of this large population would leave only four small occurrences that are not well-distributed in the Forest, which could push the species toward loss of viability. Alternatives 4, 5, and 6 would avoid impacts to known populations, so they likely would not make a substantial contribution to any cumulative effects.

Alternative 1 (no action) would have no direct or indirect effects, therefore it would not contribute to any cumulative effects on RFSS plants.

Effect Determinations for RFSS Plants

Action Alternatives – Large-flowered Barbara's buttons could occur in the project vicinity, but is not likely to occur within project activity areas due to lack of habitat. Therefore, Alternatives 2, 3, 4, 5, and 6 will have no impacts on large-flowered Barbara's buttons.

Based on the above effects analysis, the following RFSS plants have the potential to occur in the Lower Williams vicinity and could be affected by project activities. However, occurrences within project activity areas are not known for most species, and the known occurrences of long-stalked holly will be avoided. Therefore, the potential for

impacts is considered low. For these species, Alternatives 2, 3, 4, 5, and 6 may impact individuals, but are not likely to lead to loss of viability or a trend toward federal listing:

Table 19. RFSS in LWPA, with Potential to be Affected by the Proposed Activities

Scientific Name	Common Name
Baptisia australis var. *australis*	Blue wild indigo
Botrychium oneidense	Blunt-lobed grapefern
Euphorbia purpurea	Darlington's spurge
Hasteola suaveolens	Sweet-scented Indian plantain
Hypericum mitchellianum	Blue Ridge St. John's wort
Ilex collina	Long-stalked holly
Pedicularis lanceolata	Swamp lousewort
Poa paludigena	Bog bluegrass
Potamogeton tennesseensis	Tennessee pondweed
Taxus canadensis	Canada yew
Vitis rupestris	Sand grape
Woodwardia areolata	Netted chain fern
Botrychium lanceolatum var. *angustisegmentum*	Lance-leaf grapefern
Corallorhiza bentleyi	Bentley's coral root
Cypripedium parviflorum var. *parviflorum*	Small yellow lady's slipper
Cypripedium reginae	Showy lady's slipper
Juglans cinerea	Butternut
Viola appalachiensis	Appalachian blue violet
Cornus rugosa	Roundleaf dogwood
Gymnocarpium appalachianum	Appalachian oak fern
Heuchera alba	White alumroot
Juncus trifidus	Highland rush
Pycnanthemum beadlei	Beadle's mountainmint
Scutellaria saxatilis	Rock skullcap
Syntrichia ammonsiana	Ammon's tortula
Trichomanes boschianum	Appalachian bristle fern

Alternatives 2 and 3 could extirpate the largest known population of nodding pogonia on the Forest. **Therefore, Alternatives 2 and 3 are likely to lead to loss of viability of nodding pogonia.** Alternatives 4, 5, and 6 would avoid known populations of nodding pogonia. **Therefore, Alternatives 4, 5, and 6 may impact individuals, but are not likely to lead to loss of viability or a trend toward federal listing for nodding pogonia.**

All other RFSS plants are unlikely to occur in the Lower Williams vicinity (see Likelihood of Occurrence document in the project record). **Therefore, Alternatives 2, 3, 4, 5, and 6 will have no impacts on all RFSS plants not addressed above.**

Alternative 1 (No Action) – Alternative 1 would not implement any ground- or vegetation-disturbing activities. **Therefore, Alternative 1 will have no impacts on any RFSS plants.**

NON-NATIVE INVASIVE PLANTS

Scope of the Analysis

This section covers potential effects of the Lower Williams project on the establishment, spread, and control of non-native invasive plants. Indicators used include the following:

- Length of skid trails
- Length of new road construction
- Total length of road reconstruction, maintenance, and hardening
- Number and acreage of landings

Spatial Boundary

The spatial boundary for direct and indirect effects is the same boundary used for the Terrestrial Ecosystems analysis. This boundary includes all activities proposed in all alternatives; therefore, it is an appropriate boundary for analyzing direct and indirect effects of the activities.

For cumulative effects, the spatial boundary of the analysis is also the same boundary used for the Terrestrial Ecosystems analysis. This boundary includes the terrestrial ecosystem within which the effects of the project will occur: the low to mid-elevation mountain ridges that surround the lower Williams River.

Temporal Boundary

The temporal boundary for analyzing non-native invasive plant effects is 30 years. This time period should allow more than enough time for completion of the control activities that are needed to mitigate potential spread of invasive plant species due to project activities. It should also encompass the time period needed for redevelopment of a forest canopy over disturbed sites such as skid trails. Redevelopment of the forest canopy

should greatly reduce any shade-intolerant invasive plant species that become established in these disturbed areas.

Affected Environment

Seventeen non-native invasive plant species are known to occur in the Lower Williams direct and indirect effects boundary (Table 20). Of these seventeen species, garlic mustard (*Alliaria petiolata*) and Japanese stiltgrass (*Microstegium vimineum*) can cause serious ecological impacts in forested ecosystems because of their ability to tolerate shade. Japanese knotweed (*Polygonum cuspidatum*), while not as shade tolerant, also has the ability to disrupt ecosystems due to its rapid spread via rhizomes. The other species are less tolerant of shade and typically do not disrupt intact forested ecosystems, but they can sometimes become a problem in disturbed ecosystems.

Table 20. Non-native invasive plants known to occur in the Lower Williams vicinity.

Scientific Name	Common Name
Alliaria petiolata	Garlic mustard
Anthoxanthum odoratum	Sweet vernal grass
Arctium minus	Lesser burrdock
Barbarea vulgaris	Yellow rocket
Chrysanthemum leucanthemum	Ox-eye daisy
Daucus carota	Queen Anne's lace
Eleagnus umbellata	Autumn olive
Festuca pratensis	Meadow fescue
Hieracium pratense	Field hawkweed
Holcus lanatus	Velvet grass
Microstegium vimineum	Japanese stiltgrass
Poa pratensis	Kentucky bluegrass
Polygonum caespitosum var. *longisetum*	Asiatic water pepper
Polygonum cuspidatum	Japanese knotweed
Rosa multiflora	Multiflora rose
Rumex crispus	Curly dock
Tussilago farfara	Colt's foot

Most occurrences of invasive plants are located along roads or associated skid trails and log landings. This pattern of occurrence suggests that these transportation features have served as the primary invasion route in the watershed, probably through transport of seeds by vehicles, construction and maintenance equipment, and horses. The worst

infestations of garlic mustard and Japanese stiltgrass in the direct and indirect effects boundary are concentrated south of the Williams River, particularly in the vicinity of Red Oak Knob. This area receives a high amount of horse use, which likely has contributed to the invasions via seed transported in hay and horse droppings. Garlic mustard and Japanese stiltgrass have the potential to infest most of the proposed harvest units south of the river.

Large infestations of Japanese knotweed occur along the river, mostly away from any proposed activity areas. However, one area of Japanese knotweed occurs along Forest Road 787, which will be used as a haul road.

Desired Conditions

The Forest Integrated Desired Conditions (Forest Plan p. II-6) call for containing the expansion of existing non-native invasive species infestations and preventing the establishments of new invasive species. Desired conditions for vegetation (p. II-17 and II-18) envision use of an early detection/rapid response strategy to prioritize control needs based on threat severity and ability to achieve control. The desired conditions also call for using native species and desired non-invasive non-native species for re-vegetation efforts.

Environmental Consequences

Direct and Indirect Effects

Under all of the action alternatives, soil and vegetation disturbance associated with skid trails, landings, harvest activities, and road activities has the potential to spread non-native invasive plants. The potential is greatest in the vicinity of existing infestations, but also could occur in other areas due to long-distance seed movement by vehicles and equipment. All action alternatives would include control and monitoring aimed at all known infestations of garlic mustard, Japanese stiltgrass, and Japanese knotweed in harvest units, landings, and road activity areas. This control and monitoring would reduce the likelihood of project activities spreading these three invasive plants and would ensure compliance with Forest Plan direction toward that end (p. II-20, Standard VE22). However, these measures likely would not eliminate all potential for spreading these three invasive plant species. If they do spread into the harvest units and are not effectively controlled, they likely would persist indefinitely and could eventually dominate the herbaceous layer of these stands. The other lower priority invasive plant species likely would spread wherever ground disturbance and canopy reduction occurs. These increased populations of shade-intolerant invasives would persist until the tree canopy closes over the disturbed areas in about 30 years.

Invasive plant impacts would vary by alternative (Table 21). Alternative 2 would have the greatest potential to spread invasives along skid trails, new roads, and at new landing sites, while Alternatives 3, 4, 5, and 6 would have greater potential for spread associated with road reconstruction and hardening. Overall ecological risk probably is greatest under Alternative 2 because skid trails, new roads, and the greater number of landings have the potential to spread shade-tolerant NNIS deep into previously undisturbed forest.

Impacts due to road maintenance and road hardening would be concentrated along existing ecological edges, many of which have already been impacted by invasive plants. Alternative 5 would have the least risk of impacts because it would not include any skid trails or new roads. Alternative 4 also would have low risk due to the lack of new roads and the low mileage of skid trails. Alternatives 3 and 6 would have higher risk, but not as high as Alternative 2.

Table 21. Comparison by alternative of features that may cause the spread of non-native invasive plants.

Feature	Alternatives – Estimated Acres					
	No Action	Proposed Action	3	4	5	6
Miles of skid trails	0	64	46	19	0	42
Miles of new road construction	0	3	2	0	0	2
Miles of road reconstruction, maintenance, and hardening	0	6	17 – 27	17 – 31	21 – 28	11 – 20
Number of landings	0	56	53	30 – 49	27 – 42	48
Acreage of landings	0	20	31	19 – 36	27 – 42	27

The effects of the introduction and spread of non-native invasive plants could include crowding out of native plant species. This competition could cause reduced species diversity of native plants. In areas where threatened, endangered, or sensitive plants occur, competition from invasives could lead to reduction in vigor or loss of populations. Additionally, impairment of ecosystem function and reduction of preferred food and cover sources for various wildlife species could occur.

Alternative 1 (No Action) would have no effects on the introduction and spread of non-native invasive plants. The introduction of additional invasives due to other activities (e.g., road maintenance, recreation) likely would continue, and the natural spread of existing infestations also would continue.

Cumulative Effects

The major potential negative effect of the Lower Williams project relative to non-native invasive plants is the potential for introduction and spread of invasives in areas disturbed by project activities. This effect would add to the effects of past activities that may have caused the introduction and spread of invasives. Examples of such past activities include widespread timber harvest, soil erosion, and fires between the years 1880 and 1930, Forest service timber sales and road building in more recent years (see Table 4 in EIS Chapter 3), historic strip mining on private land and what is now National Forest land, recent timber harvests and road building on private land, and small amounts of residential

and agricultural development. Specific information on the introduction and spread of non-native invasive plants due to these past activities is not available. However, the current distribution of invasives in disturbed areas strongly indicates that these activities were collectively responsible for the introduction and spread of existing invasives.

Any effects of the Lower Williams project also would be additive to the effects of future activities within the cumulative effects boundary. On National Forest land, the proposed terrestrial liming in the Lower Williams watershed is the major reasonably foreseeable future activity that could contribute to the introduction and spread of invasive plants. By increasing available calcium and magnesium, liming could make disturbed areas more susceptible to invasion, especially by calcium-associated species such as garlic mustard (Nuzzo 1991).

Another reasonably foreseeable future activity with great potential to facilitate invasions is continuation of horse use. Roads and skid trails associated with timber harvest activities would open up new routes for horse travel, thereby making new areas susceptible to invasion. This risk would continue long after control measures used to mitigate direct effects of the project have ceased.

The contribution of the Lower Williams project to cumulative effects of non-native invasive plants would vary by alternative approximately in proportion to the direct and indirect effects. Thus, Alternative 2 would make the greatest contribution to cumulative effects, while Alternatives 4 and 5 would make smaller contributions. Alternatives 3 and 6 would contribute more than Alternatives 4 and 5, but less than Alternative 2. Alternative 1 (No Action) would have no direct and indirect effects, therefore it would make no contribution to cumulative effects. Cumulative effects under the action alternatives likely would be measurable, but cannot be quantified currently due to the lack of invasive plant inventory information for most of the land in the cumulative effects boundary.

Physical Environment

Soil

Resource Impacts or Issues Addressed

This section discloses the soil resource issues and impacts identified during interdisciplinary meetings and public scoping. The Forest Service identified soil resource issues associated with the proposed action as described in Chapters 1 and 2.

Issue 1: Erosion and Sedimentation

Issue: Soil disturbance associated with timber and road management activities may increase erosion and sediment delivery to streams. This can effect soil and water quality, as well as impair trout productivity within the project area. Measures are identified to compare the potential soil disturbance in each alternative.

Measure 1: Miles of new road construction and road reconstruction
Measure 2: Miles of skid roads and trails

Scope of the Analysis

The spatial boundary used to evaluate direct consequences is the activity areas where actions are proposed within the project area. Activity areas are those areas in which harvesting, herbicide treatment, and wildlife opening creation are proposed. This spatial boundary was chosen because it can be used to determine threshold effects to soil quality from proposed actions associated with this project. Indirect consequences also are bounded within the project area because effects are not expected to move outside of the subwatersheds within the project area. Refer to the Alternative Maps (Chapter 2) for the locations of the proposed activities.

The spatial boundary used to address cumulative impacts is the project area. This allows the assessment of past and future effects and the determination of threshold impacts to soil quality as defined the Region 9 Soil Quality Standards FSH 2518, when added to the proposed actions.

There are two time frames for effects for this analysis, short-term and long-term. Direct, indirect, and cumulative effects can occur within short-term and long-term time frames. Short-term effects to soils are considered to occur over a period of a decade. If recovery of the soil properties does not occur within this duration, effects then are considered to be more long-term in nature. Long-term effects to soils would last for more than 100 years. Soil formation, and thus soil replacement takes 200-400 years and depends on local climate and ecological conditions.

Methodology

The action alternatives have the potential to affect soil resources as a result of commercial timber sale activities, road construction and reconstruction, and log landing construction and use. The Proposed Action and other action alternatives have the potential to affect soil resources as a result of commercial timber sale activities, road construction and reconstruction, and log landing construction and use. The effects of these activities may include soil disturbance, soil compaction, soil rutting, erosion, slumping and mass wasting, accelerated decomposition of organic mater, changes in nutrient cycling due to biomass removal and mixing of the soil surface horizons, and changes in soil temperature and moisture. The effects of these activities on soil resources in the activity area can be described in terms of short- and long-term effects on the productivity or quality of the soils. Short-term effects are those effects expected to last less than a decade. Effects to surface soil from tree felling and skidding in the unit may be an example. The soil surface is slightly mixed and disturbed. The time for soil properties to recover is short. For soils, large scale disturbances are rarely considered to be short-term in nature. It is only when the changes that occur to soil properties happen

within the decade and the effects of those changes are no longer noticeable after a decade. In contrast, long-term effects are associated with activities that displace soil permanently and change the physical, chemical, and biological properties of the soil. Many years are needed for the soil to recover its original productivity when the surface layers are removed, deeply compacted, or altered in some manner that changes the chemical composition such as the effects with intense fire in these ecosystems. Additions to the soil profile from fill would also have long-term effects. An example of an addition to the soil may be adding fill to the top of the soil profile from road building.
Important factors considered in evaluating effects to soil resources from this project are the extent of the activity area and the current soil chemistry data of different soils within the project area. Effects to the soils from this project are not considered to be significant when 85 percent of the activity area retains its potential long-term soil productivity (Forest Service Handbook, 2509.18.2.2, Soil Quality Standards). Acres of soil impacted by soil-disturbing activities (log landings, skid trails, skid roads, road construction, and wildlife openings) were estimated using the best available information and compared to the total acres of the activity areas (harvest units).

Erosion hazard potential is a risk rating based on the susceptibility of bare, cultivated soil to detach from other soil particles and be transported by water. Factored in to the hazard rating is soil composition, saturated hydraulic conductivity, and structure. Also, slope is a very important variable in the Appalachian Mountains that dictates erosion potential.

Affected Environment

Geology within the Project Area
The surface geologies of the project area are comprised of the Kanawha and New River Formations of the Pottsville Group and the Mauch Chunk Group. Map 2 displays the geology found within the project area. The Pottsville Group belongs to the Pennsylvanian period of the Paleozoic Era. The Kanawha Formation consists of 61.5% sandstone, 30.3% shale, 6.4% coal, and 1.8% impure and siliceous limestone (Reger, 1921). The New River Formation consists of 73.75% sandstone, 22.5% shale, and 3.75% coal (Reger, 1921). The Kanawha Formation is mapped as occurring on the ridges of the project area; however, no members of this formation were recorded in measured sections (Reger, 1921) of the area or noted on field visits (Tracy, 2005). The New River Formation of the Pottsville covers the project area with the Upper Nuttall Sandstone along the ridges (Reger, 1921). The formations of the Pottsville Group have a greater percentage of shale in the western part of the Gauley Ranger District (Tracy, 2005).

The Mauch Chunk consists mainly of the red and green shales of the Hinton and Bluefield formations. The shales in the Mauch Chunk Group are moderately high in clay minerals and are highly susceptible to weathering. The soils have a moderate shrink-swell potential meaning that they expand and contract through wetting and drying processes. The soil profile over the shale bedrock is thin and gully erosion is characteristic. The shales are prone to mass wasting; and roads crossing the Hinton or Bluestone formations of the Mauch Chunk Group are beset with falling rock and landslides in many places. Roads developed across or along these areas tend to be expensive to maintain because of the overpowering tendency for the parent material to

slump and slide, as seen with maintaince of the Highland Scenic Highway. Only a portion of Units 6 and 12 are on the Mauch Chunk geology; the rest occur on the Pottsville Group.

Soil Types within the Project Area
The following is a description of each soil series located in the project area that would potentially be affected by the proposal. Soil types not affected by any of the proposed activities are not discussed.

Dekalb: The Dekalb soil series consists of moderately deep, well-drained soils that form in acid material weathered from sandstone and some interbedded siltstone and shales. The available water capacity is low to moderate, runoff is rapid, and permeability is moderately rapid or rapid. The root zone of some types of plants is restricted bedrock at a depth of 20 to 40 inches. The hazard of erosion is severe on unprotected areas and is a major management concern, as is erosion on logging roads and skid trails. Erosion can be mitigated to some degree by providing a well-designed skid trail system in harvest units and planned road layouts.

Gilpin: The Gilpin series consists of soils that are moderately deep and well-drained. The soil forms in residuum parent material, meaning that the soil weathers directly from the acid sandstone, quartzite, siltstone, and/or shale below. These soils are found on ridgetops, benches, hillsides, and on outcropping sideslopes. Runoff is medium or rapid, available water holding capacity is moderate, and permeability is moderate. In places on the landscape, large stones 10 to 24 inches cover the surface. Boulders may also be present on the surface.

Laidig: The Laidig series consists of very deep, well-drained soils that formed in acid, colluvial material moved downslope from soils on uplands. The Laidig soils are on foot slopes, head slopes near mountain tops, along drainage ways, on benches, and mountain side slopes. Slope ranges mainly from 8 to 35 percent and in some areas may range up to 45 percent. Stones 10 to 24 inches in diameter cover 15 to 75 percent of the surface. Laidig soils have a fragipan. The seasonal high water table is approximately 2.5 to 4 feet in depth. For this reason, this soil type for this project was identified as sensitive for wetness when considering the construction of skid road systems. This is because often the blading into the soils cuts deep into the soil profile to obtain a suitable slope for the skid systems that is safe and runs along contour. Slopes are steep in this project area and because of the combination of steepness and contour cutting could intercept these subsurface flows produced by the perching of water from the fragipan. Runoff is rapid or very rapid. Permeability is slow and moderately slow in the firm layers of the profile (in the fragipan). The available water capacity is low or moderate. Natural fertility is low. The Laidig soils have low shear strength. The hazard of erosion is severe on slopes greater than 30 percent and moderate on less steep slopes (8 to ~30 percent).

Kaymine: The Kaymine series consists of very deep, well-drained soils that formed in a mixture of partially weathered sandstone, siltstone, shale, mudstone, and coal rock fragments and partially weathered fine-earth material in areas that have been disturbed by surface mining operations. These soils are on ridgetops, benches, and side slopes.

Because of the highly variable weatherable material found in these soils, soil characteristics and properties can vary widely. Included in these soils are areas of shallow, moderately deep, and deep soils, small areas of rubble land, and vertical highwalls. The available water capacity is low to high, permeability is moderate and moderately rapid in the substratum, and runoff is very rapid. Soil fertility is medium or high. Soil reaction is moderately acid to neutral. Slope ranges from 3 to 80 percent.

Mandy: The Mandy series consists of moderately deep, well-drained soils that formed in acid material weathered from interbedded sandstone, siltstone, and shale bedrock. These soils are on mountain side slopes, shoulder slopes, and ridgetops, mainly at elevations of more than 3,400 feet. The soils have more than 35 percent rock fragments in the subsoil, and 3 to 5 percent of the soil surface is covered with stones 10 to 24 inches in size. The available water capacity is very low or low, permeability is moderate, and runoff is rapid or very rapid. Soil reaction is extremely acid or very strongly acid. Erosion potential on unprotected areas is very severe; otherwise, erosion potential is moderate to severe depending on slope. Shear strength is low.

Pineville: Pineville series consists of very deep, well-drained soils that formed in colluvial material that moved downslope from soils on uplands. The Pineville soils are on mountain side slopes and foot slopes. The available water capacity is moderate or high, permeability is moderate, and runoff is very rapid. Shear strength is low. Slopes in the project area where Pineville soils are mapped range from 55 to 70 percent. Slope is the major management concern where this soil series is mapped.

Simoda: The Simoda series consists of deep and very deep, moderately well-drained soils formed in residuum weathered from interbedded sandstone, siltstone, and shale. They are on broad ridgetops and upland depressions on mountains. Permeability is moderate above the fragipan and slow in the fragipan. Depth to the fragipan ranges from 15 to 30 inches. Seeps are common on these soils. Potential productivity of this soil for red spruce trees is high if an available seed source exists, or there is already red spruce in the understory. Stones and boulders on this soil interfere with logging equipment use. The wetness restricts vehicular equipment during spring and winter.

Snowdog: The Snowdog series consists of very deep, moderately well-drained soils that formed in acid, colluvial material on uplands. The Snowdog soils are on foot slopes, along drainage ways, on head slopes near mountain tops, benches, and mountain side slopes, mainly at elevations of more than 3,400 feet. The available water capacity is low or moderate; and permeability is slow and moderately slow in the firm portion of the soil profile. Runoff is rapid or very rapid. Natural fertility is medium. A seasonal high water table is at a depth of about 1.5 to 2.5 feet. The hazard of erosion is moderate. Stones that are 10 to 24 inches cover 15 to 75 percent of the soil surface. Included in areas where Snowdog soils are mapped are soils that are somewhat poorly and poorly drained.

The following soils occur in the project area but are not proposed to have activities occurring on them: Atkins, Cataco, Chavies, Craigsville, Fenwick, Gauley, Itmann, Pope,

Potomac and Udorthents,. A complete description of each soil type and the map units they are found in can be located in the county soil survey report (USDA-NRCS, 1992).

Data Inconsistencies for Unit 12 (Common to Alternatives 2, 4, 5, & 6)
Unit 12 is shown in the GIS data to have soil series mapped as Gilpin and Laidig. However, the geology map shows that this unit is underlain by the Mauch Chunk geologic formation. Typically, the Cateache and Shouns soils series are mapped in relationship to this geologic formation. Due to a lack of resources and time, this unit was ground-checked for this data inconsistency. Therefore, sensitivities to mass wasting and a severe hazard of erosion may exist within this unit for ground-disturbing activities. Below is a description of these two soil types.

Cateache: The Cateache series consists of moderately deep well-drained soils with moderate permeability. These soils directly overlay the parent material from which they develop and are described as being "residual." This soil series weathered mainly from red interbedded siltstone and shale. Cateache soils are on steep and very steep side slopes of mountains and ridges and on gently sloping to moderately steep benches and ridgetops. Slope ranges from 3 to 80 percent. Permeability is moderate, the available water capacity is moderate, and runoff is medium to very rapid. In areas that have not been limed, Cateache soils are strongly acid to moderately acid. These soils are highly erosive and prone to mass movement and slippage. These soils have moderate shrink-swell potential and low shear strength. The depth to bedrock is 20 to 40 inches and may restrict root growth. The bedrock is soft and weathers relatively easily.

Shouns: The Shouns series consists of very deep, well-drained, moderately permeable soils on footslopes and in coves. These are colluvial soils formed from weathered sandstone, siltstone, and shale. Colluvial soils are soils that have moved down slope from the landscape position where they originally developed. The Shouns soil series primarily is located on the lower part of hillsides, benches, and foot slopes. Runoff is medium to very rapid, permeability is moderate, and available water capacity is moderate or high. In areas that have not been limed, reaction is strongly acid to moderately acid. These soils are highly erosive and prone to mass movement and slippage. These soils have moderate shrink-swell potential and low shear strength.

Sensitive Soils within the Project Area
Various sensitivity ratings have been applied to map units within the project area based on soil interpretations from the Webster County Soil Survey Report. Table 22 shows the map units and the sensitivity ratings. Wet soils have seasonally high water tables within 18 inches of the soil surface. The drainage class of these soils is moderately well-drained or wetter. Wet soils have a higher sensitivity or risk of effects such as compaction and ponding of water. Wet soils, when disturbed to the depth of the water table, have the ability to bring subsurface flows to the surface. A good example of how this occurs on the landscape is the excavation of bladed skid roads in conventional harvest units. A more detailed discussion of these effects can be found under direct and indirect effects for

the PA and Alternatives 3 and 4. Steep slopes are identified as being sensitive for land management activities. Activities proposed on these steep slopes are examined closely for slippage potential and the use of mechanized equipment.
Wet Soils were considered without Gilpin-Laidig (GLF10) soils, because they are quite extensive in the project area and may preclude skid road activity. However, this soil map unit lays on "bench-slope" topography, and skid roads will be designed to fall on the bench features and not the slope portion of the hillsides, so this soil type was removed from consideration as wet since they will be managed to avoid exposing groundwater that occurs by blading on steep slopes.

Table 22. Sensitive Soils with proposed activities in the Lower Williams Project Area.

Map Unit Symbol	Map Unit Description	Sensitivity Type(s)
GLF10	GILPIN-LAIDIG ASSOCIATION, VERY STEEP, EXTREMELY STONY *	• wet • slopes 30-70%
KaF10	KAYMINE VERY CHANNERY SILT LOAM, VERY STEEP, EXTREMELY STONY	• slopes 30-70%
LgE10	LAIDIG CHANNERY SILT LOAM, 8 TO 35 PERCENT SLOPES, RUBBLY	• wet • slopes 30-70%
PgG10	PINEVILLE-GILPIN COMPLEX, 55 TO 70 PERCENT SLOPES, EXTREMELY STONY	• slopes 55% or greater
SmC10	SIMODA SILT LOAM, 3 TO 15 PERCENT SLOPES, VERY STONY	• wet
SwE10	SNOWDOG CHANNERY LOAM, 15 TO 35 PERCENT SLOPES, RUBBLY	• wet • slopes 30-70%

***** GLF10 was eliminated from consideration as "wet" for the purposes of Alternative 4 development because it is so prevalent and because blading skid trails on steep slopes can be avoided by placing them on the bench features of the bench-slope topography.

Direct/Indirect Environmental Consequences by Alternative

Alternative 1 - No Action Alternative

The **No Action Alternative** proposes no soil-disturbing activities. Existing areas of bare soil in the project area, such as roads and trails would continue to have soil movement. Signs of erosion around culverts and on bare cut banks are evident on the existing road system. Surface water flows down the middle of some roads during heavy precipitation events. The erosion and surface flow over bare soils adds to the already existing sediment load in streams. Soils would continue to erode in these areas until some physical point of stabilization is met. Natural weathering and erosion occurs at background levels throughout the project area.

Environmental Consequences Common to All Action Alternatives

Soil Disturbance (Ground-Disturbing Activities)

Filterstrips: Filterstrips are the primary sediment and nutrient-trapping mechanism in areas of ground-disturbing activities such as skid trail development, landing construction, and road building. Filterstrips are required on all perennial, intermittent, and ephemeral water courses with functioning channels that are adjacent to activities that expose mineral soil. They are generally 100 feet-wide and may be adjusted to address site-specific conditions such as soil types and slope.

Skid Trails and Roads: Amounts of skid trails/roads that occur within conventional harvest units are accounted for in the skid trail tables under each alternative. However, there are some skid trails that extend beyond the unit boundaries; these are additive to the numbers supplied in the tables and will be represented in Short- and Long-Term Effects Tables for each alternative.
Note: These numbers did not match what was originally provided out of GIS, but the discrepancies are not large and still display relative numbers across alternatives. There are only four units in the PA where this discrepancy could be falsely inflating numbers above the 15% aerial disturbance maximum from the R9 Soil Quality Standards (see Alternative 2 Effects).
Clearcut unit 27 and thinning unit 4 are helicopter harvest in every alternative because they fall within the North Cove subwatershed, in which a 15-mile road decommissioning project was completed in the summer of 2006. The Deciding Official (Gauley District Ranger) determined that conventional harvesting would negate any beneficial effects the watershed project will have and that any harvesting in the subwatershed would be by helicopter only.

Landings: Landings are used in both conventional and helicopter harvest systems. Helicopter landings are approximately 1 acre and 0.25 acre in conventional harvest systems. About half of a landing will have most of the topsoil and some of the mineral soil cleared away and cast aside in order to create a relative flat area for loading logs (Tom Bailey, pers. comm., 2004). The remainder of the landing remains relatively in tact with some mixing occurring as logs are stacked and moved on and off the site. Landings are often revegetated and used as wildlife openings. Landings may be created within the boundaries of proposed harvest units as well as outside of harvest units. This was accounted for in the calculations of soil productivity loss. Some of landings may be developed from existing openings that have been used as log landings in the past. (Landings are discussed by alternative below.)
The landing near unit 35 (which is in all action alternatives) is thought to be wet and will require a mat to be used if conditions warrant it at the time of operation. A soil scientist will need to visit the site with the Timber Sale Administrator to determine this.

Road-Related Activities
Road Construction: The direct effects of new road construction include a complete removal of the O and A horizons (organic material), and removal of the subsoil material to varying depths in creating a road base in the cut locations. In fill locations, there would be areas where soil material would be borrowed and placed over the native soil surface to bring the soil to grade for the roadbed. Soil properties in the roadbed surface and borrow areas are altered to the degree where they do not resemble native soil properties after construction. Compaction, loss of surface water infiltration, and loss of overall long-term

soil productivity are to be expected. It is recommended that silt fences be installed between the road construction and stream channel when construction would be within the designated buffer width to minimize sediment moving into the channel. This recommendation comes from 2003 field observations made by research Hydrologist, Dr. Pamela Edwards, USFS-Fernow Experimental Station. This mitigation would be used on all new road construction where the road crosses the channel, (ephemeral, perennial, or intermittent). This mitigation exceeds Forest Plan standards and guidelines and WV State Forestry BMPs. All disturbed areas of soil would be seeded, fertilized, and limed immediately after disturbance. If the construction occurs when seeding is recommended, heavy mulching should occur instead. New road construction is not considered to be part of the soil productivity because it is considered to be a permanent commitment of forest resources and will be added to the Forest System Roads Inventory.

Road Reconstruction: All action alternatives propose road reconstruction except for Alternative 5 (Table 2) that would include activities such as relocating or improving the roadbed, adding and replacing culverts, brushing, cleaning ditches, and cleaning existing culverts. Road reconstruction would cause new soil disturbance and the potential for sediment to enter the stream channels and ditches in the short-term. Areas of disturbed soil would be limed, fertilized, and seeded thereby reducing the initial impacts of the soil disturbance after the vegetation is established (LRMP, II-10).

Road reconstruction of Level 2 roads intended for future use by vehicular traffic (high-clearance vehicles and logging trucks) would be a positive impact to the soil resource by addressing existing problem areas, which would decrease the amount of sediment being generated by the road surface. Approximately 2 miles of roads in the Proposed Action would be reconstructed, and about 1.5 miles of roads in Alternative 3, a half mile in Alternative 4, and 2 miles in Alternative 6 would be reconstructed for the project. Examples of these problem areas include eroded road surfaces that allow water to run down the road instead of in the ditch, undersized culverts, rutting in places where rock has been displaced or embedded into subsoil. Replacing undersized culverts would allow water to flow unrestricted through the drains, decreasing the amount of sediment movement. Proper alignment of culverts would help to decrease the amount of soil eroded by water moving through the culverts and would prevent both upslope and downslope undercutting of road fill material. Existing areas of active erosion on road banks, and road surfaces would be eliminated or reduced by the use of mulch and seeding and/or additional applications of surface gravel.

Road Maintenance: Road maintenance activities include brushing, cleaning culverts, cleaning ditches, blading the road surface and adding surface rock as needed. Short-term effects would include increases of soil movement as the soil on the road surface and in the ditch line would be exposed to surface water. There would be a slight to moderate risk of destabilizing toe slopes when ditches are cleaned by removal of the soil material. This may cause additional soil movement.

Topsoiling: There would be an additional effect in areas which receive the topsoil from excavated areas, such as fill slopes along roads. With this added mineral soil material and organic matter, productivity on these areas would be improved by increasing soil

depth, moisture-holding capacity, organic matter and nutrients. This would not be to say that excavated sites, which have long-term effects to soil productivity, are offset by these areas where topsoil would be deposited. It is mentioned here as an indirect effect of excavation activities associated with all action alternatives. Topsoil deposition areas are not likely to offset any effects in this analysis, since it would be an effect which would be not easily calculated or displayed. However, as an indirect effect of topsoil displacement associated with excavation, it would be a benefit to the areas receiving this excavated material.

General Effects from Timber Harvesting

Compaction: General timber harvest areas are expected to recover quickly from compaction caused by harvesting activities. Research has shown that the upper few inches of soil recovers quickly from light to moderate compaction (Adams 1991; Burger 1985; Hatchell 1971; Kozlowski 1999). This is a result of organic matter additions from logging debris, soil biota activity, freezing and thawing, and plant root growth from existing and new vegetation. Recovery from compaction would be slower if severe compaction occurs. These areas are associated with log landings and primary skid trails/roads, where equipment has passed over the ground many times. Severe compaction must be mitigated by ripping or soil tillage of the upper 7 to 24 inches to break up the compacted soil surface and promote water infiltration and root growth. The Region 9 Soil Quality Standards dictate that bulk density values be no greater than 1.54 to 1.63 g/cm^3 for loamy soils (range dependent upon specific soil textures). Untreated severely compacted areas have long-term (8-40+ years) impacts to soil productivity. Potential areas within units may exist from past activities; however, no areas where identified during field review. There may be some remnant compaction from historic logging practices from the early 1900s; however, most of the soil disturbance has recovered. There are signs of old skid trail systems which may imply that compaction in these areas still persists because trees are not generally present in these corridors. New areas of compaction on log landing areas may result from blading of the surface and heavy equipment use while stockpiling logs. These areas could be ripped after harvest within the unit to mitigate the compaction during the conversion of the site from a landing to a wildlife opening. As noted in the Cherry River EA, district staff has observed that in these areas, that a small amount of compaction is beneficial to competing grass stands in maintaining the wildlife opening (Jane Bard, pers. comm., 2003). Therefore, decompaction may not be desired and will be determined if necessary during mitigation of landings after the harvesting and use is complete.

Nutrient Cycling: The above-ground nutrient content of the forest stand is relatively small compared to the total nutrient pool of the soil (Patric and Smith 1975, Adams 1999.) Probable effects of proposed harvesting activities on nutrient cycling include: increased mineralization of organic material, resulting in increase available nutrients, particularly nitrogen; increased nitrification of soil nitrogen to nitrate, a more mobile form; increased leaching of soil nutrients (nitrogen, calcium, and magnesium) as uptake by plants decreases temporarily due to removal of the overstory; and increases in rates of cycling of some nutrients in the upper soil horizons. Increased soil moisture, surface soil temperatures, and increased organic matter which has been observed after clearcutting produce ideal conditions for rapid decomposition of the organic matter available on-site.

Soil organisms responsible for decomposition would benefit from this surge in organic materials. Mineralization of organic compounds and nitrification has been shown to increase after clearcutting. Changes in nutrient cycling in areas of thinning and shelterwood cuts are not likely to be detectable in the short-term because of the dispersed nature of the removals. The dispersed removal of trees within the project area has relatively little, if any, effect on microclimate and thus nutrient cycling processes. Also, because the rates of these processes vary considerably spatially within a stand, detecting an adverse effect would be unlikely. Sprouts from the existing root systems on harvested areas along with new germinations would benefit from any increase in available nutrients.

Soil Fertility: Fertility would be expected to increase from pre-harvest levels as increases in soil moisture and soil temperature from timber harvest contribute to an increase in organic matter decomposition. This effect would produce and increase in nutrients available to plants and soil organisms on the sites. This surge in nutrients, along with additions of nitrogen from the atmosphere and precipitation, would be expected to promote rapid growth on the sites as well as benefiting many soil-borne organisms. On roads and landings, where soils have been disturbed, additions of limestone and fertilizers prior to revegetation would contribute to soil fertility by adding calcium. Possible losses of nutrients to ground water and volatilization are expected to be offset by addition of nutrient rich leafy tops and woody debris left on-site after harvest. Although frequently hypothesized, nutrient deficiencies as a result of overstory removal have not been reported in the eastern hardwood forests (Adams, 1999). Therefore, no adverse impacts to soil fertility are expected from the proposed treatments. Further discussion of effects to vegetation and soil fertility can be found in the Soil Resource Report specifically discussing the effects of acid deposition on the soil resource.

Canopy Removal: Canopy removal is proposed to some degree in all action alternatives. The soil surface would be subject to effects from the removal of the tree canopy. It would be anticipated that an initial surge of nutrients would occur as the vegetation canopy would be opened. Soil moisture, soil surface temperatures, and an increase in organic matter produce ideal conditions for rapid decomposition. Sprouts from the existing root systems on harvested areas along with new germinations would benefit from the increase in these available nutrients. A surge in growth would occur. Possible losses of nutrients to ground water and volatilization are expected to be offset by the addition of nutrient-rich leafy tops from harvested trees and woody debris left on-site after the harvest. In addition, a decrease in evapotranspiration would result in increased runoff. These are considered short-term impacts and would be quickly reduced with regeneration of understory species.

Soil Temperature: Timber harvesting activities temporarily disturb the forest floor by mixing the organic layers with the mineral soil. Removal of a portion of the forest stand by harvesting can increase the amount of sunlight reaching the forest floor, higher soil temperature, increased soil moisture, as well as increased decomposition and mineralization rates resulting from increased microbial activity. The increase in soil temperatures would occur primarily during the growing season, but once the forest

canopy closes (within ten years), temperatures would return to normal. Soil biota activity would increase in the upper horizons of the soil and decomposition rates would increase temporarily. Bacterial activity assumes a more important role in the latter stages of decomposition. The increase in decomposition rates along with increased sunlight reaching the forest floor leads to an increase of leguminous plants, which are capable of fixing large amounts of nitrogen. Symbiotic nitrogen fixation by actinorhizal plants makes a considerable input of nitrogen to many ecosystems (Youngberg and Wollum, 1970.)

Helicopter Yarding: Helicopter yarding is proposed to varying degrees in all action alternatives. Helicopter yarding minimizes the amount of soil disturbance and sedimentation production that occurs because no skid roads are used to move the logs from the unit to the landings. There would be little direct impact to the soils in the form of compaction, rutting, and erosion due to helicopter yarding. Field observations and ocular estimates of MNF timber sales in 2001 (North Gauley Mountain, Marlinton Ranger District) and 2004 (Smoke Camp Timber Sale, Greenbrier Ranger District; Dry Run Timber Sale, Cheat Ranger District) show that very little ground disturbance (less than one percent) occurs within an activity area during timber harvesting when using helicopters. Therefore, it would be feasible to harvest areas with a helicopter and not have adverse effects to the soil water resources which may otherwise be susceptible if conventional methods were utilized.

Helicopter yarding would take place during the winter period. The roads in the Lower Williams project area were not designed for hauling logs during the winter period when soil is unfrozen and saturated. The road surfaces would be upgraded to withstand the impact of heavy logging trucks hauling timber in a more compressed time frame than conventional hauling operations. This would include the addition of rock to the road surface and some road reconstruction. The source of the gravel and rock would be such that it does not readily weather and produce a sediment source to the watershed. Upgrading road surfaces helps to avoid rutting the road surface during hauling and decrease the potential for sedimentation. Soil samples are taken prior to design and sent to a certified lab for soil engineering properties analysis (AASHTO and UNIFIED measurements). The design would then account for the soil type, type of logging truck, and expected loads and hauling rates. If these steps are not taken to ensure that roads are designed for the intended use in the winter months, adverse effects to the road surface are expected to occur and sediment will likely move from roads into ditch lines and into drainage channels. Severe rutting would be likely to occur without close monitoring of daytime freeze-thaw conditions. It is preferable to design the roads to the standard of use to avoid adverse effects.

Additional cross drains would also be added to the roads that would be used to access harvest units proposed for helicopter yarding. Cross drains would be added so that the roads drain adequately during the wetter winter periods, avoiding rutting of the road surface and potential road failures. Placement of these drains would be determined during implementation and would depend on depth of soil, drainage location, and slope of the road.

All Action Alternatives

Soil Quality

The Soil Management Handbook (FSH 2509.18) indicates a threshold of 15% reduction in "measurable or observable soil properties or conditions, or any measurable or observable reduction in soil wetland or hydrologic function," referred to here as soil productivity or soil quality. This measurement is applied to activity areas. System roads, trails, and administrative facilities such as campgrounds are not included when calculating loss of soil productivity. For this analysis, harvest units, helicopter landing sites, and skid trail development are included in estimates for loss of soil productivity and are then compared between the alternatives.

Timber Harvesting

The majority of soil disturbance in a timber sale occurs during the harvesting of the timber. In conventional harvesting methods, using rubber tire skidders, skid trails and/or skid roads are created in order to extract timber. Landings are also created in order to temporarily deck the timber until it can be loaded on to trucks and hauled off-site. The percent of land disturbed is often dependent upon slope of the activity area. In general, the steeper the slope, the higher the road density is in order to safely operate on the hill slope. A 1970's study conducted near Parsons, WV showed that the lowest measured road density of 5.6 percent occurred in a selectively cut harvest area with slopes less than 30 percent (Kochenderfer, 1977). A study on the nearby Fernow Experimental Forest indicated that roads in Haddix watershed occupied 10.6% of the logged area (Kochenderfer and Edwards, 1997). Slopes in the Haddix watershed were greater than 30 percent.

Kochenderfer et al. (1997) reported that the amount of exposed soil due to skid trails and hauling roads decreases rapidly after logging. This is because grasses and shrubs are re-established quickly in the disturbed areas. The study measured skid and truck roads in 1987 and again five years later in 1992. The percent of the disturbed are in the skid roads decreased from 6.2 percent of the logged area in 1987 to 5.1 percent in 1992 measurements. The percent of disturbed area in truck roads decreased from 4.5 percent to 3.1 percent. It was thought that practically all of the skid roads, especially in heavily cut areas, would eventually convert back to forest. However, Kochenderfer et al. (1997) recommended water-control structures (broad-based dips, waterbars, and any other mitigations directed by the Aquatics Report) on closed-out roads whether they are skid roads, skid trails, or abandoned system roads, because bare soil (up to 4 percent of the area) can remain on these roads, even after six growing seasons.

Research and actual timber sale monitoring shows that soil disturbance within units consistently runs around 10 percent (Kochenderfer et al., 1997; 2005 MNF Soil Resource Monitoring Report). Actual monitoring shows that there is a substantial increase in disturbance if the landing is constructed within the unit boundary and can increase the percentage from approximately 10 percent to 15 percent or greater.

Alternative 2- Proposed Action

Skid Roads and Trails: There are approximately 75 miles of skid trail/skid road construction within the units in the project area under the PA. The sizes of landings are discussed below. However, even with additional disturbance from a landing the percent disturbed within the activity area would fall below the 15 percent threshold indicated by the R9 Soil Quality Standards, with the possible exception of units 13, 20, and 21. The data inconsistencies preclude verifying these numbers, so a site visit by a soil scientist will be required during skid trail layout. There is a high level of concern and risk related to the amount of disturbance in the PA with regard to the watershed and the potential for erosion and sediment production. The potential for severe adverse effects to hydrology and aquatics from the amount of disturbance and the location of the disturbance is likely based on the existing conditions of the subwatersheds of the Lower Williams. A detailed discussion of those effects can be found in the Hydrology/Aquatics Report.
The interdisciplinary team participated in a paper exercise to develop a conceptual design of the logging system layout. The locations on the ground may change substantially during implementation due to logistics of harvesting activities and avoidance of important resources warranting protection from soil disturbance such as springs, archeology points, and rock outcrops. If resource concerns are identified at that time, specialists would be called into the field to help with locating skid trail/roads and landing sites as needed.

As part of this proposal, approximately 20 acres of log landings (49 conventional landings at .25 ac. each and 7 one acre helicopter landings) would be developed in the project area. A temporary bridge will be utilized to access Unit 9.

Table 23 displays the feet of skid trail and/or road per unit and the amount of acreage disturbed based on widths of 10, 12, and 15 feet for the Proposed Action. The width of disturbance on the roadbed may vary due to the type of equipment used, operator style, or logistics of moving within the unit; therefore, all three widths were analyzed to show a range of effects for soil disturbance.

Table 23. Length of skid trail and/or road by unit and the acreage disturbed based on 10 foot-, 12 foot- and 15 foot-wide skid trails/roads for Alternative 2.

Unit	Feet	Miles	10 ft.	12 ft	15 ft.	Unit Acres	10 ft.	12 ft	15 ft.
			(Area in acres)				(% Unit Disturbance)		
1	6156	1.2	1.4	1.7	2.1	25.3	6%	7%	8%
2	10404	2.0	2.4	2.9	3.6	39.9	6%	7%	9%
3	7415	1.4	1.7	2.1	2.6	33.5	5%	6%	8%
4	5779	1.1	1.3	1.6	2.0	32.6	4%	5%	6%
5	6742	1.3	1.6	1.9	2.3	39.3	4%	5%	6%
6	5408	1.0	1.2	1.5	1.9	24.9	5%	6%	8%
7	5386	1.0	1.2	1.5	1.9	27.4	5%	5%	7%
8	7684	1.5	1.8	2.1	2.7	40.3	4%	5%	7%
9	3898	0.7	0.9	1.1	1.3	17.4	5%	6%	8%

10	4548	0.9	1.1	1.3	1.6	28.7	4%	4%	6%
11	6864	1.3	1.6	1.9	2.4	32.5	11%	12%	13%
12	5451	1.0	1.3	1.5	1.9	27.7	5%	5%	7%
13	12214	2.3	2.8	3.4	4.2	26.6	11%	13%	**16%**
14	7842	1.5	1.8	2.2	2.7	26.8	7%	8%	10%
15	8316	1.6	1.9	2.3	2.9	19.7	10%	12%	15%
16	5441	1.0	1.3	1.5	1.9	31.4	4%	5%	6%
17	4973	0.9	1.1	1.4	1.7	22.1	5%	6%	8%
18	7647	1.4	1.8	2.1	2.6	36.1	5%	6%	7%
19	5302	1.0	1.2	1.5	1.8	31.9	4%	5%	6%
20	11692	2.2	2.7	3.2	4.0	23.0	12%	14%	**18%**
21	15047	2.8	3.5	4.2	5.2	27.4	13%	**15%**	**19%**
22	2250	0.4	0.5	0.6	0.8	9.7	5%	6%	8%
23	11434	2.2	2.6	3.2	3.9	28.9	9%	11%	14%
24	11260	2.1	2.6	3.1	3.9	28.1	9%	11%	14%
25	5965	1.1	1.4	1.7	2.1	36.8	4%	5%	6%
26	4939	0.9	1.1	1.4	1.7	22.7	5%	6%	8%
28	5447	1.0	1.3	1.5	1.9	17.7	8%	9%	12%
29	6020	1.1	1.4	1.7	2.1	24.9	5%	5%	7%
30	4874	0.9	1.1	1.4	1.7	18.0	10%	12%	15%
31	7731	1.5	1.8	2.1	2.7	31.1	10%	11%	12%
32	4967	0.9	1.1	1.4	1.7	33.8	3%	3%	4%
33	4170	0.8	1.0	1.2	1.4	15.8	6%	7%	9%
34	8829	1.7	2.0	2.4	3.1	33.7	5%	7%	8%
35	7928	1.5	1.8	2.2	2.7	26.8	6%	7%	8%
36	6434	1.2	1.5	1.8	2.2	20.9	10%	11%	14%
37	8638	1.6	2.0	2.4	3.0	33.8	5%	6%	7%
38	6728	1.3	1.6	1.9	2.3	23.8	7%	8%	10%
201	27556	5.2	6.3	7.6	9.5	119.4	7%	8%	10%
202	35016	6.6	8.1	9.7	12.1	181.9	4%	5%	7%
203	47633	9.0	11.0	13.2	16.4	215.6	5%	6%	8%
204	7197	1.4	1.7	2.0	2.5	233.2	1%	1%	1%
301	7095	1.3	1.6	2.0	2.5	38.4	4%	5%	6%
401	643	0.1	0.2	0.2	0.2	34.7	0%	1%	1%
402	6793	1.3	1.6	1.9	2.3	34.8	5%	5%	7%
TOTAL	393749	74.6	90.6	108.7	135.8	1879.0	5%	6%	7%

Percentages shown in bold indicate potential exceedance of 15% disturbance as required by R9 SQS.

New Road Construction: 3.3 miles of new road construction would occur in the PA. New road construction requires approximately 40 foot-wide swath of soil disturbance. This would equal approximately 16 acres of soils being permanently converted to a use other than growing vegetation.

Savannas: Permanent openings would be developed to provide open, grassy habitat for such species as white-tailed deer, wild turkey, and black bear. Once the overstory is cut down, the stumps would be grubbed out, and then the trees, stumps, and other logging debris would be pushed into piles and retained downslope of the disturbed soil to help prevent sediment from leaving the site. The area would be fertilized, limed, seeded with native grasses, legumes, and wildflowers, and planted with shrubs or trees. The two openings will be approximately 35 acres each and represent an immediate loss of soil productivity. Removing the A horizon via blading would cause a permanent loss of soil productivity. Nutrient cycling and carbon sequestration would be altered because pasture lands have different nutrient cycles than forested areas. Effects are expected to be minimal and not adverse since it only accounts for less than 1% of the total project area (see Wildlife Resource Report for details and description). General measures for soil protection are required until an established vegetative cover is accomplished. The measures include silt fences around any ephemeral streams. Soil productivity is expected to be altered due to the change in vegetation cover and the removal of most trees and understory vegetation. Stumps would be grubbed, therefore soil disturbance is expected to occur not only in the O and A horizons but down into the subsoil when removing root wads. Extensive mixing of the soil profile would result. Liming, fertilization, and seeding should occur as part of the creation of these areas. Soil fertility testing should be done to get recommended application rates for lime and fertilizer to ensure successful revegetation.

Short-Term and Long-Term Effects: The extent of ground disturbance and the estimated short and long-term effects to soils for the Proposed Action and Alternative are displayed below. In conventional harvesting operations, the impacts of unbladed primary skid trails and unbladed log landings are considered to be short-term impacts to soil productivity because there would be no removal of the surface horizons. These horizons may be mixed due to rubber tire movement on top of the soil surface, but the majority of the soil remains on site and relatively in place. The table below displays the estimated effects to soils from the activities proposed in the alternatives considered in this environmental analysis**.** The assumptions used to display the effects are shown below the table. The extent of the effects in the activity areas are computed using these assumptions, reviewed literature, field visits and preliminary logging plans for the proposed project alternatives. The project area is approximately 14,400 acres and activities will occur on approximately 1900 acres.

Table 24. Estimated Maximum Acreage of Short- and Long-Term Effects to Soil Productivity in Activity Areas for the Proposed Action.

Activity	Short-Term	Long-Term
	Acres	
Skid Roads/Trails *(15 ft.width)*	135	88
Log Landings	20	10
Savannas	70	70

Table 24. Estimated Maximum Acreage of Short- and Long-Term Effects to Soil Productivity in Activity Areas for the Proposed Action.		
Activity	Short-Term	Long-Term
	Acres	
Total Acres Affected	***225***	***158***
Percent of total activity area disturbed *(1900 acres)*	**12%**	**8%**
Percent of project area disturbed *(14400 acres)*	**2%**	**1%**

Assumptions used for Table 4:

- Skid roads have 10-15 feet of travel way plus cutslope and 3 feet of fill slope.
- Primary skid trails are unbladed and have a 10-15 foot width.
- Approximately 65 percent of skidded areas would potentially have bare soil after six growing seasons (long-term effect) (Kochenderfer, 1997)
- Conventional log landings are approximately 1/4 acre each and helicopter landings are 1 acre. 50% of this area would be a long-term impact due to blading the area where trucks are loaded, while the balance of the area would be unbladed and considered a short-term impact.
- Primary skid trails and unbladed portions of log landings are short-term impacts due to ripping/tillage mitigation.

Less than 15 percent of overall soil productivity would be lost under this proposed action for the unit boundaries, activity area, and project area for both short and long-term effects.

Alternative 3

Skid Roads and Trails: There are approximately 42 miles of skid trail/road construction proposed for Alternative 3 see Table 25 below). Under this alternative, 31 acres of log landings would be developed in the project area. However, even with additional disturbance from a landing the percent disturbed within the activity area would fall below the 15 percent threshold indicated by the R9 Soil Quality Standards. Map 6b shows the potential location of log landings and skid system in relationship to units. A temporary bridge will be utilized to access Unit 9.

Table 25. Length of skid trail and/or road by unit and the acreage disturbed based on 10 foot-, 12 foot- and 15 foot-wide skid trail/road for Alternative 3.									
			10 ft.	12 ft	15 ft.	Unit	10 ft.	12 ft	15 ft.
Unit	Feet	Miles	(Area in acres)			Acres	(% Unit Disturbance)		
1	6371	1.2	1.5	1.8	2.2	34.5	4%	5%	6%
2	7323	1.4	1.7	2.0	2.5	37	5%	6%	7%
3	6301	1.2	1.5	1.7	2.2	33.5	4%	5%	7%
6	4686	0.9	1.1	1.3	1.6	24.3	4%	5%	7%

7	5386	1	1.2	1.5	1.9	27.4	5%	5%	7%
8	6138	1.2	1.4	1.7	2.1	30.8	5%	6%	7%
9	3659	0.7	0.8	1.0	1.3	17.4	5%	6%	7%
10	4498	0.9	1	1.2	1.6	28.7	4%	4%	5%
11	6806	1.3	1.6	1.9	2.4	32.5	5%	6%	7%
16	5717	1.1	1.3	1.6	2.0	32.9	10%	11%	12%
18	6772	1.3	1.6	1.9	2.3	36.1	4%	5%	7%
19	4230	0.8	1	1.2	1.5	23.8	4%	5%	6%
20	3983	0.8	0.9	1.1	1.4	21.3	4%	5%	7%
21	6106	1.2	1.4	1.7	2.1	27.1	13%	14%	15%
23	7384	1.4	1.7	2.0	2.6	28.7	6%	7%	9%
24	7595	1.4	1.8	2.1	2.6	28.1	6%	8%	9%
25	6182	1.2	1.4	1.7	2.1	35.9	4%	5%	6%
26	4711	0.9	1.1	1.3	1.6	26.5	4%	5%	6%
29	4393	0.8	1.0	1.2	1.5	23.8	4%	5%	6%
31	7731	1.5	1.8	2.1	2.7	29.1	6%	7%	9%
32	4298	0.8	1.0	1.2	1.5	33.8	3%	4%	4%
34	7521	1.4	1.7	2.1	2.6	33.4	5%	6%	8%
35	7156	1.4	1.7	2	2.5	26.8	6%	7%	9%
36	5880	1.1	1.4	1.6	2.0	20.9	7%	8%	10%
37	7884	1.5	1.8	2.2	2.7	33.8	5%	6%	8%
38	5978	1.1	1.4	1.7	2.1	23.8	*6%*	7%	9%
201	22122	4.2	5.1	6.1	7.6	108.1	5%	6%	7%
202	4635	0.9	1.1	1.3	1.6	151.9	1%	1%	1%
203	27713	5.2	6.4	7.7	9.6	197.3	3%	4%	5%
301	7066	1.3	1.6	2.0	2.4	38.4	4%	5%	6%
401	6246	1.2	1.4	1.7	2.2	34.7	4%	5%	6%
TOTAL	*222468*	*42.1*	*51.2*	*61*	*76.8*	*1282.3*	*4%*	*5%*	*6%*

Road Construction: Alternative 3 proposes an average of 2 miles (based on the minimum and maximum numbers provided) of new road constuction. This activity creates approximately a 40 ft.-wide swath of soil disturbance. This would equal approximately 10 acres of soils being permanently converted to a use other than growing vegetation.

Savannas: One permanent opening would be developed to provide open, grassy habitat for such species as white-tailed deer, wild turkey, and black bear. Once the overstory is cut down, the stumps would be grubbed out, and then the trees, stumps, and other logging debris would be pushed into piles and retained in the downslope position of the disturbed soil to help prevent sediment from leaving the site. The area would be fertilized, limed, seeded with native grasses, legumes, and wildflowers, and planted with shrubs or trees (see Botany/Ecology Report) and represent an immediate loss of soil productivity. Blading these sites, thereby removing the A horizon would cause a permanent loss of soil

productivity. Nutrient cycling and carbon sequestration would be altered because pasture lands have different nutrient cycles than forested areas. Effects are expected to be minimal and not adverse since it only accounts for <1% of the total project area (see Wildlife Resource Report for details and description). Alternative 3 proposes one 35-acre savanna, in which general measures for soil protection are required until an established vegetative cover is accomplished. The measures include silt fences around any ephemeral streams. No intermittent or perennial stream channels are within proximity of the savannah. Soil productivity is expected to be altered due to the change in vegetation cover and the removal of most trees and understory vegetation. Stumps would be grubbed, therefore soil disturbance is expected to occur not only in the O and A horizons but down into the subsoil when removing root wads. Extensive mixing of the soil profile would result. Liming, fertilization, and seeding should occur as part of the creation of these areas. Soil fertility testing should be done to get recommended application rates for lime and fertilizer to ensure successful revegetation.

Short-Term and Long-Term Effects: The extent of ground disturbance and the estimated short and long-term effects to soils for Alternative 3 are displayed below. In conventional harvesting operations, the impacts of unbladed primary skid trails and unbladed log landings are considered to be short-term impacts to soil productivity because there would be no removal of the surface horizons. These horizons may be mixed due to rubber tire movement on top of the soil surface, but the majority of the soil remains on site and relatively in place. The table below displays the estimated effects to soils from the activities proposed in the alternatives considered in this environmental analysis**.** The assumptions used to display the effects are shown below the table. The extent of the effects in the activity areas are computed using these assumptions, reviewed literature, field visits and preliminary logging plans for the proposed project alternatives. The project area is approximately 14,400 acres and activities will occur on approximately 1,680 acres.

Table 26. Estimated Maximum Acreage of Short- and Long-Term Effects to Soil Productivity in Activity Areas for Alternative 3.

Activity	Short-Term	Long-Term
	Acres	
Skid Roads/Trails *(15 ft.width)*	77	50
Log Landings	31	16
Savannas	35	35
Total Acres Affected	***143***	***101***
Percent of total activity area disturbed *(1680 acres)*	**9%**	**6%**
Percent of project area disturbed *(14400 acres)*	**1%**	**0.7%**

Assumptions used for Table 6:

- Skid roads have 10-15 feet of travel way plus cutslope and 3 feet of fill slope.
- Primary skid trails are unbladed and have a 10-15 foot width.

- Approximately 65 percent of skidded areas would potentially have bare soil after six growing seasons (long-term effect) (Kochenderfer, 1997)
- Conventional log landings are approximately 1/4 acre each and helicopter landings are 1 acre. 50% of this area would be a long-term impact due to blading the area where trucks are loaded, while the balance of the area would be unbladed and considered a short-term impact.
- Primary skid trails and unbladed portions of log landings are short-term impacts due to ripping/tillage mitigation.

Less than 15 percent of soil productivity would be lost under this Alternative 3 for the unit boundaries, activity area, and project area for both short- and long-term effects.

Alternative 4

Alternative 4 was developed in response to both internal and external concerns regarding soil productivity and erosion and sedimentation in the Lower Williams project area. Chapter 2 gives a detailed description of the alternative and the issues that it addresses. The Soil Scientist and Fisheries Biologist implemented criteria for determining which units are at high risk for erosion and sedimentation concerns on sensitive soils due to conventional logging systems, existing system roads, and landing sites.

Criteria Examined:

1. Wet soils are defined as those soils that are moderately well-drained or wetter, meaning that a water table exists at some time during the year in the soil profile at a depth of 18 inches to 30 inches. Information from the Webster County soil survey (1992) was used to determine which soil series are classified as wet. Certain activities on wet soils may be high risk for adverse effects such as compaction, erosion, and breaking subsurface water flow continuity. These activities include overland skidding and constructing system roads, skid roads, and landings.
2. Units that are close in proximity to a stream channel pose a greater risk of sedimentation from skid roads. The risk of erosion and sedimentation from cutting skid roads and temporary units into the hillside could be avoided with helicopter logging.
3. Units with existing skid trail systems. Units that have existing skid road systems may not benefit as much from helicopter logging due to the fact that the hydrologic continuity has already been disrupted and soil disturbance and loss of productivity has already occurred. Therefore units with a relatively good skid system in place were not identified for helicopter yarding in this alternative.
4. As defined by the Forest Plan, steep slopes are those slopes that are 40-50%. Operation on these slopes would be analyzed on a case-by-case basis to determine the best method of operation. Wheeled and/or tracked motorized equipment on slopes greater than 50% would be prohibited without recommendations from interdisciplinary team review and Responsible Official approval (LRMP, pg. II-10).

The Soil and Water Resource Rationale Matrix for Alternative 4 (Attachment 1) shows the analysis and results for each unit within the PA. The following criteria were analyzed for each unit:

- **Acres of wet soils (sensitive soil rating)** - Acres of wet soil were obtained using the sensitive soils layer (mnf_soils_sensitive.shp). This layer was clipped to the unit boundaries and acres recalculated using ArcGIS.
- **Proximity to perennial streams/trout streams** - The proximity to perennial streams (some containing native trout) was determined using topographic maps in ArcGIS and noted in the table.
- **Average slope** - The units were analyzed individually by using 3 meter Digital Elevation Model data from the MNF GIS database.
- **Skid trail needs** - Units were analyzed using the logging plan in ArcGIS to determine how much skidding and how steep the skid system would be in each unit.

Any one of these criteria by itself may be enough to recommend a unit for helicopter logging. However, most recommendations for a change that resulted in a proposal from conventional harvesting to helicopter harvesting had two or more criteria present. Differences between the Proposed Action and Alternative 4 include the conversion of units to helicopter from conventional harvest methods and the elimination of new road construction. This precludes harvesting those conventional units that needed new roads to access them; they have either been converted to helicopter or dropped from the alternative. Also, no savannas will be included in this alternative. Some potential effects were mitigated by limiting the size of some conventional units to exclude sensitive areas for hydrologic effects (see the Hydrology Report). The effect of doing so is displayed in several tables below. Table 7 below displays a lower number of miles/acreage of skid trails/roads than in the Proposed Action.

Soil – Hydrological effects on subsurface flows

Within the project area, there are a group of soil types identified as sensitive "wet" soils. This group includes the Laidig soil series, on which activities are proposed. Laidig soils have slow permeability, low strength and seasonal wetness. Rutting would be a high probability on roads, landings and harvest units on these soils. Below, the table shows where these soils are located. There is also a concern with placing skid roads across these soil types, because excavating to create skid roads, as shallow as 18 inches, can intercept the seasonal high water table. Field observations were made in summer 2006 in several of the existing road cuts within the project area where these soil types were cut for road construction. Scientists observed subsurface water flowing readily (especially during wet times of the year under saturated conditions) from the soil profile. Often, the soil surface appears dry, but the subsoil is wet above a denser subsurface soil layer which seems to perch the water and prevent it from flowing into the deeper portion of the profile. Water has been observed flowing through voids and old root channels in the subsoil. The majority of the water that flows out of the soil profile in the cutbank is caught by the ditch line and directed through culverts under roads and back onto the landscape. Potential effects of intercepting this subsurface water table are as follows:

- Erosion of the cutbank and head cutting is possible with large flows.

- Sediment from the erosion moves along the ditch line.
- Changes occur in the hydrologic characteristics of the hillslope and are dependent upon the number of times these wet soils are intercepted by roads.
- Soil moisture may be reduced.

For these reasons, it is important that skid roads have been designed to take advantage of the bench features of the "bench-slope" topography in the area.

Skid Roads and Trails: Under Alternative 4, there are 17.8 miles of skid trail. Approximately 25.3 acres of landings would be developed (averaging the minimum and maximum figures provided).

Table 27. Length of skid trail and/or road by unit and the acreage disturbed based on 10 foot-, 12 foot- and 15 foot-wide skid trails/roads for Alternative 4.

Unit	Feet	Miles	10 ft. (Area in acres)	12 ft (Area in acres)	15 ft. (Area in acres)	Unit Acres	10 ft. (% Unit Disturbance)	12 ft (% Unit Disturbance)	15 ft. (% Unit Disturbance)
2	8192	1.6	1.9	2.3	2.8	37.0	5%	6%	8%
7	5386	1	1.2	1.5	1.9	27.4	5%	5%	7%
8	6156	1.2	1.4	1.7	2.1	30.8	5%	6%	7%
10	4498	0.9	1.0	1.2	1.6	28.7	4%	4%	5%
11	6806	1.3	1.6	1.9	2.4	32.5	5%	6%	7%
12	4188	0.8	1.0	1.2	1.4	18.0	5%	6%	8%
16	5998	1.1	1.4	1.7	2.1	32.9	4%	5%	6%
18	6708	1.3	1.5	1.9	2.3	36.1	4%	5%	6%
25	6541	1.2	1.5	1.8	2.3	35.9	4%	5%	6%
26	6272	1.2	1.4	1.7	2.2	26.5	5%	7%	8%
32	4933	0.9	1.1	1.4	1.7	33.8	9%	10%	11%
34	7521	1.4	1.7	2.1	2.6	33.4	5%	6%	8%
36	5880	1.1	1.4	1.6	2.0	20.9	7%	8%	10%
37	7738	1.5	1.8	2.1	2.7	33.8	5%	6%	8%
301	7066	1.3	1.6	2.0	2.4	38.4	4%	5%	6%
TOTAL	93880	17.8	21.6	25.9	32.4	466.1	5%	6%	7%

New road construction: No new roads will be constructed in this alternative.
Short-Term and Long-Term Effects: Under this alternative, less ground based skidding would be used to reduce the likelihood of soil erosion and stream sedimentation. Some units would be harvested via helicopter logging instead of conventional ground based skidding operations to reduce the chance of soil disturbance on steep slopes and/or wet soils. Approximately 18 miles of skid trail/road would be created using conventional ground-based skidding in this alternative.
The extent of ground disturbance and the estimated short- and long-term effects to soils is displayed below. In conventional harvesting operations, the impacts of unbladed primary skid trails and unbladed log landings are considered to be short-term impacts to soil

productivity because there would be no removal of the surface horizons. These horizons may be mixed due to rubber tire movement on top of the soil surface, but the majority of the soil remains on site and relatively in place. The table below displays the estimated effects to soils from the activities proposed in the alternatives considered in this environmental analysis. The assumptions used to display the effects are shown below the table. The extent of the effects in the activity areas are computed using these assumptions, reviewed literature, field visits and preliminary logging plans for the proposed project alternatives. The project area is approximately 14,400 acres and land management activities occur on 1,630 acres within the project area.

Table 28. Estimated Maximum Acreage of Short- and Long-Term Effects to Soil Productivity in Activity Areas for Alternative 4.

Activity	Short-Term	Long-Term
	Acres	
Skid Roads/Trails *(15 ft.width)*	32	21
Log Landings	25	13
Savannas	0	0
Total Acres Affected	**57**	**34**
Percent of total activity area disturbed *(1900 acres)*	**4%**	**2%**
Percent of project area disturbed *(14400 acres)*	**0.4%**	**0.2%**

Assumptions used for Table 8:

- Skid roads have 10-15 feet of travel way plus cutslope and 3 feet of fill slope.
- Primary skid trails are unbladed and have a 10-15 foot width.
- Approximately 65 percent of skidded areas would potentially have bare soil after six growing seasons (long-term effect) (Kochenderfer, 1997)
- Conventional log landings are approximately 1/4 acre each and helicopter landings are 1 acre. 50% of this area would be a long-term impact due to blading the area where trucks are loaded, while the balance of the area would be unbladed and considered a short-term impact.
- Primary skid trails and unbladed portions of log landings are short-term impacts due to ripping/tillage mitigation.

Less than 15 percent of soil productivity would be lost under this Alternative 4 for the unit boundaries, activity area, and project area for both short- and long-term effects.

Alternative 5

Skid Roads and Trails: No skidding is required for this alternative because it involves all-helicopter harvest.
New Road Construction: No new road construction will take place under Alternative 5.
Savannas: No savannas are proposed under this alternative.
Short-term and Long-term Effects: Landings will be an average of 35 acres (averaging the minimum and maximum figures provided).

Table 29. Estimated Maximum Acreage of Short- and Long-Term Effects to Soil Productivity in Activity Areas for Alternative 4.		
Activity	**Short-Term**	**Long-Term**
	Acres	
Skid Roads/Trails *(15 ft.width)*	0	0
Log Landings	35	18
Savannas	0	0
Total Acres Affected	**35**	**18**
Percent of total activity area disturbed *(1900 acres)*	**2%**	**1%**
Percent of project area disturbed *(14400 acres)*	**0.2%**	**0.1%**

Assumptions used for Table 9:

- Skid roads have 10-15 feet of travel way plus cutslope and 3 feet of fill slope.
- Primary skid trails are unbladed and have a 10-15 foot width.
- Approximately 65 percent of skidded areas would potentially have bare soil after six growing seasons (long-term effect) (Kochenderfer, 1997)
- Conventional log landings are approximately 1/4 acre each and helicopter landings are 1 acre. 50% of this area would be a long-term impact due to blading the area where trucks are loaded, while the balance of the area would be unbladed and considered a short-term impact.
- Primary skid trails and unbladed portions of log landings are short-term impacts due to ripping/tillage mitigation.

Less than 15 percent of soil productivity would be lost under this Alternative 5 for the unit boundaries, activity area, and project area for both short- and long-term effects.

Alternative 6

Skid Roads and Trails: There are approximately 44 miles of skid trail/road construction proposed for Alternative 6 (see Table 30 below). Under this alternative, 27 acres of log landings would be developed in the project area. The percentage of disturbed soil within the activity area would fall below the 15 percent threshold indicated by the R9 Soil Quality Standards.

Table 30. Length of skid trail and/or road by unit and the acreage disturbed based on 10 foot-, 12 foot- and 15 foot-wide skid trail/road for Alternative 6.									
Unit	**Feet**	**Miles**	**10 ft.**	**12 ft**	**15 ft.**	**Unit**	**10 ft.**	**12 ft**	**15 ft.**

			(Area in acres)			Acres	(% Unit Disturbance)		
1	6371	1.2	1.5	1.8	2.2	34.5	4%	5%	6%
2	7323	1.4	1.7	2.0	2.5	37.0	5%	6%	7%
3	6301	1.2	1.5	1.7	2.2	33.5	4%	5%	7%
6	4686	0.9	1.1	1.3	1.6	24.3	4%	5%	7%
7	5386	1.0	1.2	1.5	1.9	27.4	5%	5%	7%
8	6138	1.2	1.4	1.7	2.1	30.8	5%	6%	7%
10	4498	0.9	1.0	1.2	1.6	28.7	4%	4%	5%
11	6806	1.3	1.6	1.9	2.4	32.5	5%	6%	7%
18	6772	1.3	1.6	1.9	2.3	36.1	4%	5%	7%
19	4230	0.8	1.0	1.2	1.5	23.8	4%	5%	6%
20	3983	0.8	0.9	1.1	1.4	21.3	4%	5%	7%
21	6106	1.2	1.4	1.7	2.1	27.1	5%	6%	8%
23	7384	1.4	1.7	2.0	2.6	28.7	6%	7%	9%
24	7595	1.4	1.8	2.1	2.6	28.1	6%	8%	9%
25	6182	1.2	1.4	1.7	2.1	35.9	4%	5%	6%
26	4711	0.9	1.1	1.3	1.6	26.5	4%	5%	6%
29	4393	0.8	1.0	1.2	1.5	23.8	4%	5%	6%
31	7731	1.5	1.8	2.1	2.7	29.1	6%	7%	9%
32	4298	0.8	1.0	1.2	1.5	33.8	3%	4%	4%
34	7521	1.4	1.7	2.1	2.6	33.4	5%	6%	8%
35	7156	1.4	1.7	2.0	2.5	26.8	6%	7%	9%
36	5880	1.1	1.4	1.6	2.0	20.9	7%	8%	10%
37	7884	1.5	1.8	2.2	2.7	33.8	5%	6%	8%
38	5978	1.1	1.4	1.7	2.1	23.8	6%	7%	9%
201	22122	4.2	5.1	6.1	7.6	108.1	5%	6%	7%
203	27713	5.2	6.4	7.7	9.6	197.3	3%	4%	5%
301	7066	1.3	1.6	2.0	2.4	38.4	4%	5%	6%
401	6246	1.2	1.4	1.7	2.2	34.7	4%	5%	6%
TOTAL	*208457*	*39.6*	*48.0*	*57.6*	*71.9*	*1080.1*	*4%*	*5%*	*7%*

Road Construction: Alternative 6 proposes an average of 2 miles (based on the minimum and maximum numbers provided) of new road constuction. This activity creates approximately a 40 ft.-wide swath of soil disturbance. This would equal approximately 10 acres of soils being permanently converted to a use other than growing vegetation.

Savannas: One permanent opening would be developed to provide open, grassy habitat for such species as white-tailed deer, wild turkey, and black bear. Once the overstory is cut down, the stumps would be grubbed out, and then the trees, stumps, and other logging debris would be pushed into piles and retained in the downslope position of the disturbed soil to help prevent sediment from leaving the site. The area would be fertilized, limed, seeded with native grasses, legumes, and wildflowers, and planted with shrubs or trees

(see Botany/Ecology Report) and represent an immediate loss of soil productivity. Blading these sites, thereby removing the A horizon would cause a permanent loss of soil productivity. Nutrient cycling and carbon sequestration would be altered because pasture lands have different nutrient cycles than forested areas. Effects are expected to be minimal and not adverse since it only accounts for <1% of the total project area (see Wildlife Resource Report for details and description). Alternative 6 proposes one 35-acre savanna, in which general measures for soil protection are required until an established vegetative cover is accomplished. The measures include silt fences around any ephemeral streams. No intermittent or perennial stream channels are within proximity of the savannah. Soil productivity is expected to be altered due to the change in vegetation cover and the removal of most trees and understory vegetation. Stumps would be grubbed, therefore soil disturbance is expected to occur not only in the O and A horizons but down into the subsoil when removing root wads. Extensive mixing of the soil profile would result. Liming, fertilization, and seeding should occur as part of the creation of these areas. Soil fertility testing should be done to get recommended application rates for lime and fertilizer to ensure successful revegetation.

Short-Term and Long-Term Effects: The extent of ground disturbance and the estimated short and long-term effects to soils for Alternative 6 are displayed below. In conventional harvesting operations, the impacts of unbladed primary skid trails and unbladed log landings are considered to be short-term impacts to soil productivity because there would be no removal of the surface horizons. These horizons may be mixed due to rubber tire movement on top of the soil surface, but the majority of the soil remains on site and relatively in place. The table below displays the estimated effects to soils from the activities proposed in the alternatives considered in this environmental analysis**.** The assumptions used to display the effects are shown below the table. The extent of the effects in the activity areas are computed using these assumptions, reviewed literature, field visits and preliminary logging plans for the proposed project alternatives. The project area is approximately 14,400 acres and activities will occur on approximately 1,647 acres.

Table 31. Estimated Maximum Acreage of Short- and Long-Term Effects to Soil Productivity in Activity Areas for Alternative 6.

Activity	Short-Term	Long-Term
	Acres	
Skid Roads/Trails *(15 ft.width)*	72	47
Log Landings	27	14
Savannas	35	35
Total Acres Affected	***134***	***96***
Percent of total activity area disturbed *(1647 acres)*	**8%**	**6%**
Percent of project area disturbed *(14400 acres)*	**0.9%**	**0.7%**

Assumptions used for Table 6:

- Skid roads have 10-15 feet of travel way plus cutslope and 3 feet of fill slope.
- Primary skid trails are unbladed and have a 10-15 foot width.
- Approximately 65 percent of skidded areas would potentially have bare soil after six growing seasons (long-term effect) (Kochenderfer, 1997)
- Conventional log landings are approximately 1/4 acre each and helicopter landings are 1 acre. 50% of this area would be a long-term impact due to blading the area where trucks are loaded, while the balance of the area would be unbladed and considered a short-term impact.
- Primary skid trails and unbladed portions of log landings are short-term impacts due to ripping/tillage mitigation.

Less than 15 percent of soil productivity would be lost under Alternative 6 for the unit boundaries, activity area, and project area for both short- and long-term effects.

Comparison of Environmental Consequences across all Alternatives

To put the short- and long-term impacts of each alternative into perspective, the estimated acres impacted by alternative are compared to the total acres of the activity areas in Table 33 below. This table also includes the percentage of the activity area impacted by the alternatives. Soil productivity losses are not calculated for activities conducted on adjacent private lands. Obtaining these numbers would be difficult due to the variability in landowner activities and the absence of any statewide databases documenting soil disturbance. The Forest Service is aware that private land activities include timber harvesting, skid road development, grazing, agriculture activities, and other minor residential disturbances that can reduce soil productivity (see table of known activities within the project area). However, it would be also assumed that all of the activities described do contribute to the overall cumulative effect of the decrease in soil productivity both within the project area and the watershed.

A sizeable reduction in skid trail/road length is a beneficial effect of converting units from conventional harvest methods in the Proposed Action to helicopter harvest in Alternatives 3, 4, 5, and 6 Reducing numbers of conventional units reduces amount of skid roads and trails as shown in Table 10. Increasing helicopter units increase acres of landings because helicopter landings are larger than conventional their counterparts; Table 32 displays that the trade-off of skid trails for landings is beneficial in reducing total disturbance.

Table 32. Miles of Road and Acres of Landing.

	No Action	Proposed Action	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Total Miles	**0**	**75**	**42**	**18**	**0**	**44**
Total Acres	**0**	**20**	**31**	**25**	**31**	**27**

Table 33. Estimated Percentage of the Activity Area Soils Affected by Alternative.

	Activity Area (acres)	Percent of the Activity Area	
		Short-term	Long-term
No Action	0	0%	0%
Proposed Action	1900	12%	8%
Alternative 3	1680	9%	6%
Alternative 4	1630	4%	2%
Alternative 5	1617	2%	1%
Alternative 6	1647	8%	6%

The table above shows that the alternatives considered in this analysis would affect less than 15% in accordance with the R9 Soil Quality Standards. Conventional harvesting creates much more in-unit disturbance due to the skid trail/road system, which disperses the soil disturbance. Helicopter harvesting requires minimal in-unit soil disturbance but a larger disturbance area for the landing sites, which results in a more concentrated area of soil disturbance. In this project, there are less adverse effects due to concentrated soil disturbance from the landing sites than the dispersed soil disturbance from skid trail/roads. The landing locations are generally on ridge tops, nose ridges, or other gentle sloping (less than 8 %) landscapes. Soil movement would be minimal and the risk of intercepting water would be low.

Cumulative Effects

Historical documentation and physical evidence shows that the soils in this watershed have been severely impacted from past land uses in the late 1800's to around the 1930's. Currently the soils are recovering from massive amounts of disturbance including fires. Any disturbances to the soil resource that remove the soil to bedrock start the soil forming process over again. There are no activities proposed in this assessment that would have this effect; however, there are activities such as conventional logging, landing development, and road construction that disturb the soil surface and to some degree, the subsoil. Soil development would be then set back to some time before present, and to see the recovery of that soil to its native state may take a hundred years. In the case of roads, it would take a change in management and road obliteration for soil recovery to occur. The cumulative effect on the soil resource and associated soil productivity is that it would still be recovering from historic activities in the watershed, and with additional disturbance, the soil resource would take longer to recover.

Private Lands: Please refer to Table 4, Past, Present, and Reasonably Foreseeable Future Actions within or around the Lower Williams project area for a list of these activities, which include timber operations and mineral exploration. Soil productivity losses are not calculated for activities conducted on adjacent private lands. Obtaining these numbers would be difficult due to the variability in landowner activities and the absence of any statewide databases documenting soil disturbance. The Forest Service is aware that private land activities include timber harvesting, skid road development,

grazing, agriculture activities, and other minor residential disturbances that can reduce soil productivity (see cumulative effects table of known activities within the project area and surrounding watershed). However, it would be also assumed that all of the activities described do contribute to the overall cumulative effect of the decrease in soil productivity both within the project area and the watershed. These activities also contribute to sediment loads within the subwatersheds where private land exists with National Forest System lands and overall to the Lower Williams watershed.

National Forest System Lands: Forest Service activities occurring on NFS lands are listed in Table 4, including mineral exploration and past logging activity. Effects from disturbance that would have cumulative effects to the soil resource would include compaction from heavily-used areas such as primary skid roads, landings, and natural gas right-of-ways. These activities have had mitigations applied to them that addressed the effects in varying degrees. Forest Plan standards and guidelines provide for resource protection. The majority of this area has been reclaimed to some degree either naturally or through active management.
In 2006, the Monongahela National Forest decommissioned approximately 15 miles of roads within the planning area. This included decompacting soils, restoring drainage patterns, outsloping road surfaces, seeding and mulching. The project corrected a number of road related problems which should improve long term soil productivity and water quality in the area of North Cove and Johnson Run.

The other activities listed in Table 4 generally have had small incremental amounts of soil disturbance associated with them, such as the ongoing mowing of wildlife openings, road maintenance and recreational use. Qualitatively, soil productivity has not been diminished by these activities. No quantitative soil productivity measurements have been made in association with these activities and are not measurable at the project-level scale.

Unavoidable Adverse Impacts

The No Action Alternative would not implement actions that would cause unavoidable adverse impacts, but existing erosion on the road system in the project area would continue. The Proposed Action and all action alternatives would implement activities that would disturb soils, which may cause unavoidable adverse compaction, erosion, nutrient removal, and reduced soil productivity. However, direct, indirect, and cumulative effects are expected to be limited for Alternative 4, and even more so for Alternative 5. Less than 15 percent of the project area would be affected in the action alternatives. Implementing Forest Plan direction and design features and mitigation identified in Chapter 2 would reduce the potential for adverse impacts.

Irreversible or Irretrievable Commitment of Resources

Construction of landings, skid roads and savannas under the Proposed Action would result in an irreversible commitment of soil resources on approximately 168 acres. Alternative 3 irreversibly commits 101 acres. Alternatives 4 and 5 (which do not propose savannas) are irreversible on 34 acres and 18 acres, respectively. Finally, an irreversible commitment of 96 acres would occur in Alternative 6.

Irretrievable commitments of the soil resource to new road locations are as follows:

- 16 acres of soil dedicated to new roads under the Proposed Action,
- 10 acres in Alternative 3 and 6, and
- none for Alternatives 4 and 5.

Consistency with the Forest Plan

All alternatives would be implemented consistent with Forest Plan goals, objectives, standards, and guidelines as explained in the above discussions**.**

Consistency with Laws, Regulations, and Handbooks

All alternatives would be implemented in a manner consistent with Forest Service laws, regulations, and handbooks regarding management of the soil resource.

Aquatics

Introduction

The following is a description of the aquatic resources in the Lower Williams River project area, and the potential effects of implementing the alternatives being considered in the environmental impact statement. Please refer to Chapters 1 and 2 of the EIS for more detailed descriptions of the project area and proposed activities, and the Soil Resources report for more detailed descriptions of soil resources in the planning area and the potential effects of the alternatives.

Affected Environment

The health of aquatic resources is closely linked to the health of watershed conditions. Streams are the end result of a number of watershed processes that integrate the flow of water, energy and nutrients, which in turn are products of the watershed's geology, soil, vegetation, precipitation patterns and other factors. Aquatic communities depend upon the physical, chemical and biological components of the aquatic ecosystems they inhabit and the watershed characteristics that create those conditions. Land management activities can affect the natural characteristics of watersheds and aquatic ecosystems and alter their aquatic resource potential. Today, due to historic logging activities and contemporary pressures such as timber harvesting, roads and acid deposition, most of the streams in the Lower Williams planning area are under stress and their productivity is reduced. Factors contributing to the impairment include elevated levels of fine sediment, acid deposition and passage barriers that reduce habitat availability and isolate populations. Activities proposed in the Lower Williams can potentially contribute to these impairments or correct existing problems. Because of the relationship between aquatic environments and watershed conditions, the following analysis will be based upon watershed characteristics and the potential for land management activities to affect those characteristics.

Watershed Characteristics: The Williams River watershed is a "fifth level" hydrologic unit (HUC 05050005020) which is approximately 82,620 acres in size. The Lower

Williams project area encompasses the lower 14,400 acres in the Williams River watershed. The planning area includes approximately 10 miles of the Williams River main stem which flows through the planning area in a northwesterly direction to its confluence with the Gauley River. Major drainages within the planning area include White Oak Fork, Johnson Run, Laurel Run, North Cove Run, Spice Run, Sawyer Run, Jonathan Run, Hickman Run and Craig Run. There are also numerous unnamed perennial and non-perennial channels in the area. Approximately 92% of the planning area is National Forest System (NFS) lands, and 8% is in private ownership. The planning area is identified as Management area (MA) 3.0 in the Forest Plan, which emphasizes timber management and roaded recreation.

The topography in this area consists of moderate to high relief, with an elevation difference of approximately 1,500 feet. Slopes are typically gentle in drainage bottoms and along ridgetops, but sideslopes often range from 30-50% with some areas over 60% scattered throughout. The Williams River watershed receives between 46.7 inches and 62.1 inches of average annual precipitation at various locations but averages about 54.9 inches across the watershed. The high annual precipitation combined with steeper slopes results in high gradient, high energy streams and runoff in the watershed can be fairly rapid. The planning area is largely forested, with some agricultural development occurring on private lands along the Williams River and in the western portion of the watershed.

Water quality within the Lower Williams is influenced by natural watershed characteristics as well as past and present management activities. Streams within the Lower Williams River have evolved in soils derived primarily from geologies of the Pottsville Group, and to a lesser extent the Mauch Chunk Group which is located mostly low in the watershed along the main stem. The Pottsville Group is rated high for sensitivity to acid deposition and streams in the area are susceptible to acidic conditions. Currently, two streams within the planning area have segments identified on the West Virginia Division of Environmental Protection's 303d list of impaired waters (WVDEP 2006). The Williams River main stem, from river mile (RM) 2.6 upstream to its headwaters is listed for aluminum impairment, and the lower reach of Craig Run, up to RM 0.4, is listed for pH impairment. These impairments are likely related to the geology found within the Lower Williams River and the effects of acid deposition. It should be noted that we cannot assume that streams <u>not</u> on the 303d list are in full compliance with water quality standards. Streams may be impaired but there is inadequate information to make a determination and formal 303d listing. We also can't assume that streams that comply with water quality standards do not have impairments that reduce their biological productivity.

Aquatic Biota: A number of native fish species, primarily non-game species, inhabit the streams within the planning area. No fish sampling was conducted specific to this assessment, but a review of existing fish sampling data shows that the Williams River watershed is inhabited by 31 fish species representing Cyprinidae (minnow), Catostomidae (sucker), Salmonidae (trout), Centrachidae (bass), and Percidae (perch) fish families. There are 25 native fish species (6 non-native) including 4 Regional Foresters

sensitive species - candy darter (*Ethoestoma osburni*), Appalachian darter (*Percina gymnocephala)*, New River shiner (*Notropis scabriceps*), and Kanawha minnow (*Phenacobius teretulus*). The four sensitive fish species and bigmouth chub (*Nocomis platyrhychus*) are endemic to this watershed. In addition to the four sensitive fish species, one sensitive amphibian, the eastern hellbender (*Cryptobranchus alleganiensis*) has been reported within the Williams River watershed. There are no aquatic species that are federally listed under the Endangered Species Act (ESA) known to occur in the watershed. Species diversity is generally greatest in the main stem and the lower reaches of the larger tributaries. The smaller, colder streams and headwaters typically support fewer species such as native brook trout and blacknose dace.

Aquatic RFSS: A goal of the Forest Plan is to maintain viable populations of native and desired non-native species, and keep RFSS from a trend towards federal listing. In some cases, sensitive fish have not been reported in several decades and their presence in the main stem is questionable. But, in the absence of conclusive data, the assumption of this analysis is potential habitat still exists and will be considered.

Little is known of the habitat requirements of the Appalachia darter. In a study of four darter species in streams on the Monongahela N.F., Chipps (1993) observed that Appalachia darters tended to use deeper habitats (runs and pools) than the other species. He also classified them as benthic-insectivores. Fishbase (2004) characterizes Appalachia darter habitat as gravel and rubble runs and riffles of small to medium size rivers. There is no information available on temperature preferences, but the collection sites within the proclamation boundary can generally be characterized as cool to cold water systems.

Appalachia darters were last recorded in the Williams River in 1977 (Heritage database). Their presence within the planning area is currently unknown, but their preference for larger streams means suitable habitat would be found in the main stem of the Williams River and they are unlikely to be found utilizing the tributaries.

Candy darters prefer swift flowing riffles and runs with rocky substrates. They are typically found in small to moderate size streams with cool to cold water and feed on aquatic insects. Chipps et al 1993, reported on the status of candy darters on the Monongahela National Forest. He stated they are well distributed in the Cherry, Upper Greenbrier and Upper Gauley river systems, but expressed concerns for populations in the Williams River, Deer Creek and Anthony Creek. He identified siltation as the major threat to candy darter populations. Past records found candy darter distributed in the main stem Williams River and more recent sampling indicate that candy darter may be making a recovery in the Williams River possibly due to acid remediation efforts in the watershed (Dan Cincotta, personal communication, 2003).

Kanawha minnow typically inhabit medium sized rivers with clear, warm water, and substrates of gravel, rubble and boulders (Sporre et al. 1995). Adults prefer riffles and runs with swift currents, while juveniles occupy areas with slower currents. Kanawha minnows primarily feed on aquatic insect larvae. Sporre et al. 1995, speculated that Kanawha minnow populations may be threatened by acidic conditions and fine sediment. There is only one record of Kanawha minnow in the Williams River and that was

collected in 1944 (Heritage database). It is unlikely to be present within the watershed and may even be extirpated from the Gauley River (Dan Cincotta, personal communication, 2003).

New River shiner inhabit pools and slow runs of small to medium size streams and rivers with rock, gravel, sand and sometimes even moderately silty substrates. Stream temperatures range from cool to warm water. They feed upon insects and leeches. New River shiner populations may be impacted by mining and logging activities, and increased stream temperatures due to the removal of riparian vegetation (NatureServe 2004). Dan Cincotta (personal communication, 2003) considers them to be declining in the Gauley River system, possibly due to acidic or low productivity streams. There are two records of New River shiner in the Williams River and they were both collected in 1944 (Heritage database). Potential habitat for New River shiner would be the main stem of the Williams River, but it is unlikely that they presently occur within the planning area.

One amphibian on the RFSS list, the Eastern hellbender (*Cryptobranchus alleganiensis*), has been reported within the Williams River watershed. They were observed in Red Lick Run, which is a small tributary to the Williams River just upstream of the planning area (Heritage database). Hellbenders reside in rocky, clear creeks and rivers, usually where there are large shelter rocks. They usually avoid water warmer than 20°C. Males prepare nests and attend eggs beneath large flat rocks or submerged logs. Hellbenders are completely aquatic salamanders, remaining under cover by day, and occasionally foraging on the stream bottom at night. They are carnivorous and eat primarily crayfish, although fishes (often scavenged) and other aquatic invertebrates are also eaten. The principal threat to hellbenders is degradation of habitat, including silt and nutrient runoff (NatureServe, 2005). The species depends on cool, flowing, well-oxygenated water, and it needs a coarse (rocky) substrate. It appears to be intolerant of heavy recreational use of its habitat. Streams within the planning area are potential habitat for Eastern hellbender, but they may be limited by siltation and acidic conditions.

Aquatic MIS: Native brook trout are identified in the Monongahela National Forest Land and Resource Management Plan (USFS 2006) as a management indicator species (MIS), with a management objective to maintain or improve their habitat. Brook trout prefer streams with cold, clean water, a 1:1 pool to riffle ratio and abundant cover (USFWS 1982).
A number of streams within the planning area support native brook trout populations. White Oak Fork, Sawyer Run, Spice Run, Jonathan Run and Craig Run are all identified on the presumptive list of Tier 2.5 streams under the anti-degradation rule (West Virginia Department of Environmental Protection web site 2006). Under the anti-degradation rule, Tier 2.5 streams are those streams that support naturally reproducing trout populations, are identified as reference streams, or have a high biological rating that indicates high water quality. In addition to the streams listed as Tier 2.5, brook trout were collected in Johnson Run in 2003 (fish sampling data on file at Monongahela NF Supervisor's Office), and they could be present in other tributary streams.

Aquatic Habitat and Water Quality: Overall, fish habitat and trout productivity in the Lower Williams project area are considered to be reduced due to impacts associated with logging around the turn of the last century and contemporary land uses. Streams generally have elevated levels of fine sediment and reduced channel structure that effects water quality and habitat conditions. It is also likely that acid deposition is affecting stream productivity in the planning area.

Fine sediment in stream channels can affect water quality and trout productivity. The reproductive success of native brook trout is reduced as levels of fine sediment (<6.5mm) exceed 20% in spawning gravels (Bjornn and Reeser, 1991). On the Monongahela National Forest, fine sediment is defined as particles less than 4mm in size, which approximates the size of a brook trout egg. An analysis of paired trout and sediment data collected from streams on the Monongahela National Forest showed that trout productivity generally began to decrease around 20% fine sediment (Edwards, personal communication 2002).

Existing data on fine sediment samples collected within the planning area showed consistently high levels of fine sediment for the period 1994-1999 in Craig Run and Jonathan Run (Table 34). Two more recent samples, one in Craig Run and one in Sawyer Run, collected in 2006, showed fine sediment levels to be 11.2% and 20.9% respectively. The 11.2% for Craig Run suggests that conditions are currently good, but, due to the limited sampling size and past sampling results this figure is probably an anomaly. Observations made during field reconnaissance for this project support the concern that streams in the planning area are impaired by elevated levels of fine sediment.

Table 34. Percentage of Fine Sediment (<4mm in size) in Potential Spawning Sites.

Stream	1994	1995	1996	1997	1998	1999	Avg.
Craig Run 1	35.0	32.0	32.0	28.0	31.0	-	31.6
Craig Run 2	26.0	23.0	26.0	38.0	31.0	-	28.8
Jonathan Run	27.0	38.0	27.0	30.0	41.0	36.5	33.3

The concern is additional ground disturbance within the Lower Williams River may result in additional sources of erosion and sedimentation and exacerbate the problem of fine sediment in native brook trout streams. Opportunities to improve watershed conditions and minimize additional impacts would be beneficial for reducing the effects of sedimentation in the planning area and improving trout productivity.

Fish habitat conditions in the Lower Williams River are also affected by a loss of large woody debris (LWD). Large woody debris is important for a number of functions in perennial, intermittent and ephemeral channels. In perennial streams LWD increases habitat complexity by scouring pools, trapping spawning gravels, provides hiding cover, and helps to dissipate stream energy. In intermittent and ephemeral channels LWD helps to trap and store sediment in the watershed, provides structure for channel stability, and helps retain moisture (Duncan et al 1987, Hicks et al 1991, Flebbe and Dolloff 1995).

Past logging activities have left most streams in the Lower Williams River planning area with limited levels of LWD. The extensive clear cutting around the early 1900's removed trees adjacent to stream channels that were the source of LWD. Until the riparian timber stands mature, recruitment of LWD has been greatly reduced for the past 60+ years. This has resulted in the existing low levels of LWD in stream channels, and stream environments that are simplified and generally lack adequate pool habitat and hiding cover. Today, the riparian timber stands are maturing and natural recruitment of LWD is expected to increase as trees die and fall into the stream channels. Protecting riparian timber stands to retain this source of recruitment is important for the restoration of aquatic habitat in the Lower Williams planning area. Another stressor to the aquatic biota in the Lower Williams River project area is acid deposition. Streams draining acid sensitive geologies are susceptible to acidification, and water chemistry sampling indicate that most streams sampled in the project area are acidic for all or portions of the year (Table 35).

Table 35. Stream pH and Acid Neutralizing Capacity (ANC) Measurements within the Lower Williams Project Area.

Stream/Season	pH	ANC (ueq/L)	Stream/Season	pH	ANC (ueq/L)
Craig Run/Fall 2006	6.43	70.04	Spice Run/Fall 2006	5.89	N/A
Johnson Run/Fall 2006	5.42	N/A	White Oak Fork/Fall 2006	5.99	14.40
Jonathan Run/Fall 2006	5.19	-44.85	Williams River/Fall 2001	7.65	467.7
North Cove Run/Fall 2006	7.21	86.29	Williams River/Spring 2002	7.17	144.7
Sawyer Run/Fall 2006	5.51	-30.30	Williams River/Fall 2006	7.24	364.83

N/A: Data is not available.

Stream pH is typically lower in the spring during runoff conditions and then increases during the summer baseflow conditions. Most of the samples recorded were taken in the fall at a time when pH levels should be near their highest, and even then most streams were acidic (below 7.0). The two exceptions were the Williams River main stem and North Cove. Results from the Williams River are influenced by the mix of geologies within the larger watershed area, including a predominance of Mauch Chunk in the headwaters, and the addition of limestone fines in Tea Creek and Sugar Creek upstream. Otherwise, most of the tributaries sampled within the project area had low pH levels (<6.0) and low levels of ANC (<50). The listing requirement criteria for pH in West Virginia is less than 6.0 (WV 47CSR2, Appendix E, Table 1), so a number of streams in the planning area could be considered impaired for pH, and existing conditions are likely stressing aquatic communities.

The concern is that additional soil disturbance and removal of timber can contribute to the loss of soil nutrients and base cations, and exacerbate the effects of acid deposition. Our understanding of the impacts of acid deposition on watersheds and aquatic ecosystems is increasing, but how land management activities relate to this issue is currently unclear.

Streams within the Williams River planning area represent habitat for a number of aquatic organisms. The amount of habitat available is dependent upon a number of factors such as water quality, stream temperatures, habitat characteristics and accessibility. The influence of culverts on the movement of aquatic organisms is becoming an increasingly important issue related to the connectivity of stream segments and populations. The improper sizing and installation of culverts can result in passage barriers for organisms moving upstream and down. This in turn has the potential to isolate populations and habitat upstream of barrier culverts, and reduce the genetic mixing between populations. Should an upstream population fail, for example, during a period of drought, then downstream populations would be unable re-colonize the habitat during more favorable conditions.

Problems typically arise from culverts that are undersized and create water velocities that are impassable, culverts set too high so fish and other organisms are unable to enter from downstream, or culverts that are difficult to pass through because of their length, flow conditions and/or substrate. Direction in the Forest Plan (WF 20) would provide passage when new roads are constructed or reconstructed; unless a passage barrier is needed to meet aquatic resource management objectives (e.g., restrict the movement of non-native or undesirable species).

Utilizing geographic information system (GIS) layers for roads and streams, 53 stream crossing on systems roads and 12 stream crossings on woods roads were identified within the planning area. All of the stream crossing have not been inventoried, so the type of stream crossing that is present and if it is a passage barrier is undetermined. Opportunities do exist, when roads are reconstructed or when culverts are replaced due to maintenance needs, to correct existing problems when they are encountered.

Resource Impacts or Issues Addressed

Issue 1: Erosion and Sedimentation

Issue: Soil disturbance associated with timber and road management activities may increase erosion and sediment delivery to streams. This can effect soil and water quality, as well as impair trout productivity within the project area through deposition of fine sediment and potentially exacerbate the effects of acid deposition by reducing soil nutrients and base cations. Measures are identified to compare the potential soil disturbance in each alternative.

Measure 1: Miles of new road construction and road reconstruction
Measure 2: Miles of skid roads and trails
Measure 3: Acres of soil disturbance

No other significant aquatic resource issues were identified during scoping. However, the action alternatives can affect aquatic resources in other ways that will be addressed in this analysis. These include potential effects to riparian areas, road crossing impacts on stream channels and aquatic organism passage, the potential for increased runoff and floods due to the removal of the forest canopy and potential effects to water chemistry.

Scope of the Analysis

Proposed activities are distributed throughout the planning area and have the potential to affect a number of tributaries to the Williams River. Of particular concern are the larger, fish-bearing tributaries Craig Run, Jonathan Run, Sawyer Run, Spice Run and White Oak Fork. Each alternative will be evaluated for potential direct and indirect effects on aquatic resources within the planning area. **Direct** effects are caused by activities that have a direct impact on aquatic resources and occur at the time the project is implemented. Activities in the action alternatives that have direct effects on aquatic resources include skid roads that cross stream channels and road construction and reconstruction at stream crossings. Otherwise, management activities are typically designed to avoid direct impacts to stream channels. **Indirect** effects are effects that occur at a later time or location from where or when the project is implemented. Indirect effects can be caused by activities that change runoff patterns, erosion rates, water chemistry or riparian characteristics.

The spatial boundary used to address **cumulative** impacts is the Lower Williams River watershed. The effects of the alternatives are considered in context with past, present and reasonably foreseeable future actions of other activities within the watershed. Any substantial or measurable influence associated with the project is not expected to extend further downstream than the limits of the project area at the mouth of the Williams River (at its confluence with the Gauley River). This is because of the modest acreage of proposed activities relative to the size of the planning area and the Williams River watershed, and the mitigation measures that have been designed into the project to reduce effects.

The temporal boundary used to evaluate direct and indirect consequences is about 10 years. Research has shown that sediment and hydrologic effects from timber harvesting generally return to pre-harvesting levels in about 5-10 years (Kochenderfer et al. 1997, Hornbeck et al. 1997, Swank et al. 2001). Therefore, the temporal boundary used to evaluate cumulative impacts will also be about 10 years.

Methodology

Timber harvest and connected actions have the potential to affect a number of watershed processes. The removal of timber, the type of logging method used and the associated transportation system can alter watershed, riparian and aquatic conditions to varying degrees. The potential risk of these activities is dependent upon the scope of the action, the existing site conditions and the effectiveness of the mitigation measures used. It is assumed that the more acres treated, the greater the risk to watershed, riparian and aquatic conditions.

Because the amount, type and distribution of timber harvest varies by alternative, it can be used to show the relative differences between alternatives and their potential impacts related to:

1) Soil erosion and sedimentation effects on aquatic ecosystems,
2) Water quality and quantity
3) Channel and floodplain modifications

The primary concern is the potential to affect watershed and aquatic conditions due to ground- disturbing activities that cause erosion and reduce water quality and fish habitat. The extent of the effect is largely based on the magnitude of the ground disturbance, soil characteristics, topography, proximity to a stream channel, effectiveness of the mitigation measures, and the existing conditions of the receiving channel. Elevated sediment levels can adversely affect spawning and rearing habitat, and macro-invertebrate populations that are important food sources for fish. See the Soil Resources report for more detail on existing soil conditions and potential effects of management activities in the Lower Williams project area.

The evaluation for sedimentation considers the amount of ground disturbing activities that may result in increased erosion, and the location of the disturbance relative to the channel network. Ground disturbing activities are primarily associated with timber and road management activities. The greatest source of sediment due to timber management activities is generally due to the transportation system and logging roads (Duncan et al 1987, Waters 1995). Existing road related problems and construction of new roads are the greatest concern along with the development of skid roads and trails in conventionally logged units. Improving the drainage and surfacing on existing roads and closing any unneeded roads can help reduce sediment inputs (Swift Jr. 1984, Trieu 1999).

The analysis differentiates between acres treated using helicopter logging and acres using conventional, ground-based logging systems. The potential for soil disturbance in conventional units is much greater than in helicopter units. The assumption is the greater the level of ground disturbance, the greater the potential for impacts associated with erosion, sedimentation, soil nutrient loss, and modified runoff patterns. Conventional logging may also require more roads than helicopter logging in order to access remote units. Potential road-related impacts include ground disturbance, sedimentation, modified runoff patterns, channel and floodplain modifications, and aquatic passage barriers.

The following assumptions were made to evaluate the area of ground disturbance associated with logging methods. In units that are conventionally logged, soil disturbance occurs along skid roads and at landing sites. Assuming skid roads average **15 feet in width, there are 1.82** acres of soil disturbance for each mile of skid road. Landings for conventional units are assumed to be 0.25 acres in size. Units harvested by helicopter are considered to have negligible ground disturbance as the trees are felled and then lifted from the site, and helicopter landings are estimated to be 1 acre in size.

Road management activities proposed in the Lower Williams planning area can also affect watershed conditions and aquatic resources. New road construction represents

areas of new soil disturbance within the watershed and potential sources of erosion. For the purpose of this analysis, it is assumed that each mile of road construction represents 4 acres of new soil disturbance. This assumes that the average width of system roads is 33 feet which includes the cut and fill slopes and running surface. Roads that are reconstructed can be beneficial in the long run if existing road related problems are corrected, but short term impacts are likely to occur from road widening, replacement of culverts and installation of cross drains. The work is also a precursor to increased road use due to timber harvesting. Many of the roads identified for reconstruction are behind gates, so they currently receive little use and have re-vegetated in some cases. For the purposes of this analysis, roads to be reconstructed are identified as a short term impact to aquatic resources. An exception to this is if the reconstruction results in improved passage at barrier culverts which would be beneficial. Implementing Best Management Practices and Forest Plan standards and guidelines can minimize the potential impacts of the roads, but the management activity represents a disturbance over existing conditions. Road hardening and road maintenance are also proposed for a number of roads in the planning area. These can be beneficial if they correct existing problems such as rutting, but are generally considered a preventative action by maintaining culverts and cross drains, and protecting the running surface of the road.

In addition to effects associated with erosion and sedimentation, timber management activities can also affect runoff patterns, water chemistry, riparian conditions, and stream channel conditions. Trees play a role in the hydrologic function and nutrient cycling within watersheds. Runoff from forested watersheds is influenced by a number of factors such as precipitation patterns, vegetative cover, soil characteristics, elevation, and topography. Management activities that alter soil or vegetative characteristics can potentially affect the hydrologic response of the watershed if the size and intensity of the activity is great enough.

Studies of the effects of timber harvesting on stream flows in small, headwater drainages have shown that, as hardwood forests are harvested, evapo-transpiration is reduced and stream flows can increase (Lull and Reinhart 1967, Hornbeck et al. 1997, Kochenderfer et al. 1997). This effect is most pronounced during the growing season and the increase is relatively short lived (Hewlett and Helvey 1970, Douglass and Swank 1972, Swank et al. 2001). Within a year, as the harvested sites revegetate, the influence on stream flows is greatly reduced and the hydrologic response of the site generally returns to pre-harvest conditions in 5-10 years (Hornbeck et al. 1997, Swank et al. 2001).

Increased stream flows due to timber harvesting primarily occur during the summer and fall when flows are typically at their lowest (Hornbeck 1973, Hornbeck et al. 1997, Swank et al. 2001). Studies show that timber harvesting can affect storm flows and peak flows, mainly during the growing season, and to a lesser extent during the dormant season (Hewlett and Helvey 1970, Swank et al. 2001). In watersheds that receive snow during the dormant season, peak flows can even be reduced because of changes in the distribution and melting of snow packs due to timber harvesting (Hornbeck 1973, Hornbeck et al. 1997). In a 74 acre watershed that was clearcut on the Fernow

Experimental Forest, peak flows increased an average of 21% during the growing season and decreased 4% in the dormant season (Reinhart et al. 1963).

The amount of stream flow increase is largely dependent upon the type of harvest (e.g. clearcutting, partial cutting, or thinning) and the size of the area harvested (Reinhart et al. 1963, Douglass and Swank 1972, Arthur et al. 1998, Swank et al. 2001). Approximately 20-30 percent of the watershed basal area needs to be removed before an increase in flows due to harvesting can be detected (Hornbeck et al. 1997, Hornbeck and Kochenderfer 2000). Although increases in storm flows and peak flows have been measured on small, headwater channels where the entire catchment has been harvested, the effect on downstream channels is quickly diminished due to the limited treatment area relative to the increasing drainage size. In order to influence large-scale floods, large-scale harvesting would have to occur throughout a watershed (Hornbeck and Kochenderfer 2000). Researchers have generally concluded that contemporary timber harvesting in forests of the eastern United States is not on a scale that would affect flooding downstream (Douglass and Swank 1972, Hornbeck 1973, Hornbeck et al 1997). There is a potential though that harvesting that is concentrated in smaller headwater drainages may have localized effects to stream flows.

For the purpose of this analysis, clearcuts and shelterwoods are considered to remove 100% of the basal area within the harvest unit and will have the highest potential for effecting streamflows. In addition, the creation of savannahs is also considered to remove 100% of the basal area in the treated area. Units to be commercially thinned generally remove an average of 33% of the basal area. The analysis will also assume that all vegetative treatments within the project area will occur in the same year. The resulting hydrologic response will represent a "worse case" scenario if all vegetative treatments are conducted at the same time. The first year after treatment is the period when the project area would show the greatest hydrologic response and is most vulnerable to the cumulative effects of increased flows. The analysis considers that a detectable change in streamflow occurs when 20% of the existing basal area is removed by all the vegetative treatments combined. It should be noted that the existing baseline conditions represent modified hydrologic conditions due to past and present land management activities, such as roads and past harvest activities. It is assumed that these conditions have been present for several years and channels have adjusted to the modified flows during this time. The analysis will look at the potential effect of the proposed projects on these modified baseline conditions.

Roads, skid trails and landings can also influence the hydrologic response of a watershed by compacting soil and reducing the infiltration rate of water, or by intercepting groundwater along road cuts (Coats 1999). Roads efficiently route water through the watershed and act as extensions to the stream drainage network. The construction of new roads and skid roads are considered to be areas of new disturbance over existing conditions and can contribute to modifying the hydrology of the project area. Roads that are reconstructed may reduce the current effect of roads on the watershed by improving existing road drainage problems, and opportunities to decommission unneeded roads would also be beneficial.

The role of trees in nutrient cycling is a growing concern in watersheds with geologies that have poor acid-buffering capacity and are sensitive to acid deposition. Soil nutrient loss and base cation depletion due to acid deposition can impact water quality in the streams draining these watersheds (see the *Soil Resource and Air Quality* sections for more detailed descriptions). A number of streams in the planning area have pH levels that impair stream productivity. The alternatives will be evaluated on the potential level of ground disturbance and timber harvest within the drainage areas that support these streams potentially resulting in a loss of base cations and aggravating the effects of acid deposition.

Timber harvest has the potential to affect riparian areas which in turn can affect recruitment of large woody debris, stream shading and bank stability. Channels that are within or adjacent to timber harvest units will have buffer strips where no programmed harvest will occur. Along perennial channels the buffer strip will be a minimum of 100 feet wide on both sides of the channel to provide the full potential of LWD recruitment. The buffer strip will also provide bank stability and stream shading along perennial streams. On intermittent channels where the stream energy and transport of LWD is reduced, buffer strips will be a minimum of 50 feet wide on both sides of the channel. Ephemeral channels within or adjacent to units will have a 25-foot wide buffer strip on both sides of the channel.

Channel buffers are intended to provide for a variety of functions, including recruitment of LWD. There are a number of studies on the importance and role of LWD in stream channels, but few addressing the recruitment potential from riparian stands. McDade et al 1990, evaluated the source distance of LWD in 39 streams in the Pacific Northwest and found that 70% of the LWD that was recruited from riparian areas originated from within 66 feet of the stream channel. For hardwood species, 83% of the recruitment came from within 33 feet, and all hardwood LWD originated from within 82 feet. For conifers with taller average stand heights, the source distances were greater. Approximately 53% of the conifer LWD recruitment originated from within 33 feet of the channel, and 87% originated within 82 feet. A similar study in Oregon by May and Gressel, 2003, found 80% of LWD recruitment in headwater streams came from source distances of 30-50 meters (98-164 ft). We can speculate that our buffers along perennial channels will provide similar rates of recruitment potential as those observed in the studies and protect close to 100% of the recruitment potential in treated stands. For small, intermittent and ephemeral channels the default channel buffers are reduced to 50 feet and 25 feet along both sides of the channel respectively. These represent a decrease in the recruitment potential within the treated areas, but these streams are typically smaller with less stream energy so losses of LWD due to transport are reduced.

One unit, Shelterwood 1, proposes to use herbicides if striped maple or beech impede regeneration of desirable species have the first harvest. The herbicides triclopyr and glyphosate would be used in this treatment and applied directly to seedlings and saplings. Information obtained from reviews of the effects of herbicides, and on the results of some monitoring work done elsewhere, have shown that these herbicides are safe to water quality and aquatic biota, and to the public when they are applied according to label

directions and all applicable laws and regulations, and with mitigation measures for the protection of water and aquatic resources. These mitigation measures include filterstrip protection along stream channels, target-specific application methods, and wet weather restrictions on application. Supervision of herbicide treatments will be by a State certified applicator. As long as all requirements and mitigations are followed, no substantial offsite adverse effects in streams or groundwater are expected. No measurable adverse effects to the aquatic community are expected.

Roads in the Lower Williams River planning area will be utilized to access units and to haul timber. Aside from their potential effects on erosion and sedimentation as discussed earlier, roads can create passage barriers for aquatic organisms and fragment stream habitat. The alternatives will be evaluated for their potential to create additional stream crossings on existing or potential fish-bearing streams, and for their potential to correct existing problems when roads are reconstructed.

Direct/Indirect Environmental Consequences by Alternative

Under the **No Action Alternative**, current management activities and natural processes would continue, but no new actions would be implemented. In the short term, current sediment and LWD conditions in the Lower Williams River project area are likely to persist and continue to suppress trout populations. No new sources of sediment would be created under the No Action Alternative, but existing sources would not be repaired and would continue to contribute sediment to the streams in the planning area. In the long term, LWD levels should increase as the existing forest matures and trees adjacent to functioning channels fall. As a result, sediment levels may decrease through time as sediment storage within the watershed increases with increased levels of LWD in perennial, intermittent and ephemeral channels. Fish habitat diversity will also increase as LWD is incorporated into channels and improves spawning and rearing habitat. No vegetative treatments would be implemented so the hydrologic response of the watershed would largely remain as is and the source for LWD recruitment would not be reduced. Any changes in runoff patterns or LWD recruitment would be due to natural events that create openings in the forest, such as fire, wind or disease, or from increased activities on private lands.

Alternative 2 represents the **Proposed Acti**on and has the greatest level of activity. The alternative includes 1,054 acres of regeneration harvest, 38 acres of shelterwood harvest, 750 acres of commercial thinning, and 70 acres of savannah development. In addition, 20 acres of wildlife openings will be created from landing sites. The savannahs and wildlife openings will be maintained through the use of herbicides and mowing. In the regeneration units, 1,021 acres will be conventionally logged and 33 acres will be helicopter logged. The commercial thinning will consist of 521 acres of conventional logging and 229 acres of helicopter logging. The shelterwood and savannahs will also be conventionally logged. All the conventional logging will utilize 13 landings, and seven landings will be developed for helicopter logging. The Proposed Action includes three miles of new road construction, two miles of road reconstruction and nearly 64 miles of skid roads and trails.

Erosion and Sedimentation: Overall, the combination of activities in Alternative 2 will disturb an estimated 193 acres of soil in the planning area (Table 36). Aside from road reconstruction which may result in correcting some existing road related problems, the majority of acres disturbed represent potential new sources of erosion and sedimentation and a general downward trend in watershed conditions over existing conditions.

Table 36. Estimated Acres of Soil Disturbance in Alternative 2.

Alternative 2	Miles or No.	Acres Disturbed
Skid Roads/Trails (avg. 15 ft wide)	64	116.5
Conventional Landings (¼ acre)	13	3.3
Helicopter Landings (1 acre)	7	7.0
Savannah (35 acres)	2	70.0
New road const. (4 acres/mi)	3	12.0
Road reconstruction (4 acres/mi)	2	8.0
Total		216.8

Activities in the Proposed Action are distributed throughout the Lower Williams River planning area and can potentially affect a number of streams and aquatic resources. Forest Plan direction provides one hundred foot wide filterstrips between ground disturbing activities, such as skid roads, and functioning stream channels (SW 40). Filterstrips are designed to protect groundcover in order to trap sediment into the existing forest floor before it can reach the stream channel and the width can be adjusted to account for soil types and slope. An evaluation of proposed skid road locations using GIS shows that most skid roads (94%) are located greater than 200 feet from streams that show as blue lines on topographic maps. The skid road locations are approximate and adjustments will be made on the ground to avoid seeps, springs, rock outcrops and other resource concerns. This may affect the filterstrip widths either positively or negatively, but the standard for 100 feet will be retained except for at essential channel crossings or if greater resource protection could be achieved by relocating the proposed skid road.

The location of activities, coupled with Forest Plan direction will minimize erosion and sedimentation, but given the existing conditions and stresses even minimal effects can be detrimental to native brook trout populations. Of particular concern are ground disturbing activities that are located within the drainage areas of native brook trout streams. Craig Run, Jonathan Run and Sawyer Run have relatively high levels of activities that can result in increased erosion and sedimentation. Within the Jonathan Run drainage, an old woods road will be used as a skid trail for the portion of Thinning Unit 3 that is located on the west side of Jonathan Run. This road is wet, poorly drained and could deliver sediment to Jonathan Run via ephemeral channels and the drainage ditch associated with FR 429. A similar situation occurs in Sawyer Run where an old mine road will be utilized as a skid trail for Regeneration Unit 6. Drainage patterns within the area have been modified by past mining activity and the old road currently is wet in numerous spots and drains towards Sawyer Run. Frequent cross drains should be established on these roads to disperse water, and sediment traps, such as debris bundles,

should be used to minimize sediment movement below the skid roads. After completion of harvest activities, these roads should be ripped, outsloped and revegetated to restore watershed conditions. The concerns for these old roads used as skid trails apply to Alternatives 3 and 6 which also propose to utilize these roads.

Alternative 2 has the highest level of new road construction with three miles proposed. The proposed roads (FR 82C, FR 82D, FR 101A-A, FR 272B and FR 735A) represent new areas of soil disturbance but they are generally located high in the drainages and along ridgelines or saddles. The new construction with the greatest concern for aquatic resources is FR 101A-A. It is a mid-slope road located within the Craig Run drainage on slopes generally ranging from 31-40%, and some over 40%. Development of this road in conjunction with the reconstruction and use of FR 101A will likely have direct and indirect effects to Craig Run. Reconstruction of FR 101A would provide an opportunity to correct any passage problems that might occur where the road crosses the headwaters of Craig Run.

In Alternative 2, Unit 9 is proposed for conventional logging. Access to the unit would cross an unnamed perennial tributary to the Williams River and logs would be skidded across the tributary to the landing site. In order to minimize potential sedimentation and bank damage to the tributary, a temporary bridge should be utilized for the stream crossing.

Stream Flow: Overall, the level of harvest activity does not appear to influence stream flows, but localized affects are likely to occur where activities are concentrated. Table 37 displays the projected percentage of basal area removed by activities in Alternative 2. As discussed earlier, approximately 20-30% of the basal area needs to be removed before a change in stream flows can be detected. Within the planning area an estimated 10% of the existing basal area would be removed from all activities combined in Alternative 2.

Table 37. Estimated Basal Area Removed in Alternative 2.

Alternative 2	Acres	% BA Removed	Clear Cut Equiv	% Planning Area
Clear cut	1,054	100	1,054	7.3%
Shelterwood	38	100	38	0.3%
Thinning	750	33	248	1.7%
Savannah	70	100	70	0.5%
Conventional Landings (1/4 acre)	3.3	100	3	0.0%
Helicopter Landings (1 acre)	7	100	7	0.0%
New road	12	100	12	0.1%

construction				
Total	**1,934**		**1,432**	**9.9%**

Although for the planning area the level of harvest is well below 20%, where activities are concentrated within the North Cove area localized effects are likely to occur. In 2006, watershed improvements were made in the North Cove area to decommission and obliterate old roads and skid roads that had captured groundwater and had drainage problems. In order to protect these improvements, units in the North Cove area are proposed for helicopter logging. The concern is the concentrated harvesting in the area can create saturated conditions that generate a different drainage pattern and capture some of the decommissioned roads. The combination of harvest activities in North Cove would remove approximately 47% of the basal area. The potential hydrologic modifications could be reduced by staggering the harvesting in the North Cove area through time. Due to the helicopter logging in the area, it is likely that this would occur through two entries with at least two full growing seasons between entries. Assuming the harvest is evenly divided in each entry, representing approximately 23% of the total basal area, this still exceeds 20% and hydrologic effects could occur. The potential effects are reduced due to riparian buffers that will be left which reduce the total harvest, and residual trees left in thinning stands will utilize some of the additional water which is made available. Allowing that hydrologic recovery takes 5-10 years, there is a greater risk that hydrologic effects may occur during the second entry after only two full growing seasons after the first entry.

LWD: There is minimal concern with the effects of Alternative 2 on LWD recruitment. Riparian buffers along functioning channels will retain the majority of LWD recruitment potential in the areas treated. The buffers coupled with the limited scale of harvest relative to the drainage network should protect riparian functions throughout the planning area. Some localized impacts may occur where new roads cross ephemeral channels, but this should be limited and generally located high in the drainages and near ridge tops.

Water Chemistry: Based on the water samples collected in 2006, Johnson Run, Jonathan Run, Sawyer Run, Spice Run and White Oak Fork have low pH and ANC and are prone to impacts due to acid deposition. The concern is additional ground disturbance and timber harvest within these drainage areas could result in a loss of base cations and exacerbate the problem of acid deposition. It is unclear how the proposed harvest activities will affect water chemistry in these areas, other than potentially increasing the risk of acid impacts. Relative to other alternatives, Alternative 2 has the highest level of conventional logging and harvest so would therefore be an overall greater risk than the other alternatives. The exception is Spice Run, where there is very little activity proposed in any action alternative and potential risks are negligible.

Alternative 2 includes the potential use of herbicides in Shelterwood 1. The unit is 38 acres and located near an unnamed tributary to the White Oak Fork. The herbicides triclopyr or glyphosate would be applied to individual striped maple and beech if the stocking survey determines that these species are an impediment to regeneration of desirable species after the first cut. The herbicide will be applied using target-specific methods including basal spraying and cut surface of individual stems. The use of herbicides utilizing these methods and following proper handling procedures, protection

of riparian areas, wet weather restrictions and on such a limited area does not represent a risk to aquatic resources. The proposed use of herbicides is similar in all actions alternatives (Alternatives 2-5) and will not be further discussed.

Habitat Connectivity: New roads proposed for construction in Alternative 2 do not cross any existing or potential fish-bearing streams. Opportunities to correct existing passage problems associated with road reconstruction include two culverts in Craig Run (FR 101A).

Alternative 3 is similar to the Proposed Action, but some timber and road management activities have been modified to protect soil, water and heritage resources. The alternative includes 937 acres of regeneration harvest, 38 acres of shelterwood harvest, 670 acres of commercial thinning, and 35 acres of savannah development. In addition, 31 acres of wildlife openings will be created from landing sites. The savannahs and wildlife openings will be maintained through the use of herbicides and mowing. In the regeneration units, 752 acres will be conventionally logged and 185 acres will be helicopter logged. The commercial thinning will consist of 304 acres of conventional and 366 acres of helicopter logging. The shelterwood and savannah will also be conventionally logged. The conventional logging combined will require the development of 9 landings, and 13 landings will be developed for helicopter logging. Alternative 3 includes two miles of new road construction, two miles of road reconstruction and 46 miles of skid roads and trails.

Erosion and Sedimentation: Overall, the combination of activities in Alternative 3 will disturb an estimated 136.3 acres of soil in the planning area (Table 38). Similar to the Proposed Action, these activities are distributed throughout the Lower Williams River planning area and can potentially affect a number of streams and aquatic resources. Although the level of helicopter logging increases in Alternative 3, the level of skid roads within the drainage areas of Craig Run, Jonathan Run and Sawyer Run increase slightly. This includes the concerns of skidding on old roads within the Jonathan Run and Sawyer Run drainage areas as described in Alternative 2. The benefits of helicopter logging generally occur in areas that are identified as Direct Drains, which can be beneficial for the Williams River main stem, but of minimal value for brook trout streams in the project area.

Total		**151.6**

Table 38. Estimated Acres of Soil Disturbance in Alternative 3.

Alternative 3	Miles or No.	Acres Disturbed
Skid Roads/Trails (avg. 15 ft wide)	42	76.4
Conventional Landings (1/4 acre)	9	2.3
Helicopter Landings (1 acre)	22	22.0
Savannah (35 acres)	1	35.0
New road construction (4 acres/mi)	2	8.0
Road reconstruction (4 acres/mi)	2	8.0

Alternative 3 reduces the level of new road construction to two miles proposed. The proposed roads (FR 82C, FR 82D, FR 272B and a potential spur off of a private road in lieu of FR 735A) represent new areas of soil disturbance but they are generally located high in the drainages and along ridgelines or saddles. FR 101A-A is not included in this alternative which reduces the potential impacts to Craig Run associated with the Alternative 2.

Similar to Alternative 2, Unit 9 is proposed for conventional logging. Access to the unit would be across an unnamed perennial tributary to the Williams River and logs would be skidded across the tributary to the landing site. In order to minimize potential sedimentation and bank damage to the tributary, a temporary bridge should be utilized for the stream crossing.

Stream Flow: Overall, the level of harvest activity in Alternative 3 is not enough to influence flow conditions. An estimated 8.8% of the basal area would be removed from all activities combined. Potential effects to the North Cove area are similar to those described in Alternative 2. Table 39 displays the projected percentage of basal area removed by activities in Alternative 3.

Table 39. Estimated Basal Area Removed in Alternative 3.

Alternative 3	Acres	% BA Removed	Clear Cut Equiv	% Planning Area
Clear cut	937	100	937	6.5%
Shelterwood	38	100	38	0.3%
Thinning	670	33	221	1.5%
Savannah	35	100	35	0.2%
Conventional Landings (1/4 acre)	9	100	9	0.1%
Helicopter Landings (1 acre)	22	100	22	0.2%
New road construction	8	100	8	0.1%
Total	**1,719**		**1,270**	**8.8%**

LWD: There is minimal concern with the effects of Alternative 3 on LWD recruitment. Riparian buffers along functioning channels will retain the majority of LWD recruitment potential in the areas treated. The buffers coupled with the limited scale of harvest relative to the drainage network should protect riparian functions throughout the planning area. Some localized impacts may occur where new roads cross ephemeral channels, but this should be limited and generally located high in the drainages and near ridge tops.

Water Chemistry: Based on the water samples collected in 2006, Johnson Run, Jonathan Run, Sawyer Run, Spice Run and White Oak Fork have low pH and ANC and are prone to impacts due to acid deposition. The concern is additional ground disturbance and timber harvest within these drainage areas could result in a loss of base cations and exacerbate the problem of acid deposition. It is unclear how the proposed harvest activities will affect water chemistry in these areas, other than potentially

increasing the risk of acid impacts. Although Alternative 3 has more helicopter logging than Alternative 2, there are more miles of skid roads within the drainage areas of concern and the alternative represents a greater risk to these streams.

Habitat Connectivity: There would be no change to the existing habitat fragmentation from this alternative. FR 101A would not be reconstructed, as identified in Alternative 2, so passage barriers associated with this road on Craig Run would not be corrected. The opportunity exists to decommission this road if it is no longer needed.

Alternative 4 is designed to further minimize the risk to soil and water resources by utilizing helicopter logging in units with steep slopes and wet soil types and proposing no new road construction. The alternative includes 921 acres of regeneration harvest, 38 acres of shelterwood harvest and 670 acres of commercial thinning. No savannah development would occur in this alternative due the level of soil disturbance needed to remove stumps and create the savannah. Approximately 32 acres of wildlife openings would be created from landing sites and maintained by herbicides and mowing. In the regeneration units, 428 acres will be conventionally logged and 493 acres will be helicopter logged. The commercial thinning would all be helicopter logged. The shelterwood and savannah will be conventionally logged. The conventional logging combined will require the development of 18-28 landings, and 14-25 landings will be developed for helicopter logging. For the purposes of this analysis, when given a range of landing sites the higher number of landings will be addressed. Alternative 4 includes 0.5 miles of road reconstruction and 19 miles of skid roads and trails.

Erosion and Sedimentation: Overall, the combination of activities in Alternative 4 will disturb an estimated 60.2 acres of soil in the planning area (Table 40). A number of the units that were changed from conventional logging to helicopter logging are within the drainage areas of Craig Run, Jonathan Run and Sawyer Run, which will reduce the risk of sedimentation impacts on brook trout in these systems. This includes Thinning Unit 3 and Regeneration Unit 6 which are proposed for helicopter logging and would not utilize the existing roads with poor drainage for skid trails as described in Alternative 2. Remaining conventional units within these drainage areas should employ mitigations similar to those described in the prior alternatives.

There are no new roads proposed in this alternative and only 0.5 miles are proposed for reconstruction. Unit 9 is dropped in this alternative so potential impacts associated with crossing a perennial stream to access the unit are eliminated.

Stream Flow: Overall, the level of harvest activity in Alternative 4 is not enough to influence flow conditions. An estimated 8.7% of the basal area would be removed from all activities combined. Potential effects to the North Cove area are similar to those described in Alternative 2. Table 41 displays the projected percentage of basal area removed by activities in Alternative 4.

Table 40. Estimated Acres of Soil Disturbance in Alternative 4.

Alternative 4	Length/Size	No.	Acres Disturbed
Savannah	0	0	0.0
New road const. (4 acres/mi)	0		0.0
Road reconstruction (4 acres/mi)	0.5		2.0
Skid Roads/Trails (avg. 15 ft wide)	19		34.6
Total			**68.6**
Conventional Landings (1/4 acre)	0.25	28	7.0
Heli. Landings (1 ac ea.)	1	25	25.0

Table 41. Estimated Basal Area Removed in Alternative 4.				
Alternative 4	**Acres**	**% BA Removed**	**Clear Cut Equiv**	**% Planning Area**
Clear cut	921	100	921	6.4%
Shelterwood	38	100	38	0.3%
Thinning	670	33	221	1.5%
Savannah	35	100	35	0.2%
Conventional Landings (1/4 acre)	7	100	7	0.0%
Helicopter Landings (1 acre)	25	100	25	0.2%
New road construction	0	100	0	0.0%
Total	1,696		1,247	8.7%

LWD: There is minimal concern with the effects of Alternative 4 on LWD recruitment. Riparian buffers along functioning channels will retain the majority of LWD recruitment potential in the areas treated. The buffers coupled with the limited scale of harvest relative to the drainage network should protect riparian functions throughout the planning area. With the absence of new road construction and reduced skid trail development, the potential for localized impacts on ephemeral channels is reduced.

Water Chemistry: The increase in helicopter logging in the Johnson Run, Jonathan Run, Sawyer Run and White Oak Fork drainage areas reduces the concern of base cations being lost due to accelerated erosion. Base cations could still affected through the removal of timber and the limited number of units that are still proposed for conventional logging, but the relative risk is lower than in Alternatives 2 or 3.

Habitat Connectivity: There would be no change to the existing habitat fragmentation from this alternative. There is no new road construction proposed and

Alternative 5 has the lowest level of disturbance of all action alternatives and poses the least amount of risk to soil and water resources because only helicopter logging would occur. The level of harvest activity is relatively similar to the other action alternatives, but soil disturbance is primarily limited to the area of helicopter landings. The alternative includes 909 acres of regeneration harvest, 38 acres of shelterwood harvest and 670 acres of commercial thinning. No savannah development would occur in this alternative due the level of soil disturbance needed to remove stumps and create the savannah. Approximately 42 acres of wildlife openings would be created from landing sites and maintained by herbicides and mowing. Helicopter logging will require the development of 27-42 landing sites. For the purposes of this analysis, the potential effects of the higher number of landings will be addressed. There will be no road construction, reconstruction or skid road development.

Erosion and Sedimentation: Soil disturbance in Alternative 5 is limited to helicopter landing sites (Table 42). These are distributed throughout the planning area and located along existing roads. It is unlikely that all 42 landings would be developed, so the potential soil disturbance will likely be even less. This alternative greatly reduces the

risk of sedimentation on brook trout in the planning area and should not contribute to existing stresses.

Table 42. Estimated Acres of Soil Disturbance in Alternative 5.			
Alternative 5	**Length/Size**	**No.**	**Acres Disturbed**
Skid Roads/Trails (avg. 15 ft wide)	0		0.0
Conventional Landings (1/4 acre)	0.25	0	0.0
Helicopter Landings (1 acre)	1	42	42.0
Savannah	0	0	0.0
New road construction (4 acres/mi)	0	0	0.0
Road reconstruction (4 acres/mi)	0	0	0.0
Total			**42.0**

Stream Flow: The level of harvest activity in Alternative 5 is not enough to influence flow conditions. An estimated 8.7% of the basal area would be removed from all activities combined. Potential effects to North Cove are similar to those described for previous alternatives. Table 43 displays the projected percentage of basal area removed by activities in Alternative 5.

Table 43. Estimated Basal Area Removed in Alternative 5.				
Alternative 5	**Acres**	**% BA Removed**	**Clear Cut Equiv**	**% Planning Area**
Clear cut	909	100	909	6.3%
Shelterwood	38	100	38	0.3%
Thinning	670	33	221	1.5%
Savannah	0	100	0	0.0%
Conventional Landings (1/4 acre)	0	100	0	0.0%
Helicopter Landings (1 acre)	42	100	42	0.3%
New road construction	0	100	0	0.0%
Total	**1,659**		**1,210**	**8.4%**

LWD: There is minimal concern with the effects of Alternative 5 on LWD recruitment. Riparian buffers along functioning channels will retain the majority of LWD recruitment potential in the areas treated. The buffers coupled with the limited scale of harvest relative to the drainage network should protect riparian functions throughout the planning area. With the absence of new road construction and no skid trail development, the potential for localized impacts on ephemeral channels is eliminated.

Water Chemistry: The use of helicopter logging only eliminates the concern associated with base cations being lost due to accelerated erosion. Base cations could still be affected through the removal of timber, but Alternative 5 represents the lowest level of risk of all the action alternatives.

Habitat Connectivity: There would be no change to the existing habitat fragmentation from this alternative. There is no new road construction or reconstruction proposed.

Alternative 6 is similar to Alternative 3, but some timber and road management activities have been dropped and modified to protect federally list plant species and aquatic resources. The primary differences between Alternative 3 and 6 are Regeneration Units 9 and 16 are dropped to protect rare plants. This also results in a slight decrease in log landings and skid trails associated with these units, and eliminates the concern associated with crossing the perennial channel to access Unit 9.

The alternative includes 887 acres of regeneration harvest, 38 acres of shelterwood harvest, 670 acres of commercial thinning, and 35 acres of savannah development. In addition, 27 acres of wildlife openings will be created from landing sites. The savannahs and wildlife openings will be maintained through the use of herbicides and mowing. In the regeneration units, 703 acres will be conventionally logged and 184 acres will be helicopter logged. The commercial thinning will consist of 304 acres of conventional and 366 acres of helicopter logging. The shelterwood and savannah will also be conventionally logged. The conventional logging combined will require the development of 8 landings, and 19 landings will be developed for helicopter logging. Alternative 6 includes two miles of new road construction, two miles of road reconstruction and 42 miles of skid roads and trails. Alternative 6 also provides for improving aquatic passage where FR 429 crosses Craig Run and Jonathan Run.

Erosion and Sedimentation: Overall, the combination of activities in Alternative 6 will disturb an estimated 133.1 acres of soil in the planning area (Table 44). The effects are relatively similar to Alternative 3, with a slight decrease in soil disturbance within the drainage area for White Oak Fork and an unnamed tributary to the Williams River. Concerns with using the old roads to access Regeneration Unit 6 and Thinning Unit 3 remain in this alternative, but the concern of crossing an unnamed tributary to the Williams River to access Regeneration Unit 9 are eliminated.

Table 44. Estimated Acres of Soil Disturbance in Alternative 6.

Alternative 3	Miles or No.	Acres Disturbed
Skid Roads/Trails (avg. 15 ft wide)	42	76.4
Conventional Landings (1/4 acre)	8	2.0
Helicopter Landings (1 acre)	19	19.0
Savannah (35 acres)	1	35.0
New road construction (4 acres/mi)	2	8.0
Road reconstruction (4 acres/mi)	2	8.0
Total		**148.6**

Two miles of new road construction are proposed in Alternative 6. The proposed roads (FR 82C, FR 82D, FR 272B and a potential spur off of a private road in lieu of FR 735A) represent new areas of soil disturbance but they are generally located high in the drainages and along ridgelines or saddles. These pose little risk to aquatic resources in the planning area.

Stream Flow: Overall, the level of harvest activity in Alternative 6 is not enough to influence flow conditions. An estimated 8.4% of the basal area would be removed from all activities combined. Potential effects to the North Cove area are similar to those

described in Alternative 2. Table 45 displays the projected percentage of basal area removed by activities in Alternative 3.

Table 45. Estimated Basal Area Removed in Alternative 6.

Alternative 6	Acres	% BA Removed	Clear Cut Equiv	% Planning Area
Clear cut	887	100	887	6.2%
Shelterwood	38	100	38	0.3%
Thinning	670	33	221	1.5%
Savannah	35	100	35	0.2%
Conventional Landings (1/4 acre)	8	100	8	0.1%
Helicopter Landings (1 acres)	19	100	19	0.1%
New road construction	2	100	2	0.0%
Total	**1,659**		**1,210**	**8.4%**

LWD: There is minimal concern with the effects of Alternative 63 on LWD recruitment. Riparian buffers along functioning channels will retain the majority of LWD recruitment potential in the areas treated. The buffers coupled with the limited scale of harvest relative to the drainage network should protect riparian functions throughout the planning area. Some localized impacts may occur where new roads cross ephemeral channels, but this should be limited and generally located high in the drainages and near ridge tops.

Water Chemistry: Based on the water samples collected in 2006, Johnson Run, Jonathan Run, Sawyer Run, Spice Run and White Oak Fork have low pH and ANC and are prone to impacts due to acid deposition. The concern is additional ground disturbance and timber harvest within these drainage areas could result in a loss of base cations and exacerbate the problem of acid deposition. It is unclear how the proposed harvest activities will affect water chemistry in these areas, other than potentially increasing the risk of acid impacts.

Habitat Connectivity: Under this alternative Craig Run and Jonathan Run stream crossings, on FR 429, would be improved. The crossing on Craig Run is a box culvert with a smooth, flat bottom and shallow flows. Passage would be improved by adding grade control structures below the culvert to help create a pool of water through the culvert. Jonathan Run is a culvert that is suspended above the channel and is inaccessible for aquatic organisms moving upstream. The culvert would be replaced with an open bottom arch or a box culvert that is counter-sunk into the substrate.

Cumulative Effects

Cumulative effects address the environmental consequences from all activities implemented within the Lower Williams River watershed in the past, present and reasonably foreseeable future. Refer to Table 4 for projects considered in the cumulative effects.

The combination of activities on NFS and private lands can create an effect at a watershed scale that otherwise would not be perceived as a problem at the project, or subwatershed scale. The Lower Williams River watershed is 92% NFS lands, so the effects of Forest management activities, including the proposed Lower William's project,

constitute a large part of the past, present and reasonably foreseeable future actions. It is assumed that activities on private lands will remain relatively constant through the reasonably foreseeable future with the continuation of dwellings and agricultural uses.

The existing conditions of the aquatic resources in the Lower Williams River watershed reflect the cumulative effects of past and present actions. Streams have elevated levels of fine sediment, impaired water chemistry and are deficient in LWD due to past and present management activities both on Forest and, in the case of acid deposition, off. Future activities can contribute to these effects or alleviate some of the problems. On NFS lands, the reasonably foreseeable future actions are considered to be the continuation of existing activities such as roads, trails, utility corridors, developed and dispersed recreation, and the new activities identified in the Lower Williams River Environmental Impact Statement. On private lands, the foreseeable future activities are assumed to be similar to activities currently taking place in the watershed. No significant development is anticipated and agricultural and logging practices are assumed to continue on a similar pace. Assuming the activities on private lands remain relatively constant, existing watershed and stream conditions within those areas should persist in the foreseeable future.

On NFS lands, it is anticipated that the implementation of actions identified in the Lower Williams River EIS will not result in a measurable change to stream flows and LWD recruitment, so it will not have a cumulative effect from activities in the watershed. The following cumulative effects analysis addresses the overall influence of land use activities in the Lower Williams River watershed on the aquatic resource issues of sedimentation, and to a lesser extent acid deposition. It assumes the recovery of watershed, stream and riparian conditions is on a longer timescale than this planning effort. Actions taken now can result in erosion and sedimentation impacts that may last for years, and it also assumes that atmospheric deposition will continue to stress aquatic resources through the foreseeable future.

Alternative 1: Alternative 1, the No Action alternative, would neither create new sources of sedimentation nor correct existing sources. Ongoing management actions associated with the maintenance of roads, trails and recreation sites would continue. The cumulative effect on sedimentation is similar to current conditions, and the potential for road related problems remains on a number of roads. There will be no additional ground disturbance or timber removal that would potentially contribute to the cumulative effects of soil nutrient and base cation loss due to acid deposition. Implementation of a liming project in the reasonably foreseeable future (500-1,500 acres) should increase base cations and calcium levels at the sites treated, which should be beneficial for watershed conditions. The areas targeted for treatment are generally along ridgetops and the treatment is relatively limited in scope (4-10% of the planning area), so it is unclear if the treatments will show a measurable improvement in aquatic resources. A study of similar terrestrial liming in two subwatersheds of Mosquito Creek in Pennsylvania, showed increases in pH and ANC where 51-76% of the subwatershed was treated (Pennsylvania Department of Environmental Protection 2006). If the proposed liming treatments are

concentrated within a specific drainage area of the Lower Williams project area, there is the potential that pH and ANC could increase as a result of the project.

Overtime, physical aquatic habitat conditions should improve as natural recruitment of LWD occurs. The recruitment of wood to channels will improve channel stability, habitat complexity, hiding cover and a number of other functions that will improve aquatic resource conditions.

Alternative 2: Alternative 2, the Proposed Action, has the greatest level of activity of the action alternatives. The combination of Forest Plan standards and guidelines and project design, will minimize the potential effects of sedimentation within the streams of the Lower Williams River project area. Although the effects are anticipated to be minimal, they are likely to be detrimental to brook trout populations in the tributaries affected. No road decommissioning or soil restoration activities are proposed by this project, but benefits could occur if road reconstruction corrects existing road related problems. The existing conditions of the tributaries in the planning area make them sensitive to additional disturbances and the effects are likely to be limited to these streams. It is anticipated that the project will not have a measurable or detectable effect on sedimentation in the Williams River main stem given the size and energy of that system, the location of the project area near the mouth of the river, and the relatively small area of disturbance associated with the project. The Williams River fifth level watershed is approximately 82,620 acres in size, and the planning area (14,400 acres) represents 17% of the overall watershed. Within the planning area, approximately 209 acres of soil disturbance is anticipated which represents less than 2% of the project area and less than 0.3% of the Williams River watershed.

Acid deposition will continue to affect the watershed in the reasonably foreseeable future, resulting in losses of soil nutrients and base cations. The disturbance of 209 acres of soil and the removal of timber on 1,054 acres can contribute to the cumulative impacts of acid deposition by accelerating erosion and removing nutrients and base cations that are stored in trees. These losses are minor compared to the effects of acid deposition, but would contribute, even slightly to the current condition of declining nutrients and base cations. The future liming project on 500-1,500 acres within the planning area would benefit soil conditions within the areas treated and help to defer the effects of nutrient and base cation losses.

Alternative 3, 4, 5 and 6*:* An increase in helicopter logging and varying levels of road reconstruction reduces the potential impacts of sedimentation in these alternatives respectively. Localized effects may occur in some tributaries, but they are not anticipated to have a cumulative impact on the Williams River main stem. Reductions in soil disturbance and regeneration harvest may also reduce the potential losses of soil nutrients and base cations in the planning area.

Effects to Sensitive Species and Aquatic MIS

Alternative 1: No projects will be implemented, so the existing aquatic resource conditions will persist. This is likely to have no effect to the four sensitive fish that have

been reported in Williams River main stem. Eastern hellbender has been reported in a tributary just upstream of the project area, so potential habitat could exist in the streams within the project area. Eastern hellbender prefer cold, clear creeks and rivers and are sensitive to silt and nutrient runoff (NatureServe 2005). The existing conditions of the streams within the project area may limit their presence and productivity. Native brook trout also prefer cold, clear streams and are also sensitive to elevated sediment levels and acid deposition. Brook trout are found in a number of tributaries within the project area, but existing conditions likely limit their numbers and productivity. These populations should persist unless losses occur due the effects of acid deposition.

Alternative 2: The Proposed Action would have a negligible effect on the Williams River main stem, and therefore is unlikely to affect the habitat or individuals of the four sensitive fish species that have been reported there. Due to the existing conditions, species that utilize habitat found within the tributaries in the project area (Eastern hellbender and brook trout) are potentially affected by additional disturbances. There are few activities proposed in Alternative 2 that are beneficial to watershed and aquatic resource conditions. These are primarily associated with the limited road reconstruction proposals which could correct some existing road related problems, including passage barriers on FR 101A. The other activities that are proposed may either have no effect or a detrimental effect to aquatic resources in the planning area which in turn can impact brook trout habitat and potential hellbender habitat. Mitigation measures have been designed to minimize potential effects but not to improve existing conditions. Alternative 2 proposes the highest level of activity, including ground disturbance, of the action alternatives. There is an inherent risk when implementing projects that something can go wrong that was not anticipated or intended. An example of a potential risk is a heavy rainfall when soils have been recently disturbed. Alternatives that have a greater level of activity therefore have a greater inherent risk that something could go wrong.

The risk to brook trout habitat and potential hellbender habitat is greatest in Alternative 2 than the other action alternatives. The potential consequences are more difficult to determine. It is likely that brook trout will persist in the planning area, but additional effects could further stress existing populations and lower their resiliency to other events such as drought and floods, or the effects of acid deposition. It is unclear if hellbenders currently exist within the project area, but additional project related impacts could reduce potential habitat for this species.

Alternatives 3, 4 and 5: Similar to Alternative 2, the other action alternatives have very few activities designed to improve existing conditions. Mitigation measures and project design features are intended to avoid or minimize potential effects associated with the project. The result is a reduction in risk to potential adverse impacts to brook trout and potential hellbender habitat. Effects to brook trout and potential hellbender habitat are likely to occur, but presumably to a lesser extent as the level of ground disturbance is reduced in the alternatives. FR 101A would not be reconstructed in Alternatives 3-5, so the potential passage barriers on Craig Run would remain.

Alternative 6: Alternative 6 is largely similar to the other action alternatives with the exception that passage would be improved in Craig Run and Jonathan Run where FR 429 crosses these streams. This would be beneficial to brook trout and other aquatic organisms that move and down stream.

Comparison of Alternatives

Utilizing the unit of measures identified earlier, Table 46 displays the comparison of alternatives. In addition, the number of stream crossings potentially improved in each alternative is displayed.

Table 46. Comparison of Alternatives Based on the Units of Measure.

Unit of Measure	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Road Construction (miles)	0	3	2	0	0	2
Road Reconstruction (miles)	0	2	2	0.5	0	2
Skid Roads (miles)	0	64	46	19	0	42
Soil Disturbance (acres)	0	217	136	69	42	149
Stream Crossings Improved (#)	0	2	0	0	0	2

Unavoidable Adverse Impacts

The No Action Alternative would not implement actions that would cause unavoidable adverse impacts, but existing erosion on the road system in the project area would continue. The action alternatives would implement activities that would disturb soils and result in unavoidable soil disturbance. Activities that result in crossing stream channels (e.g. road construction, reconstruction or skid roads) will have unavoidable adverse impacts. Design features and mitigation measures are intended to reduce the potential effects of erosion and sedimentation.

Irreversible or Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitment of aquatic resources associated with this project. The exception would be if riparian trees are cut for stream crossings, but this is expected to be minimal.

Consistency with the Forest Plan

All alternatives would be implemented consistent with Forest Plan goals, objectives, standards, and guidelines.

Consistency with Laws, Regulations, and Handbooks

All alternatives would be implemented consistent with Forest Service laws, regulations, and handbooks regarding management of the soil resource.

Social Environment

Heritage Resources

Scope of the Analysis

Prehistoric and Historic Patterns

Given the current state of research in the region, which includes several recent site evaluations conducted in or near the project area by National Forest archaeologists, it is now possible to begin to characterize prehistoric use of landscape. The major periods of prehistoric use appear to have been the Late Archaic and Early Woodland. These periods witnessed increasing sedentism by human groups, intensive food collection, increasing population, and a developing reliance on food production.

Many of the previously recorded prehistoric sites have a very high potential for yielding important information on prehistoric utilization of the area. Until these sites and potentially important open-air sites are evaluated, however, our knowledge of the prehistory of the project area will remain limited. It is known that the area has a high potential for locating prehistoric resources based on the results of previous surveys, coupled with the facts that the project area lies near the confluence of three major rivers and a known prehistoric transportation route.

Not surprisingly, the results of archaeological surveys indicate that most historic period activity in the area was related to resource extraction, particularly logging. A comparatively small proportion of historic period sites located in the area were devoted to human habitation. The historic period occupation of the area was, and continues to be, focused on the town of Richwood.

The vast majority of the area has been impacted by human use. Forest species age and diversity, wildlife populations, stream profiles, soils, viewsheds, fragmentation/openings ratios, and the demographic profile of the area (Indian-to-colonial; low-to-moderate population density) all changed between the 18th and early 20th centuries. Some of these changes were dramatic.

There are numerous sites and features left on the landscape; they are the correlates to the standing architecture and functional outbuildings of the historic economy. We would therefore expect the remains of communities, houses, barns, outbuildings, mills, blacksmith shops, schools, logging camps, mining structures, etc. Also, the footprints of transportation systems, and vegetative "artifacts" in the form of complete and partial cultural landscapes (apple orchards, pine plantations, sugar bushes, openings, and more) will likely be located. Their distribution is heavily biased toward the main transportation arteries

Alternatives 1-5: Potential Effects and Mitigation Measures

Potential Effects to Heritage Resources: No Action/Alternatives 2-5

It should be noted prior to a discussion of the effects of the proposed project that, at the time of the preparation of this contribution to the Draft Environmental Impact Statement (SDEIS), not all of the necessary heritage resources surveys have been completed. It is, however, fully expected that such surveys will be completed prior to the preparation of

the Final EIS. Also, it should be stated that the following effects analysis will be amended with the addition of new survey data.

Alternative 1 – No Action
From the perspective of heritage resources protection, the No Action alternative would provide greatest protection to cultural resources, as no additional erosion or soil disturbance would occur.

Alternatives 2-5
An examination of the four remaining alternative management treatments to the Lower Williams project area reveals that minimal project impacts will occur in all alternatives. Alternative 4, in particular, has the least negative impacts to heritage resources. Potential negative direct effects to heritage resources can derive from ground disturbance due to tree felling and skidding, and activities associated with new road construction, road storage, and road abandonment (grading, cutting, pulling culverts, culvert construction, etc). Skidding damage will not occur in helicopter logging. Negative indirect effects to cultural heritage resources can derive from increased erosion associated with road construction, skidding, and regeneration cutting.

Direct and Indirect Effects
All non-helicopter logging and other activities, such as the construction of wildlife savannahs and shelterwoods, have a great deal of ground disturbance associated with them from skidding, felling and, in the case of wildlife savannahs, plowing. The alternative with the least amount of these types of disturbances is Alternative 1 (No Action), followed in order of magnitude from most to least by Alternatives 2, 3, 4, and 5. However, it should be stated that, as a standard Forest procedure, all recorded sites that are either unevaluated or are determined eligible for inclusion in the National Register of Historic Places, will be excluded from the project area. Therefore, no direct effects are expected to occur as the result of the implementation of any of the action alternatives.

The only indirect effects expected from implementation of the alternatives may be the result of increased erosion brought about by the removal of vegetation and ground cover from areas above site locations.

Cumulative Effects
The foreseeable effects of carrying out all of the action Alternatives are approximately equal. Management of the project area for timber and wildlife purposes will lead to heavier pedestrian and vehicular use of the landscape. Consequently, more individuals will become aware of site locations, thereby exposing them to potential vandalism and loss of scientific information.

Comparison of Alternatives
Of the five alternatives, all the action alternatives should have no direct effects to heritage resources. However, indirect effects may accrue to heritage resources in all of the action alternatives as a result of erosion from road construction, vegetation disturbance and plowing from savannah construction. The alternative with the least amount of indirect effects is Alternative 1, the No Action alternative. The next least impacting alternative as regards heritage resources is Alternative 5, the all helicopter alternative. The next most favorable alternative for heritage resources is Alternative 4, a mixture of

conventional and helicopter logging methods with no new road construction. Alternative 3 is the next most favorable alternative for heritage resources, as it contains a mixture of conventional and helicopter logging. Alternative 2, the proposed action, is the least favorable alternative for heritage resources, as its timber harvest methods are solely conventional.

Recommended Mitigation Measures
Since all of the possible alternatives for this project have already been designed to avoid and minimize direct effects, no direct effects will accrue to heritage resources as a result of the implementation of any of the action alternatives. Therefore, no mitigation measures are recommended.

However, as project implementation occurs, Forest Service staff should be aware of the potential for locating additional historic and prehistoric sites in the project area.

Finally, should additional or potential prehistoric or historic sites be located during the course of implementation, the Forest Archaeologist should be notified and activity in that area cease until the size and nature of the resource can be determined

All sites as having potential direct effects from project activities should be marked and avoided during all phases of project implementation. If tree felling occurs adjacent to a heritage resource, it is recommended that either directional felling away from the site be implemented, or a buffer comprising the height of the nearest possible fell, plus one-half, be established. These buffers have already been incorporated into the field marking of sites.

These recommendations are designed to avoid impacts to known cultural resources and to help identify and protect resources that may be impacted in the course of project implementation.

Forest Plan and Statutory Consistency
Forest Goal HR01 provides for the identification and management of cultural resources on the Forest, as does direction in Heritage Resources Standards HR04, HR05. Executive Order 11593, promulgated in 1971, instructs that all archaeological resources on Federal land are to be evaluated, while the 1988 amendment to the Archaeological Resources Protection Act (16 USC 470 mm) instructs federal land-managing agencies to develop and implement a plan for archaeological survey and evaluation. Provided that National Register eligible sites are avoided or mitigated, and unevaluated sites are avoided or evaluated and appropriate management taken, then any of the Alternatives is consistent with the Forest Plan and legal statute.

Relevant Laws, Regulations, and Authorities
Antiquities Act of 1906 (16 USC 431-433)
Historic Sites Act of 1935 (16 USC 461-467)
National Historic Preservation Act of 1966 (16 USC 470)
National Environmental Policy Act (42 USC 4321-4347)

Archaeological Resources Protection Act of 1979 (16 USC 470)
Archaeological and Historical Conservation Act of 1974 (16 USC 469)
Executive Order 11593
FSM 2361

Recreation

Affected Environment

The Lower Williams River project area is within management prescription 3.0 area, as identified in the Forest Plan. This prescription emphasizes a motorized recreation environment, with a system of roads that provide abundant opportunities for driving for pleasure, and access to dispersed recreation activities such as fishing, hunting, and camping.

Fishing in the Williams River is the most common activity in the project area. The West Virginia Division of Natural Resources stocks trout each spring and fall, making these seasons the busiest times of year for recreational use in the area. Fishing pressure drops in the summer months when water levels are lowest, and is basically non-existent during the winter, when the Williams River Road is sometimes blocked by snow.

Driving for pleasure, or sightseeing, is most common on the Williams River Road (FR 86), and to a lesser extent is also popular on FR 101. The Williams River Road also serves as a minor through-route for some traffic between the Cowen area and the Highland Scenic Highway. Traffic on the Williams River Road is high during the spring months, and moderate during the summer and fall periods. The road is not maintained for winter travel.

Hunting is also common in the project area, with most activity concentrated in the vicinity of Bishop Knob Campground, during the gun deer season. Hunting pressure is considered light throughout the remainder of the project area. The Spice Run Road, FR 787, provides access to disabled hunters during all hunting seasons.

There are no developed recreation facilities within the project area. Two primitive campsites are located within the project area along the Williams River near Three Forks. There are also no official recreation trails in the area.

A segment of the Williams River is an eligible Wild and Scenic River, with a classification of Recreational; containing the “remarkable values” of scenery and recreation. The entire section of the river within this project area fits this classification. The Forest plan directs that the river corridor, generally described as one-quarter mile from each bank, shall be managed to maintain the characteristics that made the river eligible for classification.

Direct and Indirect Effects of Alternatives

Under Alternative 1 (No Action), there would be no effects to the recreation resource or recreational activities within the project area.

Each of the action alternatives proposes vegetative management activities that could potentially affect recreation uses within the project area. These effects include:

Increased traffic on forest roads – Each of the action alternatives would result in timber products being transported on roads open to the public within the project area. This activity can temporarily increase traffic levels on these roads during timber harvest activities, creating a short-term inconvenience to recreational users of these roads. Timber hauling on the Williams River Road (FR 86) is the primary concern. About forty percent of the proposed timber harvest activity will occur in the area north of the Williams River, and will be hauled on FR 86. It is likely that this timber would be hauled downriver towards Cowen, WV. This would mean about five to seven miles of FR 86 will receive increased truck traffic during the life of the proposed timber sales. Alternative two would create slightly more traffic on this road, since more area is harvested in this alternative (66 acres more than alternatives three thru five).

The timing of this increased traffic will differ by alternative, based on the harvest type. Timber stands harvested by conventional means could create traffic annually throughout the normal operating season of mid April thru November. This time period would include the busy spring and fall fishing seasons on the Williams River. Conversely, timber stands that are harvested with helicopter logging would likely be active during the leaf-off months of late October thru early April, thereby missing some of the fall fishing season, and some of the spring season. Alternative two would utilize mostly conventional logging methods, thereby creating timber-hauling traffic over a wider span of time, and which would potentially have a greater effect on recreational traffic (related to fishing) on the Williams River. The remaining Action Alternatives utilize more helicopter logging; Alternative 3 = 552 acres, Alternative 4 = 1,163 acres, and Alternative 5 = 1,632 acres. The timber sale contract will require the posting of caution signs that warn visitors of logging traffic on these open roads.

Helicopter operations: controlled public access - Helicopter logging will necessitate temporary closure of harvest areas to public use during logging operations. These closures will occur during the late fall thru early spring months, to provide for public safety. This will potentially displace hunters during these periods, with the greatest effect occurring during the deer gun season, when the greatest numbers of hunters are present in the project area. Alternative 2 would have the least effect on hunting activity, while using helicopter logging on 262 acres. The remaining alternatives utilize progressively more helicopter logging, with Alternative 5 utilizing this method exclusively on 1,632 acres. Closure of these areas would cause hunters to seek alternate locations for their activity, as there are ample areas with similar forest conditions located within the general area. Also, open roads in the vicinity of helicopter operations would be closed for brief periods during helicopter fly-overs.

Potential Disturbance In The Bishop Knob Area – Some of the proposed harvest units are located in the vicinity of Bishop Knob Campground, and nearby FR 82 (the Red Oak Road), which is open for public motorized use during fall hunting seasons. Although this campground is under-utilized, it does experience increased use during the gun deer

season in November. During this time, people staying at Bishop Knob Campground tend to hunt in the immediate vicinity, including the area around FR 82. Each of the action alternatives includes proposed harvest units in this area. Alternative two would harvest the most acreage in this area, while the remaining action alternatives harvest about the same number of acres. Harvest activities during the fall hunting seasons will create some general disturbance and background noise in this area. This disturbance would be reduced somewhat, by a ban on harvest operations during the first week of gun deer season, as is traditionally required in timber sale contracts.

Wild and Scenic River (W&SR) Status – The W&SR classification (Recreation) for the Williams River will not be adversely affected by any of the proposed alternatives. The only activity planned within the river corridor is the regeneration harvest planned for unit #12, contained in Alternatives two, four, and five. This proposed activity is compatible with the guidance for the Recreational classification contained in the W&SR Act. The harvest unit would not be visible from the River or the Williams River Road, and will have no adverse impacts on the river values.

Cumulative effects

Timber harvests have occurred within the Lower Williams area over the past ten to fifteen years in the vicinity of Johnson Run, Craig Run, and White Oak Run. The effects of these past timber harvests and related road construction and wildlife habitat improvements were similar to the effects expected for the current proposed activities.

The most recent activities related to the recreation resource were the paving of the Williams River Road, including a short section completed in this project area in 2005, and improvement of dispersed campsites scattered along the river corridor upstream from this area. The paving project occurred during the summer months, and created a short-term inconvenience to people who were traveling this route.

No other recreation related projects are ongoing within the project area at this time.

Two projects are being considered for the near future within the project area. Two dispersed campsites are currently located within the project area along the Williams River near Three Forks. There are plans to abandon these flood-prone sites, by removing the existing components and returning the sites to a natural condition. The campsites would be replaced with newly constructed campsites located upriver, outside this project area. The remaining three miles of the Williams River Road, located within this project area, will be paved sometime in the near future. This activity would likely occur during summer months, and would affect traffic flow on this road. Based on recent experience with this paving project, the interruption caused by this activity would last approximately three to four weeks.

There are no known or expected activities occurring on private lands within the project area that would have an effect on the recreational resource within the Lower Williams area.

Scenery/Visuals

Resource Impacts or Issue Addressed

This section describes the existing condition of the scenic resources that may be affected by activities proposed in this analysis area.

Recreation opportunities within the Lower Williams Project Area consist primarily of dispersed recreation activities including; hunting, fishing, developed and dispersed camping and driving for pleasure. Recreation use within the area is considered moderate with periods of high recreation use occurring during hunting and the spring and fall fishing seasons. Primary viewpoints within the analysis area include Bishop Knob Campground, Three Forks of the Williams River and associated campsites and wilderness trailhead, the eligible wild and scenic river recreation segment of the Williams River, Forest Roads 86 and 101, and the community of Dyer, WV.

Scenery/ Visual Quality Management – Existing Landscape Character

The Monongahela has been mapped into four ecological zones. These zones serve as the basis for forest project planning. In order to implement the Scenery Management System into the planning process, the existing landscape character of each of these four zones was described.

Before getting to the specific description for the zone within the proposed lower Williams project area, it is important to discuss some overall facets of the existing landscape character that apply forest wide.

The Monongahela National Forest is mountainous. This has important implications on how the forest is seen and how the people feel about living, recreating, and working within it. The public involvement which took place for the 2006 plan revision indicates that the entire Monongahela National Forest is a special place to West Virginia residents. Its presence is regarded as a green jewel in the State in contrast to the remainder of West Virginia where the impacts of extractive industries and urban developments are relatively more common. Because of the Forest's mountainous terrain, the Monongahela props management activities up as on an easel for all to see. When compared to a national forest with flatter topography, management activities are much more visible and more difficult to screen from public view. As a general rule, residents and visitors travel in the open valleys while the national forest forms a backdrop on the mountains and ridges behind the houses and beside the roads. Also, because it is a mountainous area, the forest offers outstanding opportunities for a wide range of recreational activities across a variety of Recreational Opportunity Spectrum (ROS) settings.

In order to establish a baseline against which to measure and evaluate changes within the landscape, a description of the existing landscape character is needed. Landscape character is a reflection of the physical, biological, and cultural attributes in the landscape, and the beliefs, values and attitudes that people assign to these attributes. The existing landscape character has its origins in and is informed by early settlement patterns and land uses which have taken place over the years. These early and continuing influences affect the attitude toward landscape uses today. It is the physical appearance and cultural context of a landscape that gives it an identity and a "sense of place." The description conveys a "word picture" to the reader to create an image of the landscape.

The narrative includes a description of landform patterns, water characteristics, vegetative patterns, and cultural elements. It is based on an ecological framework developed by the forest ecologist and others.

The Lower Williams analysis area lies within the Northern Hardwood and Red Oak/Sugar Maple Land Type Associations of the Monongahela National Forest. Landforms in the northern hardwood zone are rolling to steeply sloped mountains with narrow, winding valleys. Northern hardwood forests are the rule across the zone; pastures are also common throughout. Temporary openings of less than 40 acres, due to timber harvests are common, as are changes in vegetative texture brought about by partial harvests (two-age management). Mountainsides within the zone typically have an even-textured appearance, often punctuated by temporary openings. The line introduced by road construction on mountainsides is most evident during leaf-off periods. Streams in the zone have steep gradients, are swift flowing, clear, and normally have horizontally fractured, dark brown rock beds.

The landforms of the red oak/sugar maple zone vary from gently rolling, highly dissected low hills to steep sided and massive mountains. Valleys are narrow to very narrow and winding. Visitors encounter enclosed landscapes with foreground detail views. Views of the near middle ground are common, but background vistas are rare. In the northern portion of the forest, the red oak/sugar maple zone is generally found on the mid to lower slopes. Mixed mesophytic vegetation is interspersed with northern hardwoods. Oaks are present. This zone contains the most productive sites on the forest. Valleys are often in open farm or pasture. High altitude openings are rare. Temporary openings, of less than 25 acres, due to timber harvests are common, as are changes in texture where partial harvests have been implemented. The overall appearance is of an even textured forest with scattered openings, either permanent or temporary. Streams have steep gradients and are swift flowing over rock beds within this zone. Natural rock forms are relatively visually unimportant. The scattered ownership pattern of intermingled private and public lands reduces the opportunity for the visitor to sense an undisturbed expanse of forested land. Valued cultural features include pastures and woodlots in the valleys and lower slopes.

All proposed actions within the Lower Williams project area are located in Management Prescription (MP) 3.0 which emphasizes vegetation diversity. The desired condition of this MP is a mosaic of stands of predominately hardwood trees and associated under-stories that provide habitat for a variety of wildlife species. The stands vary in size, shape, height, and species depending on the silvicultural system applied. Management activities result in relatively high levels of sustainable timber and mast production. The Scenic Integrity objectives for the proposed project area range from high along sensitive roads and trails to low in the middle-ground and background.

The existing Recreational Opportunity Spectrum (ROS) classes within the proposed project area range from Rural (R) to Semi-primitive Motorized (SPM) with a few small pockets of Semi-primitive Non-motorized (SPNM). There are no proposed units within areas with a SPNM existing condition. The Forest Plan identifies a secondary

management objective for management prescription 3.0 as an area that provides a Roaded- natural (RN) **ROS setting** which includes a system of roads and trails to provide abundant opportunities for motorized recreation, high scenic integrity is maintained along visually sensitive viewpoints and travel-ways.

2. Issues/ Concerns Addressed
The following scenery related issues and concerns were identified during the internal scoping process for the Lower Williams Project Area. Public scoping issues will be addressed as received. These issues/ concerns will be addressed, as appropriate, in the recreation effects section for this project.
* Will the cut areas affect the recreation use of the Forest in the future.

Scope of the Analysis

This section describes the area of analysis for direct and indirect effects and the area evaluated for cumulative affects.The scope of the analysis will include the primary viewpoints within the analysis area including Bishop Knob Campground, Three Forks of the Williams River and associated campsites and wilderness trailhead, the eligible wild and scenic river recreation segment of the Williams River, Forest Roads 86 and 101, and the community of Dyer, WV.
Because the Forest provides a wide range of recreation opportunities and scenic landscapes, there are no scenery resources or recreation activities limited or specific to the Lower Williams Project Area. Therefore, any analysis beyond that described above will not be necessary.

The spatial boundary used to evaluate direct and indirect consequences and cumulative impacts is the Lower Williams Project Area including Bishop Knob Campground, Three Forks of the Williams River, the eligible wild and scenic river recreation segment of the Williams River, Forest Road 86, 101 and the community of Dyer, WV. This area was used because it will adequately address any affects related to vegetative management and road construction on the recreation and scenery resources.

Methodology

This section describes the process that will be used to describe how the alternatives will affect the resources and the units of measures used to measure change.
The following materials were used to evaluate the affects of alternatives on the scenery resources within the Lower Williams analysis area:
*The Monongahela National Forest Land and Resource Management Plan Standards and Guidelines,
* National Forest Landscape Management Handbook,
* Recreation Opportunity Spectrum,
* The Wilderness Act of 1964,
* Monongahela National Forest Wild and Scenic River Study Report,
* The National Wild and Scenic Rivers Act of 1968.
The units of measure which are used to analyze change are as follows:

Scenery/ROS Resource	Unit of Measure

Landscape Visibility/ Scenic Integrity	# units/ acres not consistent with Forest Plan Scenic Integrity Objectives for MP 3.0
Recreational Opportunity Spectrum (ROS)	# units/ acres not consistent with MP 3.0 Roaded Natural ROS Class

Direct/Indirect Environmental Consequences and Cumulative Impacts

The primary viewpoints within the analysis area include Bishop Knob Campground, Three Forks of the Williams River, the eligible wild and scenic river recreation segment of the Williams River, Forest Road 86, 101 and the community of Dyer, WV. These areas will be used as viewpoints for evaluating the alternatives below.

Alternative 1 – No Action

Based on the methodology described above, there are no effects to the scenic quality/ visual management objectives.

This alternative maintains the status quo. Although there would be no effects to scenic/ visual resources there is also no opportunity to develop a mosaic of age classes which will diversify the age and structure, which includes scattered openings and a variety of landscapes, within the assessment area over time.

Alternative 2 – Proposed Action

The proposed action includes 38 units totaling 1054 acres of clear-cut with residual tree harvesting, 4 units totaling about 750 acres of commercial thinning 1 shelter-wood unit of about 38 acres and 2 savannahs's of approximately 70 acres would be created. In total, about 1,842 acres will have vegetative management actions within the project area. A total of about 3.0 miles of road will be constructed and 6.0 miles reconstructed. Thirty seven of the clear-cut units will be conventionally harvested and one unit totaling about 32 acres will be helicopter harvested. Three of the thinning units (473.7 acres) will be conventional and one unit (212.6 acres) will be helicopter harvested. The one shelter-wood (38.4 acres) and both Savannahs will also be conventionally harvested. The direct and indirect affect of implementing this alternative on the scenery resources is as follows:

All 43 proposed units and 2 savannah's (1,809 acres) proposed for either regeneration harvesting or commercial thinning are within a Typical Scenic Attractiveness Zone with the exception of unit #12 (25 acres) in alternatives 2,4, and 5 which is located in a Distinctive Scenic Attractiveness Zone.

Units 1-3,10, 15-24, 30-34, 39, 40, 42, 43, 45-47, 49, and 56-58 are located in Middle-ground 1 (MG-1) which has a high sensitivity level. Proposed unit 37 is partially located in Foreground 1 (FG-1) which has the highest sensitivity level. All remaining units are located in FG-3, MG 2 and 3 and seldom seen areas all of which have a lower sensitivity level are have a low existing Scenic Integrity (state of naturalness) with all remaining units located within a moderate existing Scenic Integrity Zone. All or portions of units 1, 4, 10, 15-22, 29, 31-36, are within a foreground high visibility zone with all remaining units located within middle-ground high to middle-ground low.

For all action alternatives clear-cut harvest units 10 and portions of unit 11 are located in Fore-ground and Middle-ground and will be visible to residents within the community of Dyer and portions of Forests Roads 86 and 101. Units 11, 20, 21 25, 26, 27 and 32 will be partially visible for a short driving distance year-round and units 28 and 30 will be visible only during leaf-off from Forest Road 86. Units 18 and 23 will be partially visible from Forest road 101 during leaf-off only. Unit #12 although located in a Distinctive Scenic Attractiveness Zone should not be visible from Forest Road 86 or the Williams River due to topography and vegetation along the road and river. No other units will be visible from the viewpoints established above.

Scenery/ROS Resource	Unit of Measure
Landscape Visibility/ Scenic Integrity	0 units/ acres not consistent with Forest Plan Scenic Integrity Objectives for MP 3.0
Recreational Opportunity Spectrum (ROS)	0 units/ acres not consistent with MP 3.0 Roaded Natural ROS Class

Alternative 3 – Modified Proposed Action

This Alternative includes 35 units totaling 937 acres of clear-cut with residual tree harvesting, 4 units totaling about 670 acres of commercial thinning 1 shelter-wood unit of about 38 acres and 1 savannah of approximately 35 acres would be created. In total, about 1,645 acres will have vegetative management actions within the project area. A total of about 2.0 miles of road will be constructed and between 15 and 25 miles reconstructed. Twenty six of the clear-cut units will be conventionally harvested and nine unit totaling about 185 acres will be helicopter harvested. Portions of three thinning units (273 acres) will be conventional and portions of three units (397 acres) will be helicopter harvested. The one shelter-wood (38.4 acres) and the Savannah will also be conventionally harvested. The direct and indirect affect of implementing this alternative on the scenery resources is as follows:

All 40 proposed units and 1 savannah (1,645 acres) proposed for either regeneration harvesting or commercial thinning is within a Typical Scenic Attractiveness Zone. Unit #12 (25 acres) which is located in a Distinctive Scenic Attractiveness Zone was dropped in this alternative.

Units 1-3, 10, 15-24, 30-34, 39, 40, 42, 43, 45-47, 49, and 56-58 are located in Middle-ground 1 (MG-1) which has a high sensitivity level. Proposed unit 37 is partially located in Foreground 1 (FG-1) which has the highest sensitivity level. All remaining units are located in FG-3, MG 2 and 3 and seldom seen areas all of which have a lower sensitivity level are have a low existing Scenic Integrity (state of naturalness) with all remaining units located within a moderate existing Scenic Integrity Zone. All or portions of units 1, 4, 10, 15-22, 29, 31-36, are within a foreground high visibility zone with all remaining units located within middle-ground high to middle-ground low.

For all action alternatives clear-cut harvest units 10 and portions of unit 11 are located in Fore-ground and Middle-ground and will be visible to residents within the community of Dyer and portions of Forests Roads 86 and 101. Units 11, 20, 21 25, 26, 27 and 32 will be partially visible for a short driving distance year-round and units 28 and 30 will be visible

only during leaf-off from Forest Road 86. Units 18 and 23 will be partially visible from Forest road 101 during leaf-off only. No other units will be visible from the viewpoints established above.

Scenery/ROS Resource	Unit of Measure
Landscape Visibility/ Scenic Integrity	0 units/ acres not consistent with Forest Plan Scenic Integrity Objectives for MP 3.0
Recreational Opportunity Spectrum (ROS)	0 units/ acres not consistent with MP 3.0 Roaded Natural ROS Class

Alternative 4 – No New Roads (Maximum skid ½ mile within units)
Alternative 4 includes 34 units totaling 921 acres of clear-cut with residual tree harvesting, 4 units totaling about 670 acres of commercial thinning and 1 shelter-wood unit of about 38 acres. No savannahs would be created in this alternative. In total, about 1,629 acres will have vegetative management actions within the project area. No new road construction would occur under this alternative and approximately 15-25 miles would be reconstructed. Fourteen of the clear-cut units will be conventionally harvested (428 acres) and 20 unit totaling about 493 acres will be helicopter harvested. All thinning units (670 acres) will be helicopter harvested. The one shelter-wood (38.4 acres) will also be conventionally harvested. The direct and indirect affect of implementing this alternative on the scenery resources is as follows:

All 40 proposed units and 1 savannah (1,680 acres) proposed for either regeneration harvesting or commercial thinning are within a Typical Scenic Attractiveness Zone. Unit #12 (25 acres)
Units 1-3, 10, 15-24, 30-34, 39, 40, 42, 43, 45-47, 49, and 56-58 are located in Middle-ground 1 (MG-1) which has a high sensitivity level. Proposed unit 37 is partially located in Foreground 1 (FG-1) which has the highest sensitivity level. All remaining units are located in FG-3, MG 2 and 3 and seldom seen areas all of which have a lower sensitivity level are have a low existing Scenic Integrity (state of naturalness) with all remaining units located within a moderate existing Scenic Integrity Zone. All or portions of units 1, 4, 10, 15-22, 29, 31-36, are within a foreground high visibility zone with all remaining units located within middle-ground high to middle-ground low.

For all action alternatives clear-cut harvest units 10 and portions of unit 11 are located in Fore-ground and Middle-ground and will be visible to residents within the community of Dyer and portions of Forests Roads 86 and 101. Units 11, 20, 21 25, 26, 27 and 32 will be partially visible for a short driving distance year-round and units 28 and 30 will be visible only during leaf-off from Forest Road 86. Units 18 and 23 will be partially visible from Forest road 101 during leaf-off only. No other units will be visible from the viewpoints established above.

Scenery/ROS Resource	Unit of Measure
Landscape Visibility/ Scenic Integrity	0 units/ acres not consistent with Forest Plan Scenic Integrity Objectives for MP 3.0
Recreational Opportunity Spectrum (ROS)	0 units/ acres not consistent with MP 3.0

	Roaded Natural ROS Class

Alternative 5 – All Helicopter Harvesting
Alternative 5 includes 34 units totaling 909 acres of clear-cut with residual tree harvesting, 4 units totaling about 670 acres of commercial thinning and 1 shelter-wood unit of about 38 acres. No savannahs would be created in this alternative. In total, about 1,617 acres will have vegetative management actions within the project area. All units would he helicopter harvested and no new road construction and about 21-28 miles would be reconstructed in this alternative. The direct and indirect affect of implementing this alternative on the scenery resources is as follows:

All 40 proposed units and 1 savannah (1,680 acres) proposed for either regeneration harvesting or commercial thinning are within a Typical Scenic Attractiveness Zone. Unit #12 (25 acres) which is located in a Distinctive Scenic Attractiveness Zone was dropped in this alternative.
Units 1-3, 10, 15-24, 30-34, 39, 40, 42, 43, 45-47, 49, and 56-58 are located in Middle-ground 1 (MG-1) which has a high sensitivity level. Proposed unit 37 is partially located in Foreground 1 (FG-1) which has the highest sensitivity level. All remaining units are located in FG-3, MG 2 and 3 and seldom seen areas all of which have a lower sensitivity level are have a low existing Scenic Integrity (state of naturalness) with all remaining units located within a moderate existing Scenic Integrity Zone. All or portions of units 1, 4, 10, 15-22, 29, 31-36, are within a foreground high visibility zone with all remaining units located within middle-ground high to middle-ground low.

For all action alternatives clear-cut harvest units 10 and portions of unit 11 are located in Fore-ground and Middle-ground and will be visible to residents within the community of Dyer and portions of Forests Roads 86 and 101. Units 11, 20, 21 25, 26, 27 and 32 will be partially visible for a short driving distance year-round and units 28 and 30 will be visible only during leaf-off from Forest Road 86. Units 18 and 23 will be partially visible from Forest road 101 during leaf-off only. No other units will be visible from the viewpoints established above.

Scenery/ROS Resource	Unit of Measure
Landscape Visibility/ Scenic Integrity	0 units/ acres not consistent with Forest Plan Scenic Integrity Objectives for MP 3.0
Recreational Opportunity Spectrum (ROS)	0 units/ acres not consistent with MP 3.0 Roaded Natural ROS Class

Alternative 6 – Modified Alternative 3
This Alternative includes 33 units totaling 887 (units 9 & 16 dropped) acres of clear-cut with residual tree harvesting, 4 units totaling about 670 acres of commercial thinning 1 shelter-wood unit of about 38 acres and 1 savannah of approximately 35 acres would be created. In total, about 1,595 acres will have vegetative management actions within the project area. A total of about 2.0 miles of road will be constructed and between 11 and 20 miles reconstructed. Twenty four of the clear-cut units will be conventionally

harvested and nine unit totaling about 135 acres will be helicopter harvested. Portions of three thinning units (273 acres) will be conventional and portions of three units (397 acres) will be helicopter harvested. The one shelter-wood (38.4 acres) and the Savannah will also be conventionally harvested. The direct and indirect affect of implementing this alternative on the scenery resources is as follows:

All 40 proposed units and 1 savannah (1,595 acres) proposed for either regeneration harvesting or commercial thinning is within a Typical Scenic Attractiveness Zone. Unit #12 (25 acres) which is located in a Distinctive Scenic Attractiveness Zone was dropped in this alternative.
Units 1-3, 10, 15-24, 30-34, 39, 40, 42, 43, 45-47, 49, and 56-58 are located in Middle-ground 1 (MG-1) which has a high sensitivity level. Proposed unit 37 is partially located in Foreground 1 (FG-1) which has the highest sensitivity level. All remaining units are located in FG-3, MG 2 and 3 and seldom seen areas all of which have a lower sensitivity level are have a low existing Scenic Integrity (state of naturalness) with all remaining units located within a moderate existing Scenic Integrity Zone. All or portions of units 1, 4, 10, 15-22, 29, 31-36, are within a foreground high visibility zone with all remaining units located within middle-ground high to middle-ground low.
For all action alternatives clear-cut harvest units 10 and portions of unit 11 are located in Fore-ground and Middle-ground and will be visible to residents within the community of Dyer and portions of Forests Roads 86 and 101. Units 11, 20, 21 25, 26, 27 and 32 will be partially visible for a short driving distance year-round and units 28 and 30 will be visible only during leaf-off from Forest Road 86. Units 18 and 23 will be partially visible from Forest road 101 during leaf-off only. No other units will be visible from the viewpoints established above.

Scenery/ROS Resource	Unit of Measure
Landscape Visibility/ Scenic Integrity	0 units/ acres not consistent with Forest Plan Scenic Integrity Objectives for MP 3.0
Recreational Opportunity Spectrum (ROS)	0 units/ acres not consistent with MP 3.0 Roaded Natural ROS Class

Summary

All of the proposed action alternatives are consistent with the Forest Plan forest-wide as well as management prescription 3.0 standards and guidelines for Scenery Management. Although some units were dropped in alternatives 3-5 and unit sizes and harvesting types vary across alternatives unit locations stay basically the same. Therefore, there is little change to the effects on the scenic resource across alternatives. All action alternatives provide the opportunity to move toward the desired condition of this MP which is a mosaic of stands of predominately hardwood trees and associated under-stories that provide habitat for a variety of wildlife species. These stands vary in size, shape, height, and species depending on the silvicultural system applied.

The no action alternative does not provide the opportunity to move this area toward the desired condition by providing a variety of forest scenery through age class distribution.

Unavoidable Adverse Impacts
There are no unavoidable adverse impacts identified that would impact the recreation and scenic resources within the project area other than those discussed in the Scenery Management effects section of this document.

Irreversible or Irretrievable Commitment of Resources
There are no irreversible or irretrievable commitment to the recreation and scenery resources within or adjacent to the project area.

Consistency with the Forest Plan
This alternative is consistent with the 2006 Monongahela National Forest Land and Resource Management Plan Revision for recreation and visual quality management for management prescription 3.0.

Consistency with Laws, Regulations, and Handbooks
There are no conflicts between this alternative and the Federal, regional, State, and local laws, land use plans, policies, and controls for the recreation and visual resources.

Economic

Resource Impacts Addressed
This section of the EIS discloses the potential economic impacts of the Lower Williams alternatives. It addresses public comments regarding the monetary costs and benefits of proposed activities. Other sections of the EIS describe effects on non-monetary values such as water quality, fish and wildlife habitat, recreation opportunities, vegetation, etc.

Affected Environment
The area has provided direct economic benefits in terms of forest products removed in previous timber sales. Firewood permits currently sold may include the project area. These permits provide very little revenue, and will not be considered as direct economic benefits. The project area offers many indirect economic benefits via the ecosystem services it provides: water storage and filtration; a diversity of habitats for aquatic and terrestrial fauna and flora, including threatened, endangered, and sensitive species; miscellaneous non-timber products, such as berries and ramps; and recreational opportunities, like wildlife viewing, fishing, hunting, hiking, and biking. The Forest has not tracked such economic benefits in quantitative terms. Qualitative descriptions of the resources provided by the project area are described in other parts of the EA. Costs currently incurred in the area are associated with routine maintenance, like grading and brushing roads, cleaning ditches, mowing wildlife openings, etc.

Scope of the Analysis
The project area is located within Webster County, near the community of Dyer. The nearest town is Cowen, WV. The project area, and as appropriate, nearby communities,

were considered in the analysis of effects. Most Gauley Ranger District sales are sold to sawmills located within a two hour drive of the sale. Residents and associated businesses in nearby communities are expected to benefit directly from timber products removed from the area and indirectly from employment opportunities generated. The temporal boundary used for analysis of effects was up to ten years from the time a timber sale is awarded. Most costs and benefits from timber harvest activities (sale of timber products, employment opportunities, etc.) are expected to be generated in the first five years after a sale is awarded. Post-timber sale related activities are usually completed within the first year after a sale closes; although, some post-sale activities such as stocking surveys and tree planting can occur five years after a sale is completed.

Methodology

Table 39 displays the direct costs and values for each alternative. The costs identified are only those direct costs expected to be incurred by the Federal government. Costs incurred by timber purchasers or other parties are not known. Road maintenance costs are not included as that activity would occur regardless of the alternative selected.

The costs of road construction, reconstruction, and hardening (making the road suitable for four season hauling as opposed to three season hauling) were included as separate items and were based on estimates provided by engineers on the basis of recent values for similar work on the National Forest. The cost per mile is based on constructing four season gravel roads for those roads that would be used for helicopter units. Road hardening includes adding more gravel so the road can be used for hauling during the winter.

There are many site-specific and economic factors that determine the cost of performing road work. Site-specific factors include the following: length, width and grade of the road, sideslope and terrain, intended vehicle use, season of use, existing drainage and aggregate, subgrade soil properties, season that work would be performed, and complexity of work required. Economic factors include the following: fuel prices, availability of labor, material prices, quantity of work available to contractors, location, inflation, equipment required to perform the work and its availability.

The Logcost 8.0 program was used to calculate the cost of helicopter logging, as well as to evaluate the feasibility of the method. The helicopter logging adjustment is based on the weight of each timber species and the distance to landings which is specific to each alternative, and to each stand. A copy of the Logcost 8.0 calculations is in the project file. The adjustment reflects the additional costs of helicopter logging over that of conventional logging. Conventional logging costs were not included, as these costs are already reflected in the average timber values used.

The costs for timber sale administration and preparation were derived from comparisons of past forest budgets for timber sale preparation and administration and timber volume outputs. Cost for required snag creation in timber sale units is based on an approximate acreage where the work would be needed. Project costs are based on similar projects that have been done recently.

Timber volumes per acre were calculated for each stand and combined based on acreage for each alternative. The basis for the calculation was tree data mostly from 2003 in the

CDS database, with some stands having older data. Pulpwood was not included from helicopter logged units under Alternatives 2, 3, 4, 5, and 6. Timber volumes were slightly underestimated to allow for riparian and other areas that would not be harvested within stands. Shelterwood harvests involve two separate entries for volume removal. Volumes, values, and helicopter adjustments for the second entry are calculated separately. No additions to volume are made for the expected growth or mortality.

The values shown in the table are based on the proportion of each species expected to be harvested in each stand. Red oak, yellow poplar, and black cherry sawtimber make up the biggest proportion of the trees expected to be cut, with over 12 other species represented. Values are from the base period selling prices in FSH 2409.18, Chapter 40, effective date of April 15, 2007. These prices were derived from actual bid prices for National Forest timber sales for the past three years, and are adjusted to represent the minimum acceptable bid rate. Prices used range from $12.35 for other hardwood species such as birch and beech up to $839.13 for Black Cherry, with Red Oak being $201.96 and Yellow Poplar being $83.61 per CCf. Competition and other market forces often result in bids that are greater than the minimum acceptable bid rate for timber, but would not necessarily have that result. The Desert Branch Timber sale sold for 100% more than the minimum acceptable bid rate in September 2005. On the Upper Williams timber sales, bid premiums ranged from 0.3% on the Friel Laurel Sale (all helicopter) to 36.9% on the Day South Timber Sale (all conventional) to 54.5% on the Big and Little Timber Sale (majority helicopter).

Values and costs for the second shelterwood harvest included in Alternatives 2, 3, 4, 5, and 6 are shown separately, since these volumes would be sold about 5-7 years after the initial harvest in these stands.

Direct/Indirect Environmental Consequences

The following table summarizes the expected costs and revenues for Alternatives 2, 3, 4, 5, and 6. Maintenance and administrative costs included are those that would be required over and above the current level of maintenance and administration under the No Action alternative.

Table 47. Total Volumes and Costs, by Alternatives

		Alternatives					
	Value/Unit	**No Action**	**Proposed Action**	**3**	**4**	**5**	**6**
Timber Volume Estimated							
Volume CCF		0	29,414	26,221	23,426	21,707	25209
Projects							
Acres Wildlife Openings		0	20	31	32	42	27
Acres Savannahs		0	70	35	0	0	35
Number of Waterholes		0	2	1	0	0	1
Acres of Regeneration		0	1,054	937	921	909	887

Acres Herbicide Treatment		0	38	38	38	38	38
Acres Grapevine treatment		0	1,842	1,645	1,629	1,617	1,595
Acres Planting			10	10	10	10	20
Acres Snags		0	1,842	1,645	1,629	1,617	1,595
Miles Road Construction		0	3.26	1.72	0.00	0.00	1.72
Miles Road Reconstruction		0	2.0	1.5	0.4	0.0	1.5
Miles Road Hardening		0	3.3	15.4	20.7	23.8	11.5
Stream Crossings FR 429		No	No	No	No	No	Yes
Revenues							
Sawtimber/Pulp		0	5,883,161	5,577,104	5,222,860	5,302,936	5,260,767
Helicopter Adjustment		0	351,836	903,902	2,049,596	2,624,103	969,508
Total Revenue		0	5,531,325	4,673,202	3,173,264	2,678,833	4,291,259
Road Construction Cost	202,287	0	347,934	347,934	0	0	347,934
Road reconstruction	153,559	0	307,118	230,339	61,423	0	230,339
Road Hardening	84,131	0	277632	1,295,617	1741512	2,002,318	967,507
Sale Revenues		0	4,598,641	2,799,313	1,370,329	676,515	2,745,480
Costs of Projects							
Sale Preparation	17.59	0	517,392	461,227	412,063	381,826	443,426
Sale Administration	13.63	0	400,913	357,392	319,296	295,866	343,599
Site Preparation	213.12	0	224,628	199,693	196,284	193,726	189,037
Regeneration Surveys	83.43	0	87,935	78,174	76,839	75,838	74,002
Herbicide Treatment	684.87	0	26,025	26,025	26,025	26,025	26,025
Create Wildlife Opening	889.87	0	17,797	27,586	28,476	37,375	24,026
Construct Savannah	3,120.20	0	218,414	109,207	0	0	109,207
Construct Waterhole	1,610.82	0	3,222	1,611	0	0	1,611
Grapevine Treatment	109.64	0	201,957	180,358	178,604	177,288	174,876
Planting	459.72	0	4,597	4,597	4,597	4,597	9,194
Create Snags	101.33	0	186,650	166,688	165,067	163,851	161,621
Stream Crossings on 429	45,000	0	0	0	0	0	45,000
Total Cost		**0**	**1,889,531**	**1,612,559**	**1,407,251**	**1,356,392**	**1,601,626**
Total Net Revenues		**0**	**2,709,110**	**1,186,754**	**-36,922**	**-679,877**	**1,143,855**
Shelterwood Entry							
Volume CCF		0	341	341	341	304	341
Stumpage Revenue		0	105,351	105,351	105,351	104,936	105,351

Helicopter Adjustment						41454	
Sale Preparation		0	5,998	5,998	5,998	5,347	5,998
Sale Administration		0	4,648	4,648	4,648	4,144	4,648
Total Net Revenue		**0**	**94,477**	**94,477**	**94,477**	**63,482**	**94,477**

In conventionally logged sales, local logging crews fell the designated trees, transport the logs to the landings, and transport the logs to the mill. In helicopter sales, the helicopter company crews come in and fell the designated trees and transport the logs to the landings. In past helicopter sales, local crews have been used to transport the logs from the landing to the mill. Therefore, some may feel that using helicopter logging takes jobs away from local people since the helicopter company crews are generally from the western states. However, these crew members also contribute to the local economy by buying food and other necessities during their time in the area.

Alternative 1 – No Action
No activities would be implemented under Alternative 1. Thus, no costs, other than those currently expended for existing maintenance activities would be incurred. No direct economic benefits would be generated since timber products would not be sold from the area. Timber-related employment opportunities and incomes to associated local community businesses would not be generated. The area would continue to provide the indirect benefits described under the affected environment.

Alternative 2 – Proposed Action
Timber sale activities in the project area would generate direct and indirect costs and benefits, but only direct ones are shown in the table. Considering only helicopter logging costs and road construction costs, the total sale value is expected to be over 4.6 million dollars, at the minimum bid rate. As explained above, the value of actual bids could be more than this minimum bid rate, depending on the markets at the time and the number of interested bidders.

The helicopter adjustment is calculated based on approximately 7% of the volume being logged by helicopter.

With all costs considered, this alternative would be expected to yield positive net revenue of approximately 2.7 million dollars. Approximately $100,000 in revenue would be expected from the final cut in the shelterwood harvest approximately 5 to 7 years after the first cutting.

Alternative 3
Considering only helicopter logging costs and road construction costs, the total sale value is expected to be about 2.8 million dollars at the minimum bid rate. As in Alternative 2, the value of actual bids could be more than this minimum bid rate, depending on the markets at the time and the number of interested bidders. The helicopter adjustment is calculated based on approximately 22% of the volume being logged by helicopter.

With all costs considered, this alternative would be expected to yield a positive net revenue of approximately $1,186,000. Approximately $100,000 in revenue would be expected from the final cut in the shelterwood harvest approximately 5 to 7 years after the first cutting.

Alternative 4
Considering only helicopter logging costs and road construction costs, the total sale value is expected to be about 1.4 million dollars at the minimum bid rate. Like Alternatives 2 and 3, the value of actual bids could be more than this minimum bid rate, depending on the markets at the time and the number of interested bidders.

Alternative 4 has a large helicopter adjustment; the adjustment is calculated based on approximately 58% of the volume being logged by helicopter.

With all costs considered, this alternative would be expected to yield a negative net revenue of approximately $36,000, just a bit less than breaking even. Approximately $100,000 in revenue would be expected from the final cut in the shelterwood harvest approximately 5 to 7 years after the first cutting.

Alternative 5
Considering only helicopter logging costs and road construction costs, the total sale value is expected to be about $670,000 at the minimum bid rate. Like the other action alternatives, the value of actual bids could be more than this minimum bid rate, depending on the markets at the time and the number of interested bidders.

Alternative 5 has a very large helicopter adjustment because all of the volume would be harvested by helicopter. This also results in more miles of road hardening for four season hauling than in the other alternatives. Although the timber value is expected to be large enough to cover the cost of road building and logging by helicopter, it does not cover the other administrative costs of the project.

With all costs considered, this alternative would be expected to yield a negative net revenue of approximately $680,000. Approximately $50,000 in revenue would be expected from the final cut in the shelterwood harvest approximately 5 to 7 years after the first cutting.

Alternative 6
Alternative 6 is very similar to Alternative 3 except for dropping Unit 16 and having Unit 17 flown to a different landing to avoid the use of FR 425. The increase in helicopter logging costs is likely to be offset by lower costs for road hardening. Alternative 6 also includes 10 more acres of planting than do the other action alternatives and also the stream crossing work on FR 429.

Considering only helicopter logging costs and road construction costs, the total sale value is expected to be about 2.75 million dollars at the minimum bid rate. Like the other action alternatives, the value of actual bids could be more than this minimum bid rate, depending on the markets at the time and the number of interested bidders. The helicopter adjustment is calculated based on approximately 25% of the volume being logged by helicopter.

With all costs considered, this alternative would be expected to yield positive net revenue of approximately $1.14 million. Approximately $100,000 in revenue would be expected from the final cut in the shelterwood harvest approximately 5 to 7 years after the first cutting.

Cumulative Impacts

Alternative 1 – No Action
Alternative A would not generate new direct or indirect costs and benefits that would add to the effects of past, present, or future actions because new activities would not be implemented. Therefore, there would be no cumulative effects.

Effects Common Alternatives 2, 3, 4, 5, and 6
The timber from Alternatives 2, 3, 4, or 5 would not have a significant impact on the local or regional economy. It, however, along with timber from other National Forest sales or from private lands, would help maintain that aspect of the local or regional economy. Depending on the successful bidder, the logs would be expected to go to a mill within the region. The ripple effect would be the maintenance of jobs in the area and economic activity by those people holding the jobs. Potential for economic benefits from timber sales within the project area would be maintained or enhanced by all of the alternatives in the long term.

The thinned areas would still retain about 2/3 of their stocking, and thus a comparable percentage of their value. This volume remaining could provide economic timber sales either immediately or in the future. In the clearcut areas, commercial timber harvest would be expected to be possible within 60 years or so, if timber markets were similar to current ones. Alternatives 2, 3 and 6 would build roads that would add to maintenance costs in the future, and that would make it possible to harvest timber with less upfront cost in the vicinity. These effects of roads would be greater with Alternative 2, with the greater road mileage.

Unavoidable Adverse Impacts

The No Action Alternative would not have unavoidable adverse impacts, but the purpose and need identified for the area would not be met. Alternatives 2, 3, 4, 5, and 6 could result in unavoidable costs if no bids are received at the minimum bid rate. In Alternative 5, the direct project costs are expected to be greater than the expected revenue at minimum bid rate.

Within the stands harvested using thinning harvest methods under the action alternatives, the volume available for future sales would be reduced for the next ten years or so. After that time, the volume and values are expected to approach that currently present. Within the stands that are harvested by clearcut and shelterwood methods, the volume (and thus value) available for harvest would not be sufficient for a commercial harvest for 60 or more years.

Irreversible or Irretrievable Commitment of Resources

Alternatives 2, 3, and 6 would be expected to return a surplus to the treasury, even considering all direct project costs. In Alternative 5, the sale revenues would not be expected to cover the cost of all projects, unless the bid rates exceeded the minimum by about 13%.

Volume reductions in the areas harvested are not irreversible, since they would be expected to grow back in the time frames shown above.

Consistency with the Forest Plan

The National Forest Management Act requires that National Forest land be managed for a variety of uses to ensure a continued supply of goods and services to the American people in perpetuity. The National Environmental Policy Act requires that environmental information be disclosed to public officials and citizens before federal decisions are made and actions are taken (Forest Plan, p. I-3). None of the alternatives violate any of the standards or goals or deviate from the guidelines in the Forest Plan.

Safety

Affected environment

Since this area is used by recreationists, particularly along the Williams River and Forest Road 86, some potential hazardous situations would exist for users. Logging truck traffic is a normal occurrence along these roads and the state roads in the area. Other than the area along the Williams River, most of the use in the rest of the area would be from hunting.

One fairly common occurrence during logging or road construction/reconstruction activities is dust. Users in the area could experience some airborne dust during road work or logging activities. However, dusty conditions would be expected to be restricted to the work areas and not affect the general public.

Helicopter logging, while reducing the use of heavy machinery in some of the cutting area, does result in a potential hazard of logs being accidentally dropped from the helicopter. While this is rare, it does present a potential danger to people in the area. Therefore the sale areas will be closed to the public during periods of helicopter logging. Closure may not include an entire sale area, but would include all areas within helicopter flight paths. Areas effected and duration of closures would vary between alternatives.

Direct and Indirect Effects of Alternatives

Under the No Action alternative, no activities would occur that could affect human safety. Natural mortality would continue to result in snags, which could potentially fall on someone. However, the likelihood of a snag falling on a person is very low.

All of the action alternatives would result in logging truck traffic on the roads in the sale areas. Logging truck warning signs would be posted on open Forest Service roads (FR 101, 86, 735, and 133) warning travelers of logging traffic.

Under Alternative 2, helicopter logging would occur in the Jonathon Run and North Cove drainage areas. These areas users would have to walk or bike to reach this area. This area would be closed to public use and posted at entry points during the helicopter logging. Access to the helicopter landing area would be along a road closed to public vehicular use. During sale active operations, the gates may be open to allow log trucks easier access and some curiosity seekers may try to drive to the landing sites. Signs

posted at the normal road closure site warning the public would be posted to discourage people from trying to go to the landing sites.

In Alternatives 3 and 6, helicopter logging would occur in several other locations in addition to the area included in Alternative 2. A couple of potential landing sites would be along roads open to public use. Flaggers would be used to stop traffic along the road when the helicopter is approaching the landing site. Other mitigations would be similar to those of Alternative 2 except for more areas being affected.

Alternative 4 would expand the helicopter logging over Alternative 3. Effects would be similar to those of Alternative 3 except for the closure areas being more extensive and closures lasting longer. Mitigations would be similar to those of Alternative 3.

Alternative 5 would expand the helicopter logging over Alternative 4. Effects would be similar to those of Alternative 4 except for the closure areas being more extensive and closures lasting longer. Mitigations would be similar to those of Alternative 4.

In the years after the sale is completed, there should be fewer snags in the thinned areas, as thinning is expected to result in fewer trees dying. Although the likelihood of a snag falling on a person is very low, a reduction of snags in areas used by people would further reduce this possibility. However the creation of snags in the cutting units as a mitigation for the Indiana bat would cancel the effects of fewer snags in the cutting areas.

Cumulative Effects

With mitigations, risks from potentially hazardous conditions would be minimized. The additional truck traffic increases the chance for accidents, and activities on private lands could result in additional truck traffic at any time, but mitigations should keep safety from being jeopardized. After sale activities are completed, any cumulative effects on safety would be negligible if any. The hemlock wooly adelgid, beech bark disease, snag creation connected with the sale, and gypsy moth could be expected to increase the amount of snags in the area, near trails and roads and thoughout.

Unavoidable Adverse Impacts

None of the alternatives would result in unavoidable adverse impacts.

Irreversible or Irretrievable Commitment of Resources

None of the Lower Williams activities would result in irreversible or irretrievable commitment of resources as it relates to safety.

Consistency with the Forest Plan

All the Lower Williams alternatives would be consistent with the Forest Plan (Forest Plan, pp. I-8, I-10).

Herbicides

Resource Impacts or Issues Addressed

Herbicide use is preferred in some situations over other vegetative management methods such as prescribed burning and mechanical treatments. The small local areas to be

treated, and the small extent of such treatment, make herbicide use more practical to achieve the objectives of regeneration, elimination or reduction of NNIS, and maintenance of wildlife savannahs. Mechanical treatments are not preferred because of their lack of effectiveness, and the potential need for repeat treatments. However, hand pulling of some small patches may be substituted for herbicides, where it could potentially be effective. In the shelterwood harvest, beech and striped maple would vigorously sprout after being cut, and thus it may be necessary to use the planned herbicide treatment.

Herbicides are a type of pesticide used to control plants. Herbicides affect biochemical pathways that are specific to plants, making herbicides the least toxic form of pesticides. One measure of toxicity is lethal dose 50 (LD50) which means the amount of chemical it takes to kill 50 percent of a population. For example, imazapyr has an LD50 above 5,000 mg/kg (milligrams per kilogram), making it practically non-toxic. The reason for this is that imazapyr works on amino acid pathways that are specific to plants and not found in animals (McKnapp 1997).

Herbicides are used infrequently to accomplish forest management objectives.

Methodology

In selecting the pesticides to be used in the Lower Williams project, integrated pest management principles were used. The selection of corrective measures takes into account the management objectives, effectiveness, safety, environmental protection, and cost of corrective measures. (Forest Plan p. II-20)

A risk assessment was done for the herbicides proposed in this project. A risk assessment is required under the National Environmental Policy Act (40 CFR Part 1502.22). Syracuse Environmental Research Associates (SERA) recently created new models for the Forest Service to better predict the effects of proposed pesticide use. The hazard quotient is used to determine the relative hazard of using a proposed herbicide. Hazard quotient is numbers above or below 1.0. Below 1.0 indicates a negligible risk.

In considering the potential risk of herbicide applications, the maximum amounts of each herbicide that could be used were the basis of analysis. Herbicide use in the shelterwood harvest and in maintenance of the savannah depends on post harvest evaluation of regeneration or sprouting and growth of undesirable plants. For the treatment of garlic mustard, hand pulling of plants in small patches may be used, thus reducing the total amount of chemicals that would actually be used. Post harvest monitoring would determine whether the herbicide is actually needed, and how much would be needed.

Environmental Consequences

Environmental Consequences Common to All Action Alternatives

Herbicide applications would take place in all of the action alternatives, with acreages shown in Chapter II.

Direct/Indirect Environmental Consequences by Alternative

Alternative 1 - No Action

Human Health Risk

Under the No Action alternative no herbicides would be applied in the project area. No direct or indirect consequences to human health would occur in this alternative.

All Action Alternatives.

Human Health Risk: Public Risk

The term public includes hikers, campers, hunters, fuelwood gatherers, and other forest users. It basically includes all people who use or work in the project area except those who work with the herbicide treatments.

Potential public exposure from herbicide treatments in the project area is limited. Labeling requirements would be followed for each herbicide. Herbicide treatments of NNIS that occur along roads are the most likely place for any exposure. Roads where herbicide treatments are proposed are normally closed during the time of treatment, and would thus restrict any normal access. No trails or campgrounds are nearby. People hunting and fishing are the primary public users in the project area. The risk of herbicide exposure for hunters is low because most of the treatments would occur outside of hunting season and people fishing would run a low risk due to the large untreated buffers left around streams.

Results of the public health portion of the risk assessments done for the herbicides used in this project are show below; these represent extreme cases of accidental contamination of a member of the public.

Table 48. Summary of the hazard quotients for the general public for the Lower Williams Project

Herbicide	Category	Typical	Maximum
Glyphosate	Public		
	**Dermal		
	----Onsite	0.01	0.03
	**Dietary		
	----Water	0.4	0.7
	----Fish	0.02	0.03
Triclopyr – cut surface	Public		
	**Dermal		
	----Onsite	3.0	26.0
	**Dietary		
	----Water	3.0	15.0
	----Fish	0.03	0.09

Table 48. Summary of the hazard quotients for the general public for the Lower Williams Project

Herbicide	Category	Typical	Maximum
Triclopyr – basal spray	Public		
	**Dermal		
	----Onsite	7.0	57.0
	**Dietary		
	----Water	3.0	20.0
	----Fish	0.02	0.1
Imazapic	Public		
	**Dermal		
	----Onsite	0.06	0.2
	**Dietary		
	----Water	0.3	0.8
	----Fish	0.004	0.009

Represented in the table is worst case scenarios for any of the given herbicides used.

The high hazard quotients for dermal exposure of triclopyr are because triclopyr is mixed with oil making it easier to penetrate the skin. The numbers in the table reflect worst case scenarios of a person being accidentally sprayed with the herbicide, or for dietary consumption of water, an accidental spill in a very small pond. For a person coming into contact accidentally with vegetation, the risk is much less because of the location far from access points, and the scattered nature of treated stems, and treatment only of the lower 12-18 inches of small trees. Triclopyr is to be used only in the shelterwood harvest which is located on a road that is closed to the public, and to treat Japanese Knotweed, currently located in a very small area on a road closed to the public, except for handicapped hunting access. However, the treatment of the Japanese Knotweed is to occur during June and August, during no hunting seasons.

Human Health Risk: Worker Risk

The term 'workers' includes all personnel involved in applying the herbicide.

Results of the risk assessment for the project show the typical exposure rates for a worker are not a concern. There is a slight chance that a sensitive worker could experience problems, the maximum rate of exposure was used to account for sensitive workers. Only the triclopyr had hazard quotients above 1.0 for worker exposure, at the maximum exposure level.

Cumulative Impacts

Alternative 1 - No Action

No cumulative impact would result from the no action alternative, since there would be no direct effects of herbicides.

Table 49. Summary of the hazard quotients for workers for the Lower Williams Project

Herbicides	Category	Typical	Maximum
Glyphosate	Accidental Exposure		
	----Spill on Worker	0.00126	0.00121
	----Contaminated Gloves	0.000234	0.00154
	Normal Exposure		
	----Mechanical ground	0.0605	0.408
	Spray	0.0354	0.216
	----Manual Ground Spray		
Triclopyr – cut surface	Accidental Exposure		
	----Spill on Worker	0.08	0.7
	----Contaminated Gloves	.08	0.1
	Normal Exposure		
	----Mechanical ground	0.2	2
	Spray	0.1	1.2
	----Manual Ground Spray		
Triclopyr – basal spray	Accidental Exposure		
	----Spill on Worker	5	43
	----Contaminated Gloves	.02	1.5
	Normal Exposure		
	----Mechanical ground	0.5	6
	Spray	0.9	12
	----Manual Ground Spray		
Imazapic	Accidental Exposure		
	----Spill on Worker	0.002	0.008
	----Contaminated Gloves	0.004	0.02
	Normal Exposure		
	----Mechanical ground	0.003	0.008
	Spray	0.0007	0.004
	----Manual Ground Spray		

All Action Alternatives

Human Health Risk

Cumulative effects to human health are not likely to occur because none of the herbicides are persistent in the environment or in the human body. None of the herbicides in this project bioaccumulate in animal tissue, so there is no threat of human exposure by eating animals that have come into contact with the herbicides.

Irreversible or Irretrievable Commitment of Resources

Since applying herbicides to these areas would have no effect on human health, no irreversible or irretrievable commitments of resources would occur from this project.

Consistency with the Forest Plan

Alternative 1 - No Action
Since no herbicides would be applied, Alternative 1 is consistent with the Forest Plan (Forest Plan, p. II-20).

All Action Alternatives
The application techniques are consistent with the standards and guidelines laid out in the Forest Plan (Forest Plan, p. II-20).

Consistency With Laws, Regulations, and Handbooks

All the alternatives are consistent with the following laws and regulations:

- Federal Insecticide, Fungicide, and Rodenticide Act
- West Virginia Pesticide Control Act of 1990

Forest Service Handbook 2109.14 Chapters 10, 20, and 3

Environmental Justice

Resource Impacts Addressed

This section summarizes the results of the analysis the Forest completed to assess the impacts of proposed activities on minority and low income populations per Executive Order 12898.

Affected Environment

There are no known community-identified environmental justice related issues. Recent data indicate that Webster County, the county in which the Lower Williams project area is located, does not demonstrate ethnic populations or low income percentages greater than two times that of the State average (U.S. Census Bureau, Census 2000). The same holds true for Greenbrier County, Pocahontas County, and Nicholas County, the other counties with land in the Gauley Ranger District.

Scope of the Analysis

The counties in which the Gauley Ranger District is located were considered in the scope of the analysis. Cowen, in particular, was considered since it is the nearest town (and census area) to the project area. The temporal boundary considered was five years from the date timber sales are awarded, since average MNF sales are implemented within five years from the date of award. Other post sale activity, such as monitoring, may continue for approximately five years after the sales are closed, but effects would be negligible.

Methodology

The potential for Environmental Justice effects was evaluated by using demographic and income data from the 2000 U.S. Census. Demographic data for Webster, Nicholas, Greenbrier, and Pocahontas Counties were compared to the data for West Virginia. Income data for Webster, Nicholas, Pocahontas, and Greenbrier Counties and the towns of Richwood and Cowen were compared to that of West Virginia. The minority populations in all four counties are lower than the state average. None of the towns or counties evaluated has low income percentages greater than two times the state average.

Direct/Indirect Environmental Consequences of All Alternatives

None of the alternatives would pose disproportionately high or adverse impacts on minority or low income populations, because these populations in Webster County and the other counties with lands in the Gauley Ranger District are not greater than two times that of the State average. Affected communities have been provided opportunities to comment during the planning process (see Public Involvement section in Chapter 2).

Cumulative Impacts
No past, present, or future actions previously identified in this chapter are expected to contribute cumulative disproportionately high or adverse impact on minority or low income populations.

Unavoidable Adverse Impacts
None of the alternatives would result in unavoidable adverse impacts.

Irreversible or Irretrievable Commitment of Resources
None of the Lower Williams activities would result in irreversible or irretrievable commitment of resources as it relates to environmental justice.

Consistency with the Forest Plan
All the Lower Williams alternatives would be consistent with the Forest Plan (Forest Plan, pp. I-8, I-10).

Other Required Disclosures

Unavoidable Adverse Effects
There would be unavoidable impacts with both action alternatives. These are discussed in depth above and are related to the Heritage, Recreation, and to a smaller extent soils and aquatics.

Short-Term Use vs. Long-Term Productivity
There will be no change in the productivity of the FS managed lands because all activities are on an existing railroad grade.

Irreversible or Irretrievable Commitment of Resources
Irreversible and irretrievable commitments of resources are defined in Forest Service Handbook 1909.15, Environmental Policy and Procedures (9/21/92).

Irreversible commitments of resources mean the consumption or destruction of nonrenewable resources, such as minerals or cultural resources, or the degradation of resources such as soil productivity, which can be renewed only over long periods of time.

Irretrievable commitments of resources are opportunities foregone; they represent tradeoffs in the use and management of Forest resources. Irretrievable commitments of resources include expenditure of funds, loss of production, or restrictions on resource use. When one alternative produces less of a natural resource (such as timber volume) or offers fewer opportunities for use (such as motorized recreation) than another alternative, the difference represents an irretrievable commitment of resources.

There will be no irreversible or irretrievable commitment of resources. There is no transfer of management direction (i.e. changes in management areas) and all activities on National Forest lands occur within the roadbed and adjacent ditches.

Energy Requirements and Conservation Potential

This proposal is not expected to change any requirements for energy nor have any potential for conservation of energy.

Prime Farmland, Rangeland, and Forestland

There is no prime farmland, rangeland, or forestland in the project area.

Effects on the Human Environment

Effects on the human environment are documented throughout Chapter 3 of this EIS. Further documentation can be found in the project record. Effects related to Environmental Justice are found in the Social and Economic section of Chapter 3.

Threatened and Endangered Species

Potential effects to species listed under the Endangered Species Act can be found in Chapter 3 of this EIS (Threatened and Endangered Species section) and in the specialist reports in the Project File. Prior to making a final decision, consultation with U.S. Fish and Wildlife will be concluded.

Wetlands and Floodplains

There are no wetlands or floodplains that would be impacted on National Forest System lands. Except for maintenance of the culverts and ditch cleaning, all activities will occur on the railroad grade bed.

Conflicts with Other Agency or Government Goals or Objectives

Contact, review, and public involvement with other federal and state agencies have indicated no major conflicts between this project and the goals and objectives of other governmental entities.