3.1. Introduction

This chapter summarizes the existing condition of physical, biological, and social resources in the Middle Mountain Wildlife Savannah project area and explains how they may be affected the "No Action" and action alternatives. It describes the direct, indirect, and cumulative environmental consequences of implementing proposed alternatives (40 CFR 1508.7-1508.8). Direct effects are those environmental consequences that are caused by the action and occur at the same time and place. Indirect effects are the environmental consequences that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative effects are the consequences to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes the other actions. The methodologies used to evaluate effects are briefly mentioned in each section. More details may be found in resource reports in the project file.

3.2. Past, Present, and Reasonably Foreseeable Future Actions

The actions listed in the following table are activities of the Forest Service and other entities that have occurred within or around the Middle Mountain Wildlife Savannah project area in the past, are currently being implemented, or may be implemented in the reasonably foreseeable future. All or only some of these actions may contribute cumulatively to the effects of Middle Mountain Wildlife Savannah activities depending on the resource affected.

Table 3-1: Past, Present, and Reasonably Foreseeable Future Actions within or around the Middle Mountain Wildlife Savannah project area.			
Action	**Past**	**Present**	**Reasonably Foreseeable**
Timber harvesting within the Middle Mountain Wildlife Savannah at the turn of the 20th century, prior to federal ownership.	X		
Douthat Creek EA, Timber Sale (approximately 96 acres of regeneration harvest, 184 acres of Two-age harvest, and 59 acres of thinning)	X		
Site preparation on approximately 280 acres for natural regeneration following regeneration harvest to release desirable species	X		
Approximately 133 acres of herbicide treatment to control stripe maple by using basal streamline and hack and squirt methods	X		
Created six acres of wildlife savannah, three small wildlife openings, three water holes for wildlife	X		
Construct 60 stream improvement structures	X		
Agriculture activities such as pasture lands and small gardens on same private lands	X	X	X
Mowing of Middle Mountain trail every two or three years	X	X	X
Dispersed recreation on NFS lands (e.g. hunting, hiking the Middle Mountain Trail, biking, camping, equestrian use (very low), fishing in Douthat Creek minimal), etc.)	X	X	X
Road maintenance and use of State Roads and Highways and Forest System roads, especially FR 790, FR 962.	X	X	X
Introduction of non-native or weed species	X	X	X
Insect and disease occurrence and damage, especially hemlock wooly adelgid, gypsy moth, beech bark scale			X
Weather and flood events	X	X	X

3.3. Presence or Absence of Resources

The following resources are not present in the Middle Mountain Wildlife Savannah project area: wild and scenic rivers; ecologically critical areas; coastal zone areas; research natural areas; State or national parks; conservation areas; other areas of ecological, scenic, or aesthetic importance; or wilderness. There are also no Native American concerns associated with proposed activities or minority and low-income populations that would be adversely affected.

Historic or cultural resources exist in the project area. The historic or cultural resources would not be adversely impacted by the proposed action (see Heritage effects report). Appropriate measures would be followed to mitigate the impacts of the proposed action. The effects to migratory birds and threatened, endangered, and sensitive species are documented later in this

chapter. None of the alternatives are expected to result in short or long term adverse effects to these species' population viability.

3.4. Physical Resources

3.4.1. Soils/Geology

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 proposed actions:

- Sensitive soil types for steep slopes
- Soil effects from herbicide use
- Soil effects from prescribed fire
- Soil effects from timber harvest

Scope of the Analysis

The spatial boundary used to evaluate **direct** consequences would be the activity areas where actions are proposed within the project area. Activity areas are where harvesting, herbicide treatment, prescribed fire treatment, and savannah construction 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 are bound within the project area because effects are not expected to move outside of the subwatersheds within the project area. Please refer to the Alternative Maps (Chapter 2) for the locations of the proposed activities.

The spatial boundary used to address **cumulative** impacts was the entire Middle Mountain project area. This allows us to assess past and future effects within this boundary and determine threshold impacts to soil quality when added to the proposed actions.

Methodology

The Proposed Action and Alternative 3 have the potential to affect soil resources as a result of commercial timber sale activities, herbicide use, and burning (prescribed fire) of the understory vegetation and savannahs. These activities and resulting effects may include soil disturbance, soil compaction, soil rutting, erosion, slumping, accelerated decomposition of organic matter, changes in nutrient cycling due to biomass removal and disturbance of the soil surface horizons, changes in soil temperature and moisture, and burning of the O horizon or soil surface. 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 lasting three years or less and are associated with the recovery period in which disturbed soils become reestablished with vegetative cover. Short term effects imply that the existing soil profile has very little to no impact from proposed activities. Surface disturbances, such as compaction and removal of vegetation are the primary short term impacts. In contrast, **long term effects** are associated with activities which displace the upper portions of the soil profile

(topsoil). Many years are needed for the soil to recover its original productivity when the surface layers are removed. Soil formation typically occurs at a rate of one inch per 200-400 years, and depends on many local environmental factors.

Important factors considered in evaluating effects to soil resources from this project are: 1) the extent of the activity area and the extent of the activity area where long term soil productivity has been reduced historically and 2) possibly by the implementation of the project. Effects to the soils from this project are considered not significant when 85 percent of the activity area retains its potential for 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, and wildlife openings – including savannahs) were estimated using the best available information and compared to the total acres of the activity areas.

Environmental Consequences Common to All Action Alternatives

The discussion for environmental consequences common to all Action Alternatives for roads, wildlife openings (savannahs), wildlife water hole development, timber harvesting, and prescribed fire are found in the soils report, in Section F of the project file. The discussion on wildlife openings focuses on savannahs maintained by fire only where no grubbing of stumps occurs and savannahs maintained by fire and mowing where the stumps are grubbed. The general effects for timber harvesting discussion are broken into compaction, nutrient cycling, soil fertility, canopy removal, soil temperature, and filterstrips application. The prescribed fire discussion is about direct heating, soil exposure and physical properties, erosion and hydrology, soil fertility and nutrient availability, microclimate alteration, biological and ecological consequences, fire lines (dozer and hand lines), and prescribed fires in savannahs.

Direct/Indirect Effects

No Action - Alternative 1

The current GIS layer for surface geology in the MNF GIS files shows that the geology of this area is comprised of 4 different geologic groups. After a review of this information by the Forest Geologist Linda Tracy and GIS Staff Sam Lammie and Patricia Felton, it was determined that the maps were incorrect. This entire project area is actually underlain by the Chemung Group (Geology Map 2, Section F of the Project File). Soils formed from these formations are moderately susceptible to compaction. They have a moderate to low shrink-swell potential and moderate to low shear strength potential, factors that are important in determining the capacity of soils to support road and skid road use in the area.

The Chemung geology weathers into soils that have numerous rocks throughout the soil profile and fractured bedrock. These soil properties provide for somewhat stable road surfaces during drier periods of the year which the Middle Mountain project area receives much less precipitation than the western portion of the Forest (see Hydrology Report for Precipitation data).

Soil Types and Soil Sensitivity Ratings within the Project Area
The types of soils and sensitivity ratings for soils within the project area discussion is found in Section M of the project area, along with maps and tables to help illustrate the soil ratings and soil types. The types of soils found within the project area are Berks, Calvin, Weikert, Potomac, and Dekalb. The discussion on soil sensitivity rating focuses on wet soil types (possible inclusions within the project area) – hydrological effects on subsurface flows.

Prime Farmland Determination
All action alternatives do not propose any actions on soils considered **prime farmland**. No soils found within harvest units or along road corridors are on the **prime farmland** list for West Virginia according to the USDA Natural Resources Conservation Service's soil survey for the county.

Effects Summary
The No Action Alternative proposes no soil disturbing activities. Areas of bare soil existing in the project area such as roads and trails would continue to have soil movement. Signs of erosion around culverts and on non-revegetated 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.

Proposed Action – Alternative 2

Soil Quality Effects
The Soil Management Handbook (FSH 2509.18) suggests a threshold of 15 percent 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 would be applied to activity areas. System roads, trails, and administrative facilities such as campgrounds, are not included in measurements for loss of soil productivity because these are permanent commitments of the soil resource and this area is not intended to grow vegetation. For this analysis, disturbance within harvest units, log landings, and fire lines would be included in estimates for loss of soil productivity. The measures would be compared between the alternatives.

Savannahs for Proposed Action
Below is listed the savannahs proposed for the Proposed Action. The acres and numbers of savannahs vary by alternative. A total of 26.5 acres of savannah would create in the Proposed Action. 13.4 acres (Unit 3, 4, and 5) of these savannahs would be included within thinning units.

Table 3-2. Middle Mountain Savannah Descriptions for the Proposed Action				
Unit	**Method**	**Herbicide**	**Maintenance**	**Acres**
1	Minimal soil disturbance	Yes (stump treatment)	Fire	5.4
2	Minimal soil disturbance	Yes (stump treatment)	Fire	6.2
3/4	Grubbing of stumps	No	Fire/or mowing	5.6
5	Grubbing of stumps	No	Fire/or mowing	9.3
TOTAL ACRES OF SAVANNAHS				**26.5**

Timber Harvesting and the Savannahs units within the Harvest Units: A total of 82.3 acres of commercial timber would be thinned in the proposed action. The majority of soil disturbance in a timber sale occurs during the harvesting of the timber. Each savannah would be created initially using commercial timber harvest. Savannahs would be thinned to a much lower basal area than the thin units (See Chapter 2 for specific descriptions). In conventional harvesting methods, using rubber tire skidders, skid trails and/or skid roads are created in order to extract the 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 would be often dependent upon slope of the activity area. In general, the steeper the slope the higher the road density would be in order to safely operate on the hill slope.

There would be a preliminary logging plan developed for the Middle Mountain project that displays tentative landing locations and skid trail/road placement for the Proposed Action and Alternatives. These locations were done through paper exercise and field verified by the Timber Sale Administrator (A. Mullins, personal communication, May 2006). Although the locations on the ground may change substantially during implementation due to logistics of harvesting activities, the Timber Sale Administrator would layout the skid trail system prior to operation. Because of the relatively gentle slope of the harvest units, there would be little to no soil removal in the creation of the skidding system. Over land skidding would be the primary mode of operation. Multiple passes would be made on the primary skid trail to remove timber; however most over land skidding would occur through one pass off the skid trail and be approved by the TSA. 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.

Prescribed Fire: A total of approximately 442 acres is proposed for burning in the PA (see map 2-1 for location of boundary lines). The effects are described in the effects common to all action alternatives; however the size of the units is discussed below in the soil productivity measurements.

Waterhole development: Multiple waterholes would be developed under this alternative. General effects and mitigation has already been described in the effects common to all action alternatives.

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 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.

Therefore the total defined acreage of the activity area would be:

26.5 acres of savannah (13.4 acres of savannah are within the thinning units)

82.1 acres of area to be thinned (see note above)

Approximately 442 acres of prescribed burning

1 acre of log landings

Table 3-3. Estimated Acreage of Short and Long Term Effects to Soil Productivity in Activity Areas for the Proposed Action.

ACTIVITY	SHORT TERM	LONG TERM
	Acres	
Skid Trails (1.5 miles of existing road and 0.9 miles of new skid trail) The new skid trail construction is only counted - .9 miles * 12 feet width)	2	0
Log Landings (.25 acres)	1	.5
Hand Lines (1.0 miles * 3 feet wide)	.36	0
Dozer Line (1.5 miles * 10 feet wide)	1.5	0
Water holes	<1	<1
Savannas	27	27
Total Affected Area (approximation)	**34**	**29**

Assumptions used for above table:

1. Log landings are approximately ¼ acre each and 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 short term impacts.

2. Savannahs are both short term in that the soil would be mixed in the O, A and transition horizons but not displaced and long-term impacts due to minimal soil displacement but a conversion of soil productivity in the long-term. However if soil is removed and stockpiled, and stumps are grubbed, all acreage disturbed would be a adverse short term effect and long-term effect for site productivity.
3. Primary skid trails are unbladed and have a 10-15 foot width.
4. Log landings are approximately ¼ acres each and approximately 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 short term impacts.
5. Dozer lines are 10 feet wide. O and some small portion of the A horizon is displaced.
6. Hand lines are 3 feet wide

Alternative 3 – Effects
Alternative 3 was developed in response to internal and external comments directed at the Proposed Action: The following issues were taken forth and put into the EA. This issues result in soil effects described in detail below.

- Herbicide Use
- Increased number of water holes for wildlife
- Additional number of savannah units
- Increase in acreages of savannah units
- Additional wildlife openings

Herbicide Use in Conjunction with Savannah Maintenance
For **Alternative 3** two herbicides: triclopyr and glyphosate are being proposed for use in units to aid savannah maintenance when prescribed fire is not an option due to missed burning windows or persistent non-favorable climatic conditions occur. Chapter 2 provides greater detail on the description of which herbicide would be used in each unit, the method of application, and any minor differences in application for each savannah. A detailed effects and description discussion of each herbicide with regard to the soil resource are in the "Soils Report, found in Section F of the Project File.

Timber Harvesting and the Savannahs units within the Harvest Units
Alternative 3 would have the same effects for timber harvesting and savannah creation as discussed in the Proposed Action above; however the number of units and the size of the units varies are seen in the table 3-4. A total of approximately 137 acres would be harvested to create the savannahs and thinned. Only 83 of those acres would be actually commercially thinned and the remaining 54 acres would be the savannah creation. See Table 2-1 in Chapter 2 of this document for a break down of activity acres.

Table 3-4. Middle Mountain Savannah Descriptions for Alternative 3

Unit	Method	Herbicide	Maintenance	Acres
1	Minimal soil disturbance	Yes (stump treatment)	Fire	3.9
2	Minimal soil disturbance	Yes (stump treatment)	Fire	5.2

6	**Minimal soil disturbance**	**Yes (stump treatment)**	**Fire**	**6.3**
7	**Minimal soil disturbance**	**Yes (stump treatment)**	**Fire**	**3.4**
8	**Minimal soil disturbance**	**Yes (stump treatment)**	**Fire**	**7.1**
3/4	**Grubbing of stumps**	**No**	**Fire/or mowing**	**7.5**
5	**Grubbing of stumps**	**No**	**Fire/or mowing**	**20.2**
TOTAL ACRES OF SAVANNAH CREATED				**53.6**

A Wildlife Opening is also created in this Alternative equaling **2.8 acres**. All over story would be removed and stumps with similar effects as the savannah creation and the prescribed fire on savannahs.

Prescribed Fire: There is approximately 432 acres for prescribed fire is proposed in Alternative 3, a slight lesser number of acres than the PA. Burning would occur in the project area boundary as seen on Map 2-2 and defined in Chapter 2. However, the burning acres would be less than the project area boundary due to establishing burn lines on the roads, ridges, and avoiding rhododendron and azalea thickets.

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.**

Under Alternative 3, approximately 5 conventional log landings would be utilized and 3 would be created. The conventional log landings would be the same size as those for the Proposed Action, averaging ¼ acres each.

Therefore the total defined acreage of the activity area would be:

54 acres of new savannah

3 acres of wildlife openings

133 acres of area to be harvested – 86 acres would be commercially thinned and the remainder of the acres is used for savannah creation.

432 acres of prescribed burn (approximate)

1 acre of log landings

Activity Area = 432 acres

Table 3-5. Estimated Acreage of Short and Long Term Effects to Soil Productivity in Activity Areas for Alternative 3.		
ACTIVITY	**SHORT TERM**	**LONG TERM**
	acres	
Skid Trails (1.5 miles of existing road and 1.1 miles of new skid trail) The new skid trail construction is only counted - 1.5 miles * 12 feet)	2.2	0
Log Landings	1	.5
Wildlife openings	3	3
Savannahs	53.6	28
Water holes	1	1
Dozer and Hand Lines	1.5	0
Total Affected Area	**62.3**	**32.5**

Assumptions used for above table:

1 Primary skid trails are unbladed and have a 10-15 foot width.
2 Log landings are approximately ¼ acres each and approximately 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 short term impacts.
3 Dozer lines are 10 feet wide. O horizon and some small portion of the A horizon is displaced.
4 Hand lines are 3 feet wide
5 Savannahs are both short term in that the soil would be mixed in the O, A and transition horizons but not displaced and long-term impacts due to minimal soil displacement but a conversion of soil productivity in the long-term. However if soil is removed and stockpiled, and stumps are grubbed, all acreage disturbed would be a adverse short term effect and long-term effect for site productivity.

Comparison of Environmental Consequences across all Alternatives

Short-term impacts would occur on approximately 34 acres under the Proposed Action and approximately 62 acres under Alternative 3. Long-term impacts would occur on approximately 29 acres under the Proposed Action and on approximately 33 acres under Alternative 3.

To put the magnitude of these impacts into perspective, the estimated acres impacted by Proposed Action and Alternative 3 are compared to the total acres in the activity areas in Table 3-6 below. This table displays the percentage of the activity area impacted by the proposed activities for the alternatives. As stated earlier, the scope of this analysis would be the activity areas, which are 442 acres for the Proposed Action and 432 acres for Alternative 3**.**

The following table outlines the estimated reduction in soil productivity within the activity area as defined by the total acres receiving treatment that involves soil disturbance for each

Alternative. Soil productivity losses are not calculated for activities being 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.

Table 3-6. Estimated Percentage of the Activity Area Soils Affected by the Alternatives

Alternative	Activity Area (acres)	Total Acres of Activity	Percent of the Activity Area	
			Short Term Effects	Long-Term Effects
No Action	0	0	0	0
Proposed Action	442	442	7.7	6.6
Alternative 3	432	432	14.4	7.5

Table 3-6 shows that the alternatives considered in this analysis would affect an estimated less than 15 percent of the overall proposed activity area, and most of the impacts would be short term, as shown. This estimate falls within the 15 percent threshold for impaired soil productivity loss from the R9 Soil Quality Standard as stated previously in the report.

Cumulative Effects

Historical documentation and physical evidence shows us that the soils in this watershed have been severely impacted. 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 all over, Time = 0. There are no activities proposed in this assessment that do this to the soil; however, there are activities such as conventional logging, prescribed fire, landing development, and road reconstruction that disturb the soil surface and to some degree the subsoil. Soil development would be then setback to some time before present, and to see the recovery of that soil to its native state may take a hundred years. The cumulative effect would be that the soil resource and associated soil productivity would be still recovering from historic activities in the watershed and with additional disturbance; the soil resource would take that much longer to recover.

Prescribed fire is also part of the cumulative effects; however, there are long-term benefits from periodic fire in the ecosystem. Periodic fire in oak systems acts to clear the understory vegetation and regenerate vegetation. Periodic fire cumulatively benefits nutrient cycling and

the release of nutrients back into the soil surface. There is evidence of charcoal in the lower soil horizons indicating that fire has been a long time part of this ecosystem.

Private Lands: Please refer to Table 3-1. Past, Present, and Reasonably Foreseeable Future Actions within or around the Middle Mountain project area for a list of these activities. There are approximately 800 acres of private lands within the Douthat Creek Opportunity Area in which the Middle Mountain project lies. Soil productivity losses are not calculated for activities being 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 OA. These activities also contribute to sediment loads within the subwatersheds where private land exists with National Forest System Lands and overall to the major watershed, Douthat Creek.

National Forest System Lands: Forest Service activities occurring on NFS lands are listed in Table 3-1. There has been recent commercial timber harvesting within the area (within the past twenty years). 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 other right of ways. These activities have had mitigations applied to them that have addressed the effects in varying degrees. Forest Plan standards and guidelines within Appendix S of the Forest Plan provide for resource protection. The majority of this area has been reclaimed to some degree either naturally or through active management. Also, only a small portion of this timbering activity fell within the OA (Table 3-7 below); therefore, it can be derived that much less than 15 percent of federal land (6800 acres) within the OA has soil disturbance from the associated activity.

The other items listed in Table 3-7 have had minor amounts of soil disturbance associated with those activities. Qualitatively, soil productivity has not been diminished by these activities. No quantitative soil productivity measurements have been made in association with these activities. Many of them are on-going such as wildlife opening mowing, road maintenance and recreational activity. So overtime small amounts of sediment are generated but not measurable at the project level scale.

Table 3-7 Previous Timber Sales in the MMWSEA Project Area				
Activity Name	**OA#/ Compartment**	**Year Completed**	**Acres**	**% of OA Affected**
Lost Bottom Timber Sale	46.118/51,52,53,54	2001	281	4.1
Douthat Creek Timber Sale	46.118/51	1990	235	3.5

Acid Deposition: The geologic formation associated with the Middle Mountain area is the Chemung geologic formation. This formation is known to have some associated acid buffering capacity potential related to the geochemistry of the formation. The amount is unknown exactly; however, water quality data suggests that acidity is being buffered (Forest Annual Monitoring Report 2003-2004). The USDA Natural Resource Conservation Service has sampled these soil types in the recent past on the forest (2002). Soils data from these soil types shows that certain criteria being considered for effects (base saturation, effective cation exchange capacity, calcium to aluminum ratios, and pH) shows that the soils still are able to adequately buffer acidic inputs from the atmosphere. The Acid Deposition Soil Nutrient Sensitivity Risk Assessment Map (Map 7), when considering the new geological information give by Linda Tracy April, 2006, shows the area as having a moderate risk for such effects. The available data suggests that there would be little to no effect to soil productivity decline in the area. (The available data for these soil types is stored in the USDA – National Soil Survey Center (Lincoln, Nebraska) Soil Survey Laboratory Research Database accessible via the internet at http://ssldata.nrcs.usda.gov. Specific lab data for the area can be found under Tucker and Randolph Counties.)

Harvesting can remove significant amounts of nutrients from a stand. However, because of the relatively dispersed nature of the cuts, the removals are not expected to be significant, particularly for nitrogen (Adams, 1999.) Much of the watershed is underlain by the Hampshire and Chemung geologic groups. These geologies have moderate amounts (when compared to other geologies on the forest) of weatherable minerals that add nutrients back into the system upon weathering.

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 Alternative 3 would implement activities that would disturb soils, which may cause unavoidable adverse compaction, erosion, nutrient removal, and adversely affect soil productivity. However, direct, indirect, and cumulative effects are expected to be limited. Less than 15 percent of the project area would be affected. A much less percent of the total watershed would be affected by the activities described in this EA. 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 landing and skid roads proposed under the Proposed Action and Alternative 3 would result in an irreversible commitment of soil resources on approximately 29 and 33 acres, respectively.

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 (Forest Plan pp 40, 79-80, 82, 128, Appendix R, and Appendix S.)

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.

3.4.2. Hydrology/Watershed/Aquatics

Affected Environment
The project area (approximately 486 acres) lies along the Middle Mountain ridgetop and on small ridges to the east and west of Middle Mountain, and extending down the mountain slopes to Douthat Creek on the west, entirely within Pocahontas County, West Virginia. The majority of the project area occurs within the watershed of Douthat Creek, to the west of Middle Mountain, a tributary of Knapp Creek of the Greenbrier River. A smaller portion of the project area lies to the east of Middle Mountain within the watershed of Cochran Creek, a tributary of Laurel Creek of Douthat Creek. And about 15 acres lie to the east of the Middle Mountain watershed divide within the Anthony Creek watershed. The headwaters of smaller named streams within these watersheds extend up into the project area, including Kline Hollow on the west, and Lost Bottom Run and Nicholas Run on the east. Small un-named perennial, intermittent and ephemeral streams also occur within or adjacent to the project area.

The project area is split into two sections. The southern section is approximately 122 acres, occupies land between Forest Road 790 and the ridge, and lies primarily within the Douthat Creek watershed, with 15 acres of it in the Anthony Creek watershed. The northern section is approximately 364 acres, occupies land between Douthat Creek on the west and FR962 on the east, and lies within small portions of both the Douthat Creek and Cochran Creek watersheds.

The project area lies primarily within the 5th level hydrologic unit designated as Knapp Creek watershed (HUC code 0505000302), a watershed of approximately 70,152 acres (110 sq. miles) and a tributary of the Greenbrier River. One 6th level hydrologic unit includes all of this main portion of the project area, designated Douthat Creek (HUC code 050500030201, about 19,330 acres). The remaining 15 acres of the project area lie within the Upper Anthony Creek 6th level watershed, (HUC code 050500030503, about 20,974 acres). These 6th level sub-watersheds, approximate sub-watershed acreage and project area acres are in Table 3-8.

Table 3-8. Sub-watershed and project area acreage by 6th level sub-watersheds.

Sub-watershed Name	6th level HUC code	Total Sub-watershed (acres)	Project area (acres)	% of Total
Douthat Creek	050500030201	19,330	471	2.4
Upper Anthony Cr.	050500030503	20,974	15	0.07

A very small portion of the western boundary (northern section) of the project area occupies flood-prone area along Douthat Creek. Mapped soil in a narrow strip along Douthat Creek is classified as Potomac very gravelly loam, which is a floodplain soil. See the Soils Resource Report. Adjacent to the narrow flood-prone area, slopes steepen dramatically and are not considered floodprone. No other mapped floodplain soils occur within the project area, although very narrow areas subject to brief flooding occur along small streams, such as Kline Hollow. No mapped wetlands occur within the project area.

The project area lies within an area underlain by Devonian System bedrock primarily of the Chemung Group, and bordering on Brallier Formation bedrock within the Douthat Creek valley. Bedrock is predominantly composed of siltstone, sandstone and shale. Soils are erosive, especially on steeper slopes, but generally provide adequate to good construction opportunities for road building materials. See the Soils Resource Report. Some of the project area (mostly areas proposed for prescribed burning) has steep to very steep slopes, according to the soils maps. Other portions, especially areas proposed for savannahs and thinning harvest, are predominantly on more gentle topography and along ridgetops. Steep slopes, wet soils, coves and riparian areas should be considered sensitive from the standpoint of erosion, aquatic and riparian resource effects, and the potential to influence hydrologic function.

The area receives moderate annual precipitation, estimated to be around 50 inches per year as the annual average for the Knapp Creek watershed. Precipitation at the higher elevations within the project area may be slightly higher. Evapotranspiration losses back to the atmosphere are likely to exceed 50% of the total precipitation (source: USDA Forest Service, Northeastern Research Station, Parsons, West Virginia.)

There is no recent Forest Service water quality data for small streams within the project area. The nearest water quality data collected by the Forest Service was collected in upper Knapp Creek near Frost, WV, in fall 2001, spring 2002, and spring 2005. Stream pH was 6.8 to 7.2, and acid neutralizing capacity (ANC) was consistently above 125 microequivalents per liter (ueq/L), while dissolved aluminum was very low. This data indicates that Knapp Creek has good water chemistry that would provide good aquatic productivity and support the aquatic community of fish and other biota, provided that other factors did not limit aquatic populations (like high summer stream temperatures). Water chemistry in the project area may differ slightly from the Knapp Creek data (above), but still would be expected to be somewhat similar because of similar geology and soils. The Chemung geology in the project area typically gives rise to streams with moderate to good water chemistry and aquatic productivity. During most normal runoff conditions (not stormflow), streams generally run clear and meet State water quality standards for turbidity. During storm events and periods of storm runoff, suspended sediment and turbidity is likely to be elevated in some of these streams, especially for the larger storm events and floods.

None of the streams within or near the project area is listed in the State's 303(d) list of streams not meeting water quality standards, however, not all streams have been tested. Possum Hollow is the only stream within the Knapp Creek watershed that is included in the 303(d) list, but it is a direct tributary to Knapp Creek downstream from Douthat Creek, is entirely in private ownership, and would not be affected by any of the proposed USFS activities. The most recent

303(d) list was prepared in 2004. Knapp Creek is the municipal water supply for the city of Marlinton, but the water intake is approximately 12 or more stream miles below the project area.

Small streams within the project area, including intermittent and ephemeral streams, are generally low in large woody debris which contributes to simplistic in-stream habitat conditions and some channel instability in portions of these streams. They are below their resource potential in this regard. Riparian areas along most of the smaller streams are in fair condition and adequately forested, but are still too young to be fully functioning riparian systems.

No fine sediment surveys have been conducted for streams within the project area. Past land management activities on both federal and private lands would be expected to have contributed sediment to streams within these watersheds, including Douthat Creek and Cochran Creek. Sediment delivered to lower gradient streams such as these may reside in stream substrate for long periods of time, decades or more. Elevated levels of fine sediment in stream substrates would be expected to reduce oxygen levels in spawning substrate needed by developing fish embryos, and impair pool and riffle habitat quality.

Some streams in the Knapp Creek system support native cold-water biota typically associated with brook trout (*Salvelinus fontinalis*) communities. Brook trout prefer streams with cold, clean water, a 1:1 pool to riffle ratio and abundant cover (USFWS, 1982). Many streams are better suited for cool-water aquatic communities characteristic of smallmouth and rock bass communities. Water quality in these cool-water transitional areas may be too stressful for cold-water biota during much of the year but these areas can offer important seasonal habitat for cold-water biota during winter months.

Streams within the Knapp Creek watershed are inhabited by 32 fish species representing Cyprinidae (minnow), Catostomidae (sucker), Salmonidae (trout), Centrachidae (bass), and Percidae (perch) fish families. There are 24 native fish species (8 non-native) including 2 Regional Foresters Sensitive Species - candy darter (*Ethoestoma osburni)* and New River shiner (*Notropis scabriceps)*. Three native fish species are endemic to this watershed, including the 2 sensitive fish species listed above and bigmouth chub (*Nocomis platyrhychus*). Fish species that are federally listed under the Endangered Species Act (ESA) are not known to occur in the Knapp Creek watershed.

Fish surveys conducted in 1989 and 1992 found native brook trout in Kline Hollow and in upper portions of Douthat Creek. Wild trout (including brook trout) are identified in the Forest Plan as management indicator species (MIS). The objective for MIS is to maintain or improve their habitat. Trout productivity is limited by elevated levels of fine sediment, reduced quality of the riparian forest and vegetation, and reduced amounts of large woody debris which affects the quality of trout pool and spawning habitat and hiding cover, as well as other limiting factors such as water quality. The lower reaches of Douthat Creek (in private ownership) are listed as cool-to-warm water habitat for fish.

Issues/Concerns Addressed

This section discloses the water and aquatic resource issues and impacts identified during interdisciplinary meetings and public scoping. Internal scoping identified stream sedimentation and aquatic biota protection as important resource issues associated with the action alternatives. Timber harvesting, skid routes and log landings could result in soil erosion and faster rates of

runoff, resulting in increased sediment delivery to streams. Prescribed burning may expose mineral soil, and associated dozer-constructed firelines would expose soil, and may result in increased rates of erosion and increased sedimentation. Wildlife ponds intercept and hold surface and ground water, and have the potential to overtop their fills during storm runoff events, eroding soil and causing channel cutting below the pond. Another effect of concern to be addressed in this report includes riparian resource effects from harvesting and prescribed burning activities that disturb soils and remove or kill woody vegetation along perennial and non-perennial channels. Potential effects to water quality from use of herbicides are another resource issue of concern. Another is the potential for increased water runoff in stormflow and floods, resulting from watershed disturbance and the removal of the forest canopy and understory.

The action alternatives have the potential to adversely affect aquatic biota from sedimentation effects to aquatic habitat, loss of riparian habitat along streams, and potentially from herbicides that could enter streams and have toxic effects. These potential effects to aquatic and riparian habitats may adversely affect the productivity of the aquatic ecosystem for management indicator fish species (wild trout), Regional Forester's sensitive fish species, and their associated communities.

Activity measures being used to evaluate these issues include:

- Miles of skid trail developed or used to harvest timber.
- Acres of prescribed burning, and miles of dozer fireline constructed.
- Acres of potential herbicide treatment.
- Number of channel crossings by skid roads.
- Percent of project area harvested.

Scope of the Analysis

The spatial boundary used to evaluate direct and indirect consequences is the area occupied by the watersheds of the perennial, intermittent and ephemeral tributaries within the project area, and which have project activities planned within their watershed boundaries. A small portion of Douthat Creek downstream of the project boundary is included in the spatial boundary for direct and indirect consequences. The spatial boundary used to evaluate cumulative impacts is the Douthat Creek watershed to its confluence with Knapp Creek, including private land ownership, totaling about 19,330 acres. Any substantial or measurable influence from the project area activities is not expected to extend further downstream than the mouth of Douthat Creek. This is because of the very small acreage of proposed activities relative to the size of Douthat Creek watershed, the type of activities proposed, the mitigation of effects that have been designed into the project, and the location of proposed activities which are mostly on the upper slopes and ridgetops.

The temporal boundary used to evaluate direct and indirect consequences for the thinning harvest is about 10 years, because research has shown that sediment and stormflow effects from timber harvesting generally returns to pre-harvesting levels in about 5-10 years, or less for thinning harvest. For permanent partial openings like savannahs, the temporal boundary may be longer, because the area is maintained in a partially un-forested condition. The temporal boundary for prescribed burning effects would be much shorter, on the order of a year or two, while disturbed soils are naturally revegetating, or seeding with native plants becomes effective. Water quality

and aquatic biota effects from the use of herbicides would likely be very short for the herbicides that may be used and their method of application. Riparian resource effects, however, generally can be expected to last many decades, before riparian vegetation returns to a fully functioning condition. The temporal boundary used to evaluate cumulative impacts would be about the same as described above for the various types of activities: about 10 years for harvesting trees, because the evapotranspiration capacity and revegetation of the site is generally restored within that time frame.

Methodology

The evaluation of effects is based on watershed management and forest hydrology studies in the eastern United States spanning many decades of investigation. Studies of the effects of harvesting timber, which frequently involves skid trail construction, have documented sedimentation and streamflow effects of those practices. Reported effects included analysis and discussion of erosion and sedimentation on streams, and stormflow and peakflow characteristics of small streams that drain the small study watersheds.

The results of streamflow studies describe a range of effects on stormflow and peakflow, from either increasing the effect, having little or no change, to possibly decreasing the effect under some situations. The results used cover a wide range of studies done in the Appalachian Mountains, from North Carolina to New Hampshire, and include some studies conducted on the Fernow Experimental Forest, at Parsons, West Virginia. These results were the basis for predicting the kind and magnitude of stormflow effects that could be expected from project activities. In this report, "effects on stormflow characteristics" (or changes in stormflow) means changes in stormflow volumes or changes in the peak rates of storm runoff (peakflows).

Other studies have reported on the structure, function and composition of riparian ecosystems and their resources, riparian values and benefits, and on effects of riparian management. Professional knowledge and judgment were used to assess the effects of each alternative. Direct and indirect effects on aquatic resources were evaluated for the influence each alternative would have on the potential to increase stream sediment by activities that disturb soils. Riparian resource effects were evaluated primarily for the influence each alternative would have on non-perennial stream stability, large woody debris recruitment, and related hydrologic function of those channels. Factors considered included the size and location of proposed harvest areas, location of ground skidding, the presence of functioning stream channels and riparian areas within or near harvest areas, and the presence/absence of sensitive landforms such as steep slopes and coves.

The type and magnitude of expected effects within the project area were made by comparing watershed conditions, types and locations of proposed harvesting and skid road practices, proportion of areas harvested, and prescribed burning practices with above described studies and research results.

Effects

No Action

The No Action alternative would not implement any of the activities that are included in the action alternatives. There would be no timber harvesting for savannah development or wildlife related thinning improvements, and no wildlife pond construction. There would be no prescribed

burning and no dozer fire-lines. And since no wildlife savannahs would be developed or maintained, there would be no potential herbicide treatments. None of the potential adverse effects (such as stream sedimentation, loss of riparian vegetation, or herbicide runoff to streams and toxic effects to aquatic biota) associated with those types of treatments would occur. These small watersheds would remain in their current condition for the near term, with no new sources of potential sediment for streams. Existing sediment sources such as roads and general background levels and sources of watershed erosion and sediment would continue. Riparian areas would continue to mature over the longer term, moving toward a more fully functioning riparian condition. Large woody debris would naturally increase in small headwater coves and stream channels as trees mature and die or blow over, which would improve stream habitat and contribute to greater stream stability, and benefit riparian areas.

Existing Forest Roads (FR 962, 962C and 790) and the Middle Mountain Trail #608 would continue to be maintained. These maintenance activities potentially may result in small, short-term increases in sediment from the minor earth disturbance that would occur. But they also have long-term benefits in overall reduced levels of stream sedimentation, by keeping roads and trails stable and protected from accelerated erosion. Water control structures like dips, culverts and ditchlines would be maintained and kept functional, and driving surfaces protected from rutting and erosion.

Proposed Action (Alternative 2)

The Proposed Action is to create 5 savannahs through partial timber harvest on gentle mountain-top terrain along and near the ridge top of Middle Mountain. The five savannahs would total about 26.5 acres. Two savannahs created in the southern (smaller) unit of the project area would leave the cut trees on the site, so no skidding of logs from the site would occur. Stumps would be grubbed in all five, and savannahs maintained by mowing. Adjacent areas of thinning harvest would occur in the northern (larger) unit of the project area, totaling about 82 acres thinned, to improve habitat for wildlife. Three savannahs and thinning harvest in the northern unit would be accomplished commercially, with timber removed from the site by ground skidding. Approximately 2.4 miles of skid trail would be used to harvest timber. Wildlife water holes (small ponds) would be constructed within the project area (please refer to Table 2-1, Comparison of Alternatives). Most of the entire project area (approximately 122 acres in the south unit and 364 acres in the north unit) would be prescribed burned every 3-5 years for a variety of ecosystem management objectives. Total burning acres would be about 442 acres (less than the total project area acreage because of locating firelines on old existing roads or ridges, or avoiding some potential problem areas). No herbicide treatments for woody vegetation control would occur in the Proposed Action.

Direct and Indirect Effects or Proposed Action

Sedimentation and Water Quality

The Proposed Action includes activities that expose soil or disturb the forest floor, increasing the potential for soil erosion and stream sedimentation, and sediment effects to water quality. Those activities include about 26.5 acres of savannah, 82 acres of thinning, and approximately 442 acres of prescribed burning. The 11.6 acres of savannah in the southern unit would not have any skid roads since it would not be commercially harvested, but stumps of cut trees would be grubbed out. Grubbing stumps would extensively disturb soil, but not in continuous corridors

like skid roads. Less than 100 acres of commercial harvesting would occur in the northern unit (about 15 acres of savannah and 82 acres of thinning), with grubbed stumps in the savannahs, and approximately 2.4 miles of skid trails to access the harvested acreage (please refer to Table 2-1, Comparison of Alternatives).

Proposed activities within the watershed of Upper Anthony Creek are limited to about 19 acres (or less) of prescribed burning, on the eastern edge of the southern unit. All of this burning would occur in mostly gentle terrain, along or immediately adjacent to the ridge top, and would have no functioning stream channels within or near the burn acreage. The potential to deliver sediment to any of the non-perennial headwater streams within the Upper Anthony Creek watershed would be very minor. There would be no substantial or even measurable effects in Anthony Creek, or in any of its tributaries. No other adverse effects would occur within the Upper Anthony Creek watershed.

The two savannahs in the southern unit have low risk of erosion and soil movement to headwater streams. This is because of their small size, location, no skid roads, and distance to functioning stream channels. These two savannahs are about 5.4 and 6.2 acres in size, located along the ridge top in gentle terrain, and separated by more than a quarter mile. Creating no skid roads would substantially limit the risk of sedimentation. A bulldozer would grub stumps creating disturbed soil throughout much of the savannah acreage, but savannahs would be fertilized and quickly revegetated to control erosion, and the potential to deliver sediment further downslope would be low. No stream channels extend upslope anywhere near these savannahs, including the smallest ephemerals. Sedimentation from these two savannahs would be expected to be very low.

The three savannahs in the northern unit also have very low risk of delivering sediment to small streams, as well as the proposed thinning harvest. The three savannahs are in separate blocks of 3.9, 1.7 and 9.3 acres (please refer to Table 2-1, Comparison of Alternatives) and are separated by areas of thinning harvest. All savannahs lie along the ridge top in very gentle terrain. No functioning stream channels extend upslope anywhere near the savannahs. Stumps would be grubbed, but with low potential to deliver sediment, as described above. The thinning harvest would likewise be located in gentle terrain along or near the ridge top and on adjacent, mostly gentle sideslopes. The tops of a few ephemeral stream channels extend up near the limits of thinning harvest, but would be protected by filterstrip and riparian area protection measures. All intended skid routes have been identified on the ground, and they are located along the ridge tops in gentle terrain and well away from all stream channels. None of the skid trails (routes) would require construction with cuts and fills; they would simply be overland routes of skidding in gentle terrain, with much less soil disturbance than a constructed skid road on a sideslope would have. Thinning harvest that extends down the sideslopes would be carried out by pulling trees up to the skidders by winching with cable, with limited soil disturbance. No skidder disturbance of stream filterstrips or steeper sideslopes would occur, and with no constructed skid roads. Areas of soil disturbance that do occur would be waterbarred if necessary, and revegetated with approved species to protect the soil from erosion. Also, these harvested acres in the northern unit would fall within the extreme upper watersheds of five small watersheds that flow in different directions, reducing the potential impact in any one of them. Expected sedimentation from all these activities would be very low.

Mowing maintenance of the savannahs would take place every 2-3 years or so to maintain the savannah habitat. Mowing generally does not create new areas of concentrated soil disturbance, and the potential for erosion and stream sedimentation would be very low.

Wildlife water holes (small ponds) are planned in several locations within the two units of the project area. They are typically located in coves or in small channels in the upper portion of a watershed. The risk goes up of capturing too much water during stormflows or snowmelt events when these wildlife ponds are located within or close to functioning stream channels. There is a greater potential for ponds to overtop and breach their embankments in this way, and start accelerated channel erosion below. This increases sedimentation effects below. It is recommended that wildlife ponds be located well upslope of the tops of all functioning stream channels and as near the ridge as would be practical, considering other factors such as soil type and water holding capacity (see Mitigation Measures and the Soil section recommendations). Wildlife ponds located by this method, and well above all functioning channel tops, would have much reduced risk of overtopping and causing sediment effects downstream. Expected effects would be small and mostly short-term.

Prescribed burning would occur on about 442 acres (within the 122 acres in the south unit, and 364 acres in the north unit, as described above), because of location of firelines on existing old roads or skid roads, and avoidance of some sensitive areas like stream channels. These burns are planned to be low intensity burns, with minimal impact to soil organic layers, and little exposure of mineral soil. Riparian areas within the planned burn area would either be avoided, or burn intensity would be controlled to get a "cooler" surface fire that burns the surface organic layer, and burns out in the riparian area because of increasing soil moisture and burn design. Burn intensity within riparian areas would be controlled by starting the fire upslope on the hillside, and then letting it slowly burn downslope toward the riparian area. Prescribed burns are conducted in such a way that substantial exposure of mineral soil does not generally occur, especially within streamside riparian areas. The planned prescribed burning would not be expected to generate substantial amounts of eroded soil or stream sedimentation.

Bulldozer created firelines raise the risk of soil erosion. The dozer fireline is generally intended to be a shallow swath of mineral soil disturbance, not as deep into the soil as a road would be. But they do expose mineral soil in a long continuous path, and may have some steeper grades depending on the landform they follow. Dozer lines would be located to take advantage of existing roads or natural control breaks like nose ridges wherever possible. Dozer firelines would be used mostly in gentle to moderate terrain, on moderately sloping nose ridges, and away from streams. Approximately 1.5 miles of dozer fireline would be created for the prescribed burn activity. Hand constructed fireline would also occur, where dozer lines are not possible or too damaging. Hand fireline disturbs much less soil, and has limited potential for erosion of soil and sediment delivery to streams. The planned firelines have been identified on the project maps. Nearly all dozer firelines are located in flatter or moderately sloping terrain and away from streams, utilizing some existing roads and old roads as the fireline. Keeping all dozer lines outside of stream filterstrips (such as in Kline Hollow) would help reduce the potential for sedimentation. (See mitigation measures). All dozer lines would be waterbarred immediately following their construction wherever uncontrolled erosion may occur, and revegetated to protect the soil from erosion. Prompt waterbarring and revegetation would substantially reduce the risk of erosion and sedimentation to streams.

Activities included in the Proposed Action have mostly low potential to erode substantial amounts of soil. Sedimentation resulting from implementation of the Proposed Action would be expected to be low, short-term and not substantial. This is because of the types of projects proposed, their relatively small size, locations primarily in gentle terrain along ridges and away from streams, and other mitigations. The greatest potential for sediment effects would occur during periods of storm runoff. It is likely that for relatively short periods of time during the life of the project and for some months thereafter, impacts to water quality could occur in terms of sediment delivery and modest increases in turbidity, mostly during storm runoff. These effects would be most noticeable in small non-perennial streams draining the project area. Noticeable sediment effects in Douthat Creek or other larger streams would be less likely. The project would be considered to be in compliance with the Clean Water Act.

Riparian Areas. Riparian protection measures being used in this EA have been developed as site specific mitigation for riparian resource effects. Refer to Attachment 1 in this report. These measures provide a higher level of riparian resource protection than those found in the 1986 Forest Plan.

Riparian areas are not expected to be substantially impacted by the Proposed Action. The planned harvesting is located primarily along ridge tops and upper slopes, and outside riparian areas. Small intermittent to ephemeral streams approach the lower limits of proposed thinning harvest in the northern unit, or may enter those units in a few locations. But all skid routes have been planned for locations that are well away from streams and riparian areas. No bladed skid roads are planned for this project. Recommended riparian area protection measures (see Mitigation Measures below) would adequately protect riparian resources and functions associated with those small stream channels that could enter the lower limits of thinning harvest.

Prescribed burning activities would protect riparian areas by maintaining reduced burn intensity within the riparian area, or by avoiding them. Some riparian areas that fall within or next to the project area would be avoided by locating firelines further inside the project area boundary (thus effectively reducing the size of the potential burn area, as well as eliminating some riparian area from burning). The potential burn area includes the riparian area along a short section of Douthat Creek, which would increase the potential for killing vegetation along this large perennial stream. It is recommended that the 100 foot riparian area along Douthat Creek not be burned. Otherwise, effects to riparian areas from the Proposed Action activities are expected to be small, short-term and not substantial. Riparian vegetation would be expected to be minimally impacted by prescribed fire, especially the larger vegetation. Adverse effects to riparian resources would be extremely small from the proposed timber harvest and savannah development.

Streamflow and Stormflow. Under some types of timber harvest and road building activities, effects on streamflow and stormflow can occur. Timber harvesting effects on normal streamflows is generally considered a positive effect, because the primary effect is to increase normal flows (baseflows) during the periods of lowest streamflow (the dry summer and fall months when flow is at its lowest). Effects on stormflows are usually not substantial, although some research has shown small to modest increases in stormflow for several years after harvesting. Stormflow increases are generally not considered to occur until at least 20-30% of an area is harvested.

As was mentioned previously, five distinct small watersheds were identified that drain the northern project unit (where most of the harvesting is proposed). One of them was selected to consider possible stormflow effects from the harvesting, that being the small un-named tributary to Douthat Creek on the northwest side of the project area. It was selected because it is comparable in size (about 90 acres) to the watersheds in which much of the eastern streamflow research has been done, and because relative to its size, it has the largest proportion of harvesting that would occur in the Proposed Action. The approximate watershed size is 90 acres for this small un-named watershed, and the approximate harvested acreage would be 22 acres. This represents about 24% of the watershed that would be harvested by thinning. Based on harvested proportion alone, this would be marginally within the range at which stormflow increases might be observed.

However, other factors would tend to further reduce the potential for stormflow effects in this small watershed. All of the proposed harvesting in this watershed is thinning, and 50-60 feet of basal area would remain on the ground, so a sizeable portion of the evapotranspiration capacity of the site would remain, which is an important factor. (Some of the water that is made available by cutting trees is often utilized by the residual stand, reducing the potential water yield from the site.) Also, all of the proposed thinning harvest is on the upper ridges, in gentle topography and not occupying the near-channel area. And there would be no bladed (constructed) skid roads within the watershed to concentrate runoff. The combination of these factors would likely reduce the potential for stormflow effects substantially.

The prescribed burn acreage in each of the five smaller watersheds in the northern unit (and in the southern unit as well) would add to the acres treated. But little effect on the evapotranspiration capacity of the site would be expected, because larger trees would not be expected to be killed or substantially injured. And the type and intensity of burning planned for these watersheds would not be expected to do any substantial damage to the soil or to water holding or runoff characteristics. Prescribed burning in these watersheds would not be expected to add to potential stormflow effects in any substantial way.

It is highly likely that there would be no substantial effect on stormflows resulting from the activities in the Proposed Action. Any small or modest increases in stormflows, in any of the individual small watersheds within the project area, would likely be too small to have any substantial adverse effect and may not be measurable. And there likely would be no adverse effects to downstream channels in terms of channel scour or bank erosion, because the magnitude and duration of potential stormflow increases would be too small to cause those effects. There would be no adverse or measurable effect on flood flows in any of the streams draining the project area.

Herbicides. There is no proposed use of herbicides in the Proposed Action.

Municipal Water Supply. The municipal water supply for Marlinton is Knapp Creek. The water supply intake in Knapp Creek is just upstream of Marlinton. The intake is about 12 (or more) stream miles downstream from the project area. The proposed action would have very minor sediment effects to water quality, which likely would not be noticeable much downstream of the project area. At the Douthat Creek confluence with Knapp Creek, sediment effects from the Proposed Action would not be noticeable or measurable. For this reason, there would not be

adverse effects to the quality of water in Knapp Creek that would diminish its suitability as a source for drinking water.

Aquatic Biota. Adverse effects to aquatic biota in Douthat Creek, Cochran Creek, Anthony Creek or any of their tributaries are expected to be small and not substantial. There are no perennial stream channels within the proposed timber harvest areas, although a short section of Douthat Creek borders the west edge of prescribed burning. (A no-burn zone of 100 feet along the creek is recommended below.) Otherwise, streams within the project burn areas are mostly intermittent and ephemeral, with the smallest channels extending up to near the thinning harvest. All streams will be protected with riparian area and filterstrip protection measures. Prescribed burning will be conducted in a manner that substantially protects riparian areas, watershed soils, and hydrologic integrity. Earth disturbance from project activities will be extremely small, except for bulldozer constructed firelines, and their location and erosion control measures will control most soil loss and sedimentation from them.

Sedimentation within the project area and downstream would have small adverse effects to the aquatic community, primarily in fine sediment deposition within channel substrate and habitats of the small non-perennial streams draining the project area. The northern project unit is where most of the potential for these small effects occurs; the southern unit has little soil disturbance (11.6 acres of savannah) and prescribed burning. Downstream in the larger intermittent and perennial streams, the potential for sedimentation effects to aquatic habitats and biota are further reduced, and not substantial. The low potential for adverse sediment effects is because of the types of activities proposed and their low risk of generating substantial amounts of sediment, project locations primarily in low risk areas, and other mitigations being recommended. Dozer-constructed firelines are a potential concern for sedimentation effects to aquatic biota, but those effects can be effectively mitigated through good location and prompt waterbarring and revegetation. Potential small and short-term turbidity increases would not adversely affect aquatic biota. Over all, sedimentation effects to aquatic biota would be small, short-term and not substantial.

Adverse effects to aquatic biota from impacts to riparian resource condition would be extremely small, if project activities are conducted as planned and with the recommended mitigations. Those potential riparian effects would likely be miniscule and short-term, and would have no substantial impact on the aquatic community. There will be no aquatic organism passage effects from any of the proposed activities, and no substantial stream temperature effects are expected.

Two Regional Foresters Sensitive Species of fish occur within the Knapp Creek 5th level HUC, as described in the Affected Environment. Forest records do not show any of these sensitive species located within the project boundaries. However, their presence within the broader general area of the Knapp Creek watershed and their mobility could allow for their presence within the Douthat and Cochran Creek stream systems. The Proposed Action will not occupy or substantially modify any of the aquatic habitats. Sedimentation resulting from all project activities would have a small and not substantial impact on aquatic habitat quality downstream for a short distance. This would be a small and short-term source of sediment, and would mostly occur during storm runoff conditions. Other water quality and aquatic habitat conditions would not be substantially affected by these activities.

Cumulative Effects of Proposed Action

Refer to Table 3-1, Past, Present and Reasonably Foreseeable Future Actions within or around the project area for a list of these activities.

Past and Present Actions

The Douthat Creek (6^{th} level HUC) watershed was substantially impacted by widespread and nearly complete timber harvesting during the late 1800's to the early 1900's, prior to federal ownership. Extensive watershed and soil disturbance took place at that time, accompanied by damaging wildfires and substantial damage to stream channels and sedimentation. The watershed and streams are likely still recovering from historical timber harvest and fire impacts. Stream sedimentation within the Douthat Creek watershed as a result of the early timber harvesting is likely greater than what would otherwise have occurred, and to some extent from a variety of more contemporary private and federal sources. Much of the Douthat Creek watershed is in federal ownership (National Forest), but substantial portions of the Douthat and Cochran Creek streambottoms and adjacent lands are in private ownership. The dominant use of these private lands is for residential development, and there are a number of hunting camps on these lands as well. Other private land uses include primarily periodic timber harvesting, and pasture for livestock grazing. Sedimentation to these streams from private land uses and management is probably higher than the average for the watershed as a whole, partly because of their locations near the larger stream channels.

Other present day sources of sedimentation include private, state and National Forest roads. Roads with the highest potential to deliver sediment to streams are those within or crossing stream filterstrips, roads on steep slopes, or roads that are not well-maintained and eroding. State roads 39, 92 and 23 closely follow and cross substantial lengths of Douthat, Laurel and Cochran Creeks, all within the Douthat Creek watershed cumulative effects area. Some private roads are located within the watershed, portions of which also closely follow smaller stream channels. Also, a number of National Forest roads traverse portions of these watersheds, but are located mostly in the upper elevations or away from the larger streams; although they are generally better maintained, there are numerous small stream crossings. All these roads deliver some sediment to streams within the watershed, but roads closest to streams are likely having the greatest impacts in terms of sedimentation, and in terms of riparian vegetation clearing and channel stability impacts.

In addition to past and recent timber harvesting on the private lands, a small portion of the federal lands have been harvested over the last 16 years. National Forest timber harvesting occurred on 235 acres in the Douthat Creek watershed (completed in 1990), and on 281 acres primarily in the area of Laurel Run, Lost Bottom Run and Nicholas Run (tributaries of Cochran Creek) and Kline Hollow of Douthat Creek (completed in 2001). This past harvesting was done by conventional ground-skidding methods, with most of their skid roads still in place, and these would have been waterbarred and revegetated. During that harvesting, some soil erosion would have occurred, and sediment would have been delivered to small streams within the occupied watersheds. Some of the sediment delivered to streams would be expected to reside within the downstream channel systems for long periods of time, possibly decades or longer. Following the completion of those projects, soil would have been stabilized fairly rapidly, and sedimentation substantially reduced. These harvested areas may still be generating sediment, but they are in a period of recovery and sedimentation would be expected to be very small.

A small National Forest grazing allotment is located along Cochran Creek near its confluence with Laurel Creek (Rimel Allotment). A small number of cattle graze this area which includes part of the riparian area of Cochran Creek. But nearly all of the streamside area was fenced out in the early 1990's, providing limited stream access for watering cattle. While grazing this allotment still is causing stream sedimentation, the amount of sediment delivered is considered to be relatively small and within acceptable limits. The fencing provides a substantial level of streambank and streamside protection, although some sediment does still make its way to the Cochran Creek channel.

All these past and existing sources contribute sediment (in small to larger amounts) to Douthat Creek and its tributary streams. Most sedimentation occurs during and shortly following substantial rainfall events. Sediment is expected to be high in these major streams during storm runoff and especially floods. During normal runoff conditions (not stormflows), streams likely run clear and meet State water quality standards for sediment. None of the streams within the cumulative effects area (Douthat Creek watershed) are listed in the State 303(d) list of impaired streams.

Past and present actions have impacted riparian area vegetation within the project area, mostly from land clearing and roads and highways along the larger streams. The primary effect is in the loss of woody vegetation along stream channels, and conversion to non-woody vegetation. Frequently this can lead to accelerated stream bank erosion, and greater sedimentation. Much of this impact to riparian conditions occurs on the private lands because they are concentrated along the larger streams, and along state roads and highways that closely follow larger streams (Cochran, Laurel and Douthat Creeks). Impacts to riparian conditions in these downstream locations would have no effect on riparian conditions within the project area.

Some of these past and present actions are likely impacting stormflow conditions in the larger streams downstream from the project area. Mostly the actions and land uses that would have effects on stormflows would be private land uses (land clearing near the streams) and the existing road and highway system.

Reasonably Foreseeable Future Actions

Private Lands: Private lands described earlier are expected to remain in private ownership for the foreseeable future, occupying the lower elevations along the major streams, adjacent lands, and some small tributary watersheds. Present uses and management of these lands is expected to continue in the foreseeable future. Those uses include private residences and camps, periodic small timber sales, and a small amount of grazing. These uses would be expected to generate sediment to the larger streams and some tributaries, and because of the location of private lands along those streams, their effects could be somewhat more substantial and immediate. Most sediment would be deposited during and following storm runoff conditions, and then re-mobilized and transported during subsequent runoff events. Once in the stream systems, that sediment would likely reside there for long periods, increasing fine sediment levels in stream substrates and occupying some pool habitats. Riparian area and streamside vegetation cutting and removal would contribute to destabilized banks, greater streambank erosion and sedimentation over the long-term.

Some additional private road construction is likely in the future, but probably not in substantial amounts. Private road maintenance would likely continue at comparable standards as has occurred in the past, with comparable levels of sediment delivery to the larger streams. State roads would continue to be maintained, and because of their locations would continue to be a somewhat larger source of sediment, even though road maintenance has long-term benefits in reducing sediment over what would occur without that road maintenance.

National Forest System Lands: Forest Service management activities likely to continue in the foreseeable future include primarily timber harvesting, some road development, and road maintenance. Wildlife improvement maintenance and periodic prescribed burning would continue for the long-term. Other small facilities and uses also would continue.

National Forest timber harvesting is expected to continue to be a part of the ecosystem management plan for the watershed. However, the only future harvesting that is scheduled at this time is the Middle Mountain Wildlife Savannah project that is being analyzed in this EA. The Proposed Action would have approximately 109 acres of harvesting (savannah and thinning), as described earlier in the effects discussion. This is an extremely small proportion (0.6%) of the Douthat Creek 6th level HUC. No other timber harvesting has been proposed or scheduled at this time within the watershed.

Prescribed burning within portions of the watershed will also continue to be a part of future management activities, conducted to achieve fuels management and ecosystem management objectives. Specific burning project proposals are limited at this time to future prescribed burning within this approximate 442 acre burn area. Prescribed burns would likely occur once every 3 to 5 years or so in order to manage fuels, kill undesirable woody vegetation, and maintain productive savannah conditions.

National Forest roads (FR 55, 310, 790, 962 and others) will continue to be used and maintained. Maintenance activities (cleaning and replacing drainage structures, maintaining ditchlines, grading road surfaces to remove ruts, periodic spot gravel on road surfaces, etc.) typically may cause small and short-term increases in sediment to nearby streams, but reduce the larger long-term sedimentation that would occur if maintenance were not being done. These sediment effects generally are small and not substantial, but occur periodically (mostly during storm runoff conditions), and over the long-term. New Forest Service roads in the watershed are not planned at this time.

The Rimel grazing allotment would continue to be grazed, with comparable sediment effects to what has occurred over the last 10 or so years. Those effects are relatively small, but are a continuous long-term impact in Cochran Creek and downstream. Riparian conditions and streambank stability within the allotment should continue to improve over time, as the fencing allows vegetation to be restored to the streamside zone.

The Pocahontas Picnic Area and Campground (a small Forest Service recreation facility) would continue to be operated and maintained. It is located on the floodplain near Cochran Creek. Its management and maintenance reduces the level of sediment impact, but it is a small, long-term source of added sediment to the Creek.

The Middle Mountain trail would continue to be maintained for long-term stability and erosion control. Because of its good condition, low impact use and mostly ridge top location, it is considered to be a negligible source of sediment to streams.

Floods are naturally recurring events within these watersheds, and result in large quantities of sediment being eroded from the land and within channel sources, and transported through the channel system. Periodic flood events would continue to deliver substantial sediment loads to the streams within the cumulative effects area.

Cumulatively, past, present and future actions within the Douthat Creek 6th level watershed would contribute substantial sedimentation to the various streams. Such sedimentation occurs mostly during periods of storm runoff, when eroded soil is being transported to the streams as sediment. The greater proportion of sediment effects are likely occurring in the larger, perennial stream channels, because much of the various activities that affect erosion and sedimentation are located along or near the larger streams. The Proposed Action is expected to deliver mostly small additional sediment to headwater streams within the project area because of the project size, location and design, and mitigation measures planned. These various mitigations would be expected to substantially reduce the potential for sedimentation effects. Project sediment effects would be most likely during periods of storm runoff or flooding, when most soil erosion within the watershed is likely to be occurring. The additional sediment from the proposed action during those storm runoff conditions would be extremely small compared to sediment loads being transported by the larger streams, and would not likely be detectable under those runoff conditions. Under normal flow conditions (not storm runoff conditions) short-term sediment effects to water quality would not likely be observable much below the project area boundary. Increases in turbidity would be the most obvious effect.

Excluding repeated burning effects, these sediment effects would be relatively short-term, provided that all required mitigations were in place. Effects would not be expected to be observable or measurable beyond the mouth of Douthat Creek, and likely much further upstream than that because of the very low level of expected effects. Provided that all mitigations and other project design requirements are followed, the Proposed Action would be considered to be in compliance with the State's water quality laws and rules, and with the Clean Water Act. There would be no cumulatively substantial impacts to water quality, or to aquatic biota.

Repeated burning occurring on a 3-5 year frequency would have the potential to raise the risk of cumulatively substantial effects, at least in the near vicinity of the project area.

There would be continued uncertainty and concern for potential sedimentation effects. As explained above, the cumulative effects of repeated burning within a small headwater watershed are less well-known for this area. There is a potential for greater watershed erosion and stream sedimentation from repeated burnings over time, than what has been described above. The magnitude of that sediment effect is not known. Since repeated burns are planned within the 442 acre burn area, their cumulative erosion and sedimentation effects should be included in a monitoring plan for this project.

Cumulative effects to riparian resources would be extremely small and not substantial. The additional increment of impact on stormflow characteristics from project area activities would be extremely small and not measurable in any of the larger streams (Douthat and Cochran Creeks).

There would be no measurable effect on downstream flood flows, and no measurable effects on water quality at the Marlinton water supply.

Provided that all mitigations and other project design requirements are followed, the Proposed Action would be considered to be in compliance with the State's water quality laws and rules, and with the Clean Water Act. And there would be no cumulatively substantial impacts to aquatic biota within the Douthat Creek watershed or its tributaries.

Alternative 3

Alternative 3 is similar to the Proposed Action, but would create several more savannahs and a 2.8 acre wildlife opening. These additional activities would occur in the northern project unit. The northern savannahs in the Proposed Action would be expanded in size, and three additional savannahs would be added. Stumps would be grubbed out in savannahs #3, 4 and 5, but not in the three new savannahs #6, 7 and 8. Total savannah acreage in Alternative 3 would be about 56 acres (including the 9 acres in the southern unit). All savannahs would receive prescribed fire treatments, and savannahs #3, 4 and 5 in the northern unit would be mowed. The wildlife opening is an additional project. Water holes would be developed similar to the Proposed Action. Thinning harvest would occur on about the same acreage (86 acres), but in slightly expanded ridge top areas to the east and west of Middle Mountain.

The southern project unit activities would be nearly the same as with the Proposed Action, but with less acres treated. The two savannahs (#1 and 2) would be slightly smaller, with a total of 9 acres in savannah, and trees would be left on-site (not commercially harvested). Stumps would not be grubbed out in these two savannahs, so mowing maintenance would not occur. Prescribed fire would be used to maintain the savannahs in the southern unit. Also, the prescribed fire burn area would be slightly smaller, because about 19 acres in MP 6.2 prescription (east of the ridgeline/trail) would not be burned. Water holes would be developed. There would be no thinning harvest within the southern unit.

The primary method of maintaining the two savannahs in the southern unit and the three savannahs added to the northern unit (#6, 7 and 8) would be by prescribed fire. A backup method of controlling unwanted woody vegetation would be to use herbicides. In these five savannahs (#1, 2, 6, 7 and 8), prescribed fire treatments that did not occur when needed or was not effective would be replaced with herbicide treatments. Herbicides would only be used when prescribed fire could not be used or was not effective in accomplishing the desired vegetation treatment in these 5 savannahs. The two herbicides proposed for use would be glyphosate and triclopyr, and would be applied only by individual stem applications (basal spray or cut stem treatment). No broadcast spray application of herbicides would occur. No herbicides would be used in savannah units 3, 4 and 5 (northern unit) because prescribed fire and mowing maintenance would be used to maintain these three savannahs.

Prescribed fire treatments would be nearly identical in Alternative 3 to those in the Proposed Action, except the 19 acres in MP 6.2 would not be burned. Burning would occur on about 432 acres and in nearly the same locations (except the MP 6.2 acres). The same methods and mitigations would apply.

Sedimentation and Water Quality. There are no proposed activities within the watershed of Upper Anthony Creek. The 19 acres of prescribed burn that would occur in the Proposed Action would not occur with Alternative 3. There would be no adverse effects in Upper Anthony Creek watershed.

Activities that expose soil or disturb the forest floor in Alternative 3 are very similar to those in the Proposed Action. There are nearly 30 more acres of created savannah (56 acres), but these additional acres are also located along ridge tops and well away from stream channels. They are in areas with low risk of sedimentation effects. Thinning would occur on nearly the same acreage (86 acres) and mostly in the same locations, all in the northern unit. Some additional thinning acres (areas) would occur that were not in the Proposed Action, but these are also in low risk areas for sedimentation. Thinning acreage occurs mostly in gentle terrain along or adjacent to the ridges, and maintains filterstrips along stream channels. Added thinning acres include small areas along a couple small, non-perennial channels, and these would be protected with the filterstrip and riparian area protection measures (described in Proposed Action). A total of about 133 acres of harvesting would occur in the northern unit, and 9 acres in the southern unit. Despite the added acres of harvesting and the greater savannah acreage, the low risk location of this harvesting and low risk skid route design helps ensure that there would be no substantial increase in the potential for soil erosion and stream sedimentation effects. As in the Proposed Action, skid routes would be in gentle terrain along or near ridges, and would not be bladed roads. Approximately 2.6 miles of skid route (trail) would be used to access the harvest areas in the northern unit. Overland skidding would access the harvest area off of the low impact skid routes that are planned.

The two savannahs in the southern unit would be in the same locations, but slightly reduced in size. No tree removal from the site would occur, and no skid roads. Also with Alternative 3, stumps would not be grubbed in these two savannahs #1 and 2, and they would be maintained with prescribed fire. There would be no thinning harvest in the southern unit. The risk of soil erosion and stream sedimentation from these activities would be extremely low.

The northern unit would have the three savannahs (#3, 4 and 5) from the Proposed Action, with #3 and 4 merged into one savannah of about 7 acres. Savannah #5 would be enlarged to about 20 acres, all of it in gentle ridge top terrain. These savannahs are in low risk locations for soil and water effects, similar to the Proposed Action. Stumps would be grubbed, with mowing maintenance. The potential for sedimentation effects would be very low. Also in the northern unit, three additional savannahs (#6, 7 and 8) west of Middle Mountain in the Douthat Creek watershed have been added. They also are in gentle, ridge top locations, outside stream filterstrips and well away from functioning stream channels. Stumps would not be grubbed in these three added savannah areas, so maintenance would be by prescribed fire. The potential for substantial sedimentation effects from the savannahs in the northern unit is very low.

A small wildlife clearing of about 2.8 acres would be created between savannah units #6 and 7. Its ridge top location with no functioning stream channels and small size make it low risk for sedimentation effects. After clearing the trees, this area would be revegetated with herbaceous species to protect the soil. Potential for sedimentation would be low, short-term and not substantial.

Mowing maintenance of savannahs #3, 4 and 5 would be accomplished the same as with the Proposed Action. Mowing would not create new areas of concentrated soil disturbance, and the potential for erosion and stream sedimentation would be very low.

Wildlife water holes (small ponds) would be identical or similar to those in the Proposed Action. These small ponds should be located according to the same guidance and criteria used in the Proposed Action. Wildlife ponds should be located well upslope of the tops of all functioning stream channels and as near the ridges as would be practical, considering other factors such as soil type and water holding capacity (see Mitigation Measures and the Soil section recommendations). Wildlife ponds located by this method, and well above all functioning channel tops would have much reduced risk of overtopping and causing sediment effects downstream. Expected effects would be small and mostly short-term.

Prescribed burning would occur on about 432 acres within the project area similar to the Proposed Action, with location of firelines on existing old roads or skid roads, and avoidance of some sensitive areas like stream channels. The same riparian and stream protections would apply. Substantial exposure of mineral soil should not generally occur, especially within streamside riparian areas. The planned prescribed burning would not be expected to generate substantial amounts of eroded soil or stream sedimentation.

Bulldozer firelines would be the same as in the Proposed Action, in the same locations (about 1.5 miles). They would be constructed and maintained the same. All dozer lines would be waterbarred immediately following their construction wherever uncontrolled erosion may occur, and revegetated to protect the soil from erosion. Hand constructed fireline would also occur in the same locations as with the Proposed Action. All recommendations on dozer line locations and mitigation should be incorporated in Alternative 3. Dozer created firelines that are promptly waterbarred and revegetated in this way should pose low risk for substantial sedimentation. (See Mitigation Measures.)

Activities included in Alternative 3 have mostly low potential to erode substantial amounts of soil. Sedimentation resulting from implementation of Alternative 3 would be expected to be low, short-term and not substantial. This is because of the types of projects proposed, their relatively small size, locations primarily in gentle terrain along ridges and away from streams, and other mitigations. The greatest potential for sediment effects would occur during periods of storm runoff. It is likely that for relatively short periods of time during the life of the project and for some months thereafter, impacts to water quality could occur in terms of sediment delivery and modest increases in turbidity during storm runoff. These effects would be most noticeable in small non-perennial streams draining the project area. Noticeable sediment effects in Douthat or Cochran Creeks would be less likely. The project would be considered to be in compliance with the Clean Water Act.

Riparian Areas. Riparian protection measures in Alternative 3 would be identical to those used in the Proposed Action, which are site specific mitigation for riparian resource effects. Refer to Mitigation Measures below, and Attachment 1 in this report. Recommended riparian area protection measures would adequately protect riparian resources and functions associated with all stream channels. Riparian areas are not expected to be substantially impacted by Alternative 3.

Prescribed burning activities would protect riparian areas by maintaining reduced burn intensity within the riparian area, or by avoiding them. Some riparian areas that fall within or next to the project area would be avoided by locating fire lines further inside the project area boundary (thus effectively reducing the size of the potential burn area, as well as eliminating some riparian area from burning). Fire lines would be located the same as in the Proposed Action. The potential burn area includes the riparian area along a short section of Douthat Creek, which would increase the potential for killing vegetation along this larger perennial stream. Otherwise, effects to riparian areas with Alternative 3 activities are expected to be small, short-term and not substantial. Riparian vegetation would be expected to be minimally impacted by prescribed fire, especially the larger vegetation. Adverse effects to riparian resources would be extremely small from the proposed timber harvest and savannah development.

Streamflow and Stormflow. The streamflow and stormflow discussion for the Proposed Action also applies to actions included in Alternative 3, as well as background information and assumptions. Stormflow increases are generally not considered to occur until at least 20-30% of an area is harvested.

The same small watershed used in the Proposed Action was selected for stormflow effects discussion. Less acres of thinning harvest would occur with Alternative 3, but some additional savannah acres would be created. Total acres harvested would be about 25 acres within the approximate 90 acre watershed. This represents about 28% of the 90 acre watershed that would be harvested for savannah creation and thinning. Based on harvested proportion alone, this could potentially be within the range at which stormflow increases may start to occur and be observable. However, other factors discussed previously would tend to reduce the potential to detect stormflow effects in this small watershed. The proposed harvesting is a combination of creating savannahs and thinning. Savannahs maintain a small proportion of the basal area (25-35 square feet per acre), while thinning would maintain 50-60 feet of basal area per acre. So a small to modest portion of the evapo-transpiration capacity in the harvested acres would remain, more so in the thinning harvest. Also, all of the harvest would be on the upper ridges, in gentle topography and not occupying the near-channel or streamside areas, which would tend to reduce the potential for stormflow effects. And there would be no bladed (constructed) skid roads within the watershed to concentrate runoff. The combination of these factors would likely reduce the potential for stormflow effects. The potential for substantial stormflow increases in these small watersheds is extremely low. In the larger streams (Douthat Creek and Cochran Creek), stormflow effects would be negligible and not detectable.

The prescribed burn acreage in each of the five smaller watersheds in the northern unit (and in the southern unit as well) would add to the acres treated. But little effect on the evapotranspiration capacity of the site would be expected, because larger trees would not be expected to be killed or substantially injured. And the type and intensity of first-time burning planned for these watersheds would not be expected to do any substantial damage to the soil or to water holding or runoff characteristics. Prescribed burning these watersheds would not be expected to add to potential stormflow effects in any substantial way.

It is highly likely that there would be no substantial effect on stormflows resulting from the activities in Alternative 3. Any small or modest increases in stormflows, in any of the individual small watersheds within the project area, would likely be too small to have any substantial

adverse effect and may not be measurable. And there likely would be no adverse effects to downstream channels in terms of channel scour or bank erosion, because the magnitude and duration of potential stormflow increases would be too small to cause those effects. There would be no adverse or measurable effect on flood flows in any of the larger streams draining the project area.

Herbicides. Herbicides could be used in Alternative 3 to control unwanted vegetation, but only within savannahs #1, 2, 6, 7 and 8, and only if prescribed fire has been unable to control that unwanted vegetation. If prescribed fire is effectively controlling unwanted vegetation within the savannahs, then herbicides would not be used. Also, there would be no herbicide use in savannahs #3, 4 and 5, and none used outside the savannahs. None of the rest of the project area would receive herbicide treatments.

Two types of herbicides have been identified for use in the five specified savannahs, if prescribed fire has not achieved the objectives. These include glyphosate and triclopyr. The application rates and methods have been described in Chapter 2 of this EA. Garlon 4 (the ester formulation of triclopyr) would have an application rate not to exceed 2 lbs. active ingredient per acre (2 lbs a.i./acre), by the basal spray method. Glyphosate would have an application rate not to exceed 1.35 lbs a.i./acre, by the cut surface application method. And Garlon 3A (the amine salt formulation of triclopyr) may be substituted for glyphosate, at an application rate of 1 lb a.i./acre by the cut surface application method. All of these treatments would be by individual stem applications. There would be no use of broadcast spray or mechanized spray methods.

A risk assessment was utilized to determine the level of risk to aquatic biota from these herbicides applied according to approved methods and conditions. Information for this analysis is taken from Human Health and Ecological Risk Assessments and associated risk analysis worksheets prepared for the US Forest Service by Syracuse Environmental Research Associates for each herbicide used (SERA 2003a, SERA 2003b).

The SERA spreadsheet model characterizes risk. Ecological risk can be estimated numerically using the Hazard Quotient (HQ) approach. The HQ is a ratio, which can be used to estimate if risk of harmful effects is likely or not likely due to the contaminant in question. In the SERA spreadsheet model, the hazard quotient is the ratio of the exposure estimate to a reference dose (RfD). The reference dose calculated for this equation may be an acute (short term) reference dose or a chronic (long term) reference dose. If the exposure estimate is higher than the reference dose or toxicity value, then there is the potential for risk to the receptor.

Typically, all hazard quotients greater than or equal to 1.0 are generally referred to as "exceeding a level of concern" and indicate that the chronic reference dose is being exceeded. This applies to the application rate used in the calculation. Hazard quotients that exceed a level of concern are highlighted in the tables created in the model.

The SERA Risk Assessment for each herbicide provides documentation of results from the GLEAMS model which simulates a wide range of precipitation values and soil types. As with many environmental fate and transport models, the input and output files for GLEAMS can be complex. It is important to know that the model is based on application sites with slopes less than 10 percent and no buffer on streams. The tables generated from the model are based on a worse case scenario of an annual rainfall of 250 inches and a sandy soil type. For a more

accurate analysis based on local soil conditions and rainfall, each SERA report includes a table that shows average concentration of the assessed chemical in a small stream (4,420 m^3/day) adjacent to a 10 acre plot for different average annual rainfalls and different soil types. If the model shows that a hazard quotient is exceeding a level of concern, further analysis is required based upon local conditions. For the Middle Mountain project area an annual rainfall of 50 inches/year and a loam soil type would be the closest estimate.

In general, the forest floor and soil is effective in reducing the potential effect of herbicides on the watershed. Most forest soils have high infiltration rates which prevent overland flow of herbicides to streams. The chemical and biological processes of the soils alter the herbicide to a substance not considered harmful to vegetation. Stream pollution and harmful effects to aquatic organisms would be minimal when carefully controlled application of herbicides is made.

Two SERA spreadsheet model runs were made to assess risk to aquatic biota (fish and aquatic macroinvertebrates). One run was made for glyphosate at 1.35 lbs a.i./acre.

Glyphosate: the model shows risk (hazard quotients that exceed 1) to fish and aquatic macroinvertebrates only if there was a large accidental spill of glyphosate directly into a small body of water. (A large accidental spill has an extremely small chance of occurring because of all the mixing, handling and treatment precautions that would be used.) Other than for an accidental spill, there would be little risk that either fish or aquatic macroinvertebrates would be adversely impacted by this use of glyphosate. Hazard quotients in the model output do not exceed the level of concern for any of the estimated environmental exposures.

Triclopyr: a possible combined application rate of 3 lbs a.i./acre was used in the model exercise, although 2 lbs/acre would be the more likely rate of application. The model run was made for the more toxic formulation, triclopyr BEE. The model shows risk (hazard quotients that exceed 1) to fish and aquatic macroinvertebrates, primarily if there was a large accidental spill of triclopyr BEE directly into a small body of water. In the event of a large accidental spill, toxic effects to fish and aquatic macroinvertebrates would be highly likely. (A large accidental spill has an extremely small chance of occurring because of all the mixing, handling and treatment precautions that would be used.) Other than for an accidental spill, there is a low risk of adverse effects to fish and aquatic macroinvertebrates from this use of triclopyr. The model indicates that for an application rate of 3 lbs/acre, the level of concern for acute exposure (peak environmental exposure) to fish is only exceeded at the upper range of projected concentrations, and not to macroinvertebrates. Refining this analysis using more local and site specific conditions (50 inches of annual precipitation and loam soil) indicates a maximum estimated concentration of triclopyr in a small stream adjacent to a 10-acre treated plot of about 0.282 parts per million (ppm). According to the SERA Report (Appendix 12, SERA 2003b), for Garlon 4 the lowest NOEC (no observable effect concentration) for rainbow trout was 0.24 ppm in water. This is just slightly less than the 0.28 ppm maximum estimated concentration in a small stream described above. Also, LC50 effects from Garlon 4 to rainbow trout were reported to be 0.98 to 2.6 ppm for 96-hour exposure times, well above the maximum estimated concentration (0.282 ppm) used for the refined analysis. Based on these data, the potential for substantial adverse effects to fish near the area of treatment would be very low.

The potential for adverse effects to fish and aquatic macroinvertebrates from the use of herbicides would be further mitigated by a number of other factors that would be applicable to this project. These additional mitigating factors include:

a. Herbicides would only be used in the event that prescribed fire treatments have not been possible to carry out (due to poor burning conditions), or have been ineffective in controlling unwanted target vegetation.
b. Herbicides would only be used in a maximum of five savannahs (#1, 2, 6, 7, 8) if needed, and these five total about 26 acres. No herbicide use would occur outside these five savannahs.
c. Herbicide application methods would be restricted to hand treatment of individual woody stems (by cut surface application or basal spray) within the 5 savannahs. No mechanical applications or broadcast spray methods would be used. Treatment of individual stems by hand treatment methods would help limit the quantity of herbicide actually used.
d. None of the savannahs is near a functioning stream channel. All five savannahs would have wide filterstrip areas between potential areas of herbicide use and the nearest stream channel. The forest floor and filterstrip width would effectively trap herbicides from movement downslope, and facilitate herbicide degradation within the soil.

Based on the nature of the herbicide treatments that could be used, on the methods of application and numerous restrictions on herbicides that are required by the labels and US-EPA, and on the various other restrictions and mitigating factors described above, no substantial adverse effects on aquatic biota would be expected from the use of glyphosate and triclopyr as described. No adverse effects on aquatic biota or Regional Forester's sensitive species would occur in downstream areas including Douthat Creek.

Municipal Water Supply. The potential to affect the municipal water supply at Marlinton (Knapp Creek) is the same as with the Proposed Action. Alternative 3 would have no greater risk to water quality in Knapp Creek than the Proposed Action. Sediment effects in Knapp Creek from Alternative 3 would not be noticeable or measurable. There would not be adverse effects to the quality of water in Knapp Creek that would diminish its suitability as a source for drinking water.

Aquatic Biota. Adverse effects to aquatic biota in Douthat Creek or Cochran Creek, or any of their tributaries are expected to be small and not substantial. There are no perennial stream channels within the proposed timber harvest areas, although a short section of Douthat Creek borders the west edge of prescribed burning. (A no-burn zone of 100 feet along the creek is recommended below.) Otherwise, streams within the project burn areas are mostly intermittent and ephemeral, with the smallest channels extending up to near the thinning harvest. All streams will be protected with riparian area and filterstrip protection measures. Prescribed burning will be conducted in a manner that substantially protects riparian areas, watershed soils, and hydrologic integrity. Earth disturbance from project activities will be extremely small, except for bulldozer constructed firelines, and their location and erosion control measures will control most soil loss and sedimentation from them.

Sedimentation within the project area and downstream would have small adverse effects to the aquatic community, primarily in fine sediment deposition within channel substrate and habitats

of the small non-perennial streams draining the project area. The northern project unit is where most of the potential for these small effects occurs; the southern unit has very little soil disturbance and prescribed burning. Downstream in the larger intermittent and perennial streams, the potential for sedimentation effects to aquatic habitats and biota are further reduced, and not substantial. The low potential for adverse sediment effects is because of the types of activities proposed and their low risk of generating substantial amounts of sediment, project locations primarily in low risk areas, and other mitigations being recommended. Dozer-constructed firelines are a potential concern for sedimentation effects to aquatic biota, but those effects can be effectively mitigated through good location and prompt waterbarring and revegetation. Potential small and short-term turbidity increases would not adversely affect aquatic biota. Over all, sedimentation effects to aquatic biota would be small, short-term and not substantial.

Adverse effects to aquatic biota from impacts to riparian resource condition would be extremely small, if project activities are conducted as planned and with the recommended mitigations. Those potential riparian effects would likely be very minor and short-term, and would have no substantial impact on the aquatic community. There will be no aquatic organism passage effects from any of the proposed activities, and no substantial stream temperature effects are expected.

Effects to aquatic biota from the potential use of herbicides were described above. Those effects were described as small and not substantial. The potential to impact fish and aquatic macroinvertebrates from herbicide treatments in the five savannahs would be very low and not substantial.

Two Regional Foresters Sensitive Species of fish occur within the Knapp Creek 5th level HUC, as described in the Affected Environment. Forest records do not show any of these sensitive species located within the project boundaries. However, their presence within the broader general area of the Knapp Creek watershed and their mobility could allow for their presence within the Douthat and Cochran Creek stream systems. Alternative 3 would not occupy or substantially modify any of the aquatic habitats. Sedimentation resulting from all project activities would have a small and not substantial impact on aquatic habitat quality downstream for a short distance. This would be a small and short-term source of sediment, and would mostly occur during storm runoff conditions. Other water quality and aquatic habitat conditions would not be substantially affected by these activities.

Cumultative Effects of Alternative 3

Refer to Table 3-1, Past, Present and Reasonably Foreseeable Future Actions within or around the project area for a list of these activities.

Cumulative effects of Alternative 3 are nearly the same as with the Proposed Action. There are small but inconsequential differences in the proposed activities between the two action alternatives. Those small differences would not result in cumulative effects differences between the action alternatives, even though there would be more than twice the amount of savannah acreage. Past, present and reasonably foreseeable future actions from the Proposed Action section would also apply with Alternative 3.

Even though Alternative 3 includes the potential for herbicide treatments, the potential for adverse aquatic resource and aquatic biota effects is extremely low, as described earlier. Use of

herbicides with Alternative 3, if it occurs, would not result in cumulative adverse effects to the aquatic resource or aquatic biota.

Repeated burning occurring on a 3-5 year frequency (the same as in the Proposed Action) would have the potential to raise the risk of cumulatively substantial effects, at least in the near vicinity of the project area. There would be continued uncertainty and concern for potential sedimentation effects. As explained above, the cumulative effects of repeated burning within a small headwater watershed are less well-known for this area. There is a potential for greater watershed erosion and stream sedimentation from repeated burnings over time. The magnitude of that sediment effect is not known. Since repeated burns are planned within the 486 acre project area (432 acre burn area), their cumulative erosion and sedimentation effects should be included in a monitoring plan for this project.

Cumulative effects to riparian resources would be extremely small and not substantial. The additional increment of impact on stormflow characteristics from project area activities would be extremely small and not measurable in any of the larger streams (Douthat and Cochran Creeks). There would be no measurable effect on downstream flood flows, and no measurable effects on water quality at the Marlinton water supply.

Provided that all mitigations and other project design requirements are followed, Alternative 3 would be considered to be in compliance with the State's water quality laws and rules, and with the Clean Water Act. And there would be no cumulatively substantial impacts to aquatic biota within the Douthat Creek watershed or its tributaries.

Comparison of Alternatives

Comparison of the effects of the No Action, Proposed Action (Alt. 2) and Alternative 3 are summarized here. Comparison of cumulative effects will not be summarized, since the effects of primary importance in this analysis are those of the two action alternatives. Comparison of activity measures are in Table 3-9 (numbers are approximate).

Table 3-9. Comparison of Alternatives, Activity Measures for the Project Area

Project Area	No Action	Alternative 2 (PA)	Alternative 3
Skid trails (miles)	0	2.4	2.6
Prescribed burn (acres)	0	442	432
Dozer fireline constructed (miles)	0	1.5	1.5
Potential herbicide treatments (acres)	0	0	26
Channel crossings by skid trails (#)	0	0	0
Portion of project area harvested (%)	0	22.4	29.2

Unavoidable Adverse Impacts

The No Action Alternative would not implement actions that would cause unavoidable adverse impacts.

The Proposed Action would implement activities that would disturb soils and have unavoidable adverse effects to small streams within and near the project area. Unavoidable effects would be in the form of sediment delivered to streams and sediment effects on water quality. Those effects would be minor and short-term, and would occur primarily in response to storm runoff events. Mitigation measures recommended for the activities, and location and design of the project would reduce effects to acceptable levels. The Proposed Action would have no substantial water quality effects, and would be in compliance with State water quality rules and the Clean Water Act. Negligible adverse effects to riparian resources would occur from minor prescribed burn effects to riparian vegetation. Adverse impacts to aquatic biota from sedimentation and impaired habitat are expected to be very minor and not substantial, and mostly short-term. The potential to have adverse impacts on Regional Foresters Sensitive Species is extremely small. The Biological Evaluation determination for impacts to the two sensitive fish species is "may impact individuals but not likely to cause a trend to the federal listing or loss of viability." (PF, Section N, BE, p. 24)

Unavoidable adverse effects from implementing Alternative 3 would be essentially the same as with the Proposed Action. Unavoidable sediment effects would be minor and short-term, occurring primarily in response to storm runoff events. Mitigation measures recommended for the activities, and location and design of the project would reduce effects to acceptable levels. Alternative 3 would have no substantial water quality effects, and would be in compliance with State water quality rules and the Clean Water Act. Negligible adverse effects to riparian resources would occur from minor prescribed burn effects to riparian vegetation. There would be no substantial adverse aquatic effects from the potential use of herbicides, if it should occur. Adverse impacts to aquatic biota from sedimentation and impaired habitat are expected to be very minor and not substantial, and mostly short-term.

Irreversible or Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of aquatic or riparian resources by implementing either of the action alternatives in this analysis.

Consistency with the Forest Plan

Alternatives would be implemented consistent with the goals, objectives, standards, and guidelines of the Monongahela National Forest Land and Resource Management Plan (MNFLMP). This includes direction found in the Forest-wide standards and guidelines for soil and water resources (MNFLMP pages 79-82), fish habitat management (pages 83-84), sensitive species (page 87), and Amendment 3 of the Forest Plan for fishery resource management. In addition, the Alternatives would comply with all federal and state laws pertaining to protection of water quality.

Relevant Laws, Regulations, Executive Orders, and FSM/FSH Direction:

Clean Water Act of 1977 as amended, Executive Orders 11988 (floodplain management) and 11990 (wetland protection), and Forest Service Manual chapters 2520 Watershed Protection and Management, and 2670 sensitive species policy.

3.4.3. Air Quality

Resource Impacts or Issues Addressed

Prescribed fire activities described in the Middle Mountain Action Alternatives will result in associated air pollutant emissions, which can impact air quality both inside and outside of the project area. This analysis discloses the air resource impacts and air quality indicators identified during interdisciplinary meetings.

Background and Indicators

The major pollutant of concern emitted from prescribed fires is fine particulate, which is a "criteria" pollutant regulated under the Clean Air Act (CAA). Fine particulates are suspended microscopic atmospheric particles that are comprised of a variety of chemical species. These microscopic particles are generally referred to as PM_{10} or $PM_{2.5}$, a naming convention in which the numerical designation refers to the aerodynamic diameter of the particle (measured in microns); i.e. $PM_{2.5}$ refers to particles with an aerodynamic diameter of 2.5 microns or less. These microscopic particles are a concern in terms of human health and visibility impairment. Fine particles are small enough to bypass the defense mechanisms of the respiratory tract and lodge deep within lung tissue, causing inflammation and respiratory related illnesses. The smaller the particle, the deeper it can lodge in the lung tissue. For this reason, EPA has set National Ambient Air Quality Standards (NAAQS) for two size classes of fine particulates; one for PM_{10} and one for $PM_{2.5}$. The $PM_{2.5}$ standard is newer and more stringent, and is the standard of concern, since particles with a diameter of 2.5 microns or less have a greater potential to impact human health. *Over 70 percent of the particulate mass emitted in a Wildland fire is in the 2.5 microns or less size class* (Smoke Management Guide for Prescribed and Wildland Fire, 2001). The NAAQS for $PM_{2.5}$ is a 24-hour average of no greater than 65 micrograms/m^3, or an annual arithmetic mean of no more than 15 micrograms/m^3. The NAAQS for PM_{10} is a 24-hour average of no greater than 150 micrograms/m^3, or an annual arithmetic mean of no more than 50 micrograms/m^3.

Additionally, due to the physical and chemical characteristics of particles in the finer size classes, they are exceptionally effective at absorbing and scattering light in the atmosphere, a phenomenon known as light extinction or visibility impairment. Visibility impairment that can result from prescribed fire emissions is both a safety concern for nearby roadways and airports, and an air quality concern in terms of cumulative contributions to regional haze.

To a lesser extent, prescribed fires also emit nitrogen oxides (NOx), carbon monoxide and volatile organic compounds (VOCs). Both NOx and VOCs contribute the formation of a secondary pollutant, ozone, which is also a criteria pollutant under the CAA. However, the formation of ozone is dependent on the presence of precursor pollutants, sunlight and higher temperatures. Emissions of NOx and VOCs can serve as surrogates for ozone, however, emissions of fine particulates are a better indicator of air quality because they are primary

pollutants, are generally emitted in greater quantities and have associated human health concerns. Many of the smoke production and air quality dispersion models (tools that evaluate the effects of prescribed fire by predicting emissions released and downwind concentrations of pollution) focus on $PM_{2.5}$. For these reasons, this analysis uses $PM_{2.5}$ as the primary indicator for air quality.

Prescribed fire $PM_{2.5}$ emissions are a concern to the extent that they contribute to the total "criteria" pollutant load and that they pose threats to health and safety in nearby smoke sensitive areas. The goal of this analysis is to address the estimated particulate matter emissions from prescribed fire activities and to assess whether or not they would significantly impact attainment of the NAAQS or have the potential to significantly contribute to harmful or unhealthy conditions in nearby communities. Based on these two goals, this analysis is broken down into two sections. The first section addresses modeled emission estimates for each alternative and the contribution of these emissions to the total pollution load. The second section addresses modeled concentration estimates of $PM_{2.5}$ and the implications for potential human health effects.

Scope of the Analysis

Because air pollution is regional in nature and has the potential to disperse beyond project boundaries, emissions from prescribed fire must be evaluated in the context of regional pollution loads and current air quality monitoring data. Under the CAA, air regulatory agencies must identify air quality control regions for the purposes of demonstrating attainment (or nonattainment) of the NAAQS. In the vicinity of the project area, these air quality control regions are identified as individual counties. The Middle Mountain project area is located in the southeastern corner of Pocahontas County, West Virginia, but is less than five miles from the boundary of Greenbrier County, West Virginia and Bath County, Virginia. These three counties or, air quality control regions, make up the air quality analysis area for the Middle Mountain Project.

Affected Environment

Currently, the three counties in the analysis area, as well as the neighboring counties are in attainment status for all criteria pollutants, including $PM_{2.5}$. However, none of these counties have a $PM_{2.5}$ monitoring site located within the county; Greenbrier County has an ozone monitoring site, at which the annual averages of the 8-hour concentrations for the most recent three years of data is about 75 parts per billion (ppb) . This is below the current 8-hour NAAQS of 85 ppb. The closest $PM_{2.5}$ monitor is in nearby Summers County, West Virginia, which shows that the 98^{th} percentile of the 24-hour maximum concentrations averaged over the last three years is about 10.6 micrograms per cubic meter, well below the 24-hour NAAQS for $PM_{2.5}$, while the average of the annual average values for the most recent three years is approximately 31.3 micrograms per cubic meter, also well below the annual NAAQS for $PM_{2.5}$ (EPA, County Air Quality Report, AirData, 2006). Because monitoring data from this region shows that ambient concentrations of $PM_{2.5}$ are well within the NAAQS, if it can be shown that predicted emissions from prescribed fire activity in the Middle Mountain project comprise a small enough percentage of the pollution load in these three counties, it is unlikely that they will cause a violation of the $PM_{2.5}$ NAAQS.

As stated previously, even if the emissions from a prescribed fire would not be likely to cause or contribute to a violation of the NAAQS, the emissions could potentially cause high concentrations for short periods of time in nearby smoke sensitive areas such as local communities, hospitals or schools. The resultant increased concentrations have the potential to affect human health and public safety. In other words, while informative, determining the amount of emissions produced does not address where the smoke is going to go, how well it is going to disperse and what the resultant ground level concentrations are going to be. For this reason, land managers need to be aware of where smoke sensitive areas such as communities and highways are located relative to their burns. Smoke management techniques (i.e. restricting the meteorological conditions under which the burn can be conducted) should be employed to allow the Forest to avoid "smoking in" these areas. To address this potential for the Middle Mountain project, smoke sensitive areas within the vicinity of the project area were identified. Additionally, the range of typical meteorological conditions under which the burn will be conducted was identified and the area topography between the burn and smoke sensitive areas was assessed. Evaluating these factors will help determine whether or not concentrations could reach unhealthy levels within local communities, as smoke dispersion is highly variable depending on meteorology, chiefly atmospheric mixing heights and wind speed and direction as well as topography.

There are very few smoke sensitive areas located near the Middle Mountain Project area. The burn units are on the northern end of Middle Mountain in Pocahontas County, West Virginia, approximately eight miles southeast of Marlinton. Elevations within the project area range from approximately 2480 feet to 3280 feet. The counties within the project area are classified as rural areas. Marlinton is the closest sizable community (population approximately 1,400) within the vicinity of the burn, and would be the main smoke sensitive area. State highways 92 and 39/92 wind through the valleys on the northern and eastern sides of Middle Mountain and would also be identified as a smoke sensitive area.

In order to determine the level of health concern associated with predicted $PM_{2.5}$ concentrations, modeled values can be compared to the Air Quality Index (Table XX). The **A**ir **Q**uality **I**ndex (AQI) was developed by EPA to relate $PM_{2.5}$ concentrations (averaged over a 24-hour or 1-hour time period) with varying levels of health concern. The index depicted in Table xx also relates $PM_{2.5}$ concentrations to visibility distances for highway safety concerns. In terms of prescribed fire, the 1-hour averaging period for $PM_{2.5}$ concentrations is most applicable.

Methodology

Prescribed burning activities will occur across a total of 441.8 acres in Alternative 2 and 423 acres in Alternative 3 using hand firing broadcast burning techniques in a northern and southern unit. There are several activities that will be occurring within these proposed burn units that will create a range of fuelbeds across the project area. These activities include the creation of savannahs, commercial thinning, and the creation of wildlife openings (see table 3-10). Because the level of emissions produced during a prescribed burn are dependent on the fuel loadings and fuel characteristics present, it was necessary to identify these fuelbeds and the average fuel loading values in tons per acre for each unit. Four types of fuelbeds were identified within the Middle Mountain project area; commercial thinning areas, savannahs, wildlife openings and understory burns. Fuel loading estimates for each of these fuelbeds were developed in two stages: First, the Stereo Photo Series for Quantifying Natural Fuels, Volume V (Ottmar and

Vihnanek, 1999) was used to identify fuel loadings for the existing on-the-ground conditions in each fuelbed. Since the existing conditions will change once the proposed management activities have occurred, the fuel loadings for several of the fuelbeds needed to be adjusted to match what the expected fuel conditions will be when the burn is conducted; this includes the commercial thinning areas, the savannahs and the wildlife openings. Since no other management activities will occur in the understory burn areas, the existing fuel loading conditions were used in the emissions production models.

For the commercial thinning area, fuel loading estimates for duff, surface material and woody material for each size class from the fuel photo series were used for the duff, litter, and woody categories in the emissions production models, respectively. This represents what is currently on the ground. Estimates of fuel loading of additional slash that will be present after the thinning occurs were taken from the Fuel Characteristics Classification System (FCCS) v. 1.0 fuel model for a white oak-northern red oak-hickory harvest with slash; these values were added to the existing conditions to get total fuel loading.

For the savannah areas, fuel loading estimates for the smaller size classes of woody material and litter were used from an oak series model, while the larger size classes of woody material were not included because this material will be piled and protected with handline during the prescribed burn. Then fuel loading estimates from the northern tallgrass prairie series in Volume V of the photo series were used to get loading estimates for the herbaceous layer. An existing savannah site near the project area was visited and evaluated to determine the appropriate tallgrass prairie series to use. Similarly, the south unit contains a .73 acre existing wildlife opening; this was visited to identify the appropriate fuel model for these areas; the same tallgrass series was used for the wildlife openings as was used for the savannahs. Since the fuel loadings for these areas were considered to be the same, they were entered as one unit into the emissions production model.

Table 3-10. Fuelbeds identified for each unit within Middle Mountain Project Area.		
Fuelbed/Unit	**Acres Alternative 2**	**Acres Alternative 3**
Savannah North + (Wildlife Opening Alt 3)	14.9	47.2
Commercial Thinning North	82.1	83.1
Understory Burn North	222.4	189.1
Savannah South + Existing Wildlife Opening	12.3	9.8
Understory Burn South	110.1	102.9
Total Acres Prescribed Burn	**441.8**	**432.1**

After fuel loading estimates were developed, the next step was to utilize these estimates in emissions production models. Emissions estimates for broadcast burns were derived using the CONSUME Version 3.0 model (Prichard et. al, Pacific Wildland Fire Sciences Laboratory). CONSUME predicts the amount of fuel consumption, emissions and heat release from logging slash, piled and natural fuels based on local weather conditions, fuel loadings and fuel moisture content. Consume is a versatile model in that it allows the user to input multiple burn units and multiple fuelbeds of varying sizes to get total project emissions. For the Middle Mountain project, inputs for two units, the North and the South unit were entered for each action alternative. Fuel loadings and characteristics for three fuelbeds were included in the northern unit in Alternative 1; the savannahs, the commercial thinning and the understory burns. Fuel loadings and characteristics for two fuelbeds were included in the southern unit in Alternative 1; the savannahs and the understory burns. Inputs for Alternative 3 were similar to those for Alternative 1 with the exception that additional acreage was included in the savannah unit to account for the wildlife opening (these were input into one unit since the fuel loadings were considered to be the same), the total acreage for the savannah fuelbeds increased, the acreage for the commercial thinning fuelbeds increased slightly and the acreage for the understory burn fuelbed slightly decreased (see table 3-10).

In addition to the fuel loading parameters, fuel characteristics such as percent moisture content and ignition information is required by the model. These pieces of information feed into the consumption calculations and consequently they affect the amount of emissions predicted by the model. Because conducting prescribed burns is highly dependent on local weather conditions

and the availability of resources, the exact days on which burns would be conducted, and thus the exact fuel characteristics can not be determined at this time. For this reason it was necessary to determine an average percent fuel moisture content that would be within the expected range of conditions under which the burn would be conducted. It was also necessary to make some basic assumptions regarding ignition and firing times. After working with the Forest Fire Management Officer, these estimates were determined and input into CONSUME.

CONSUME can provide PM emission estimates in total tons per project or in tons per acre burned. Emissions reported in this analysis are in total tons per project per year. It should be pointed out that unless the user enters the acres consumed rather than the total project area acres, CONSUME assumes 100% burn coverage for the project area. In reality, a broadcast burn will create a mosaic pattern across the project area, with some areas burn and others relatively untouched. To be conservative, this analysis calculated emissions based on the total project acres, rather than acres burned and actual PM emissions may be somewhat less than what is reported here.

To assess the project's contribution to the regional pollution load, these emission estimates for the various types of burns were compared to the total annual county emissions for each pollutant in the analysis area. The regional emissions data were obtained from the most recent and accurate emissions database available for this area. Currently, this is the 2002 VISTAS base case emissions database. It can be assumed that if predicted emissions from the proposed prescribed fire activities contribute a small enough percentage to the total pollution load, they would not impact attainment of the NAAQS in the analysis area. *As stated previously, all counties within and surrounding the analysis area are currently in attainment status for all criteria pollutants*. A percentage threshold of 5 percent[1] has been chosen for the emissions comparison. If emissions from prescribed fire activities do not exceed 5 percent of the total pollution load in the region in a given year, they will be considered below the concern threshold for contribution to the NAAQS.

A Gaussian plume model, VSMOKE-GIS Version 2.0, was used to address public health and safety concerns related to potential short terms spikes in $PM_{2.5}$ levels in smoke sensitive areas that could occur on the day of the burn. Because it is anticipated that the north and south units will be burned on different days, only a worst case scenario was modeled in this analysis. Since the emissions from the north unit burn will be greater than those for the south unit burn, the north unit burn was chosen for the VSmoke runs.

The modeled impacts are predicted to occur over several hours as the burn progresses. However, the modeling run conservatively assumes that all 319 acres in the north unit are burning concurrently; again a worst case scenario. This likely overestimates the actual air quality effects, as not all 319 acres will be in the active flaming phase at once, only a percentage of the unit will be burning as the burn progresses through the unit.

[1] The threshold of 5% was chosen to be conservative in protecting air quality. The goal is to address how emissions from Forest activities will impact the NAAQS, and this threshold seemed appropriate because PSD increments, which are designed to protect areas meeting the NAAQS, represent a percentage of the total NAAQS that is roughly equal to 5% for class II areas. Also, this percentage is significantly less than the percentage that conformity thresholds comprise of the total NAAQS for NO_x and PM_{10}.

VSmoke utilizes background air quality conditions, the amount of emissions produced and the heat release rates from the fire and meteorology to estimate $PM_{2.5}$ concentrations in micrograms per cubic meter (ug/m^3) at varying distances downwind of the burn. These predicted concentration estimates are then compared to the Air Quality Index, a color-coded health index developed by the EPA which correlates $PM_{2.5}$ concentrations with associated levels of concern for human health. Because the exact meteorological conditions under which the burn would be conducted are not known at this time, a range of atmospheric mixing heights were chosen for each alternative to determine air quality impacts varying conditions; modeling results from the upper and lower ends of this range are shown in this document. Minimum transport and surface wind speeds under which burns would likely occur were used for VSmoke runs.

It should be noted that Gaussian plume models do not adequately account for complex terrain scenarios, and thus, these estimates must be evaluated in the context of the local topography. Despite the models inability to account for complex terrain, it can provide some sense of the downwind impacts of the plume. For this reason, the modeled concentrations presented in this analysis are evaluated in the context of wind direction and topography.

Environmental Consequences Common to all Action Alternatives

Prescribed burning activities are expected to occur in both Alternative 2 and Alternative 3. All prescribed burning will result in $PM_{2.5}$ emissions.

Direct/Indirect Effects by Alternative

No Action - Alternative 1

There would be no prescribed burning activities within the project area under the No Action Alternative, and thus there would be no additional emissions of $PM_{2.5}$. This would result in no additional air quality effects.

Proposed Action – Alternative 2

Predicted emissions of PM_{10} and $PM_{2.5}$ for Alternative 2 and their contribution to the pollution load within the analysis area are shown in Table 3-11. The results for this NAAQS comparison analysis indicate that particulate matter emissions from Middle Mountain prescribed burning activities in Alternative 2 would not exceed the 5% threshold and thus are unlikely to contribute to an exceedance of the NAAQS.

Table 3-11. Emissions from Prescribed Fire under Alternative 2 and their Contribution to the total pollution load in the analysis area.

Alternative	Pollutant	Annual Rx Fire Emissions North Unit (Tons)	Annual Rx Fire Emissions South Unit (Tons)	Total Annual Project-Related Emissions (Tons)	Total Regional Emissions (Tons per year)	Percent Rx Fire of Total Regional Emissions
Alternative 2	**PM_{10}**	40.2	15.7	55.9	5489	1.02%
	$PM_{2.5}$	35.8	14.1	49.8	1614	3.09%

Figures 3-1 and 3-2 depict transects of the plume as modeled by VSmoke, which show predicted ground-level concentrations of PM2.5 at varying distances downwind of the burn during the hour of greatest emissions release. Figure 3-1 was modeled using a mixing height of 4000 feet above ground level and Figure 3-2 was modeled using an atmospheric mixing height of 1640 feet above ground level. According to VSmoke predictions, ground level $PM_{2.5}$ concentrations under Alternative 2 during the highest emissions hour on the day of the burn will return to the yellow, or moderate AQI category approximately 15 ½ miles out from the burn, when the mixing height is 4000 feet. As is expected, the concentrations will be high close to the burn unit, but will decrease as you go further from the burn. If the mixing height is lowered to 1640, ground level concentrations are predicted to be in the orange, or unhealthy for sensitive groups category at 15 ½ miles from the burn. The model predicts that under more optimum weather conditions, greater smoke dispersion will occur and ground level impacts will be diminished.

Figure 3-1: Transect of the plume showing the distance out to which the plume is expected to return to ground-level as well as ground level concentrations at varying distances downwind of the burn, as predicted by VSmoke for Alternative 2 with a mixing height of 4000 feet.

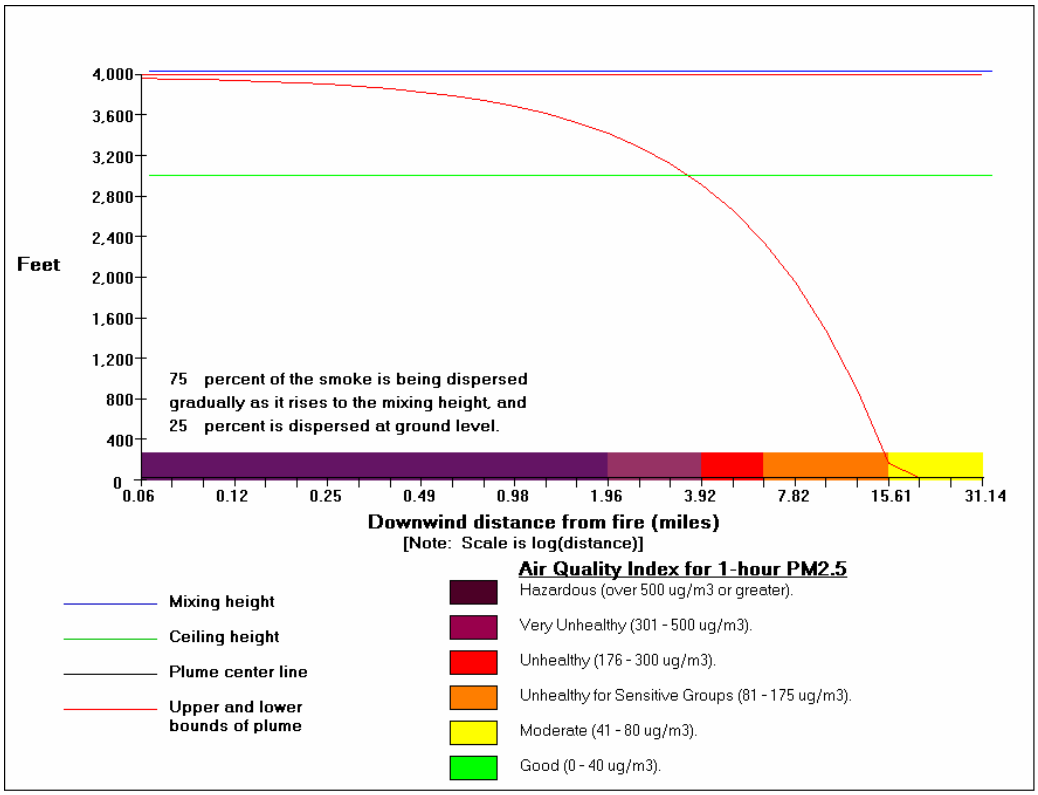
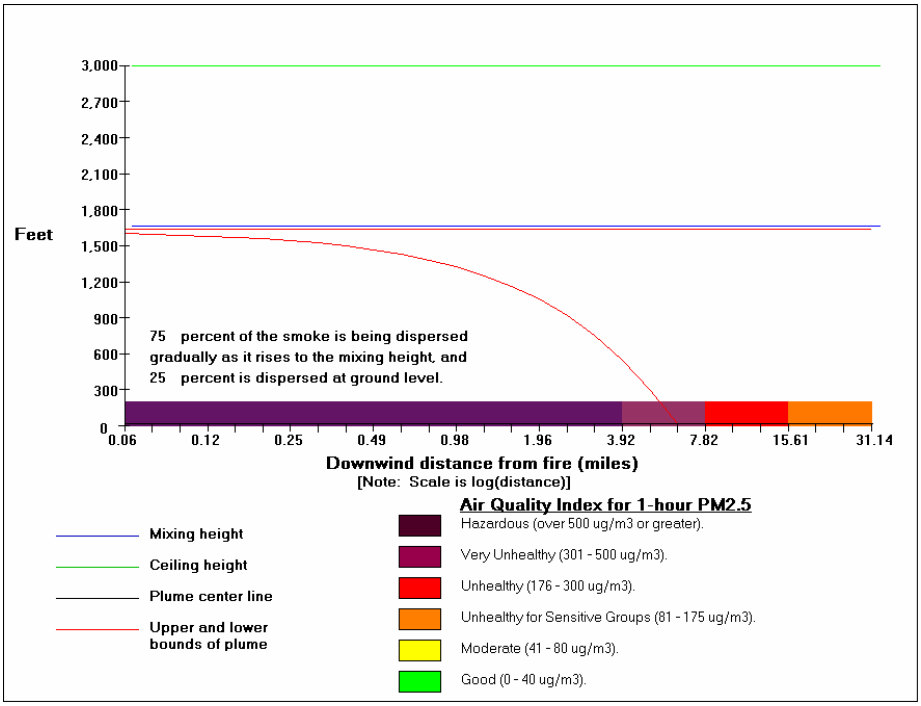


Figure 3-2: Transect of the plume showing the distance out to which the plume is expected to return to ground-level as well as ground level concentrations at varying distances downwind of the burn, as predicted by VSmoke for Alternative 2 with a mixing height of 1640 feet.



The downwind $PM_{2.5}$ concentrations predicted by VSmoke must be evaluated in terms of the topography and location of the burn relative to smoke sensitive areas. In the case of Middle Mountain, the burn unit is on a ridge top and side slopes, which will help with dispersion during the daytime hours, as smoke will already be elevated above valley communities. Additionally, the nearest sizable community, Marlinton, is located 8 miles northwest of the burn unit; smoke impacts in Marlinton can easily be avoided by burning when the winds are coming out the northwest to west southwest directions, which would push the smoke away from the community.

To summarize, predicted emissions from prescribed burning activities in the Middle Mountain project area are small enough that they are not expected to contribute to a violation of the NAAQS given that the counties in the analysis area are currently meeting the NAAQS standard for $PM_{2.5}$. In terms of human health, air quality effects from the Middle Mountain project in Marlinton can be mitigated by burning under meteorological conditions that would disperse smoke away from the community. Additionally, the above modeled concentrations are for a duration of one hour during the hour of greatest predicted emissions release. Modeled impacts at this level would only be short-term, because once the unit has burned smoke will disperse from the area and will not longer have an effect.

Alternative 3

Predicted emissions of PM_{10} and $PM_{2.5}$ for Alternative 3 and their contribution to the pollution load within the analysis area are shown in Table 3-12. The results for this NAAQS comparison analysis indicate that particulate matter emissions from Middle Mountain prescribed burning activities in Alternative 3 would not exceed the 5% threshold and thus are unlikely to contribute to an exceedance of the NAAQS.

Table 3-12. Emissions from prescribed fire under Alternative 3 and their contribution to the total pollution load in the analysis area.

Alternative	Pollutant	Annual Rx Fire Emissions North Unit (Tons)	Annual Rx Fire Emissions South Unit (Tons)	Total Annual Project-Related Emissions (Tons)	Total Regional Emissions (Tons per year)	Percent Rx Fire of Total Regional Emissions
Alternative 3	**PM_{10}**	42.5	14.4	56.9	5489	1.04%
	$PM_{2.5}$	37.9	12.9	50.7	1614	3.14%

Figures 3-3 and 3-4 again depict VSmoke modeling results for Alternative 3. These results represent the hour of greatest emissions release. Figure 3-3 was modeled using a mixing height of 4000 feet above ground level and Figure 3-4 was modeled using an atmospheric mixing height of 1640 feet above ground level. According to VSmoke predictions, ground level $PM_{2.5}$ concentrations under Alternative 3 during the highest emissions hour on the day of the burn will return to the orange, or unhealthy for sensitive groups AQI category approximately 10 ½ miles out from the burn, when the mixing height is 4000 feet. Ground level concentrations are predicted to remain in this category out to the distance limit of the model. As is expected, the concentrations will be high close to the burn unit, but will decrease as you go further from the burn. If the mixing height is lowered to 1640, ground level concentrations are predicted to be in the purple, or very unhealthy category at this same distance, 10 ½ miles, from the burn. The model predicts that under more optimum weather conditions, greater smoke dispersion will occur and ground level impacts will be diminished.

Figure 3-3: Transect of the plume showing the distance out to which the plume is expected to return to ground-level as well as ground level concentrations at varying distances downwind of the burn, as predicted by VSmoke for Alternative 3 with a mixing height of 4000 feet.

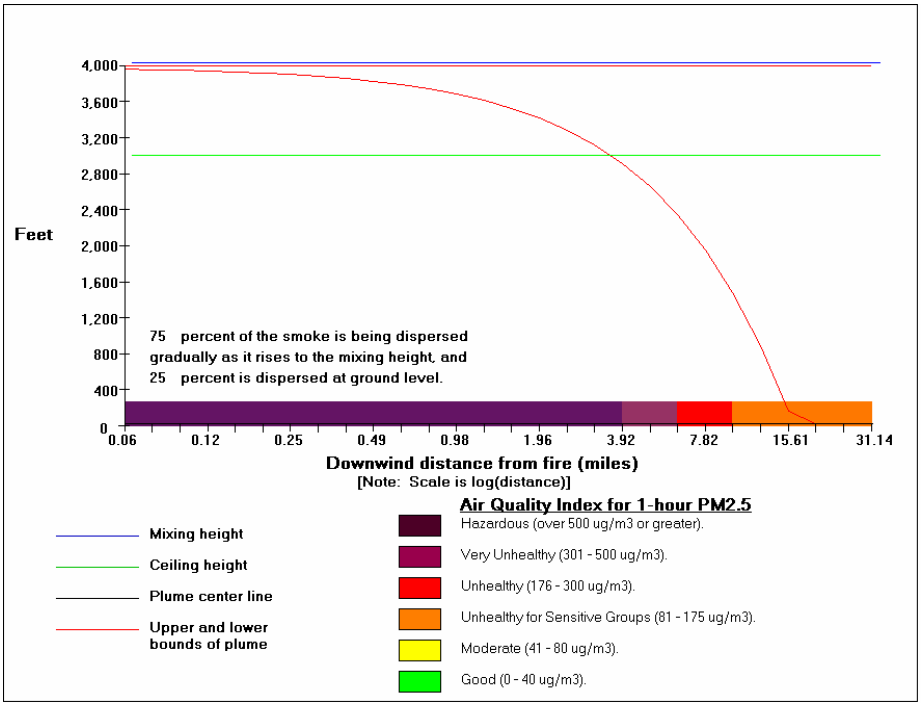
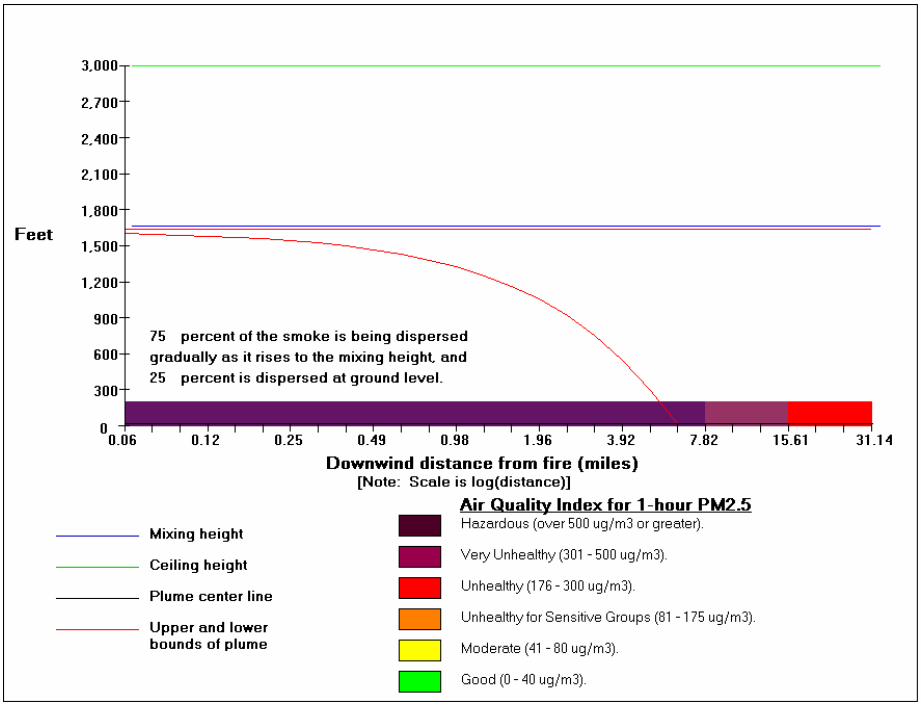


Figure 3-4: Transect of the plume showing the distance out to which the plume is expected to return to ground-level as well as ground level concentrations at varying distances downwind of the burn, as predicted by VSmoke for Alternative 3 with a mixing height of 1640 feet.



Comparison of Environmental Consequences across all Alternatives

Table 3-13 compares particulate matter emissions across all Alternatives. While estimated emissions under Alternative 2 are slightly less than estimated emissions under Alternative 3, the results are very similar for both action Alternatives. It is important to note that emissions estimates under Alternative 2 are slightly lower than those under Alternative 3, despite the fact that slightly more acres will be burned under Alternative 2. This is due to variances in fuelbed acreages between Alternatives.

Table 3-13. Emissions from prescribed fire and their contribution to the total pollution load in the analysis area.

Alternative	Pollutant	Annual Rx Fire Emissions North Unit (Tons)	Annual Rx Fire Emissions South Unit (Tons)	Total Annual Project-Related Emissions (Tons)	Total Regional Emissions (Tons per year)	Percent Rx Fire of Total Regional Emissions
Alternative 1	**PM_{10}**	0	0	0	5489	0%
	$PM_{2.5}$	0	0	0	1614	0%
Alternative 2	**PM_{10}**	40.2	15.7	55.9	5489	1.02%
	$PM_{2.5}$	35.8	14.1	49.8	1614	3.09%
Alternative 3	**PM_{10}**	42.5	14.4	56.9	5489	1.04%
	$PM_{2.5}$	37.9	12.9	50.7	1614	3.14%

Cumulative Effects

The cumulative air resource analysis is unique in that past impacts to air quality are not usually evident. Prescribed fires, particularly those that are smaller in size are short lived, lasting only a matter of hours. The residence times in the atmosphere for most air pollutants emitted from prescribed fires is also short lived; the high concentrations of pollutants that are emitted during the burn dissipate and move out of the area. In other words, the pollutants emitted during one day of burning activities would not necessarily remain in the atmosphere and accumulate with those emitted during a subsequent day (continued emission of pollutants from smoldering of fuels could however cumulatively add to subsequent activities). If burns in close proximity are not ignited on the same day the cumulative effects would not be an issue.

Unavoidable Adverse Impacts

While prescribed fires will ultimately result in the emission of particulate matter, these impacts are expected to be short term, and will not contribute to a violation of the NAAQS. Additionally, because there are relatively few smoke sensitive areas near the burn units, air quality effects to the closest smoke sensitive area, Marlinton, can be easily mitigated by burning with a wind direction that will push smoke away from the community. Given these factors, it is not expected that air quality impacts will be adverse.

Irreversible or Irretrievable Commitment of Resources

There is not an irreversible or irretrievable commitment of the air resource for the Middle Mountain project under any alternative.

3.5. Biological Resources

3.5.1. Vegetation and Timber Management

Affected Environment

Past Vegetation Management Activities

Humans have been in Pocahontas County for approximately 12,000 years beginning in the Paleo-Indian period (10,000 to 8,000 B.C.) (Yarnell 1998). Historians estimate the pre-settlement population in North America could have been as low as 18 million to over 100 million (Brose et al 2001). There is general agreement that these large populations of original inhabitants were advanced enough to significantly alter the vegetation of this region through the use of fire for subsistence agriculture, hunting, range management, and travel (Brown 2000).

The first settlers arrived in Pocahontas County around 1750. Slash and burn agriculture along with the practice of "deadening" (girdling trees) were the primary methods for growing crops and grazing livestock. Most agriculture in the area was on a land rotation basis (when a parcel of land would no longer support agriculture use another parcel of land was selected) since commercial fertilizers were not readily available and modern farming practices that limit erosion were not utilized. These methods were practiced by the first settlers and continued for several generations. In 1870 the population of Pocahontas County was 4,069 and by 1920 the population was over 15,000 (Lewis 1998). From the late 19th century through the 1920's, timber companies logged most of this area by clearcutting.

These past activities across the general landscape of the Monongahela National Forest (MNF) have set the stage for the existing conditions of the resources and are factored into the description of the affected environment.

Management activities have continued in the recent past in the Middle Mountain area. Middle Mountain lies within the Douthat Creek Opportunity Area that contains about 6,800 acres of National Forest System (NFS) lands and approximately 800 acres of private land. Timber harvest activities in the past 20 years have the potential to contribute to cumulative effects. The following timber sales have occurred on NFS lands in the Middle Mountain area since 1986.

Table 3-14: Timber Sales in the Middle Mountain area in the Past 20 Years

Activity Name	OA#/ Compartment	Year Completed	Acres	% of OA Affected
Lost Bottom Timber Sale	46.118/51,52,53,54	2001	281	4.1
Douthat Creek Timber Sale	46.118/51	1990	235	3.5

Species Composition (Forest Type)
Species composition of the forest is displayed as forest types. In the Middle Mountain area on the Marlinton Ranger District the mixed oak forest type comprises approximately 62 percent and 30 percent are in the pine-oak types. Forested stands in the mid to late successional stages make up about 88 percent of the area with about 4 percent in stands less than 20 years old (early successional stage) and less than 2 percent in non-forest openings. In comparison, on national forest lands within the MNF proclamation boundary, the mixed oak forest type comprises about 25 percent and 5 percent are in the oak-pine types with 92 percent in the mid to late successional stages and 3 percent in stands less than 20 years old. The mixed oak forest type consists of a variety of species including white, northern red, black, scarlet, and chestnut oaks with shagbark, mockernut, and pignut hickories being less abundant. Other tree species associated with the mixed oak forest type are blackgum, red maple, black locust, pitch pine, and white pine. Striped maple is a common understory species.

Issues and Concerns Addressed
Most of the issues have been addressed in the alternatives either by designing the project to avoid significant negative impacts or by using mitigation measures to minimize, reduce, or rectify expected adverse impacts. Issues significant to the proposed action were identified by the ID Team during the internal and external scoping process and have been addressed in this analysis.

Methodology

- The impacts of the alternatives on the vegetation resource will be described by a quantitative discussion of the changes in forest type and age class in terms of both acres and percentages of the opportunity area, including a description of acres of thinning and savannah harvest by alternative. This discussion will include commercial activities and cultural treatments. Normally, the forest type remains the same as the parent stand after a thinning harvest but changes when a savannah is created in place of a more densely forested stand. Openings and savannahs created for wildlife will change the forest type to a grassy/herbaceous opening or brush forest type and the age class will change to no age class. Age class changes will not occur for thinning harvests.
- The effects of herbicide use in Alternative 3 will be addressed using the Human Health and Ecological Risk Assessments prepared for the USDA Forest Service by the Syracuse Environmental Research Associates, Inc.
- Economics will be addressed through a quantitative discussion and comparison of costs vs. revenues for each alternative.

Environmental Consequences (Direct and Indirect Effects)
The project area is presently a generally even-aged forest of a wide mix of species. The mix includes species with low and high shade tolerances, different requirements for regeneration, different growth rates, and different longevity. For example, while a red oak tree may be moderately tolerant of shade when it is in the mid- or upper-canopy, the tree as a seedling needed high levels of sunlight to survive and grow to that canopy level. While a red maple may be growing in full sun in the upper canopy, maple seedlings can survive and grow for many years under the dense shade of older trees.

Stands proposed for harvest in Alternatives 2 and 3 are mostly in the mixed oak forest types. All forest types include other associated species, occurring in lower numbers than those listed as the forest type.

Intermediate harvests (thinnings) are proposed in stands adjacent to the savannah units. The purposes of the thinnings are to:

- Improve forest structure and diversity for wildlife habitat enhancement.
- Increase potential growth and improve quality in the residual trees by freeing them from competiton.

Some regeneration will occur after a thinning, though this is not the purpose of this project. Stands to be thinned will retain an average basal area of 50 to 60 square feet per acre. Oaks and hickories will be favored as leave trees along with flowering dogwood and serviceberry.

Savannahs will retain an average of 25 to 35 square feet of basal area per acre in mostly oak and hickory species.

Alternative 1 (No Action)

The no action alternative retains the existing condition of forested stands. However, the long term effect of no active management would increase the amount of maple while decreasing the oak component.

Alternative 2

The proposed action, Alternative 2, would create 5 savannah units with a total of approximately 27 acres. The direct effect would be to convert about 23 acres of mixed oak forest type and less than 3 acres of oak-pine forest type to a grassy, open non-forest type. In addition approximately 82 acres would receive an intermediate harvest treatment (thinning). The forest type would remain the same in the thinnings as the existing forest type. The direct effect of the thinnings would be to maintain the forest types as mixed oak and oak-pine rather than converting them to a forest type (in the long-term) that would contain more maple species. About 486 acres would receive a prescribed burn treatment every 3 to 5 years to maintain the savannahs as grassy openings and retain the mixed oak and oak-pine forest types that presently comprise over 90 percent of the area. The burning would likely increase regeneration potential of pine species with serotinous cones. Fire encourages the serotinous cones to open and release the seed and provides a seed bed that enhances germination and growth.

Alternative 3

Approximately 56 acres of savannahs would be created in 8 units in Alternative 3. The direct effect would be to convert about 41 acres of mixed oak forest type and 15 acres of oak-pine forest type to a grassy, open non-forest type. Intermediate harvests would occur on approximately 131 acres (49 acres more than Alternative 2). The direct effect of the thinnings would be the same as Alternative 2 except that more acres would be more likely to retain the existing forest type in the long-term. Prescribed burning would be the same in this alternative as Alternative 2.

Alternative 3 would potentially use herbicides on about 27 acres in the project area if prescribed burning does not accomplish the objective of maintaining savannah units 1, 2, 6, 7, and 8 relatively free of encroaching young woody stems of striped maple and black locust. Savannah units 3, 4, and 5 will be maintained by mowing. Herbicide use is not expected to adversely

affect resources or human health in the project area. Effects of the herbicides that may be used (triclopyr and glyphosate) are well documented in Human Health and Ecological Risk Assessment Reports performed for the USDA Forest Service by Syracuse Environmental Research Associates in 2003. The 1989 Vegetation Management FEIS conducted by Region 8 of the USDA Forest Service documents the effects of herbicide use and prescribed fire on various resources as well as human health and safety. The effects of prescribed fire for Alternative 3 would be the same as Alternative 2.

Environmental Conseqeunces (Cumulative Effects)

The proposed action and Alternative 3 attempt to control competing woody vegetation within the savannah units in an effort to maintain grassy openings. This action will not eradicate striped maple or black locust from the stands or the project area. Some stems in herbicide treated stands will be missed, some will sprout back, and seed will come in from surrounding, untreated areas (by wind, gravity, or animal). There will be no significant adverse effects of the control actions on overall stand composition, species diversity, or genetic diversity. These actions would have a positive effect on the ability of grasses to remain the dominant vegetation in the savannahs.

Due to the limited nature of application (basal spray with low pressure backpack sprayer, cut surface treatment with handtools, and treating only individual stems of striped maple and black locust), the limited amount of acres (approximately 27) involved in alternative 3, the restriction to using only triclopyr and/or glyphosate herbicides, and the mitigations that will be applied, no negative effects are anticipated. Herbicide use will be limited to treating individual stems in alternative 3 only if prescribed burning has not been successful in achieving the objective of maintaining grassy openings within savannh units 1, 2, 6, 7, and 8. There will be no broadcast spraying or aerial spraying in these projects. Application rates will not exceed those specified in this analysis.

If herbicides are applied in the manner described above, there would be little to no cumulative effects as the proposed herbicides do not bioaccumate. Over time, the applied herbicides would be broken down through degradation of many forms (microbial, chemical decay, photodegradation, etc.) and residual concentrations in the soil would be trace. Triclopyr is readily absorbed by roots and foliage and translocate easily to meristem tissue in the plants. This compound is metabolized by bacteria and photodegrades rapidly. Its half-life is less than 10 hours in water, but is more persistent in soils. It is moderately soluble and not strongly absorbed in the soil. Studies indicate it is not usually leached into the water table under normal use (Lee and others 1986). Glyphosate is a broad-spectrum herbicide that is very effective on a number of forest weed species and is strongly absorbed by the soil. The major degradation pathway is microbial breakdown in the soil although varying rates result in a longer half-life than some of the other common herbicides used in forest management. Glyphosate does not photodecompose to any extent and does not volatilize. The effects of using these herbicides would not be long-term and would not be cumulative as long as they are applied according to State law and label requirements and the recommended application rates and mitigations described in this document.

It is likely that some landowners do use herbicides and pesticides on agricultural lands, though no such use is known. Considering the past chemical uses on both private and National Forest lands, the limited potential use proposed here, and any foreseeable future actions, no significant cumulative effects will be caused by the proposed use of triclopyr and/or glyphosate.

For the past 50+ years, fire prevention and suppression have been largely successful in this area. Most forest fires are caused by arson or escaped debris burns. Debris burning laws are established within West Virginia and most landowners comply with the law within the boundaries of the national forest. An increase in burning on private lands is not expected. Prescribed burning on national forest land is expected to increase over the next 5 to 10 years. However, it is expected that the total MNF land base effected by prescribed burning will be less than 1% per year . Therefore, the cumulative effects are expected to be negligible.

The no action alternative favors natural succession and therefore favors more shade tolerant tree species. No management actions would be implemented for this entry to control species which compete with the less shade tolerant hard mast species. Striped maple and black locust would continue to encroach in grassy open areas.

Alternatives 2 and 3 include some timber harvest activity but the amount is minor and the cumulative effect is negligible:

- 82 acres in Alternative 2 or slightly more than 1 percent of the Douthat Creek Opportunity Area.
- 131 acres in Alternative 3 or less than 2 percent of the Douthat Creek Opportunity Area.

No regeneration harvests are proposed for this project.

3.5.2. Forest Ecology/Wildlife Management

Resource Impacts Addressed

This section of the document discusses how the Middle Mountain Savannah Project may change terrestrial wildlife habitat. It also considers effects to five of the species recognized as Forest management indicator species (MIS) (Forest Plan, p. 83), which represent important game species, threatened and endangered species and species inhabiting specific ecosystems.

The MIS addressed in this section include white-tailed deer (*Odocoileus virginianus*), gray squirrel (*Sciurus carolinensis*), black bear (*Ursus americanus*), *and* wild turkey (*Meleagris gallopavo*).

The effects to the four terrestrial MIS that are listed as threatened or endangered species (Virginia big-eared bat, Indiana bat, northern flying squirrel, and Cheat Mountain salamander) are documented in the specialist report "Terrestrial Threatened and Endangered Animals" section (Project File Section H). Also, effects to aquatic MIS (brook trout, brown trout, and rainbow trout) are documented in the specialist report "Aquatic Resources" section of this document and the specialist report (Project File, Section I).

Affected Environment

The Middle Mountain Savannah project area is located approximately three miles south of Minnehaha Springs in Pocahontas County, West Virginia. The project area is east of Douthat Creek and runs along the ridge of Middle Mountain adjacent to Forest Roads 790 and 962. Elevations range from about 2,480′ on Douthat Creek to about 3,280′ on Middle Mountain. The proposed project is located within the WVDNR's southern end of the Rimel Wildlife Management Area and the northern end of the Neola Wildlife Management Area.

The project area contains two management prescriptions as described in the Monongahela National Forest Land Management Plan (MNFLMP). An estimated 466 acres of Management Prescription (MP) 6.1 and an estimated 16 acres of MP 6.2 are located within the project area. This project is expected to meet the forest-wide standards and guidelines, and direction for these Management Prescriptions.

According to DeGraaf *et al*. 1992, wildlife habitat is the sum of environmental factors that a given species needs to survive and reproduce. Wildlife abundance and diversity is dependent upon habitat availability. There are approximately 542 species (68 mammals, 230 birds, 160 fish, 42 reptiles, and 42 amphibians) utilizing the Monongahela National Forest's diverse vegetative and stream habitats during their lives. To truly understand these ecosystems and more importantly to describe the relevant resources that would affect or would be affected by alternatives identified in this Environmental Assessment, each species and its niche must be considered, followed by groups of species and interactions between them. Describing all these interactions within an ecosystem rigorously and quantitatively would be impossible. Instead, the Forest has identified species that are of particular interest for various reasons. These species include 11 federally listed threatened and endangered (T&E) species, 91 regional Sensitive (S) species and 10 Management Indicator Species (MIS). Forest MIS represent important game species, T&E species and species with special habitat requirements; therefore several species are both MIS and T&E. A Likelihood of Occurrence (LOO) table (see Biological Evaluation, PF, Section N) has been used to determine if a species or habitat is found within the project area.

Forest Composition (Horizontal and Vertical Diversity)

Horizontal and vertical diversity are two components that affect wildlife distribution and use. Horizontal diversity or "patchiness" refers to plant community complexity or arrangement and is evaluated at the landscape scale. Vertical diversity refers to the extent to which plants are layered within a site and is evaluated at the stand scale (DeGraaf *et al*., 1992). Stands with a high vertical diversity typically develop multiple vegetative layers and are generally characterized by a diverse over-story, woody mid-story layers, and a well-developed herbaceous and shrub under-story. Structural diversity (usually within vertical diversity) has important wildlife implications because many songbirds, reptiles and amphibians are sensitive to vertical structure changes.

Table 3-15. Forest Types and Percent of Acres per Management Prescription			
Forest Type	**CDS Forest code**	**Acres**	**Percent of Total Acres**
Eastern White Pine	03	0.3	0.3
Oak/ Eastern White Pine	43	16.6	3.4
Virginia Pine/Hardwoods	45	94.7	19.1
White Oak	54	0.2	< 0.1
Mixed Oak	59	382.2	77.2
Opening	99	1	0.2
Total		**495**	**100 %**

Table 3-16. Size and Age Classes on National Forest System lands within compartments affected by the project.						
Age Classes	**Compartments**					
	51	**52**	**53**	**54**	**663**	**Total Ac**
Open Brushy	22.7	4.8	3.7	50.6	4.1	**85.9**
0 - 19 years old	235.5	50.8	101.7	82.2	0.0	**470.2**
20 - 39 years old	134.5	0.0	125.2	0.0	102.7	**362.4**
40 - 59 years old	32.1	0.0	0.0	20.3	41.4	**93.8**
60 - 79 years old	871.2	300.8	495.2	125.6	73.8	**1866.6**
80 - 99 years old	721.1	937.4	545.0	715.2	580.5	**3499.2**
100 - 119 years old	374.9	214.2	138.1	221.4	136.4	**1085.0**
120 + years old	121.9	107.6	92.3	115.1	178.3	**615.2**
0 - Private Ownership - unknown age	40.3	550.8	45.2	137.0	11.6	**784.9**
Total acres	**2554.2**	**2166.4**	**1546.4**	**1467.4**	**1128.8**	**8863.2**

SUCCESSIONAL STAGES

Openings/Non-forested habitat

Maintained openings, grazing allotments and non-forested habitat are important wildlife habitat components. Upland, lowland and wetland non-forest types provide basic habitats for distinct groups of species. These non-forest types are seasonally important elements for wildlife that also use forested habitat (such as brood habitat for ruffed grouse and turkey and spring and fall forage for deer and black bear). Non-forested habitat totals approximately 85.9 acre or about 1% of the analysis area.

Early-Successional Forest (seedling/sapling stages 0-19 years)

Early successional or seedling/sapling habitat is currently found on approximately 470 acres or about 5 percent of the analysis area. Thickets of rhododendron and mountain laurel are found predominantly along the lower slopes and drainages. These thickets provide protection during hunting seasons and thermal cover throughout the winter months.

Mid – Mid/ late successional habitat (20 – 59 years)

This habitat is currently found on approximately 456.2 acres of the analysis area. Species diversity numbers tend to decline in this stage (as compared to regenerated stands) because of the rapid growth and decline of herbaceous/shrub layer and diversity created by edges between habitats decrease. Species dependent on this environment include: Alder Flycatcher, Eastern kingbird, horned lark, eastern bluebird, Brown thrasher, loggerhead shrike, white-eyed vireo, yellow warbler, chestnut-sided warbler, Indigo bunting, New England cottontail, Meadow jumping mouse and white-tailed deer (DeGraaf 2001).

Mature Forest (60- 99 years)

Sawtimber forest habitat includes mature hardwoods, mature conifer and mature mixed hardwood/conifer communities. Sawtimber forest conditions predominate throughout the project area. Approximately 5,365.8 acres (61%) of the analysis area falls within this age class. Species expected in this age class include: pileated woodpecker, eastern phoebe, gray squirrel and southern flying squirrel. The majority of mature habitat occurs with the mixed hardwood community, however some areas also include a white pine component. This conifer component can affect wildlife distribution and use, since these inclusions provide feeding, nesting and winter shelter opportunities in deciduous stands that pure hardwood stands cannot provide.

Oldest Growth (100 + years)

The Forest Plan provides general guidelines that are related to the amount and distribution of old growth for each management area. For MP 6.1 lands, old growth is to be provided on a minimum of 5% of the area. While Forest Plan guidelines provide general direction as to amounts, current literature provides a more comprehensive definition of old growth features. Forest Plan criteria considered stands from the oldest age classes for designation. However, we now recognize that age is only one criterion, and that true old growth contains values that can only be developed over time. We now consider older age stands as late-successional forest or "potential" old growth. Although 1700 acres or 19% of the analysis provides the oldest forest conditions, all forested stands are second or third-growth forest and there is presently no true old

growth within the area. Species expected to inhabit this ecosystem include: Acadian flycatcher and terrestrial salamanders.

3.5.2.1. Wildlife and Management Indicator Species (MIS)

White-tailed Deer (*Odocoileus virginianus*) - This species is an indicator of early-successional or regenerating deciduous habitat in combination with mature forests. Deer rely on a mosaic of forested and non-forested ecosystems providing cover and foraging habitat. Tree harvesting typically converts forested cover into early successional stages of vegetation that function as important foraging areas. However, overabundant deer densities preclude tree regeneration and over time alter tree species composition (Tilghman 1989). White-tailed deer are considered a "keystone" herbivore, capable of affecting the distribution and abundance of many other wildlife species, plant species and plant communities (Waller and Alverson 1997).

Black bear (*Ursus americanus*) – This species is an indicator of mature/late-successional forests and does best in oak/hickory or mixed mesophytic forests with an understory of blueberry, blackberry, raspberry, rhododendron and mountain laurel. Black bear is the emphasis species in MP 6.1 areas. Black bear feed primarily on grasses and forbs and thickets of grape and greenbrier provide key feeding areas in the spring. Greenbrier thickets are found throughout the area, grape arbors are less common and blueberry occurs occasionally along upper slopes and ridge-tops.

Gray squirrel (*Sciurus carolinensis*) – This mature/late successional forest species is found virtually in most woodland areas, especially oak, hickory and beech forests which provides food over a long season and an abundance of den and cavity trees. The Forest Plan population objectives for gray squirrel in the project area are 1726-squirrel per square mile in an oak - hickory type ecosystem. This small games species is the most popular game animal in West Virginia with annual harvests approaching 2 million. Although the WVDNR does not track yearly harvests on squirrel, annual population fluctuations are normal. These fluctuations occur in response to hard mast abundance the preceding year. With approximately 80% of the analysis area currently capable of hard mast production, there is an abundance of gray squirrel habitat available within the analysis area.

Turkey (*Meleagris gallopavo*) – This species is typically associated with grassy openings, thickets of dense cover, scattered clumps of conifers and extensive tracts of mature/late-successional forests. 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 % in summer (Dickson 1990). Insects, herbaceous material and grass seed dominate the summer diet.

The thinning harvest, and wildlife opening creation proposed in both action alternatives will ensure future mast production and provide additional brood habitat. In addition the burning under alternative 3 will help open up the understory within the project area. All of these activities will help move turkey populations toward the desired population objectives for this area.

Indiana bat (*Myotis sodalis*) – See terrestrial Threatened and Endangered Animals Section.

Virginia big-eared bat – See terrestrial Threatened and Endangered Animals Section.

Cheat Mountain salamander – See terrestrial Threatened and Endangered Animals Section.

West Virginia northern flying squirrel – See terrestrial Threatened and Endangered Animals Section.

Wild trout – See Aquatic Resources section

Scope of the Analysis

The area considered for direct, indirect, and cumulative effects to MIS wildlife includes all of the compartments affected by the project (see table 3-16). Direct and indirect effects will be limited to the project area in the vicinity of management activities.

Methodology

The effects analysis was based on review of literature and scientific knowledge concerning the effects of timber harvest, herbicide use and burning 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 project area. Available population information for MIS was considered.

No Action Alternative

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, additional human presence, 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 by species dependent on open habitat. The No Action Alternative could result in an increase in maple species and an overall decrease in hard mast producing species across the project area.

Action Alternatives

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, skidding or burning; (2) disturbance or destruction of nesting and roosting sites, cover vegetation, or food sources; (3) disturbance from equipment use, vehicle traffic and from increased human activities in the area; and (5) soil disturbance and compaction during road use and skidding.

Alternative 2

The proposed action, Alternative 2, would create approximately 27 acres of additional open habitat and two waterholes within the project area. Approximately 82 acres would be thinned to allow for continued hard mast production from these stands. About 486 acres would receive a rotational prescribed burn treatment to maintain the savannahs as grassy openings and retain the mixed oak and oak-pine forest types.

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, skidding or burning; (2) disturbance or destruction of nesting and roosting sites, cover vegetation, or food sources; (3) disturbance from equipment use, vehicle traffic and from increased human activities in the area; and (5) soil disturbance and compaction during road use and skidding.

Longer-term indirect effects would include (1) increased brood range for turkey and additional habitat for other species dependent on grassy openings; (2) additional water sources for wildlife drinking and for amphibian reproduction; (3) continued hard mast production; (4) and increased soft mast production along the created edge habitat.

Alternative 3
Under Alternative 3, approximately 56 acres of savannahs and three water holes would be created with approximately 131 acres would be thinned and prescribed burning would be used on 486 acres. If prescribed burning is not sufficient to maintain the savannahs in units 1,2,6,7 and 8 then triclopyr and glyphosate will be used to maintain this habitat.

The effects of prescribed fire for Alternative 3 would be the same as Alternative 2.

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.

Proposed Action
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, 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 broader landscape surrounding the 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.

Management activities have continued in the recent past in the Middle Mountain area. Middle Mountain lies within the Douthat Creek Opportunity Area that contains about 6,800 acres of National Forest System (NFS) lands and approximately 800 acres of private land. Timber

harvest activities in the past 20 years have the potential to contribute to cumulative effects. The following timber sales have occurred on NFS lands in the Middle Mountain area since 1986.

Alternatives 2 and 3 include some timber harvest activity but the amount is minor and the cumulative effect is negligible:

- 82 acres in Alternative 2 or slightly more than 1 percent of the Douthat Creek Opportunity Area.
- 131 acres in Alternative 3 or less than 2 percent of the Douthat Creek Opportunity Area.

No regeneration harvests are proposed for this project.

The implementation of 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 proposed action and Alternative 3 attempt to control competing woody vegetation within the savannah units in an effort to maintain grassy openings. This will be accomplished by burning and or herbicide use.

An increase in burning on private lands is not expected. Prescribed burning on national forest land is expected to increase over the next 5 to 10 years. However, it is expected that the total MNF land base effected by prescribed burning will be less than 1% per year. Therefore, the cumulative effects are expected to be negligible.

Due to the limited nature of hebicide application (basal spray with low pressure backpack sprayer, cut surface treatment with handtools, and treating only individual stems of striped maple and black locust), the limited amount of acres (approximately 27) involved in alternative 3, the restriction to using only triclopyr and/or glyphosate herbicides, and the mitigations that will be applied, no negative effects are anticipated. Herbicide use will be limited to treating individual stems in alternative 3 only if prescribed burning has not been successful in achieving the objective of maintaining grassy openings within savannh units 1, 2, 6, 7, and 8. There will be no broadcast spraying or aerial spraying in these projects. Application rates will not exceed those specified in this analysis. Considering the past chemical uses on both private and National Forest lands, the limited potential use proposed here, and any foreseeable future actions, no significant cumulative effects will be caused by the proposed use of triclopyr and/or glyphosate.

These actions would have a positive effect on the ability of grasses to remain the dominant vegetation in the savannahs. Species in the project area limited to mature habitat, would experience population declines due to these cumulative effects. However, the relatively small footprint of the project activities would have a very limited impact on these species and mature forests and the species that inhabit them are expected to continue to dominate the majority of the surrounding 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 alternative are unavoidable because they are associated with activities that would occur if one of the action alternatives is implemented.

Irreversible or Irretrievable Commitment of Resources

The no action alternative does not involve new action, thus it would not commit any wildlife resources. The action alternative would result in the conversion of some mature forest habitat to open habitat. The action alternative would cause an irretrievable commitment of forested and herbaceous habitat associated with the construction of the savannah habitat. These commitments are not anticipated to be irreversible.

3.5.2.2. 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-foot-wide edge and a 328-foot-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-foot 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-foot 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 very 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

The analysis area (National Forest and other ownerships combined) currently contains approximately 7569 acres of closed-canopy forest and approximately 1295 acres of permanent and temporary openings. Permanent openings include agricultural fields, residential areas,

wildlife openings, etc. Temporary openings consist primarily of recent even-aged timber harvests.

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 the analysis area was determined using ArcView/ArcGis.

Based on an edge width of 49 feet, the acreage is divided into approximately 7801 acres of interior forest and approximately 506 acres of edges. Using a 328-foot edge width, the project area contains approximately 4536 acres of interior forest and approximately 3265 acres of edges. This translates to an interior to edge ratio of about 1.4:1; percent core area is about 51 percent. This level of fragmentation would typically be approaching a level of concern, but it must be realized that 470 acres (almost 1200 acres of edge) which are included in this calculation are in stages of regeneration. Current levels of fragmentation reflect the intensity of management on both National Forest and private land in the project area, but these regeneration areas mature there associated edge effect will be subtracted from the current conditions. This process would eventually move 1670 acres to interior forest and account for a 3.9:1 interior to edge ratio.

Scope of the Analysis

The areas considered for direct, indirect, and cumulative effects of fragmentation are the project area, and the corresponding compartments that will be affected by the project.

The temporal boundary for most effects would be permanent however as discussed previously 470 acres of the analyzed area will eventually return to forested conditions.

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, roads 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

Table 3 summarizes forest fragmentation impacts by alternative.

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 26 acres of the project area from forest to openings; this would increase the total area of openings from approximately 1295 acres to approximately 1321 acres. Based on a 49-foot edge width, the Proposed Action would create approximately 13 acres of new edge, raising the amount of 49-foot-wide edge from approximately 506 acres to approximately 519 acres. The proposed action would create approximately 76 acres of new 328-foot-wide edge, raising the total amount from approximately 3264 acres to approximately 3340 acres for up to 20; however, edge effects would decline gradually during this time as existing timber harvest openings close. Immediately after harvest, percent core area would decline from about 49 percent to about 47, which is above the hypothesized 40 percent threshold where fragments are believed to begin acting as population sinks.

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 23 percent (approximately 206,000 acres) of National Forest land is centered in wilderness areas and remote backcountry, and an additional 12 percent (approximately 112,000 acres) in zoological areas reserved for management of the West Virginia northern flying squirrel.

Alternative 3
Alternative would change approximately 55 acres of the project area from forest to openings, increasing the total area of openings from approximately 1295 acres to approximately 1350 acres. 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-foot edge width, Alternative 3 would create approximately 23 acres of new edge, raising the amount of 49-foot-wide edge from approximately 506 acres to approximately 529 acres. Alternative 3 would create approximately 732 acres of new 328-foot-wide edge, raising the total amount from approximately 3264 acres to approximately 3996 acres. This would cause a decrease in the interior to edge ratio from about 1.3:1 to about 0.9:1. Percent core area would also show a decline, from about 49 percent to about 40 percent. The increases in edge habitat and associated fragmentation effects would persist as long as the openings are maintained. 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 (470 acres), the area of openings and edge would decline over time and the future amount of openings and edge would depend on the extent of future activities.

Table 3-16. Forest fragmentation impacts by alternative (Estimated Numbers)

	Existing Condition/ (No Action)	(Proposed Action)	Alternative 3
Total project area size (acres)	8864	8864	8864
Open area (acres)	1295	1321	1350
Forested area (acres)	7569	7543	7514
Based on a 49-foot Edge Width			
Edge area (acres)	506	519	529
Interior area (acres)	7063	7024	6985
Based on a 328-foot Edge Width			
Edge area (acres)	3264	3340	3996
Interior area (acres)	4305	4203	3518
Change in interior (%)	NA		
Interior:edge ratio	1.3:1	1.3:1	0.9:1
Percent core area	49	47	40

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.

Proposed Action

The past, present, and reasonably foreseeable actions outlined in Table 3-1 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. 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 23 percent of the National Forest land is managed as wilderness and remote backcountry, which provides forest interior habitat.

Alternative 3
The fragmentation effects outlined above for Alternative 3 would make a greater contribution to the cumulative effects of fragmentation caused by past, present, and reasonably foreseeable future actions. This contribution to cumulative fragmentation would persist as long as the savannah habitat is maintained. However, as the 470 acres of existing regeneration units begin to convert to forested habitat the overall fragmentation of the area will decrease.

Unavoidable Adverse Impacts
The adverse effects of fragmentation identified for each alternative are unavoidable if that alternative is implemented.

Irreversible or Irretrievable Commitment of Resources
The action alternatives would cause irretrievable fragmentation of forested habitat due to creation of savannah habitat. However, these effects are not irreversible because the savannah areas would revert back to forested areas if for some reason future maintenance was not continued.

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 6.1, which calls for a areas to be a mosaic of tree stands and openings. (Forest Plan, p.165).

3.5.2.3. Terrestrial Threatened and Endangered Animals (TE)

Affected Environment
All threatened and endangered species on the Forest were considered in this analysis. Forest records do not show any threatened or endangered species located within the project's boundaries, although it may be assumed that some of these species may at times use the habitat within the project area. For more information refer to the "Likelihood of Occurrence" (LOO) table in the project file.

Bald Eagle *(Haliaeetus leucocephalus)*
On July 12, 1995, the USFWS reclassified the bald eagle, from endangered to threatened throughout the lower 48 states of the U.S. In March 1998, the USFWS announced plans to analyze information to determine if the bald eagle should be de-listed. In July 1999 the USFWS proposed de-listing the bald eagle.

Bald eagles are closely associated with large bodies of water with abundant fish populations during both the breeding and non-breeding season (DeGraaf et al. 1991, DeGraaf and Yamasaki 2001). During the breeding season, bald eagles appear to prefer large lakes, rivers, or estuaries in open areas adjacent to forests (DeGraaf and Yamasaki 2001). Nest trees are large, dominant trees, with an unobstructed flight path to the nest (McEwan and Hirth 1979, Anthony and Isaacs 1989). Andrew and Mosher (1982) found that nesting eagles in Maryland (MD) selected nest trees in forested areas with an open, mature structure located in close proximity to water. Eagles in WV appear to select similar habitats. Known bald eagle nests in WV occur along major rivers.

Eagles forage along rivers, large streams, and lakes, where they perch in trees near the waters' edge and wait for fish or waterfowl to come along. The bald eagle's diet consists of fish, waterfowl and other birds, carrion, small- to medium-sized mammals, and turtles (DeGraaf et al 1991), however the percentage comprised by each one of these food items may vary regionally. Todd et al (1982) found that fish comprised 77% of the diet for eagles nesting inland, whereas eagles nesting in coastal regions relied more heavily on fish (76%). The closest known bald eagle nest to the Cherry River watershed is located approximately 28 miles away. It is possible that bald eagles may be seen during migration along Middle Mountain, however there are no known nests within or near the project area.

Indiana bat (*Myotis sodalis*)

There is no known suitable hibernacula or maternity sites within or near the planning area. 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 Forest Plan threatened and endangered species amendment was signed in the end of 2004. The amendment created Management Prescription 6.3 areas around known hibernacula, OA 838 and identified standards and guidelines specific to Indiana bat habitat management.

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 – OA 838

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 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 on private land approximately one mile from national forest land. Hellhole cave is located approximately 56 miles from the project. There are no Indiana bat caves near the project area. At 11 miles from the project area, Tubb cave is the nearest Indiana bat hibernacula.

Maternity sites – OA 838

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 hickory, red and white oak, sugar maple, white and green ash, and sassafras, are plentiful throughout the Forest and most are found in the project area. Forest Service land within the project area is almost all forested, with 80 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. 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. At over 60

miles from the project area, the area of influence for this maternity site falls well outside of the project area boundary.

Primary Range – MP 6.3

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. 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 project area.

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," and assigned **Management Prescription 6.3**, unless they were previously assigned to another Management Prescription that does not allow programmed timber harvest. Within this 6.3 Management Prescription, vegetation greater than 5 inches dbh may be managed only for the benefit of the Indiana bat, for other threatened and endangered species habitat, for maintenance or enhancement of natural vegetative communities, or for public safety (Forest Plan, page 190b). 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 – OA 838

The 1986 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.

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 the project area.

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. 2002). 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).

The closest hibernacula to the project area is Stewart Run Cave, which is approximately 30 miles North of the project area.

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. There are no areas of influence for Virginia big-eared bat within the project area.

There are no known Virginia big-eared bat hibernacula or maternity caves 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. There is no 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 WVNFS suitable habitat is 1.5 miles from the project area.

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 use, harvest, burning and yarding activities. The time period of analysis of indirect and cumulative effects is approximately 20 years post-rehabilitation, when tree canopies of the old roadways 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 project area (LOO table). 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 2001), the corresponding Biological Opinion from the U.S. Fish and Wildlife Service (USFWS 2002), and the recently approved Forest Plan Amendment for threatened and endangered species on the MNF.

Direct/Indirect Environmental Consequences

No Action Alternative

Bald Eagle: There are no activities proposed that would directly affect bald eagles or have adverse impacts to its foraging habitat. As a result, there are no adverse effects anticipated to this species under the No Action Alternative.

Indiana Bat: The No Action Alternative would have no direct or indirect effects on Indiana bat hibernacula, maternity sites, key areas, summer foraging and roosting habitat, or fall swarming and migratory habitat. 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 Virginia big-eared bat hibernacula or maternity caves within the planning area or within a 6.5 mile radius of the watershed area. Therefore, implementation of this Alternative would have no direct or indirect effects on Virginia big-eared bats.

Cheat Mountain salamander: There is no potential CMS habitat within the planning area. Therefore, implementation of this alternative would have no direct or indirect effect to Cheat Mountain salamanders.

West Virginia northern flying squirrel: There is no potential WVNFS habitat within the planning area. Therefore, implementation of this alternative would have no direct or indirect effect to West Virginia northern flying squirrel

Threatened and Endangered Plants
There is no potential habitat for **running buffalo clover** (*Trifolium stoloniferum*), **shale barren rock cress** (*Arabis serotina*) or **Virginia spirea** (*Spiraea virginiana*) within the planning area. Therefore, implementation of this alternative would have no direct or indirect effect to these species.

S**mall whorled pogonia:** Surveys throughout the project area did not locate any small whorled pogonia, but potential habitat is found within the project area. However, the No Action Alternative would have no direct or indirect effects on this species because no activity would occur within any of the potential habitat.

Direct and indirect effects of the Action Alternatives

Bald Eagle: There are no activities proposed that would directly affect bald eagles or have adverse impacts to its foraging habitat. As a result, there are no adverse effects anticipated to this species under the Action Alternatives.

Indiana Bat - Hibernacula key areas and Maternity sites - 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 project area.

Primary Range – The Action Alternatives have no proposed, harvest activities within any 5-mile radius primary range (MP 6.3).

However, tree felling activities would have the potential for take, whether they occur inside or outside the primary range. Potential roost trees would be removed and future roost tree availability would be reduced by large tree removal.

Although the project site does not fall within any Indiana bat areas of influence, Indiana bats may at times use the potential roosting habitat found within the project area. Therefore, tree felling activities within the project area still have the potential for take.

The direct effects of the project are that tree removal during the non-hibernation period (April 1 - November 14) may result in mortality, harm or harassment (take) of an individual roosting Indiana bat. If a tree is removed while a bat is using it to roost, the bat could be killed. If not killed the bat would at a minimum be forced to find an alternative roost, potentially expending a significant amount of energy that would result in harm or harassment of the individual. All proposed 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 2002).

Virginia Big-Eared Bat: There are no known Virginia big-eared bat hibernacula or maternity caves within the planning area or within a 6.5 mile radius of the watershed area. Therefore, implementation of this Alternative would have no direct or indirect effects on Virginia big-eared bats.

Cheat Mountain salamander: There is no potential CMS habitat within the planning area. Therefore, implementation of this alternative would have no direct or indirect effect to Cheat Mountain salamanders.

West Virginia northern flying squirrel: There is no potential WVNFS habitat within the planning area. Therefore, implementation of this alternative would have no direct or indirect effect to West Virginia northern flying squirrel

Threatened and Endangered Plants
There is no potential habitat for **running buffalo clover** (*Trifolium stoloniferum*), **shale barren rock cress** (*Arabis serotina*) or **Virginia spirea** (*Spiraea virginiana*) within the planning area. Therefore, implementation of this alternative would have no direct or indirect effect to these species.

S**mall whorled pogonia:** Due to the potential habitat found within the project area the Action Alternatives could have direct or indirect effects on this species due to savannah creation and other soil disturbing activities. Although surveys throughout the project area did not locate any small whorled pogonia, individuals of this species may have been missed during these surveys.

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
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, 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. Both action alternatives would make minor contributions to the cumulative effects of roost tree loss. 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 2002).

Unavoidable Adverse Impacts
Some adverse impacts to individual species and/or species habitat are expected to occur as discussed above. These impacts have been mitigated to reduce the impacts but have not been eliminated.

Irreversible or Irretrievable Commitment of Resources
Individual potential roost trees may be irreversibly and irretrievably removed from the planning area.

Consistency with the Forest Plan
All alternatives would be consistent with Forest-wide standards and guidelines for threatened and endangered species (Forest Plan, pp. 84-88).

Sensitive Species – Terrestrial Animals

Resource Impacts Addressed
The Regional Forester for Region 9 has developed a list of sensitive species that occur on each national forest in the region (R9 SS list; 2670 technical update Oct. 20, 2003). Sensitive species (SS) are those plant and animal species identified by the Regional Forester for which population viability is a concern. To determine which RFSS could be affected by projects developed in the action alternative, a "Likelihood of Occurrence" (LOO) table specific to the project area was completed. A comparison between species habitat requirements and existing project area habitat, including a reasonable cumulative effects area, was made for each species listed in the LOO.

Affected Environment
Our discussions, surveys and databases indicate no USFS regionally sensitive species (RFSS) are known within the project area, however possible habitat exists for some of the R9 sensitive species such as timber rattlesnake, Sword-leaved phlox, and Turgid gay feather. However, given the scale and scope of this project effects to these individual species or their habitats is considered as possible but discountable. Therefore the determination for these R9 Sensitive species is "May impact individuals but not likely to cause a trend to federal listing or a loss of viability".

Direct/Indirect/Cumulative Effects
Soil disturbing activity can have direct, indirect, and cumulative effects on some of these species or their habitat and these effects can be variable in terms of the extent and duration. Soil disturbing activities associated with the Action Alternatives include removal of timber, grubbing stumps, prescribed burning, and opening creation.

Direct effects due to timber removal activities and road construction on many of the R9SS include directly crushing individuals, or permanently removing their territories.

With the exception of the species addressed above the project area is not expected to contain individuals or habitat for the other species identified on the Region 9 Regional Forester's Sensitive Species list. Therefore, it is reasonable to anticipate "no impacts" to those R9 sensitive species as a result of direct, indirect, or cumulative effects associated with this project. These remaining species are not brought further within this analysis.

3.6. Social Resources

3.6.1. Economics

This section of the EA discloses the potential economic impacts of the Middle Mountain alternatives. It addresses public comments regarding the monetary costs and benefits of proposed activities. Other sections of the EA describe effects on non-monetary values such as water quality, fish and wildlife habitat, recreation opportunities, vegetation, etc.

Affected Environment

The general 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 recreational opportunities, like wildlife viewing, 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 Pocahontas County, south of the community of Minnehaha Springs and north of the community of Neola, WV. The nearest town is Marlinton, WV. The project area, and as appropriate, nearby communities, were considered in the analysis of effects. Most Marlinton 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 can occur five years after a sale is completed.

The costs and values of the multiple resource action alternatives are shown in tables below, these were used to determine costs and benefits of actions proposed in the alternatives. 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. Project costs are based on similar projects that have been done recently.

Table 3-17. Costs and Values of Actions, all Alternatives	
Item	**Logging Cost**
Sale Preparation	$17.59/CCF
Sale Administration	$13.63/CCF
Herbicide Treatment	$684.87/acre
Prescribed Burning	$70.00/acre
Savannah Development (stumps removed)	$2,500.00/acre
Savannah Development (stumps remain)	$1,500.00/acre

The values shown in the table are based on the proportion of each species expected to be harvested in each stand. Chestnut oak, white oak, and northern red oak make up the biggest proportion of the sawtimber trees expected to be cut. Values are from the base period selling prices in FSH 2409.18, Chapter 40, effective date of July 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 $20.00 for pine up to $201.98 for red oak, with chestnut and white oak being $58.81 per CCF. Pulpwood base prices are $5.00 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.

Table 3-18. Timber Values, all Alternatives		
Species	**Value/CCF**	**Approximate % of Sawtimber Volume**
white pine sawtimber	$20.00	3
red maple sawtimber	$178.70	5
white oak sawtimber	$58.81	25
scarlet oak sawtimber	$57.56	2
chestnut oak sawtimber	$58.81	47
northern red oak sawtimber	$201.96	18
conifer pulpwood	$5.00	
hardwood pulpwood	$5.00	

The following tables summarize the costs and benefits that were included in the analysis. Herbicides will only be applied if prescribed burning does not accomplish the objective of maintaining the grassy openings within the savannah units.

Table 3-19. Timber Sale Costs and Revenue		
	Alternative 2	**Alternative 3**
Timber Costs		
Sale preparation	$9,833	$17,731
Sale administration	$7,619	$13,739
TOTAL	**$17,452**	**$31,470**
Timber Volume		
Sawtimber CCF	366	656
Pulpwood CCF	193	352
Stumpage Value[1]	**$33,679**	**$60,395**
Estimated Profits	**$16,227**	**$28,925**

[1] - Stumpage value was calculated using current Base Period Prices of July 2007. Competitive bidding may result in higher prices for timber sold.

Table 3-20. Wildlife Habitat Enhancement Projects		
	Alternative 2	**Alternative 3**
Herbicide	0	$17,807
Prescribed burning	$30,940	$29,610
Construct savannahs	$65,000	$112,000
Total	**$95,940**	**$159,417**

Direct/Indirect Environmental Consequences

The following table summarizes the expected costs and revenues for the No Action and Alternatives 2 and 3.

Table 3-21. Total values and costs by Alternative

	Value/ Unit	No Action	Alternative 2	Alternative 3
Timber Volume Estimated				
Volume CCF		0	559	1008
Projects				
Acres Herbicide Treatment		0	0	26
Acres Prescribed Burning		0	442	423
Acres Savannahs		0	26	56
Revenues				
Sawtimber/Pulp		0	33,679	60,395
Costs of Projects				
Sale Preparation	17.59	0	9,833	17,730
Sale Administration	13.63	0	7,619	13,739
Herbicide Treatment	684.87	0	0	17,807
Prescribed Burning	70.00	0	17,797	27,586
Construct Savannah	See Table 3	0	65,000	112,000
Total Cost		**0**	**113,391**	**190,886**
Total Net Revenues		**0**	**-79,713**	**-130,492**

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. As mentioned 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.

With all costs considered, this alternative would be expected to yield negative net revenue of approximately 80,000 dollars.

Alternative 3
With all costs considered, this alternative would be expected to yield negative net revenue of approximately $130,000.

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 and 3
The timber from Alternatives 2or 3 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. The savannah areas would retain a smaller amount of timber, but these areas would be managed primarily for wildlife habitat.

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 and 3 could result in unavoidable costs if no bids are received at the 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.

Irreversible or Irretrievable Commitment of Resources

Sale revenues would not be expected to cover the cost of all projects in either Alternative 2 or 3 would be expected to return a surplus to the treasury, even considering all direct project costs.

Volume reductions in the areas harvested are not irreversible, since they would be expected to grow back in the time frames shown above. If the savannahs are maintained as savannahs, timber would not be expected to grow back in these areas, but if maintenance were stopped in these areas, then timber would start to grow back in these areas.

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.

3.6.2. 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 Pocahontas County, the county in which the Middle Mountain Wildlife Savannah project area is located, does not demonstrate ethnic populations or income percentages greater than two times that of the State average (U.S. Census Bureau, Census 2000).

Scope of the Analysis

The communities in Pocahontas County were considered in the scope of the analysis. The temporal boundary considered was ten years from the date the construction on the project.

Methodology

The potential for Environmental Justice effects was evaluated in 2002. U.S. Census data remains the same, so this analysis is still current. Information from the US Census Bureau was used to assess the make up of communities in Pocahontas County and the possible effects of the alternatives.

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 Pocahontas County 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 Middle Mountain Wildlife Savannah activities would result in irreversible or irretrievable commitment of resources as it relates to environmental justice.

Consistency with the Forest Plan

All the Middle Mountain Wildlife Savannah alternatives would be consistent with the Forest Plan (Forest Plan, p. 39).

3.6.3. Heritage Resources

Affected Environment

Cultural Description: Prehistory and History

The conditions described in the terrestrial reference condition for this area for the distant past is integral to understanding the presence of people on the landscape for the last several thousand years. Studies of pollen and spore analyses from the region and comparative data (e.g., Carbone 1976; Davis 1983; Wilkins 1977) indicate that a southward displacement of boreal floral and faunal species followed the terminal glacial retreat. Pockets of tundra vegetation, dominated by spruce, fir and pine, extended from the north into the uplands region of the Appalachian range between 25,000 and 15,000 BP (before present). The transition to more modern flora begins between 12,500 and 10,000 with an increase in deciduous forest, with species including oak and ironwood present. This period coincided with the first probable human use of the region. This epoch also saw the extinction of many faunal species including elephants, camel, mastodon, giant bison, giant peccary, giant beaver, ground sloth, and woodland musk ox. By 10,000 the transition to a mixed coniferous-deciduous forest had begun.

By 7,500 BP mixed hardwood forests are present on the Allegheny Plateau, with the expansion of birch, oak and hickory communities. Continued warming trends led to mixed hardwood forests at higher elevations. Around 5,000 BP spruce forests experienced a resurgence in Pennsylvania and West Virginia, probably indicating the spread of diverse open forest canopies and bog settings (i.e., the growth of *Picea rubens*). Modern climatic conditions were probably in place by around 3000 BP, although various peaks-and-valleys in temperature and moisture regimes continued to the present. This affected both the vegetation mixes and fish/wildlife species and, by direct extension, subsistence patterns for people.

Human use of the landscape during the Paleo-Indian and Early/Middle Archaic sequences (ca. 11,000-6,000 BP) was largely restricted to hunting/gathering/fishing, and establishment of domestic sites. The bedrock types in the study area may have encouraged quarrying for raw material to make stone tools. The presence of numerous potential campsites in the form of rockshelters also may have encouraged human use of the landscape at this time.

The implications of the early prehistoric period on the reference condition of the Opportunity Area are minimal. Some modification of plant communities occurred through harvest and selective protection; some animal populations were controlled through hunting and trapping; and the use of fire as a habitat management tool may have occurred. However, by and large, human populations are perceived to have been too small during the early periods (Paleo-Indian and Early/Middle Archaic) to cause significant effects on the environment.

In contrast, Late Archaic and Woodland Period societies (ca. 6,000 BP to 1600+ AD, including early European colonization/Contact Period) had increasingly noticeable impacts on the

environment. Larger populations, new technologies, an evolving subsistence strategy, and associated increases in the size and duration of occupation of villages, all led to deeper and more widespread human impacts. The major activities that changed the environment were: the intentional encouragement and protection of plant communities; burning to open up the understory and enhance game habitat, targeting berry and mast species, and contributing to an oak presence; the adoption of horticulture and agriculture over the last 2,000 years, requiring cleared gardens and fields, many near streams and rivers; and biodegradation of local environments associated with, for example, long-term village locations.

In summary, subsistence activities and residential sites would have had an effect on the health and diversity of the forest community, size and behavior of wildlife species, and fragmentation of the forest. It also increased sedimentation rates in the streams near villages. The Native American population was displaced through disease and war, starting in the 17th century. The effect of smallpox on the Native American was enormous: by some estimates more than half the pre-European population was killed by smallpox before they had even laid their eyes upon a wagon. Thus, the pre-Contact patterns of their lifestyle are now known only through archaeology, oral history and a handful of early settlers' or explorers' accounts.

The European presence on the landscape changed everything. Colonization of the region began in earnest after more than a century of socio-economic disruption, demographic decline, disease, and three wars involving Indians and Europeans. A series of forts and trading posts were established in this portion of what was then Virginia between 1760 and 1791. After the conquest and pacification of the Ohio Valley tribes in the 1790s, the earliest towns were chartered; the first and nearest to the project area was Huntersville. Huntersville was named the county seat of Pocahontas County in 1821. The area around Marlinton, first settled in the 1750s, remained thinly settled and relatively undeveloped until the late 19th century. Beginning in the 1890s, the promise of growth and prosperity through the exploitation of coal and timber, aided by rail transport, saw the birth of numerous planned corporate communities in West Virginia. The town of Marlinton was purchased and platted in 1891 by the Pocahontas Land Development Company. The county seat was moved from Huntersville to Marlinton in that same year.

The next few decades witnessed more major changes to the landscape and impacts on the environment than the cumulative impact of 12,000 years of Native American land-use. By some estimates, upwards of 30 billion board feet of timber were cut in West Virginia between 1870 and 1920 (Clarkson 1964). The area was also subjected to slash fires and was more severely flooded as a result of increased surface runoff. Recognizing the devastation brought about by unregulated logging, President Wilson declared the boundaries of the Monongahela National Forest in 1920. Subsequently, significant reforestation was accomplished through the efforts of the Civilian Conservation Corps in the 1930s. Under the stewardship of the National Forest, the area is once again thriving, albeit with significantly altered floral, faunal, sediment, and hydrological regimes.

Exhaustion of the forests, coupled with the Great Depression, brought about a precipitous economic and social decline. Many towns and small communities were abandoned. Near to the project area, the infrastructure aspects of this settlement/industrial system (i.e., homes, farms, schools, mill sites, transportation systems, etc.) should tend to cluster around larger towns. Within National Forest System lands, much of this infrastructure now exists only as archaeological sites and some cultural landscapes.

Previous Survey and Site Information
Prior to the initiation of this project, no culture resource surveys had been conducted within the Middle Mountain Wildlife Savannah project area.

Current Survey and Site Information
Heritage resources surveys of the project area were conducted by National Forest heritage staff in 2005 and 2006 as part of the environmental analysis for this project. All areas that had been identified as potentially including project actions involving ground disturbance (bulldozed fire lines, savannah clearing, timber harvest, tree felling and tree skidding) were surveyed employing a combination of pedestrian examination and shovel testing. A total of eleven heritage resource sites were recorded. All of the sites were prehistoric.

The site locations were discussed with other project staff during the course of developing alternatives for the project. Based upon discussions with other specialists and the team leader, it was agreed that all project actions would specifically be designed to avoid ground disturbance by removing all site areas from the project action areas. The only exception to this was in the instance of existing roads planned for timber hauling that already cut through site areas. In these instances, since the area of the site within the road prism has already been disturbed, it was determined that such use of previously disturbed site areas will have no negative impact to the site. In addition, decreasing the total amount of soil disturbance would help limit the net effects of erosion to site areas.

Alternatives 1-3: Potential Effects and Mitigation Measures
Potential Effects to Heritage Resources: No Action, Proposed Action and Alternative 3. Since all site areas were removed from project action areas during the process of developing alternatives, no direct effects to heritage resources will accrue from implementation of either action alternative.

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.

Proposed Action and Alternative 3
The potential indirect effects to heritage resources foreseen by the implementation of both the Proposed Action and Alternative 3 are presented in Table 3-22.

Table 3-22. Middle Mountain Wildlife Savannah Project Area: Proposed Action and Alternative 3, Potential Effects to Heritage Resources				
Site #	**Proposed Action**	**Effect/Source**	**Alt. 3**	**Effect/Source**
04-300	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation
04-301	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation
04-302	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation
04-303	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation	-	none
04-304	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation
04-305	X	Indirect: erosion due to skidding from conventional logging/thinning for savannah creation	-	none
04-306	X	Indirect: erosion due to skidding from thinning/conv. logging	X	Indirect: erosion due to skidding from thinning/conv. logging
04-307	X	Indirect: erosion due to skidding from	X	Indirect: erosion due to skidding from thinning/conv.

		thinning/conv. logging		logging
04-308	X	Indirect: erosion due to skidding from thinning/conv. logging	X	Indirect: erosion due to skidding from thinning/conv. logging
04-309	X	Indirect: erosion due to skidding from thinning/conv. logging	X	Indirect: erosion due to skidding from thinning/conv. logging
06-228	-	none	-	none

Effects Common to All Alternative Actions
The construction of wildlife savannahs through conventional thinning will have a great deal of ground disturbance associated with them from felling and skidding. The alternative with the least amount of these types of disturbances is Alternative 1, followed in order of magnitude from least to most by Alternatives 3 and 2.

Cumulative Effects
The foreseeable effects of carrying out all of the action alternatives are approximately equal. Management of the project area 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 two action alternatives, the option with the least amount of indirect effects is Alternative 1, the proposed action. Alternatives The Proposed Action and Alternative 3 are approximately equal as regards their effects to heritage resources, with the Proposed Action having slightly greater effects. The lesser intensity of effects to heritage resources in Alternative 3 is due to the use of prescribed fire, rather than timber harvest, in the creation of savannahs in Units 1 and 2.

3.6.4. Recreation
These comments pertain to the proposed wildlife habitat enhancement projects on Middle Mountain, located on the Marlinton and White Sulphur Ranger Districts.

Existing Condition
Developed Recreation Sites: There are no developed recreation sites within the project area. The Rimel Picnic Area, which serves as a trailhead for the Middle Mountain Trail, is located at the northern terminus of the Middle Mountain Trail, approximately two miles north of the project area. Pocahontas Campground is located along State Route 92, approximately two miles southeast of the project area.

Dispersed Recreation: Hunting is likely the most common recreational activity in the Middle Mountain vicinity, including the project area. Spring turkey hunting and fall small game and deer hunting are most popular. This activity is generally dispersed throughout the area, with common entry points along State Routes 39, 92, and 23, and Forest Road 790 and the Middle Mountain Trail. One exception to this dispersion is disabled hunter activity, which occurs within

the road corridors of FR 790, FR 962, and FR 962C, which include portions of the project area. This hunting activity is regulated by special permit. In recent years, up to two permits were requested for the spring turkey season, and up to thirteen permits were requested for the fall hunting seasons. The number of permits is not restricted, and the total number of permits issued for the past ten years has been stable.

Hiking, biking, and equestrian use are also common activities in the Middle Mountain area, although overall use is estimated to be low, as compared with other trails in the vicinity. This use occurs throughout the spring thru fall months.

The project area is bisected by the Middle Mountain Trail, No. 608, which has been managed as a recreation trail since the 1950's or earlier. The trail generally follows the ridge top of Middle Mountain from Highway 39 near Rimel, south to the North Fork of Anthony Creek, near Neola WV, a total of 18 miles. A rustic camping shelter is located along the trail, very near the northern unit of the proposed project. This shelter receives very low use. The Middle Mountain Trail was constructed as a fire access trail by the Civilian Conservation Corps in the 1930's. The trail was improved and widened in the 1950's by the West Virginia Department Of Natural Resources and the Forest Service. Also at that time, thirteen wildlife openings and several water holes were constructed along the trail. The wildlife openings vary in size from one-quarter to one acre. One of these openings is within the project area, and four other openings are within a mile of the project area. The wildlife openings and the Middle Mountain Trail are currently kept open by the WVDNR using tractor mowing on a three-year rotation.

Fishing also occurs within the project area, although it also is a very minimal activity. Douthat Creek forms the western boundary of the northern unit of the proposed action. This creek receives light fishing use. Stream habitat improvement structures were placed in this stream in the early 1990's, which created numerous small pools that attract a few anglers seeking a walk-in remote fishing experience.

Cumulative Effects

Past Actions – the Lost Bottom timber sale was the only major activity in the project area during the past 15 years. Two harvest units of this timber sale were located adjacent to the Middle Mountain Trail. They included a 35-acre thinning unit, which was a long narrow unit that spanned the trail for 1.3 miles, including a portion of the northern unit of the proposed action. There was also a 20 acre clear cut unit located near the terminus of FR 962, about one mile north of the proposed project area. Timber harvested from the thinning unit was skidded on the Middle Mountain Trail. Tree length was restricted to 26 feet, and the harvest period was limited to the period April 15 through December 15. Warning signs were placed on the trail to alert trail users of the logging and hauling activity. There were no complaints from trail users during this activity. The timber purchaser was required to repair ruts, and to lime, fertilize, seed, and mulch disturbed areas on the trail. Informal observations made 2-3 years following the timber harvest showed the trail was adequately revegetated, and it was difficult to see any evidence that the trail had been used for skidding timber products.

Current and future Actions: No other recreation related projects are currently ongoing within the project area, nor are any projects planned for the near future. Annual trail maintenance activities will occur as needed, including mowing, brushing, sign maintenance, and camping shelter repairs.

Comparison of Alternatives

Alternative 1 – No Action

This alternative would have no direct affect on recreational use of the project area, including the Middle Mountain Trail. Dispersed recreational activities and trail use would be uninterrupted. Periodic maintenance would occur, but no management actions would be taken that would improve or detract from the current recreational uses of the area.

Alternative 2 – The Proposed Action

Effects on dispersed recreation: This alternative would develop five new savannah areas totaling 9.3 acres, and logging by thinning 82 acres. Both of these activities would involve commercial harvest of forest products, and the operation of mechanized equipment. These activities may temporarily displace forest visitors who would normally avoid the commotion of logging equipment; in this case they would likely be hunters. This effect would be short term, and due to the general low use of this area, few forest visitors would be affected.

Two areas totaling 423 acres would be treated with prescribed burning on a regular maintenance schedule of 2 to 3 years. This activity would also temporarily displace forest users, while these areas were closed for public safety during active burning operations. These areas would normally be burned during a one or two-day period, so the effect of public closure would be very short term. The burned areas may be temporarily unsightly to some visitors. This would be a short-term condition after springtime burns, as green-up generally occurs within a few weeks following the burn. Areas burned in the fall would remain potentially unsightly until green-up in the following spring.

Effects on the Middle Mountain Trail: The trail would be closed to public use during harvest activities, savannah construction, and during prescribed burning activity, to provide for public safety. As described earlier, the trail receives low use, so few visitors would be affected by this action. Trail users displaced by this closure could use other trails in the vicinity, which include the Allegheny Trail, Two Lick Trail, and Laurel Creek Trail.

Timber products will be skidded on the trail, and other mechanized equipment will likely be operated on the trail during savannah construction. Any trail surface damage caused by these operations will be repaired as needed. Timber harvest adjacent to the trail will create logging slash. Slash will often temporarily block the trail clearing, and can be somewhat unsightly if left in concentrated piles along the trail corridor. These effects are generally short term, and are addressed in associated contracts. Slash is required to be removed from roads and trails, and slash is lopped and scattered in areas adjacent to roads and trails.

3-23. Sections of the trail affected by these actions total	
Activity	**Estimated Miles**
Prescribed Burn Unit #1	1.25
Prescribed Burn Unit #2	0.8 – both sides of trail
Thinning Harvest	0.8 – both sides
Savannah Construction:	
Area #1	0.1
Area # 2	0.25
Area #3	0.1
Area #4	< 0.1
Area #5	0.2

Development of the five savannahs will add visual variety to the trail corridor. Currently, the trail corridor is generally forested along its entire length, with the only open areas being the existing savannahs. People traveling the trail would appreciate the open views and sunlight found within these savannahs, and also the possible sightings of wildflowers, songbirds, and other wildlife that may be more common in open areas.

Alternative 3

This alternative is very similar to alternative 2. The difference is there would be no commercial harvest of trees within savannah areas # 1 and #2. Trees within these areas would be felled and left in place, so skidding of forest products would not occur on the Middle Mountain Trail in that vicinity. All other effects of this alternative would be similar to alternative #2.

Irreversible and Irretrievable Commitment of Resources

Irreversible or irretrievable commitment of resources in terms of recreation resources will result from the implementation of the proposed action. This commitment consists will be the lost recreation opportunities from demolishing and removing the Middle Mountain Wildlife Savannah.

Consistency with the Forest Plan

All the alternatives are consistent with the Forest Plan in terms of management of recreation resources

Consistency with Laws, Regulations, and Handbooks

All actions are consistent with laws, regulations, and policy for recreation resources.

3.6.5. Public Human Health and Safety

Resource Impacts Addressed
This section discloses how public human health and safety in the Middle Mountain Wildlife Savannah project area would be affected by both of the alternatives ("No Action" and Proposed Action).

Affected Environment
The affected environment for public human health and safety is the same as the developed and dispersed recreation areas described in the "Recreation Section" of this document; therefore refer to that section for a detailed discussion. The implementation of the prescribed burns would include the areas described in the "Air Quality Section".

Scope of the Analysis
The spatial boundary used to evaluate direct, indirect, and cumulative effects will be the same boundary used for recreation, as well.

Methodology

Direct/Indirect Environmental Consequences and Cumulative Impacts
Alternative 1 – No Action
If the no action is implemented, there would not be an effect to the public human health and safety.

Action Alternatives 2 (Proposed Action) and 3
The proposed action and Alternative 3 would have an affect on the public human health and safety during the implementation of the proposed activities. However, there would be mitigation measures and forest standards and guidelines followed, to ensure the safety of the public and those implementing the project.

Consistency with the Forest Plan
All alternatives would be consistent with Forest Plan direction for special use management (Forest Plan, pp. 88 and 138a).

Consistency with Laws

The following Federal, State, or local laws or requirements imposed for the protection of the environment have been considered during the analysis of the Middle Mountain Wildlife Savannah Proposed Action and alternatives.

American Indian Religious Freedom Act of 1978

Antiquities Act of 1906 (16 USC 431-433)

Archaeological and Historical Conservation Act of 1974 (16 USC 469)

Archaeological Resources Protection Act of 1979 (16 USC 470)

Cave Resource Protection Act of 1988

Clean Air Act of 1977 (as amended)

Clean Water Act of 1977 (as amended)

Endangered Species Act (ESA) of 1973 (as amended)

Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as amended)

Historic Sites Act of 1935 (16 USC 461-467)

Multiple Use Sustained Yield Act of 1960

National Environmental Policy Act of 1969, (as amended) (42 USC 4321-4347)

National Forest Management Act (NFMA) of 1976 (as amended)

National Historic Preservation Act of 1966 (16 USC 470)

Organic Act 1897

Prime Farmland Protection Act

Wild and Scenic Rivers Act of 1968, amended 1986

Forest Service Manuals such as 2361, 2520, 2670, 2620, 2760

Executive Order 11593 (cultural resources)

Executive Order 11988 (floodplains)

Executive Order 11990 (wetlands)

Executive Order 12898 (environmental justice)

Executive Order 12962 (aquatic systems and recreational fisheries)

Executive Order 13112 (NNIS)