VEGETATION

Forest Types and Age Classes

Reference Conditions

Prior to European settlement in the area, most of the forests in the Upper Greenbrier Watershed were likely spruce-northern hardwoods, with some mixed hardwoods and oak forests at the lower elevations. Estimated presettlement forest distribution is shown in Map VG-1, and is largely based on the vegetation potential within ecological land types.

The primary agents of change in these forests were natural processes and disturbances, such as succession, fire, insects, diseases, wind storms, and floods. Presettlement forests were believed to be predominantly late successional and uneven-aged, with different-sized gaps of even-aged trees, brush, or herbaceous cover caused by the disturbances noted above. Fire return intervals were long (200+ years) over most of the watershed, so landscape-scale stand replacement was likely rare. Dominant and co-dominant trees were generally larger than they are today, and decadent features like snags, logs, and humus were more prevalent across the landscape.

Figure VG-1. Burner Mill Site with Log Pond, Circa 1905

Extensive logging in the Upper Greenbrier Watershed occurred primarily between 1901 and 1920 (see Heritage Resources section). During this time, there were seven band saw mills and associated communities along the West Fork Greenbrier River, and two mills/communities along the East Fork. The photo above shows the mill site at Burner on the West Fork, circa 1905.

Logging at the turn of the last century harvested almost all of the merchantable overstory trees in the watershed at that time. These harvests were followed by extensive slash burning that removed much of the understory. For this reason the forests that exist today are predominantly even-aged. An estimated 70 percent of NFS land is in the mid-late successional stage. The early clearcuts and burning affected forest types as well. For example, the prevalence of yellow birch today is a result of it being a pioneer species that thrived in the open landscape after the turn of the century logging; just as the reduction in spruce is likely because of the hot fires that removed the spruce seed source. The reduction of large logs and snags on the landscape is also a result of the historic logging and fires, and the fact that the forests growing today are not old enough yet to provide these features to the extent that they existed in presettlement times.

Timber management methods and objectives have changed under the guidance of the Forest Service. Many areas on the Forest—like the Gaudineer and East Fork Greenbrier Roadless Areas—do not generally allow commercial timber harvest. Where allowed, most harvesting of second growth forests has been to improve age class and habitat diversity. An estimated 3 percent of the watershed has been regenerated through harvest over the last 20 years to help move toward desired conditions for age class distribution and improve mast production. About 5 percent of NFS lands in the watershed have received some type of timber harvest over the last 15 years, including regeneration cuts, two-aged cuts, shelterwoods, thinnings, and other small salvage, locust post, and mine prop sales.

Timber harvesting has continued on private land as well. These harvests have been mostly diameter limit cuts that remove most of the trees above a certain diameter measured at about 1 foot above ground level.

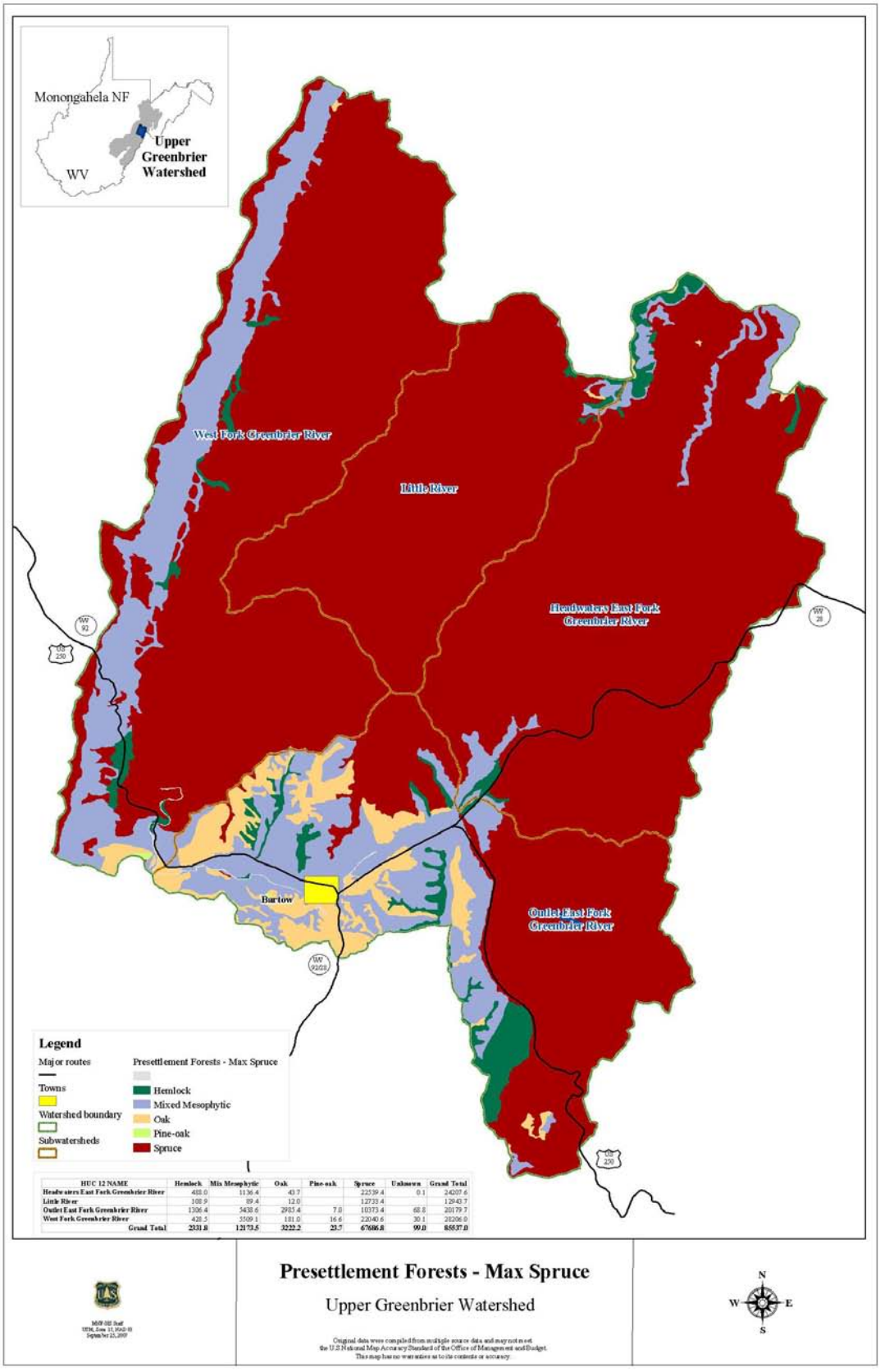
Current and Desired Conditions

The discussion below focuses on forested stands on NFS lands. Private land includes forested land, openings, and water bodies as well. However, forest size and age class information is not available for these lands, which are not managed by the Forest Service. Current and desired conditions have been combined to give the reader a better idea of the discrepancies that exist, and the needs and opportunities related to those discrepancies.

Forest Types

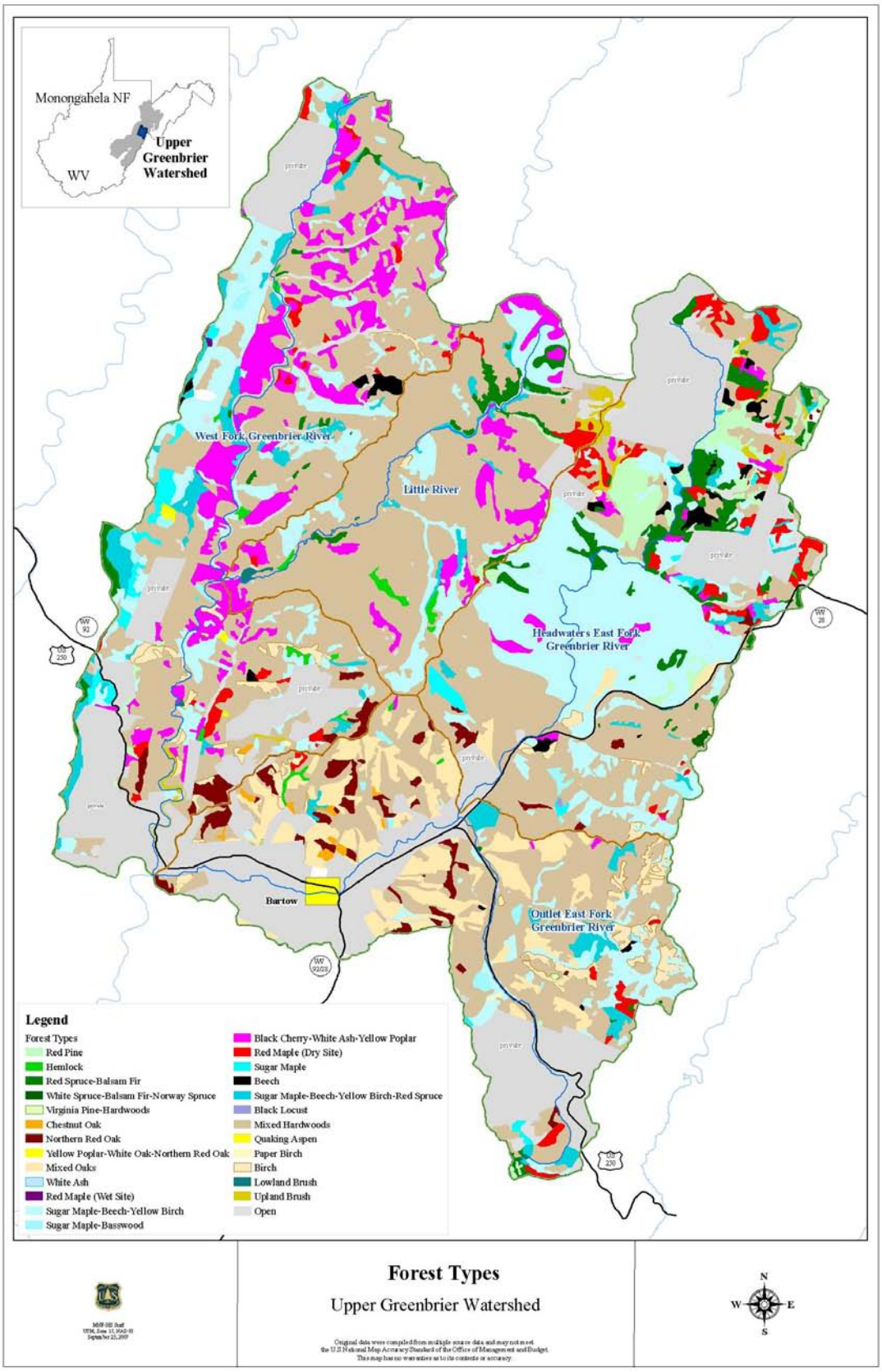
A forest type indicates the dominant tree species or group of species present in a forested stand, but it does not always reflect all of the species present. Typically many other tree species are also present with the tree species that define a forest type, but in fewer numbers. On the Monongahela National Forest, plant species common to northern climates intermingle with plant species common to southern climates. This results in stands with a large number of species and species mixes. Over 40 commercial tree species occur on the Forest, and it is not uncommon to find 10 to 15 commercial species growing in a 10-acre stand. This high level of diversity is due to the unique geographic, climatic, and topographic features of this area.

Map VG-1. Estimated Presettlement Forests in the Upper Greenbrier Watershed



HUC 12 NAME	Hemlock	Mix Mesophytic	Oak	Pine-oak	Spruce	Unknown	Grand Total
Headwaters East Fork Greenbrier River	488.0	1136.4	40.7		22539.4	0.1	24207.6
Little River	108.9	89.4	12.0		12733.4		12943.7
Outlet East Fork Greenbrier River	1306.4	5438.6	2983.4	7.0	10373.4	68.8	20179.7
West Fork Greenbrier River	428.5	5509.1	181.0	16.6	22040.6	30.1	28206.0
Grand Total	2331.8	12173.5	3222.2	23.7	67686.8	99.0	85537.0

Map VG-2. Current Forest Types in the Upper Greenbrier Watershed



Over time, a stand's forest type may change as some short-lived tree species succumb to natural mortality, while longer-lived tree species survive and become more prevalent. Other changes may result from high mortality rates of specific species due to insects and disease, such as hemlock wooly adelgid or beech bark disease. Deer may also affect forest types as they selectively browse on seedlings. Forest type modifications over time may result in changes to wildlife habitat, scenic quality, forest product availability, and recreation opportunities.

Map VG-2 shows the forest types that currently exist in the Upper Greenbrier Watershed. This map shows the watershed being dominated by mixed hardwoods and northern hardwood mixes such as sugar maple-beech-yellow birch, and black cherry-white ash-yellow poplar. For management purposes, these forest types have been lumped into the similar ecological groupings found in Table VG-1.

Over 95 percent of the Upper Greenbrier Watershed is forested. As seen in Table VG-1, the watershed is dominated by Appalachian mixed hardwood and northern hardwood forest types (85 percent). About 7 percent of the watershed has forest types dominated by oak, while about 5 percent has types dominated by conifers, most notably red spruce, eastern hemlock, and white pine. Some plantations of red pine are also present, and red spruce and hemlock are commonly found as components of northern hardwood communities.

Table VG-1. Acres of Forest Types by Management Prescription Area

Forest Type	MP 3.0	MP 4.1	MP 6.1	MP 6.2	MP 8.0	Total Acres	Percent of Forested Land in Watershed
Eastern Spruce-Fir	302	925	151	863	229	2470	3
Eastern White Pine and Hemlock	327	415	37	910	0	1689	2
Oak-Pine	10	0	2	0	0	12	0
Oak-Hickory	2613	33	2385	131	0	5162	7
Bottomland Hardwoods	0	0	0	9	0	9	0
Appalachian (mixed) Hardwoods	23958	11250	1339	3892	474	40913	55
Northern Hardwoods	8733	2938	385	8824	1310	22190	30
Open	619	1120	94	322	9	2164	3

Most vegetation management opportunities in the watershed will be in response to age class discrepancies between current and desired conditions. However, the spruce-fir, northern hardwoods, and oak forest types have special management needs that are described below.

Spruce and Spruce-Hardwood Communities - Although red spruce has been slowly expanding its range over the past few decades, red spruce and spruce-hardwoods mixed forests once covered much more area than they do today (MNF FEIS, 2006, Chapter 3, Terrestrial Ecosystem Diversity section). While opportunities for active restoration of the red spruce community are limited in areas determined to be suitable habitat for the West Virginia northern flying squirrel, there are areas in the watershed where red spruce and mixed red spruce-hardwood forests could be actively managed to increase red spruce dominance. Depending on

stand conditions, and to some extent management prescription direction, there are a number of management strategies that could be used to increase spruce dominance, including:

- Commercial timber harvest in northern hardwood stands adjacent to red spruce to release understory spruce,
- Non-commericial girdling/herbiciding overstory hardwoods around understory spruce,
- Commerical and non-commerical thinning of young spruce or spruce-hardwood stands to increase spruce growth, vigor, and composition,
- Commercial or non-commercial harvesting or thinning of mature spruce-hardwood stands to increase spruce composition and to help develop uneven-aged stand conditions,
- Planting red spruce on appropriate sites, either alone or in conjunction with some of the treatments described above,
- Commercial harvesting or thinning of red pine plantations to release existing understory red spruce,
- Regeneration harvests of hardwood stands adjacent to red spruce stands to allow for natural regeneration of red spruce.

For Management Prescription 4.1 areas, the desired conditions not only allow for the spruce management strategies described above, they encourages them: "Stands with a viable spruce component in the overstory or understory are managed to restore the natural species composition, structure, and function of spruce and spruce-hardwood communities" (Forest Plan, p. III-12).

For Management Prescription 3.0 and 6.1 areas, there are no explicit desired conditions to increase the spruce component in forested stands. However, stand prescriptions could still be designed to maintain or establish a spruce component on appropriate sites, particularly those adjacent to existing red spruce. Although Management Prescription 6.2 does allow for some ecological restoration, management opportunities are limited due to access and disturbance limitations. Some thinning, release, or planting treatments may be appropriate, however.

Oak Communities - Oak communities are currently in decline due to changes in stand density, structure, age, and composition, leading to a decreasing trend in vegetation diversity. In areas where fires helped perpetuate oak and oak-hickory forests, decades of fire suppression have created conditions where oak species are not competing well with species such as striped and red maple and American beech. Light conditions in the mid-story are not suitable for oaks to regenerate. An overabundance of deer browsing in some areas has also reduced oak regeneration. Timber harvest, thinning, and prescribed fire can be used to mimic the effects of historic fire regimes in areas where these activities are both allowed by Forest Plan direction and are considered ecologically appropriate.

Oaks are a primary producer of hard mast on the Forest, and, besides the oak types that are noted in Table 3-1, oaks are also an important component of the mixed hardwood stands that comprise an estimated 55 percent of the Upper Greenbrier Watershed.

For Management Prescription 6.1 areas, the oak management strategies described above are encouraged: "On sites where existing vegetation includes an oak component, oak restoration management focuses on achieving and maintaining oak-dominated species composition, as well

as developing the more open stand structure that likely existed in these communities prior to a period of extensive fire suppression that began about 70-80 years ago" (Forest Plan, p. III-34).

For Management Prescription 4.1 areas, oak can be managed in stands with little or no potential for spruce restoration. Desired conditions for these stands include: "Management activities result in relatively high levels of sustainable mast production, and they contribute to the long-term sustained yield of timber products" (Forest Plan, p. III-13). Similarly, Management Prescription 3.0 desired conditions state: "Management activities result in relatively high levels of sustainable timber and mast production" (Forest Plan, p. III-6). Although Management Prescription 6.2 does allow for some ecological restoration, management opportunities are limited due to access and disturbance limitations.

Age Classes

A good distribution of age classes across the landscape indicates long-term sustainability and improved forest health. Expectations to move toward a more balanced age or size class distribution were not fully achieved in the last planning cycle. Goals and objectives were adjusted for this planning cycle to help ensure that the desired composition and structure of forest vegetation, in those Management Prescriptions that allow active management, can be sustained into the future. The Forest Plan identifies long-term desired conditions for age classes have been identified for those MPs where vegetation management is emphasized. Vegetation management in areas that allow such activities, combined with natural disturbances in areas of unmanaged forest, will help achieve these desired conditions.

An estimated 70 to 80 percent of the Forest is currently the same approximate age (70-100 years) with similar stand conditions. Conversely, there are relatively few forest stands in younger age conditions. The effects of an aging forest include: 1) an increasing susceptibility to forest decline and mortality from insect and disease outbreaks; 2) a decrease in timber and mast productivity and wildlife habitat diversity; 3) an increase in shade-tolerant tree species; and 4) an increase in fuel loads from both down and standing dead trees that may result in a higher potential of more severe fires during periods of extended or extreme drought.

The current age classes of forested areas on NFS lands in the Upper Greenbrier Watershed are displayed in Table VG-2. Similar to Forest-wide conditions, an estimated 70 percent of the NFS lands in the watershed are in a single age class (mid-late successional), and 91 percent of the lands are in two age classes (mid successional and mid-late successional). Early and early-mid successional stages, on the other hand, only account for about 4 percent of the watershed NFS lands. Open/brushy areas comprise another 3 percent.

The figures in Table VG-2 indicate obvious opportunities to increase age class diversity within the watershed. These opportunities can be influenced by not only by current and desired age class conditions, but also by management emphasis and direction from the different Management Prescription areas in the watershed. Conditions and opportunities are described below for each of the Management Prescription areas (3.0, 4.1, 6.1) where vegetation management is emphasized.

TableVG-2. Tree Vegetation Age Class Acres by Management Prescription Area

Age Class	MP 3.0	MP 4.1	MP 6.1	MP 6.2	MP 8.0	Total Acres	% of NFS Land in Watershed
Open/Brush	619	1120	94	322	9	2164	3
Early Successional (0-19 years)	763	728	284	121	36	1932	3
Early-Mid Successional (20-39 years)	824	63	0	0	0	887	1
Mid Successional (40-79 years)	4342	3680	102	6370	419	14913	21
Mid-Late Successional (80-119 years)	24796	10873	3434	7882	1269	48254	70
Late Successional (≥120 years)	1097	210	327	256	298	2188	3

Management Prescription 3.0 - This MP area comprises 47 percent (32,443 acres) of NFS land in the Upper Greenbrier Watershed. Of the NFS forested lands in the watershed, an estimated 2 percent are conifer communities, 24 percent are northern hardwood communities, 68 percent are mixed hardwood communities, and 6 percent are oak communities. Less than 2 percent of the 3.0 MP areas are in an open condition. The forest communities in MP 3.0 are broken down by age class in Table VG-3.

Table VG-3. Current Age Classes of Forest Communities in MP 3.0

Forest Community	Percent by Age Class for Each Community				
	Early Successional (0-19 years)	Early-Mid Successional (20-39 years)	Mid Successional (40-79 years)	Mid-Late Successional (80-120 years)	Late Successional (>120 years)
Conifer	1%	1%	1%	40%	56%
Northern Hardwoods	2%	4%	15%	75%	4%
Mixed Hardwoods	4%	1%	13%	79%	3%
Mixed Oak-pine	6%	1%	16%	71%	6%

The age class percentages for northern hardwoods, mixed hardwoods, and mixed oak-pine are very similar, with most forest stands in the mid-late and mid successional stages. The difference in the conifer community age classes is primarily due to this community being so small and thus significantly influenced by a few areas that have received little management. However, it is noteworthy that relatively little regeneration seems to be occurring in the conifer and other forest communities. These numbers can be compared to the desired age class ranges for forest communities in MP 3.0 displayed in Table VG-4 (Forest Plan, p. III-6).

The comparison indicates that there is both a need and opportunity to regenerate stands within MP 3.0 in order to move toward desired conditions for age class distribution. Regeneration would not only reduce the amount of stands in mid-late successional stage, but would also increase the amount in the early successional stage, which over time would become early-mid and mid successional stages. Management direction in MP 3.0 provides for this type of activity.

Table VG-4. Desired Age Classes of Forest Communities in MP 3.0

Forest Community	Percent Range by Age Class for Each Community				
	Early Successional (0-19 years)	Early-Mid Successional (20-39 years)	Mid Successional (40-79 years)	Mid-Late Successional (80-120 years)	Late Successional (>120 years)
Conifer	10-20%	10-20%	20-40%	20-40%	10-15%
Northern Hardwoods	12-20%	12-20%	24-40%	24-40%	5-10%
Mixed Cove Hardwoods	12-20%	12-20%	24-40%	24-40%	5-10%
Mixed Oak	12-22%	12-22%	24-40%	24-40%	5-10%
Pine-Oak	12-24%	12-24%	24-40%	24-40%	5-10%

Note: "Conifer" opportunities would be primarily associated with pine plantations and native pine in this MP. Spruce-dominated stands that are WVNFS suitable habitat would be managed as such under Forest-wide direction.

"The Forest is a mosaic of stands of predominantly hardwood trees and associated understories that provide habitat for a variety of wildlife species. The stands vary in size, shape, height, and species depending on the silvicultural system applied. Management activities result in relatively high levels of sustainable timber and mast production. Age class distribution ranges from early to late successional stands, but the predominant age classes are represented by mid and mid-late successional stands" (Forest Plan, p. III-6-7, Desired Conditions).

"Over the next 10 years regenerate the following amounts of forest vegetation to begin moving toward desired age class conditions for these forest types:

Northern hardwoods: 1,000-2,000 acres
Mixed cove hardwoods: 8,000-12,000 acres
Mixed oak: 3,000-4,000 acres" (FP, p. III-7, Objective 3002)

There is also an opportunity to increase openings within MP 3.0 areas, as the desired condition range is 3 to 8 percent, and the current condition is at 1.7 percent.

Management Prescription 4.1 - This MP area comprises 24 percent (16,701 acres) of NFS land in the Upper Greenbrier Watershed. The management of vegetation communities under this MP is distinctly different for spruce and spruce-hardwoods than it is for communities with little or no potential to grow spruce. Red spruce, red pine, and hemlock were combined for the spruce-spruce hardwood communities. For spruce and spruce-hardwood communities, current age class conditions are shown in Table VG-5.

Table VG-5. Current Age Classes for Spruce/Spruce-Hardwood Communities in MP 4.1

Forest Community	Early Successional (0-19 years)	Early-Mid Successional (20-39 years)	Mid Successional (40-79 years)	Mid-Late Successional (80-120 years)	Late Successional (>120 years)
Spruce and Spruce-Hardwood	0	2	78	18	1

Desired age class conditions for these communties are shown in Table VG-6.

Table VG-6. Desired Vegetation Age Classes for Spruce and Spruce-Hardwoods in MP 4.1

Forest Community	Early Successional (0-19 years)	Early-Mid Successional (20-39 years)	Mid Successional (40-79 years)	Mid-Late Successional (80-120 years)	Late Successional (>120 years)
Spruce and Spruce-Hardwood	3 - 8	3 - 8	5 - 15	5 - 15	60 - 80

Desired conditions for these stands are: "Stands with a viable spruce component in the overstory or understory are managed to restore the natural species composition, structure, and function of spruce and spruce-hardwood communities. Restoration management focuses on achieving spruce and mixed spruce-hardwood species composition, as well as developing the multi-age stand structure that likely existed in this community prior to exploitation. Most spruce and spruce-hardwood stands are developing late successional conditions over time. At the stand level, these conditions include a mix of trees of different ages, complex vertical habitat structure, scattered small openings (< 2 acres) dominated by shrubs and saplings, scattered over-mature trees, and an abundance of snags, den trees, and downed woody debris. Research projects or administrative studies provide information and strategies for successfully restoring spruce and spruce-hardwood communities" (Forest Plan, p. III-12).

Vegetation management opportunities in spruce and spruce-hardwood communities over the next 10 years should focus on research/administrative studies designed to provide information on community restoration. These opportunities should be coordinated with the Northern Research Station.

Age class conditions for stands in MP 4.1 with little or no potential for spruce restoration are shown in Table VG-7.

Table VG-7. Current Vegetation Age Classes for MP 4.1 Areas with Little or No Potential to Restore Spruce

Forest Community	Percent by Age Class for Each Community				
	Early Successional (0-19 years)	Early-Mid Successional (20-39 years)	Mid Successional (40-79 years)	Mid-Late Successional (80-120 years)	Late Successional (>120 years)
Northern Hardwoods	5	0	28	60	6
Mixed Hardwoods	6	0	17	76	0
Mixed Oak-Pine	15	0	85	0	0

"Stands with little or no potential for spruce restoration are managed to promote healthy hardwood communities with a mix of age classes. Management activities result in relatively high levels of sustainable mast production, and they contribute to the long-term sustained yield of timber products. Age class distribution ranges from openings maintained for wildlife habitat to a network of late successional stands, but the predominant age class is represented by mid

successional and mid-late successional stands that feature sustainable mast production" (Forest Plan, p. III-13). The following table displays desired vegetative conditions in MP 4.1 hardwood management areas:

Table VG-8. Desired Vegetation Age Classes for MP 4.1 Areas with Little or No Potential to Restore Spruce

Forest Community	Percent by Age Class for Each Community				
	Early Successional (0-19 years)	Early-Mid Successional (20-39 years)	Mid Successional (40-79 years)	Mid-Late Successional (80-120 years)	Late Successional (>120 years)
Northern Hardwoods	15-20%	15-20%	35-45%	15-25%	5-10%
Mixed Cove Hardwoods	15-20%	15-20%	35-45%	15-25%	5-10%
Mixed Oak	10-15%	10-15%	25-35%	20-30%	15-20%
Pine-Oak	15-20%	15-20%	25-35%	20-30%	10-15%

The comparison of current and desired age class tables for MP 4.1 indicates that there is both a need and opportunity to regenerate stands within MP 4.1 to move toward desired conditions for age class distribution. Management direction in MP 4.1 provides for this type of activity.

> "Over the next 10 years regenerate approximately 2,000 to 5,000 acres of hardwoods on suited timberlands where spruce cannot be restored to begin moving toward desired age class and habitat diversity conditions" (Forest Plan, p. III-14, Goal 4108).

An estimated 6.7 percent of the MP 4.1 areas are in an open condition, including range allotment pastureland, meadows, and wetlands. The desired condition for openings is "up to 5 percent" (Forest Plan, p. III-12). Although this desired condition should not affect the management of existing range allotments, it does indicate that there is no real need to create new permanent openings during other vegetation management activities.

Management Prescription 6.1 - The 6.1 MP areas comprise about 6 percent (4,292 acres) of NFS land in the Upper Greenbrier Watershed. Of the NFS forested lands in the watershed, most are in mixed hardwood or oak forest communties. Just over 2 percent of the 6.1 MP areas are in an open condition. The forest communities in MP 6.1 are shown by age class in Table VG-9.

Table VG-9. Current Age Classes of Forest Communities in MP 6.1

Forest Community	Percent by Age Class for Each Community				
	Early Successional (0-19 years)	Early-Mid Successional (20-39 years)	Mid Successional (40-79 years)	Mid-Late Successional (80-119 years)	Late Successional (≥120 years)
Conifer	56	0	0	44	0
Northern Hardwoods	0	0	1	99	0
Mixed Hardwoods	4	2	0	93	1
Mixed Oak-Pine Oak	8	1	1	77	13

The age class percentages fall dominantly within the mid-late successional stage for the northern hardwoods, mixed hardwoods, and mixed oak communities. The difference in the conifer community age classes is primarily due to this community being so small and thus significantly influenced by fairly recent harvest activity. Again, it is obvious that relatively little regeneration is occurring in the other forest communities. These numbers can be compared to the desired age class ranges for forest communities in MP 6.1 displayed in Table VG-10.

Table VG-10. Desired Age Classes of Forest Communities in MP 6.1

Forest Community	Percent Range by Age Class for Each Community				
	Early Successional (0-19 years)	Early-Mid Successional (20-39 years)	Mid Successional (40-79 years)	Mid-Late Successional (80-119 years)	Late Successional (≥120 years)
Conifer	15-20%	15-20%	30-40%	20-30%	8-12%
Northern Hardwoods	15-20%	15-20%	30-40%	20-30%	5-10%
Mixed Cove Hardwoods	15-20%	15-20%	30-40%	20-30%	5-10%
Mixed Oak	10-15%	10-15%	25-35%	20-30%	15-20%
Pine-Oak	15-20%	15-20%	25-35%	20-30%	10-15%

The comparison indicates that there is both a need and opportunity to regenerate stands within MP 6.1 in order to move toward desired conditions for age class distribution. Management direction in MP 6.1 provides for this type of activity.

> "This area provides a diversity of habitats for wildlife species, as well as abundant security areas to provide habitat for local wildlife populations that are sensitive to disturbance. Management activities result in relatively high levels of sustainable mast production in important species such as oak, hickory, and black cherry. Age class distribution ranges from early to late successional stands, but the predominant age classes are represented by mid and mid-late successional stands" (Forest Plan, p. III-34, Desired Conditions).
>
> "Over the next 10 years regenerate an estimated 2,000 to 5,000 acres of mixed and northern hardwoods to begin moving toward desired age class and habitat diversity conditions" (Forest Plan, p. III-36, Objective 61065).
>
> "Over the next 10 years regenerate the following amounts of forest vegetation to begin moving toward desired age class and habitat diversity conditions for these forest types:
> White oak: 700-1,200 acres
> Red oak: 2,000-4,000 acres
> Mixed oak: 1,000-3,000 acres" (Forest Plan, p. III-36, Objective 6106)

There is also an opportunity to increase openings within MP 6.1 areas, as the desired condition range is 3 to 8 percent, and the current condition is at 2.1 percent.

Management Prescription 6.2 - Management Prescription 6.2 comprises about 20 percent (14,953 acres) of NFS land in the Upper Greenbrier Watershed. Although Management

Prescription 6.2 does allow for some ecological restoration, management for age class diversity is generally not an option. Management of existing wildlife openings and grasslands may occur.

Other Vegetation Management Opportunities

Timber Stand Improvement - Most of the areas that were harvested with even-aged cuts in the 1960s and 70s resulted in stands of overcrowded trees (too many trees trying to live in one area). Natural mortality can eventually reduce this overcrowding; however, timber stand improvement (TSI) techniques can select which trees will live and die. These TSI treatments are designed to improve the health and increase the growth of residual trees. One method of TSI is a non-commercial thinning in a crop tree release (CTR). Roughly 2,700 acres of young tree stands received this type of treatment in the past 10 years in the Upper Greenbrier Watershed. Crop trees are selected based on species, mast capability, health, potential wood value, and form. The stands in this area that were treated with CTR are now or, within the next 5 years, will be in the poletimber size class. There is the potential to further improve the health and growth of these stands through commercial and non-commercial thinnings using various TSI methods.

Additionally, many stands that were harvested with even-aged cuts in the Upper Greenbrier Watershed in the 1980s and early 1990s are now overcrowded with young trees. These stands will be ready for a non-commercial thinning using the CTR method within the next 5 years. Most of these stands are presently in the sapling stage of growth.

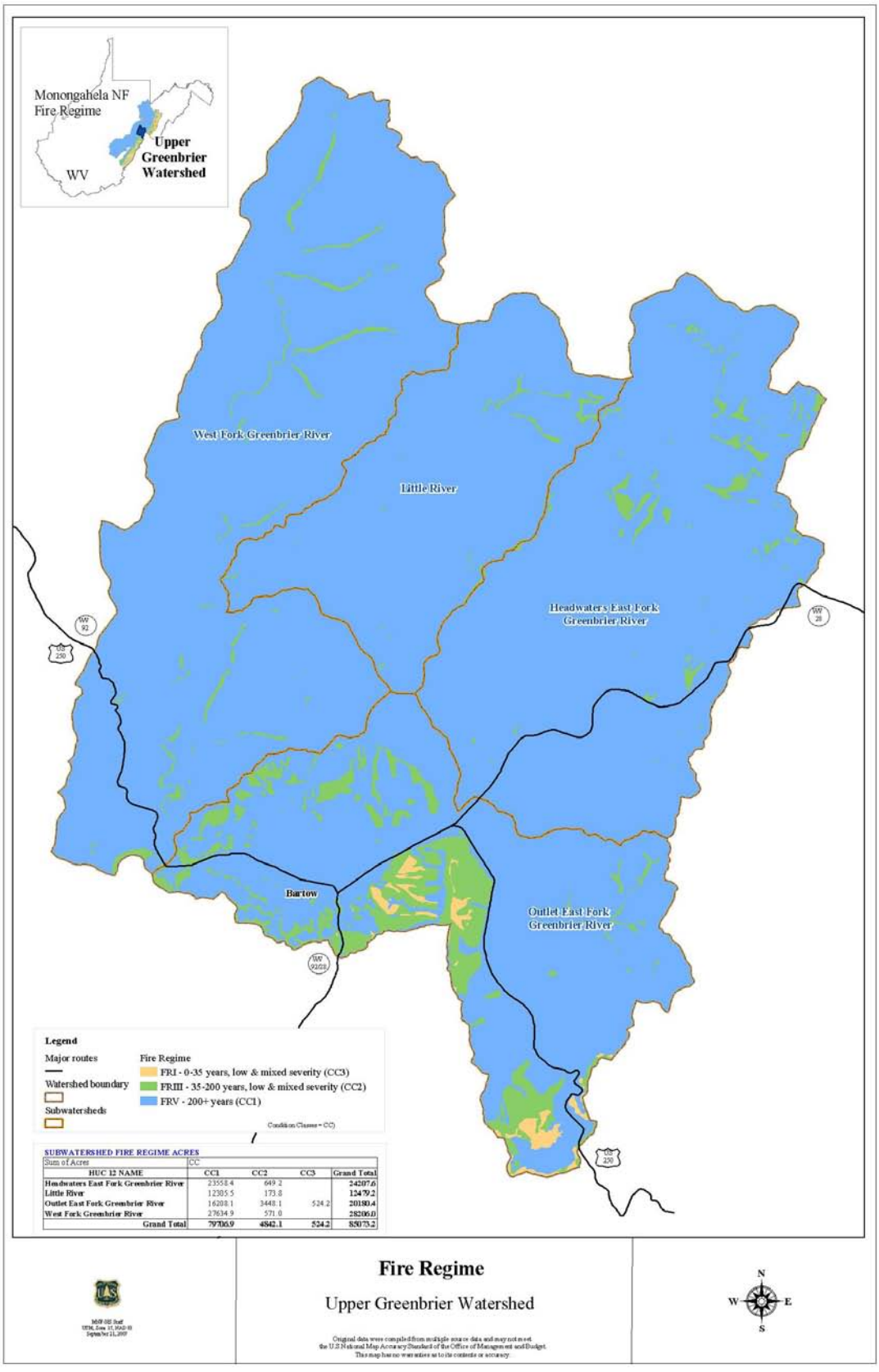
Prescribed Fire – Numerous, large fires occurred in the watershed after the extensive logging in the early 1900s. Damaged soils from the intensity of the fire and subsequent erosion have resulted in some areas of shallow soils, or exposed rock with little soil cover. Fire has been virtually excluded from the Upper Greenbrier Watershed over the past 60 years due to effective fire suppression activities. Most of the watershed, however, is considered to be in Fire Regime 5, Condition Class I, with fire return intervals of 200+ years (Map VG-3).

There are about 500 acres within the watershed that are in Fire Regime 1, Condition Class 3, and about 4,000 acres of Fire Regime III, Condition Class 2. These 4,500 acres represent about 6 percent of NFS land in the Upper Greenbrier Watershed. Most of these acres are in the Outlet East Fork Greenbrier River subwatershed (Map VG-3). These areas are at the highest risk of losing key ecosystem components, particularly in oak-dominated forests. Prescribed fire could be used to help restore composition and structure within fire-adapted ecosystems, and to reduce fuels, especially in the wildland urban interface near Bartow. Fire could also be used to create or maintain openings, savannahs, and early successional stages, to thin out understory vegetation, or to treat vegetation in Management Prescription 6.2 areas where there are restrictions on mechanical disturbance and road construction.

Desired Conditions

Additional Forest-wide desired conditions for vegetation, timber, and fire management include the following.

Map VG-3. Fire Regimes and Condition Classes in the Upper Greenbrier Watershed



Vegetation – "Forested lands exhibit variable patterns of size classes, densities, structural stages, and species composition due to a combination of successional development, disturbance regimes, and management activities. Age class distribution ranges from openings maintained for wildlife habitat to a network of late successional stands" (Forest Plan, p. II-17).

"Where vegetation development is influenced by management actions, forest succession will be interrupted in some areas to perpetuate early and mid-successional tree species and create age class diversity between stands. In some areas, forest management will perpetuate shade-intolerant or moderately tolerant tree species such as oaks. In these managed areas, a mixture of management activities and natural processes creates variety in size classes, structural stages, and species composition" (Forest Plan, p. II-17).

Timber – "Suited timberlands provide sustainable and predictable levels of forest products. Forest products include, but are not limited to, fuelwood, post and poles, and sawlogs. The Forest provides a dependable source of large-diameter, high-quality sawtimber. Commercial timber harvest is a viable tool for accomplishing vegetation management objectives" (Forest Plan, p. II-40).

Prescribed Fire – "Fire is used as a tool to achieve and maintain desired vegetative conditions and fuel levels…Fire operates within fire regimes appropriate to the vegetation type and management objectives, and helps maintain fire-adapted ecosystems" (Forest Plan, p. II-15).

Threatened, Endangered, and Sensitive Plants

Four federally-listed threatened and endangered plant species are known to occur on the Monongahela National Forest: running buffalo clover (*Trifolium stoloniferum*), shale barren rockcress (*Arabis serotina*), Virginia spirea (*Spiraea virginiana*), and small whorled pogonia (*Isotria medeoloides*). Fifty-four plant species are listed as Regional Forester's Sensitive Species (RFSS) on the Forest.

Reference Conditions

It is assumed that all of the TES plants known within the watershed today existed here prior to European settlement of the area. It is not known how much post-settlement activities have influenced the amount and distribution of these species. Some species may have always been rare on the landscape, while others may have become rare through human-caused effects. Regardless of how these plants reached their current status, Forest managers are now obligated through law and agency directives to provide habitat for these rare species, to promote the recovery of federally listed species, and to keep RFSS from a trend toward federal listing. Our goal is to have these species continue to contribute to the overall biodiversity of the Forest.

Current Conditions

Threatened and Endangered Plants

Likelihood of occurrence is based on field surveys of the proposed activity areas, historic records, and the presence of potential habitat in the project area. Based on field surveys of proposed activity areas and existing records, one of the four threatened and endangered species is known to occur within the Upper Greenbrier Watershed. Potential habitat may occur for two other species.

Virginia Spirea - Virginia spirea is a clonal shrub found on damp, rocky banks of large, high-gradient streams (USFWS 1992a). The shrub may be found in either full sun or shade. Within the watershed, potential habitat for Virginia spirea is limited to the channels and banks of large streams such as the West and East Forks of the Greenbrier River. Elevation range for known occurrences in West Virginia is 1000 to 1800 feet, which is lower than any elevation in the watershed. The only known occurrence on the Forest consists on two subpopulations along the Greenbrier River at the southern edge of the White Sulphur District.

Running Buffalo Clover - Potential habitat for running buffalo clover typically exists in lightly disturbed forests and woodlands on soils derived from circumneutral geologic features (NatureServe 2006a, USFWS 2007). The Monongahela National Forest is a stronghold for running buffalo clover, with the largest and highest quality populations range-wide occurring on the Forest (USFWS 2007). Most of the Forest's populations are associated with old skid trails, lightly used roads, or other features that cause moderate soil disturbance. Potential habitat in the Upper Greenbrier Watershed is likely concentrated in areas of favorable geology and past soil disturbance. Existing records show occurrences of running buffalo clover within the watershed.

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

Shale barren Rockcress - Shale barren rockcress is not likely to occur within the watershed due to lack of shale barren habitat. Shale barrens are limited to the drier areas on the eastern side of the Forest.

Regional Forester's Sensitive Plants

Based on field surveys and existing records, three of the 54 RFSS plants are known to occur within the Upper Greenbrier Watershed: Appalachian blue violet (*Viola appalachiensis*), butternut (*Juglans cinerea*), and rock skullcap (*Scutellaria saxatilis*). Appalachian blue violet is known from 15 locations in the project area. Butternut is known from two locations in the project area, and rock skullcap is known from one location.

Based on the Likelihood of Occurrence assessment, potential habitat could occur for 30 additional RFSS plants. However, given the lack of known occurrences despite site surveys, it is unlikely that the watershed supports substantial populations that are crucial for the continued viability of these species on the MNF.

The total for potential and known RFSS plants in the watershed is 33 species. To facilitate analysis, RFSS plants have been grouped according to their primary habitat (Tables VG-11 through VG-13). The three habitat groupings are wetland/riparian habitat, mesic/cove forest, and rocky habitat.

Table VG-11. Known or Potential Wetland and Riparian Habitat RFSS Plants in the Upper Greenbrier Watershed

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

Table VG-12. Known and Potential Mesic Forest and Cove Habitat RFSS Plants in the Upper Greenbrier Watershed

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

Table VG-13. Known and Potential Rocky Habitat RFSS Plants in the Upper Greenbrier Watershed

Scientific Name	Common Name	Habitat Comments
Cornus rugosa	Roundleaf dogwood	Rocky areas within forests
Gymnocarpium appalachianum	Appalachian oak fern	Rocky woods
Heuchera alba	White alumroot	Most likely in dry microsites
Juncus trifidus	Highland rush	Rock crevices
Oryzopsis canadensis	Canada mountain rice grass	Open canopy, sandstone
Pycnanthemum beadlei	Beadle's mountainmint	Open canopy over rocks
Scutellaria saxatilis	Rock skullcap	Rocky areas within forests. Also seen in shaded cut banks and shoulders of infrequently used forest roads.
Syntrichia ammonsiana	Ammon's tortula	Wet, cool microsites
Taenidia montana	Virginia mountain pimpernel	Dry outcrops. Typically a shale barren species, but one occurrence in Tucker County.
Trichomanes boschianum	Appalachian bristle fern	Dripping rocks

Management Implications

Site-specific field surveys for TES plants should cover all areas proposed for timber harvest, new road construction, and other ground-disturbing actions. Known or discovered populations will be protected through management requirements in the Forest Plan, and any additional mitigation measures identified at the project level.

Desired Conditions

Although all threatened, endangered, or proposed species on the Forest may not be individually addressed in the Forest-wide management direction, the Forest is obligated to provide sufficient habitat to contribute to their survival and recovery. This obligation is spelled out in more detail in the Endangered Species Act, Forest Service Manual and Handbook direction, and various recovery plans, conservation strategies and agreements, and Memoranda Of Understanding. In addition, Section 7 consultation will occur at the project level for all proposed actions that may affect these species or their habitat (Forest Plan, p. II-22).

Rare plants and their habitats are protected and enhanced across the Forest through designation and management of Botanical Areas and Research Natural Areas, and through continued surveys and mitigation for species on the RFSS list. Rare plants and communities contribute to the biodiversity of the Forest and region (Forest Plan, p. II-17).

Non-native Insects, Diseases, and Invasive Plant Species

Reference Conditions

There are many insects and diseases within the watershed that are not only native to this area but also critically important to basic ecosystem function and processes such as plant fertilization,

forest succession, and nutrient cycling. This assessment, however, focuses on non-native invasive species (NNIS) that tend to have more detrimental effects to the environment. By definition, NNIS are species that are not native to this area; therefore, reference conditions did not include NNIS prior to European settlement. Most NNIS have been introduced to the watershed within the last 100 years through a wide variety of means.

The role of non-native insects, diseases, and invasive plants as disturbance factors has increased in the past century due to the introduction of these pests from other countries. Some of the species known to influence the structure and pattern of vegetation are discussed below. The species listed here are not all inclusive of non-native insects, diseases, and invasive plants that may be present in the Upper Greenbrier Watershed.

Current Conditions

Non-native Insects

Gypsy Moth (*Lymantria dispar L.*) - Gypsy moth was introduced from France to the United States in 1869. The first defoliation outbreak occurred in 1889 (McManus, Schneeberger, Reardon and Mason 1989).

A population crash of the gypsy moth, caused by the fungus *Entomophaga maimaiga*, has kept the population under control for many years. High humidity, frequent periods of rain, and fairly constant temperatures between 14°C to 26° C are needed for the fungus to germinate and spread (Reardon and Hajek 1998). Without these conditions, increases in the number of gypsy moth egg masses on the Forest may result in a population build-up, causing defoliation in numerous "hot spots" in the eastern section of Pocahontas County where oaks predominate. Population increases do not always cause significant tree mortality in the first year. However, continued increases in populations, with successive years of defoliation, may cause extensive tree mortality. A return to a control program may be necessary to slow the spread of this insect and reduce tree mortality.

Oak trees (especially of the white oak group) are the preferred host for this insect pest. Less than 6% of the forest types in the Upper Greenbrier Watershed feature oak, and most of those are the mixed and red oak groups. Therefore, this area is considered to be at relatively low risk for massive defoliation by gypsy moth caterpillars.

Hemlock Wooly Adelgid (HWA) (*Adelges tsugae)* - This sapsucking insect, introduced to the United States from Asia in 1924, was detected in Pocahontas County in 1993 (Hutchinson 1995). The insect feeds on twigs causing the foliage to discolor and drop prematurely. Defoliation and death usually occurs about 4 years after a tree is infested. Eastern and Carolina Hemlocks are highly susceptible to this insect and no resistant trees have been located to this date. However, several common predators (including the Japanese Ladybug) of the adelgid have been released and may prove to be an effective control (Kajawski 1998; Montgomery and Lyon 1996). Severe cold weather also seems to control HWA. In January, 1985 and the winter of 1993-1994 severe cold weather (-20° to -28° F) greatly reduced HWA populations (Souto, Luther, and Chianese 1995). Infestations of HWA are not apparent above the Hudson River corridor in New York. It

appears cold weather may be a limiting factor in the spread of this insect. The cooler climate of the Upper Greenbrier Watershed may help to limit the impact of this exotic pest.

Non-native Diseases

Beech Bark Disease (BBD) - The beech scale insect (*Cryptococcus fasigua*), native to Europe, arrived in Nova Scotia around 1890. By 1932 trees in Maine were dying from BBD. The disease results when the bark is attacked by the beech scale, then invaded by fungi, primarily *Nectria coccinea* var. *faginata* and *N. galligena* which eventually kills or severely injures beech (Houston and O'Brien 1983). Beech trees over 8 inches diameter are more severely affected then smaller trees. Mortality occurs in about 30% of the trees that are infected. Up to 90% of the remaining beech trees in a stand become severely injured and do not produce quality wood (Leak and Smith 1995). It appears there are greater disease levels in stands containing hemlock (Gavin and Peart 1993). Hemlock provides high shade and moisture preferred by the fungi that attack the tree after infestation by the scale.

The advancing front of the scale is presently in the Upper Greenbrier Watershed. Cutting infected and high risk trees would provide an opportunity to salvage some of the material and improve the health and diversity of the stand (Ostrofsky and Houston 1988).

Chestnut Blight (*Cryphonectria parasitica*) - This fungus (probably introduced through the importation of chestnut trees from Asia) was first reported in the United States in 1904. Within 50 years the fungus occupied the entire range and had killed 80% of the American chestnut (Kuhlman 1978). Nearly all the remaining live trees were infected with the fungus and dying. Prior to the infestation, the American chestnut was a major component of the eastern hardwood forest comprising 25% of all tree species on over 200 million acres from New England to Georgia (MacDonald, Cech, Luchok, and Smith 1978; and Schlarbaum 1989). This tree, which once grew up to 120′ tall and over 7′ in diameter, now rarely attains heights over 30′ with diameters up to 6″ before the fungus kills the stem. The process starts over when the tree resprouts. A few resistant trees have been found. There is hope that some time in the future the American chestnut will return, as a valuable timber and wildlife tree, to the eastern hardwood forest (Newhouse 1990). An opportunity exists to plant disease resistant chestnut in this area.

Non-native Invasive Plant Species

Non-native invasive plants have been recognized as a major threat to conservation of native biological diversity (Westbrooks 1998). They out-compete native species and homogenize ecosystems, thereby threatening to destroy the distinctiveness of communities whose component species evolved in the absence of these aggressive competitors. They can also degrade forage quality on range lands, compete with desirable regeneration after timber harvest, and reduce the diversity of habitat niches available to a wide variety of wildlife species.

Many non-native invasive plant species are known to occur in the Upper Greenbrier Watershed (Table VG-14). Of these, garlic mustard (*Alliaria petiolata*) and Japanese stiltgrass (*Microstegium vimineum*) can cause serious ecological impacts in forested ecosystems because of their ability to tolerate shade. Additionally, tree of heaven (*Ailanthus altissima*) could cause

ecological disruption due to its ability to capture canopy gaps in forests. Currently, all three of these species are closely associated with roads, skid trails, and landings, indicating that these transportation features have served as the primary invasion route in the watershed, probably through transport of seeds by vehicles, horses, ATVs, boots, etc. Non-native invasive plants that are less shade tolerant—such as multiflora rose (*Rosa multiflora*), autumn olive *(Elaeagnus umbellate*) and Kentucky 31 fescue (*Festuca arundinacea*), have been seeded for wildlife food or facilitated by the disturbed habitat provided by road corridors. Such species pose less of a threat to the forested ecosystems that predominate in the watershed, but in some cases they can spread and cause ecosystem disruption after being released by natural or human-caused disturbance.

Table VG-14. Non-native Invasive Plants in the Upper Greenbrier Watershed

Scientific Name	Common Name
Alliaria petiolata	Garlic mustard
Ailanthus altissima	Tree of heaven
Microstegium vimineum	Japanese stiltgrass
Vinca minor	Periwinkle
Phalaris arundinacea	Reed canary grass
Festuca arundinacea	Kentucky 31 fescue
Rosa multiflora	Multiflora rose

Currently, surveys for invasive plants focus on proposed activity areas, so it is likely that other infestations exist within the watershed. The overall strategy for addressing non-native invasive plants is perhaps best expressed in Management Goal VE19 of the 2006 Forest Plan (p. II-19):

Manage NNIS with an Integrated Pest Management approach, using prevention, education, eradication, containment, and control strategies in a coordinated effort that includes potentially affected resources, users, funding sources, and activities.

a) Work to prevent new infestations of NNIS, with emphasis on areas where species have a high probability for establishment and spread.
b) Work with WVDNR, utility companies, and special use operators to control NNIS in openings, rights-of way, and other use areas.
c) During project-level analysis, identify and map areas of non-native invasive plants. Identify areas with extensive infestations where precautionary measures are necessary when planning and implementing management activities.
d) Develop a Forest Non-native Invasive Species Management Plan in coordination with county, state, and federal agencies, including USFWS.
e) Provide training to field-going personnel for detecting evidence of NNIS with potential for broad-scale vegetation impacts.
f) Use the Forest-wide database and map library of NNIS and susceptibility to develop site-specific Integrated Pest Management approaches and strategies to manage these species.

Desired Conditions

An early detection/rapid response strategy is employed to respond to new occurrences of non-native invasive plants that threaten forest, non-forest, and aquatic ecosystems. Existing and new occurrences are prioritized for treatment based on threats to specific resources (rare plant species, tree species regeneration, visual effects, etc.) and ability to control the species. Native species

and desired non-invasive non-native species are used to revegetate disturbed areas (Forest Plan, p. II-17).

Outbreaks and resident populations of native and non-native pests are controlled to acceptable levels through careful use of pesticides and integrated pest management. An early detection/ rapid response strategy is employed by the Forest to respond to new occurrences of plants, insects, and diseases that threaten forest and non-forest vegetation. Pesticide treatments achieve management objectives and pose little or no risk to humans and the environment (Forest Plan, p. II-18).

Ecological Areas

Only one Forest Ecological Area exists in the watershed, the **Max Rothkugel Plantation**.

Figure VG-2. Max Rothkugel Plantation

Reference Conditions

This plantation of about 150 acres was established in 1907 by Max Rothkugel, who was the forester for the George Craig and Sons Lumber Company. Norway spruce and European larch were planted from Austrian seed to provide for a succession of the valuable softwoods prevalent at the time. Black locust were also planted to help protect the seedlings from grazing cattle. The land with the plantation was sold to the federal government in 1924 as an early addition to the newly formed Monongahela National Forest. The Forest gave the plantation protection as an 8.0

Botanical Area in its 1986 Forest Plan, and as an 8.4 Ecological Area in its 2006 Revised Forest Plan. The plantation is believed to be the oldest of its kind in West Virginia.

Current Conditions

This year marks the 100th anniversary of the plantation, and it has changed considerably in the intervening years. A thriving hardwood forest has grown up around the spruce and larch, but spruce trees are still dominant in the coves, and many larch trees can be found along the ridges and drier areas. The Norway spruce have grown particularly well, and most trees are 24-30 inches in diameter at breast height (DBH) and 100 feet or more in height. Some specimens are over 30 inches DBH. The larch are smaller in girth, generally from 15-20 inches DBH, but nearly as tall. Neither species, however, appears to be regenerating. Understory trees are predominantly beech and striped maple, with some hemlock.

The Appalachian Forest Heritage Area has recently expressed interest in researching and documenting the area as it exists today, and developing an interpretive trail and informational materials for the area. They have a proposal that includes fieldwork, trail restoration, site interpretation, self-guiding walking tours, brochures, a parking area, and nomination of the site to the National Register of Historic Places. The Forest Archeologist does not believe that the plantation would technically qualify for the National Register, but he is open to working with the AFHA to improve the historical interpretation at the area (Personal Communication).

Desired Conditions

As an 8.0 Special Area, the plantation has the following general desired conditions (Forest Plan, p. III-49): "Special Areas retain the values and qualities for which they were originally designated. Areas contribute to the diversity of the Forest by preserving rare species, communities, habitats, and features. These areas also provide opportunities for scientific research and public enjoyment."

As an 8.4 Ecological Area, the plantation also has the following management goal (Forest Plan, p. III-62):

"Emphasize plantation development and protection.

a) Release, thin, and display planted trees.
b) Study and promote the regeneration of Norway spruce and European larch.
c) Use Integrated Pest Management methods to minimize development of pest problems."

Openings and Grazing Allotments

Reference Conditions

Although it is difficult to say how much of this or the general forest landscape was in openings prior to European settlement, it is widely believed that Native Americans kept some areas fairly open with fire, and that some natural openings always existed in the form of bogs, wet and dry meadows, mountain heaths, and forest gaps created by natural succession, and disturbance processes such as fire, insects, and diseases. Domestic cattle and sheep grazing likely did not

occur before the arrival of settlers. However, there were a variety of large native ungulates such as deer, elk, and bison.

Current Conditions

Less than 2,000 acres are currently typed as openings across the entire watershed. These openings represent a little more than 2 percent of the landscape. Although there are numerous small natural and man-made openings (including roads and even-aged harvest units) that have not been included in the open types, the Upper Greenbrier Watershed can still be characterized as a dominantly forested landscape, with relatively little forest fragmentation.

On private lands, most of the openings are agricultural fields, pasturelands, or land cleared for residential or commercial purposes. Many of these openings are concentrated along a southern strip of land on the East Fork Greenbrier River that includes the communities of Durbin, Frank, and Bartow. On Forest, grazing allotments, wildlife openings, and some roadside areas are presently maintained to remain open areas. A large portion of the acres in openings on NFS land in this watershed are located in three grazing allotments (see discussion below). Less than 4 percent (2,700 acres) of forested area has been temporarily fragmented by regeneration harvesting on NFS land in the past 25-30 years.

Grazing Allotments

Currently, all of the Widney and Elk Mountain Grazing Allotments lie within the watershed boundaries. Roughly 100 acres of the 168-acre Allegheny Battlefield Allotment also lie within the Upper Greenbrier Watershed. Descriptions of the allotments are presented below.

Allegheny Battlefield - The Allegheny Battlefield Allotment is a high-elevation, mostly ridge top allotment, with some sloping ground. The elevation averages over 4000 feet. The portion in the watershed lies to the west of U.S. Highway 250 in the upper drainage of the Little River tributary to the East Fork Greenbrier River, in the Outlet East Fork Greenbrier subwatershed. The allotment is split by a watershed divide, with the remaining acres falling in the North Fork Deer Creek subwatershed to the south. The allotment allows 25 Animal Unit Months (AUMs) of grazing from May 15 through October 15. Currently, a continuous grazing system is used. The allotment lies within Management Prescription 3.0 where livestock grazing is allowed. The management goal (Forest Plan, p. III-7) for grazing is:

> "Management of open areas within allotments shall be primarily for livestock grazing. Intensive management for livestock grazing may occur."

At present, the allotment has one spring/wetland/water trough livestock watering development. The spring and the small wetland below it are fenced out. On the east side of the allotment is an un-named, wooded, intermittent creek that flows into the headwaters of Little River of the East Fork of the Greenbrier River. This riparian area is wooded and downhill from forage. It is not fenced out from livestock grazing. Monitoring has shown little livestock use of this area.

The allotment is primarily native pasture consisting of velvet grass and Allegheny flyback. Other forage species include orchard grass, bluegrass, sweet vernal grass, fescue, timothy, white clover, and red clover. Noxious and/or non-native invasive brush is not considered a substantial problem on this allotment, although the area is currently being treated for a thistle infestation. As the Forest continues to refine its draft list of non-native invasive species, some herbaceous plant species that in the past were typically considered to serve as forage for livestock and wildlife are being placed on the Forest's draft list of non-native invasive species. Examples of these include crown vetch, Kentucky 31 fescue, tall fescue, and Kentucky bluegrass.

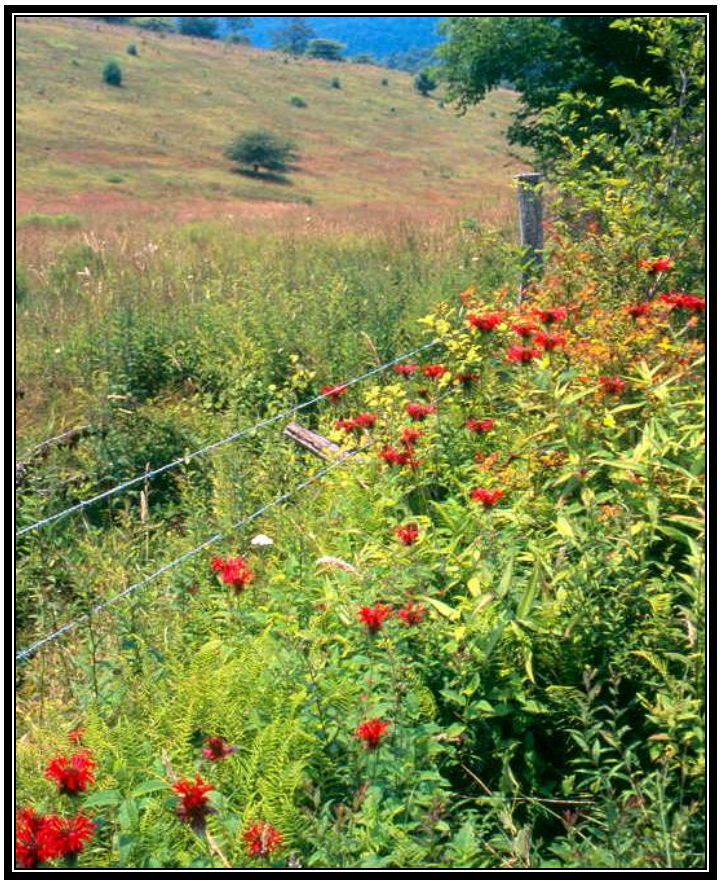


Figure VG-3. Allegheny Battlefield

The Allegheny Battlefield Allotment makes up part of an historic Civil War battlefield, a National Register of Historic Places site. Past and present Forest Archeologists have felt it is very important to continue to use livestock grazing as a tool to slow the rate of tree and brush invasion on this area and to maintain this portion of the battlefield in a pastoral condition to maintain the area's character as it likely appeared at the time of the battle.

Currently the Allegheny Battlefield Allotment only has one developed livestock watering facility. The allotment is relatively long and narrow. Usually, the farther the distance from a livestock watering source, the less grazing occurs. The addition of a livestock watering facility on the western one third of the allotment and another on the eastern one third of the allotment

would improve livestock distribution and forage utilization over the allotment. Development of livestock water on the western one third of the allotment would also allow implementation of a rotational grazing system on the allotment.

Portions of the roads leading to and within the Allegheny Battlefield Allotment are open to the public year-round and are rutted or contain mud holes. Water runs down these ruts causing soil movement, and further damage to the roads. There is a need to drain mud holes, to place gravel in spots, to install water bars, and to grade portions of these roads.

Widney – The Widney Allotment lies about 0.5 mile north and east of the Middle Mountain Road (State Route 10), about 11 miles northeast of the Greenbrier Ranger District Office, in the headwaters area of the Little River subwatershed. The main access road in FR 430. The allotment is an estimated 336 acres of high-elevation land (3460-4000 feet), with slopes ranging from 3 to 55 percent. The recommended season of use is from June 1 to October 1, though this season may be extended during warmer years. Roughly 45-50 cows/calves and 1 bull are grazed in a 2-pasture rotational system, and livestock are moved every three weeks. One of the pastures is on the permittee's adjacent private land.

This allotment is located in Management Prescription 4.1 where livestock grazing is allowed. The management goal (Forest Plan, p. III-14) for grazing is:

> "Maintain open areas within allotments predominantly by grazing cattle. Maintain a mixture of grass species suitable for supporting livestock through the grazing season."

An estimated 27 percent of the allotment was forested in 1995, and the remaining grasslands were undergoing varying degrees of hawthorn encroachment. One of the main management objectives in this area is to keep the grassland areas with relatively light hawthorn composition open to grazing. Canada bluegrass and Allegheny flyback are the most common grasses on the allotment. Scattered ferns, reeds, rushes, and sedges are indicative of wetter areas. Non-native plants, particularly Canadian thistle, are increasing.

The most recent Allotment Management Plan (AMP) and NEPA analysis for this area occurred in 1995 and 1988, respectively. Management concerns and opportunities need to be updated to reflect changed conditions and improvements since that time period.

Elk Mountain – The Elk Mountain Allotment lies on Elk Mountain, about 10 miles northeast of Bartow, in the upper portion of the Headwaters East Fork Greenbrier River subwatershed. It is bordered on the east by FR 112, one mile north of State Route 28. The allotment is an estimated 49 acres of high-elevation land (3620-4920 feet), with slopes averaging around 20 percent. The recommended season of use is generally from May 15 to October 1, although it may vary somewhat depending on climate and use levels. Roughly 20 cows/calves and 1 bull are grazed in continuous system. This allotment was vacant in 2006.

This allotment is located in Management Prescription 4.1 where livestock grazing is allowed. The management goal (Forest Plan, p. III-14) for grazing is:

> "Maintain open areas within allotments predominantly by grazing cattle. Maintain a mixture of grass species suitable for supporting livestock through the grazing season."

In 1993 the allotment had 40 acres of grassland, 2 acres of savannah, 2 acres of forest, and 5 acres of brushland. Hawthorn encroachment was a major concern at that time. Some of the hawthorn has recently been cut, but additional mowing is needed over the next few years to keep the hawthorn from growing back.

Canadian thistle infestation was also a concern, and recommendations included improving grazing distribution by adding water sources and salting, and converting to a deferred system through water development and interior fencing.

The most recent Allotment Management Plan (AMP) and NEPA analysis for this area occurred in 1993 and 1988, respectively. Management concerns and opportunities need to be updated to reflect changed conditions and improvements since that time period.

Desired Conditions

Vegetation - Forested lands exhibit variable patterns of size classes, densities, structural stages, and species composition due to a combination of successional development, disturbance regimes, and management activities. Age class distribution ranges from openings maintained for wildlife habitat to a network of late successional stands (Forest Plan, p. II-17).

Range - Grazing allotments are managed primarily for livestock grazing, wildlife habitat, visual diversity and dispersed recreation. A sustainable level of forage, consistent with other resource management direction, is available for use through the grazing permit system. Rangeland forage quality is maintained or improved in areas where vegetation management projects and range management actions occur. Riparian and upland areas within range allotments are functioning properly or have improving trends in vegetative composition, structure, and vigor. The composition and densities of tree, shrub, and herbaceous vegetation are variable and dynamic (Forest Plan, p. II-43).

Management Prescriptions 3.0 and 6.1 – Roughly 3 to 8 percent of the presciption area units are in maintained or natural openings, including beaver meadows, shrub and brush fields, savannahs, grazing allotments, seeded log landings and logging roads, mine reclamations, utility corridors, and natural disturbance gaps (Forest Plan, p. III-7 and p. III-35).

Management Prescription 4.1 – Up to 5 percent of these areas (spruce and spruce-hardwood communities) are in openings (Forest Plan, p. III-12).