INTRODUCTION

Intent And Organization Of This Watershed Assessment

Watershed assessment, as applied on the Monongahela National Forest (MNF), is a procedure to identify the interactions, processes, and functions of resources such as water, soils, plants, trees, animals, and human influence on a watershed scale. Knowing and better understanding these relationships will help us set priorities for social, economic and ecological needs when planning future activities in the area. It will also help us to better determine effects of our management. The watershed scale was chosen because it is a well-defined land area having unique features, and it allows us to analyze the interrelationships of various resources in an entire watershed.

The intent of this assessment is to develop a scientifically based document that identifies existing needs or concerns and management opportunities related to the watershed. Recommendations for the continued management and/or restoration of the watershed are included in Chapter 4.

This watershed assessment is a stage-setting process, not a decision-making process. It is designed to allow for future changes (additions/deletions) based on new information and data that become available, or on other issues that develop and raise new key questions. Key terms are defined in the glossary (Appendix B). The report covers 6 basic steps:

- Characteristics of the watershed – identifies the dominant physical, biological, and human processes within the watershed. (Chapter 1)
- Issue identification with key questions – identifies main resource concerns, conditions, and activities. (Chapter 2)
- Current condition description – describes the existing conditions of identified resources as they relate to the issues. (Chapter 3)
- Reference and desired condition description – estimates the historic and/or desired conditions of identified resources and serves as a comparison to the current conditions. (Chapter 3)
- Management recommendations – outlines potential projects and opportunities to maintain or restore the health of the identified resources. The objective is to move the area toward a desired conditions, as described in the 2006 MNF Land and Resource Management Plan. Management direction to achieve desired conditions is taken from the Plan's Forest-wide and Management Prescriptions goals, objectives, standards and guidelines. (Chapter 4)

Some of the areas in this report are in need of restoration or maintenance treatments. These problem areas were usually caused by some historic pattern of human activity. The findings within this document represent a foundation to develop site-specific project proposals and associated environmental analyses with decision documents.

General Location And Description of the Watershed

The Upper Greenbrier Watershed is located in the upper portion of the Greenbrier River in Pocahontas County, West Virginia (Map 1-1). The towns of Durbin, Frank, and Bartow are located at the southern end of the watershed. Shavers Mountain borders the area to the west, and

the West Virginia/Virginia state line forms part of the eastern boundary. Elevations range from about 2,700 feet on the Greenbrier River near Durbin to 4,600 feet on Back Allegheny Mountain.

Four sixth-level hydrologic units, or subwatersheds, comprise the Upper Greenbrier Watershed (Map 1-2), covering an estimated 85,100 acres (133 square miles). The four subwatersheds are Little River (HUC 050500030101), Headwaters East Fork Greenbrier River (HUC 050500030102), West Fork Greenbrier River (HUC 050500030103), and Outlet East Fork Greenbrier River (HUC 050500030104). These four subwatersheds form a portion of the larger fifth-level watershed named Deer Creek-Greenbrier River (HUC 0505000301). The Greenbrier River is a tributary of New River, with the confluence near Hinton, West Virginia. New River turns into the Kanawha River and enters the Ohio River at Point Pleasant, West Virginia.

The climate is characterized by annual precipitation that ranges between 49 and 60 inches per year, and averages about 54 inches per year across the watershed. The moister climates are generally found on the western side of the watershed on top of Shavers Mountain, with the drier climates near the Virginia border on the east side of the watershed. Summer temperatures average around 80°F, with occasional daytime highs in the 90s, and night time lows can fall into the upper 30s. Winter temperatures average around 30°F. Normally there are several days in the winter with temperatures at sub-zero levels.

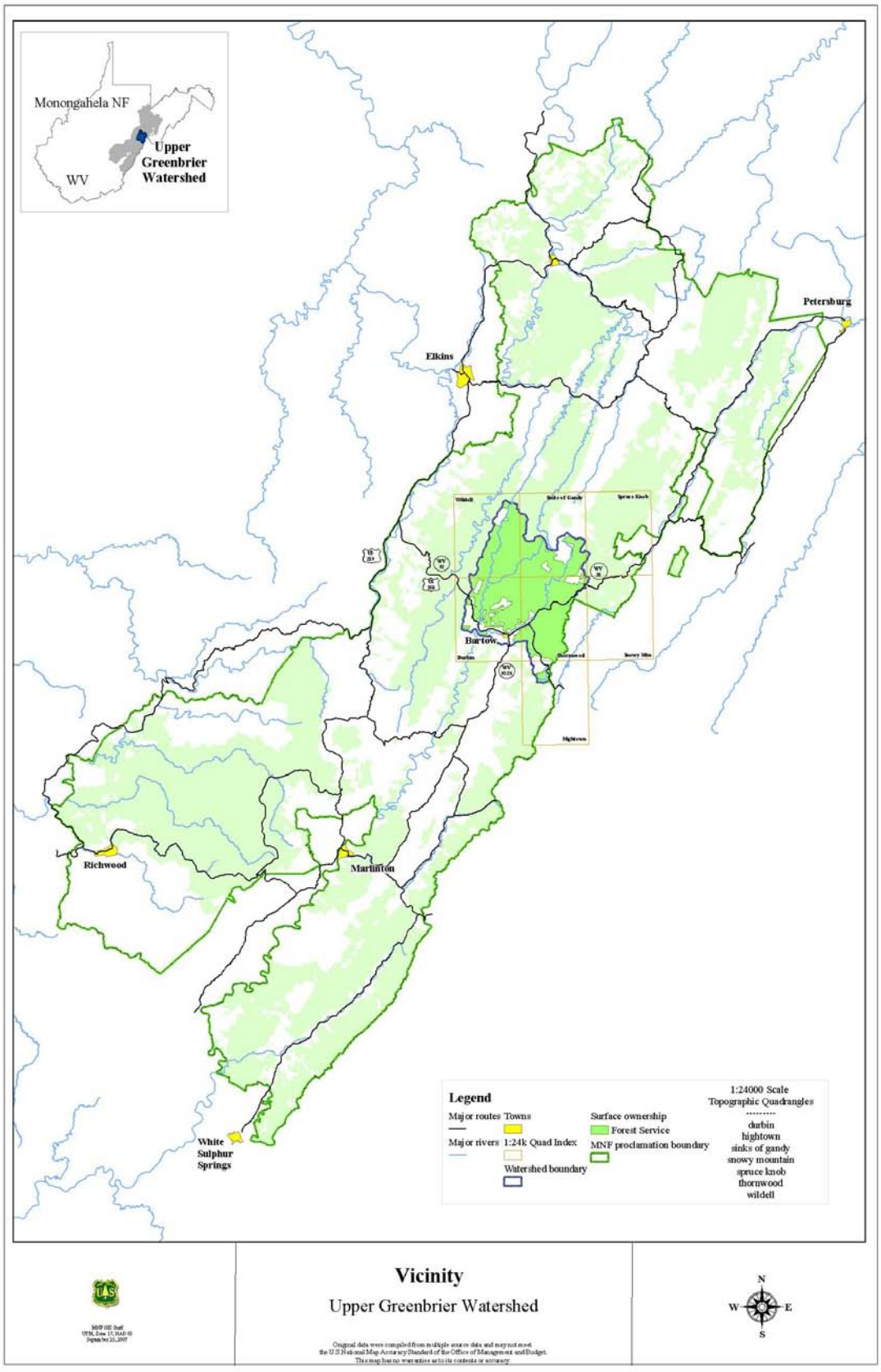
Shavers Mountain, located along the western boundary of this watershed, is the most dominant landform at over 4,000' elevation. Other notable landforms include Lynn Knob, Round Knob, Smoke Camp Knob, The Pigs Ear, and the large deep drainages created by the West Fork and East Fork of the Greenbrier River. The landscape is dominantly (>95%) forested uplands, with minor inclusions of agricultural fields, pastureland, wetlands, roads, gas well and pipeline developments, water, and residential developments.

An estimated 81 percent of the watershed is National Forest System (NFS) land, and the remaining 19 percent is under private ownership. Private lands (15,800 acres) are scattered throughout the watershed, with the largest area around the urban corridor of near Bartow (Map 1-2). Along the West Fork Greenbrier River are numerous dispersed recreation sites that are popular with seasonal occupants. Lake Buffalo provides water-based recreation opportunities in the southeastern portion of the watershed. Other notable features in the watershed include the Gaudineer Scenic Area, Island Campground, the Loop Road Research Area, the Max Rothkugel Plantation, and a portion of the Red Spruce Candidate Research Natural Area. The Gaudineer Scenic Area is also a National Natural Landmark.

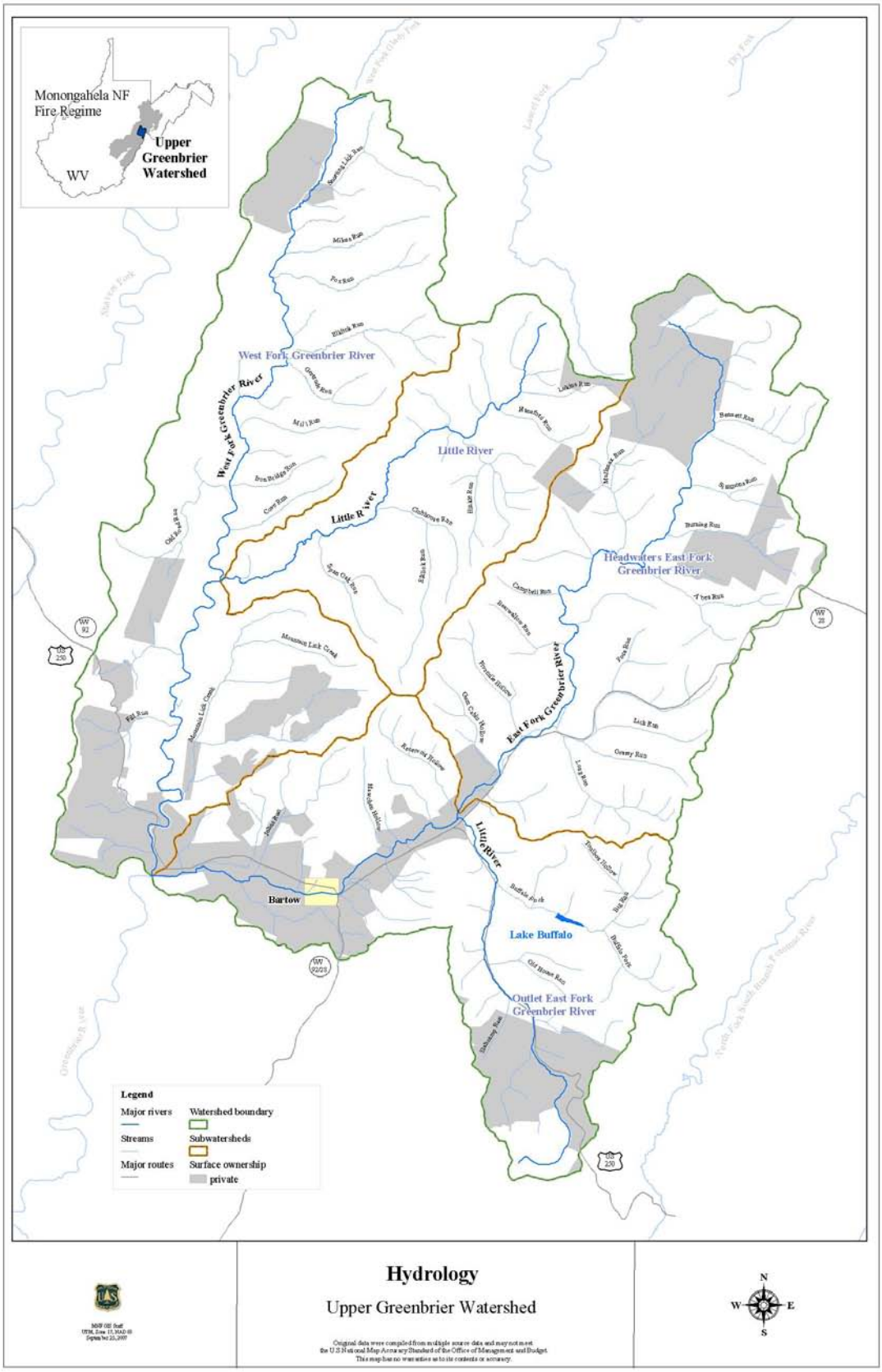
Management Prescriptions

The Upper Greenbrier River Watershed contains NFS lands under five different Management Prescriptions (see Map 1-3) as described in Chapter III of the MNF Forest Plan. These Management Prescriptions (MPs) are: 3.0 – Vegetation Diversity, 4.1 – Spruce and Spruce-Hardwood Ecosystem Management, 6.1 – Wildlife Habitat Emphasis, 6.2 – Backcountry Recreation, and 8.0 – Special Areas. The management emphasis for each prescription area is described below.

Map 1-1. Upper Greenbrier Watershed Vicinity Map



Map 1-2. Subwatersheds and Land Ownership in the Upper Greenbrier Watershed



An estimated 32,300 acres of MP 3.0 generally emphasize:
- Age class diversity and sustainable timber production.
- A variety of forest scenery.
- Habitat for wildlife species tolerant of disturbances, such as deer, grouse, squirrel.
- A primarily motorized recreation environment.

An estimated 16,690 acres of MP 4.1 generally emphasize:
- Active and passive restoration of spruce and spruce-hardwood communities.
- Research or administrative studies on spruce restoration.
- Recovery of threatened and endangered species and other species of concern associated with spruce and spruce-hardwood communities.
- Management of hardwood communities where spruce is a negligible or absent component.
- Generally restricted public motorized access and use.
- A mix of forest products.

An estimated 4,240 acres of MP 6.1 generally emphasize:
- A vegetation management strategy that emphasizes sustainable production of mast and other plant species that benefit wildlife.
- Active restoration of pine-oak and oak-hickory communities.
- Restricted motorized access and a network of security areas that reduce disturbance to wildlife.
- A primarily non-motorized recreational setting.
- A mix of forest products.

An estimated 14,960 acres of MP 6.2 generally emphasize:
- A semi-primitive, non-motorized setting with opportunity for a variety of dispersed recreation activities.
- A largely natural environment, with a general lack of management-related disturbance.
- Restoration and maintenance of ecological communities and habitats, predominantly through natural processes.
- Wildlife habitat for species that benefit from a general lack of human disturbance.
- Protection of watersheds and soils.

An estimated 1,110 acres of MP 8.0 generally emphasize:
- The preservation of unique ecosystems or areas for scientific or recreational purposes.
- Areas to conduct research
- The protection of special areas of national significance.

The specific special areas in the Upper Greenbrier Watershed are the 8.2/8.3 Gaudineer Scenic Area (140 acres), the 8.4 Max Rothkugel Plantation (150 acres), the 8.5 Loop Road Research Area (800 acres), and a portion (20 acres) of the 8.5 Red Spruce Candidate Research Natural Area (CRNA). The management goal for the Gaudineer Scenic Area is to maintain virgin forest characteristics. The management goal for the Max Rothkugel Plantation is to emphasize plantation development and protection. The Management goal for the Red Spruce CNRA is to

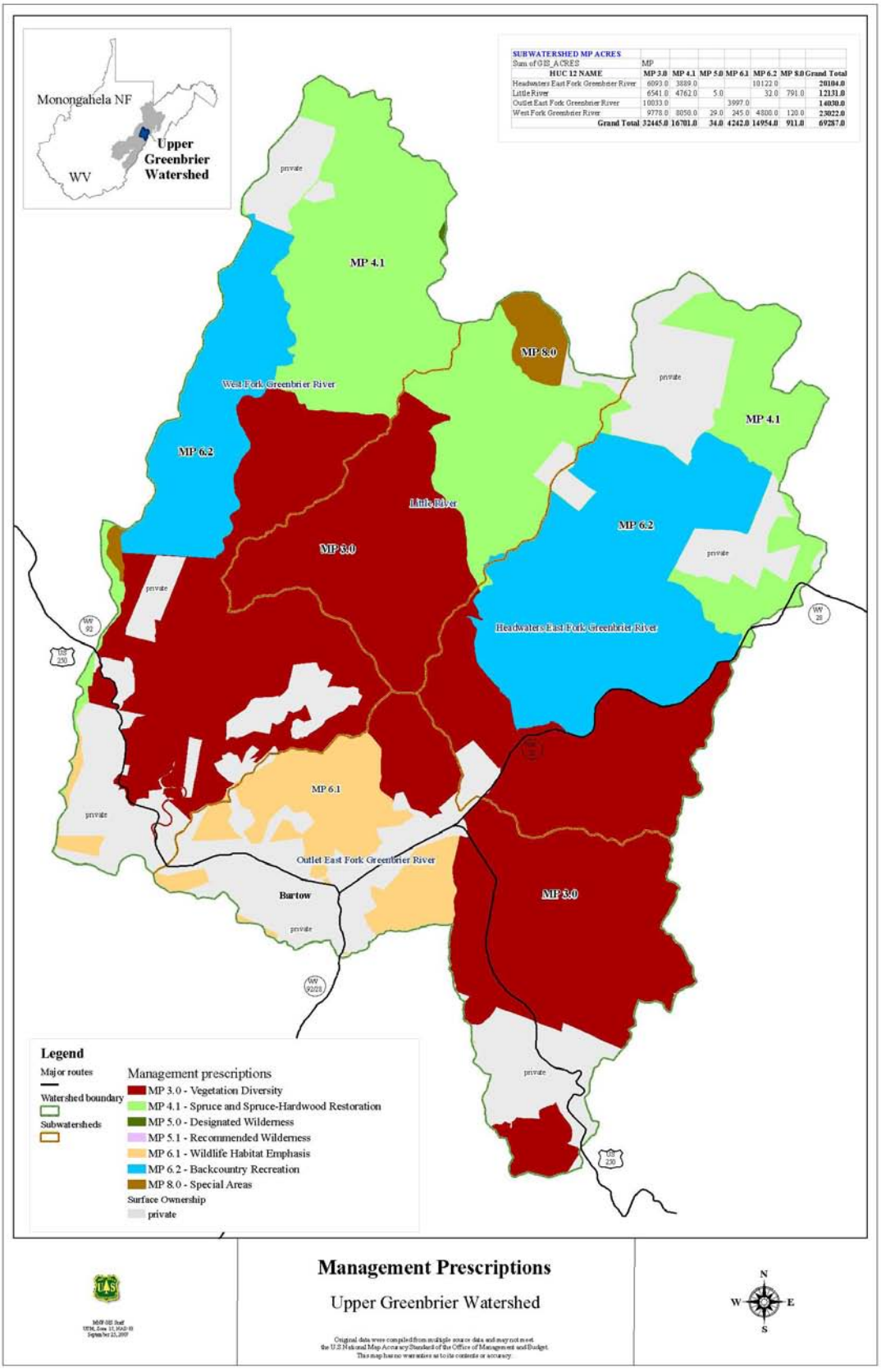
maintain designated cover types for research purposes. There are no specific management goals for the Loop Road Research Area, but it is managed in coordination with the Fernow Experimental Forest, which has several management goals (Forest Plan, p. III-65).

CHARACTERIZATION

The core topics and sub-topics that are covered in this assessment are:

- Soils and Erosion Processes
- Hydrology and Stream Channels
  - Morphology
  - Flow Rates
  - Storm Flows
- Water Quality
  - Sediment
  - Acidity
  - Temperature
- Aquatic Resources
  - Aquatic Habitat and Populations
  - Riparian and Wetland Habitat
- Vegetation
  - Forest Types and Age Classes
  - Threatened, Endangered, and Sensitive Plants
  - Non-native Insects, Diseases, and Invasive Plants
  - Openings and Grazing Allotments
  - Ecological Areas
- Wildlife
  - Threatened and Endangered Species
  - Sensitive Species
  - Management Indicator Species
  - Species of Interest
  - Birds of Conservation Concern
- Human Uses
  - Recreation
  - Heritage Resources
  - Minerals
  - Lands and Special Uses
  - Roads
  - Facilities
  - Research

Map 1-3. Management Prescription Areas in the Upper Greenbrier Watershed



These topics and sub-topics are briefly characterized below. More detailed descriptions appear in Chapter 3 of this assessment.

Soils and Erosion Processes

Geologically, the majority of the watershed is underlain by the Chemung group and Hampshire formation. The Upper Greenbrier Watershed contains an estimated 110 different soil types, though 10 of these types comprise 88 percent of the area (see Map C-1 and Table C-1 in Appendix C). Within those 10 map units, seven soil series are dominant, and these series are described in Chapter 3 of this assessment.

Soils and their parent geologies have generally good acid neutralizing capacity in this watershed, so the potential effects from acid deposition are not a significant issue as they are in some other areas of the Forest. The main issues with management implications involve soil erosion, sensitivity, and stability. An estimated 81 percent of the soils in the watershed are considered to have severe erosion potential, while 66 percent of the soils are considered sensitive. Both erosion hazard and sensitivity can be indicators of potential soil instability, or where gully erosion or mass movement may be likely to occur. Steepness of slope is a major factor in both assessments, as a high portion of the soils in the watershed fall into the 30-70 percent slope category. Other concerns with the soils include wetness, slippage, and limestone content in localized areas. Over 600 acres of the watershed are considered to be prime farmland, though most of these are on private lands.

Most soils concerns in this watershed revolve around management-created disturbance on steep slopes and wet areas. Soil disturbance related to constructing/reconstructing roads and operating heavy equipment in steep/wet areas is of particular concern. The Forest Plan has many management requirements that address this concern, and additional measures can be identified and used at the project level to reduce risks to soil stability and movement.

Hydrology and Stream Channels

Morphology

Channels have developed under complex conditions of geologic and soil parent materials, topography, land uses, and climatic conditions. The land uses that have most influenced stream morphology are associated with the historic logging that occurred between 1901 and 1920. Essentially the entire Upper Greenbrier Watershed was logged during that time, by exploitive methods that had severe impacts on soils and streams.

Historic logging developments and practices that impacted stream stability and morphology included the construction of logging camps and mill towns, mill ponds, log drives on the East and West Forks, and logging railroad lines and roads, among others. These developments affected streams and rivers by removing the riparian forest, converting riparian areas to wood processing and storage facilities and mill towns, damming streams and rivers for mill ponds and modifying runoff characteristics, filling or occupying channels, creating widespread severe

erosion of the landscape, and delivering enormous amounts of sediment for many decades. Channels still exhibit the effects of such practices, and are in a long, slow state of recovery.

More recent land uses within the watershed that affect stream condition include natural gas well development and pipelines associated with the Horton Field and Glady Storage Field, federal and private timber harvesting, a dense network of state, Forest and private roads (some of which closely follow and cross streams), some agriculture and livestock grazing, and residential and industrial uses mostly in the Durbin, Frank, and Bartow corridor.

Portions of the East and West Forks of the Greenbrier River, Little River, and limited portions of some tributaries, have developed moderately wider floodplains; otherwise floodplains are mostly narrow. Perennial streams exhibit a range of channel entrenchment from high (narrower flood prone areas) to low.

Stream Channel Types

In general, there are a wide variety of stream channel types within the assessment area, and there are both stable and unstable channels. The unstable channels have likely developed in response to natural factors (sedimentation and floods), but more so to historic and recent land uses. Historic logging in the early 1900s is thought to be the dominant land use influencing channel morphology today, because of the widespread harvesting of the entire watershed, and the destructive treatment of riparian areas and the stream channels themselves. Other land uses that continue to influence morphology have been mentioned above. Of these, roads are likely to be the dominant factor in driving channels toward an unstable condition, largely by concentrating and speeding runoff to the stream system, and increasing rates of sedimentation and bedload. Timber harvesting contributes to the problem through truck and skid road development, and their effects on runoff and erosion rates. Livestock grazing also contributes with increased erosion rates and loss of woody riparian vegetation.

Stream morphology is influenced in portions of some perennial tributaries by substantial alluvial deposits along those streams, especially within the watershed of the West Fork (Mikes, Fox, Elklick, Gertrude, Mill and Cove Runs and Little River, for example). These lengthy stream segments are largely devoid of woody overstory in the riparian zone, and portions of their riparian habitats are typed as wetlands. Stream morphologies in these areas are likely to be slowly evolving from less stable to more stable types, partly because of the open, herbaceous nature of the riparian areas.

Flow Rates

Streamflow within the watershed tends to be highly variable, dependent on season, rates of evapo-transpiration, and precipitation patterns. Monthly mean discharge ranges from 570 cubic feet per second (cfs) in March, to 71.7 cfs in September. The highest daily mean flow of 13,200 cfs, and the maximum peak flow of 37,100 cfs, occurred on November 4, 1985, while the lowest daily mean flow of 0.5 cfs occurred in September/October of 1953, 1968 and 1995.
This difference between high and low flows is very great.

These data, and what is known about the watersheds, indicates that streamflows are highly variable by season, and dependent on seasonal and precipitation characteristics. Evapo-transpiration losses in the vegetative growing season contribute most to lower streamflows. Also, snowmelt in the late winter and spring contributes somewhat to higher streamflows.

Streamflow tends to be not only variable, but higher runoff rates can be flashy, responding quickly to the influence of topography and soil/geologic characteristics, soil moisture conditions at the time of precipitation, rainfall amounts and intensity, and to land uses as well. Also, intense summer storms and large frontal system storms are common, as are periodic drought conditions, adding to the wide range of flow conditions in these streams.

Storm Flows

Stormflow within the assessment area is characterized as intense and frequent. Streams are frequently flashy in their response to larger storms, especially more intense storms. Streamflow tends to rise rapidly under those conditions, and falls rapidly as well, returning to base flow conditions rather quickly. Major frontal weather systems and tropical storms from the south can carry very substantial quantities of rainfall. Major storm events can be fairly frequent, and generally occur during the dormant season of the year (November through mid-May) when evapo-transpiration losses are minimal. This further adds to rapid storm runoff, and in less frequent cases to downstream flooding. Examples of recent dormant season major runoff events include the November 1985 flood, and the January and May 1996 floods.

Stormflows can be further influenced by land use activities and roads within the watershed. Land uses that reduce soil infiltration and water holding capacity, and reduce riparian vegetation, contribute to increased stormflow and stormflow effects on stream channels. These land uses in the Upper Greenbrier Watershed are primarily road development, ground-based timber harvest activities (including historic logging), livestock grazing, and natural gas development.

The cumulative effect of all these facilities and land uses is to capture and concentrate flows, and speed runoff to downstream portions of the watersheds. Stormflows can be impacted when water moving downslope in the soil is brought to the surface at road cuts, when infiltration and evapo-transpiration are reduced, and when surface runoff is concentrated and delivered to stream channels more quickly. Rates of runoff, stormflows, and channel stability and morphology can be affected by the cumulative impacts of these land uses and developments, but the magnitude of the effect depends on a complex interaction of factors.

Water Quality

Water quality in the Upper Greenbrier Watershed is generally moderate to good, and water chemistry is adequate to support aquatic biota that range from cool water to cold water communities. Sedimentation is a problem within much of the watershed, and streams typically transport considerable fine sediment during periods of storm runoff. Otherwise streams generally run fairly clear.

Water quality is considered adequate to meet established state standards (47CSR2), despite the recognized sedimentation problems in many of these streams. The high value that the State places on streams and water quality within the Upper Greenbrier Watershed is evident in the several special designations assigned to many of these streams. Many other streams are not specifically included in these lists, but these omissions may be due more to incomplete stream inventories, or land use impacts that are reducing habitat and water quality (such as temperature effects from reduced shade).

Sediment

Fine sediment is high within the rivers and streams of the Upper Greenbrier Watershed. Measured fine sediment levels in sampled stream substrates ranged from moderate and below the commonly accepted threshold of substantial adverse impact to brook trout spawning success, to high fine sediment composition and well above the threshold.

Sediment is delivered to streams through channel bank erosion, and through sheet, rill and gully erosion of upland slopes. Some gully erosion and headcut erosion occurs below roads where flow concentration has altered drainage patterns, increasing substantially the sediment supply to channels. There is a minor amount of mass wasting within the watershed, usually associated with road cuts and fills. Mass wasting has occurred on small segments of Forest Road 44, but delivered substantial quantities of sediment to the West Fork during those events. Some land uses and facilities within riparian areas, such as roads along streams and grazing within riparian areas, contribute to de-stabilized streambanks, accelerated channel bank erosion, and channel widening. Forest Service grazing allotments and private land grazing occur in the Headwaters East Fork, Little River, and Outlet East Fork subwatersheds. Numerous sediment sources exist within these allotments.

Much of the present day erosion and stream channel sediment conditions are consequences of the early 1900s logging and wood processing industry. Increased stormflows resulting from such land use had substantial channel stability effects, further compounded by removal of most of the riparian vegetation, including large wood, from channels. The aquatic and riparian resource condition that exists today has been and continues to be influenced by effects of the logging industry from a hundred years ago. Recovery from those impacts is a very long-term process.

Sediments, especially fine sediments, are mobilized in streams during periods of storm runoff, and increase suspended sediment and turbidity levels. As stormflows fall and streams return to baseflow conditions, suspended sediment and turbidity generally fall quickly to low levels and streams appear clear again. But fine sediments stored in and on the surface of the stream substrates are readily available to be remobilized in future runoff events. Stormflow sediment characteristics of streams within the watershed are generally considered to be high to very high.

Acidity (pH)

Water chemistry in streams is generally adequate in terms of acidity relations, and streams are relatively not susceptible to being acid deposition impaired. Limited portions of the watershed have some acid-sensitive geologic types, primarily along the top of Shavers Mountain in the

West Fork subwatershed (about 3100 acres), with another 2210 acid sensitive acres in the upper portions of the Headwaters East Fork and Little River subwatersheds. However, perennial streams in these areas gain better chemistry water as they flow through less sensitive strata immediately downstream. The poorest chemistry streams are mostly in the headwaters of Little River (Hinkle and Clubhouse Runs), and their pH stayed above 6.0 with ANC generally above 20. (WVDEP data documented several streams with pH below 6.0, but these were isolated instances, and otherwise pH remained above 6.0). Streams are otherwise adequate to good in their acid-buffering capacity, not considered to be acid impaired, and should generally sustain their aquatic communities. Several streams originating on the east flank of Shavers Mountain (including Old Road, Fill, and Braucher Runs) flow through Greenbrier Limestone strata, gaining considerable buffering capacity and have high ANC/alkalinity values.

Temperature

Aquatic ecosystems typically exhibit signature stream temperature patterns or stream temperature regimes that develop in response to prominent and persistent associations between land form, climate patterns, watershed hydrologic properties, and other watershed characteristics. Aquatic inhabitants can exhibit life history strategies that are adapted to specific stream temperature regimes and the associated environmental cues that function to initiate behavior critical to sustaining population viability for aquatic species over the long term. Changes to stream temperature regimes can alter the species composition of aquatic communities and influence the population health of individual aquatic species.

Stream temperature data recorded from June to October, 2005 and other information (see discussion on Aquatic Habitat and Populations in Chapter 3) available for streams in the Upper Greenbrier Watershed indicate portions of this system posses stream temperature regimes capable of supporting cold-water biota typically associated with native brook trout communities. Some stream reaches, particularly in larger streams such as the East Fork and West Fork Greenbrier River, are currently transitional areas better suited for cool-water aquatic communities characteristic of smallmouth and rock bass communities. Water temperatures in these cool-water transitional areas generally become too warm and stressful to sustain viable populations of cold-water biota during the summer but these areas can still provide critical seasonal habitat (*e.g.* over-wintering habitats) for cold-water biota during other times of the year.

Assessment of watershed characteristics can help explain variation in stream temperatures associated with different streams. Analysis of stream temperature datasets across the Forest suggest significant correlations exist between stream temperature and watershed characteristics including watershed area, stream length, stream elevation, percent forested area (for both riparian area and watershed area), percent wetlands, road density (for both riparian area and watershed area), and stream crossing density. Understanding these relationships can help identify opportunities to manage watersheds for desired conditions. The Forest Plan provides direction that can assist with maintaining necessary water temperatures to sustain viable populations of native and desired non-native aquatic species.

Aquatic Resources

Aquatic ecosystems consist of complex interactions among and between the physical, chemical, and biological environment. Aquatic habitats consist primarily of the physical and chemical components that develop in relation to land-forming processes dictated primarily by the geomorphic setting, climate patterns, watershed conditions, and disturbance regimes. Physical conditions and trends associated with fluvial aquatic habitats are most notably structured around a foundation of stream channel and riparian area conditions and processes. Water chemistry properties associated with aquatic habitats are largely a reflection of geochemistry and soil nutrient properties of the contributing watershed area as well as atmospheric deposition rates. The biological component of aquatic ecosystems is largely dependent on characteristics associated with available aquatic habitats.

Aquatic habitats within the Upper Greenbrier Watershed are currently inhabited by 38 fish species representing Catostomidae (sucker), Centrachidae (bass), Cottidae (sculpin), Cyprinidae (minnow), Percidae (perch), and Salmonidae (trout) fish families (Welsh *et al.* 2007). The aquatic community includes 29 native fish species, 9 non-native fish species, 7 aquatic species (4 fish species, 1 aquatic amphibian species, and 2 mussel species) listed as Regional Forester's Sensitive Species, 5 endemic fish species, and the only aquatic Management Indicator Species (brook trout, *Salvelinus fontinalis*) for the Monongahela National Forest

Many fish species that occur within the Upper Greenbrier Watershed (*e.g.* the Centrachids, Catastomids, and many of the Cyprinids), including most of the non-native species, are associated with warm to cool water habitats. Other species, particularly native brook trout, are associated with coldwater aquatic communities that are typically centered on stream reaches with the coolest stream temperatures. Though non-native trout species (*i.e.* rainbow trout and brown trout) that have been introduced into the Upper Greenbrier Watershed are typically associated with coldwater fish communities, these species were opportunistically introduced (McGavock and Davis 1935) and continue to be stocked in part because they are a sport fish that tolerate warmer stream temperatures than can native brook trout.

The West Virginia Code of State Rules establishes general Water Use Categories and Water Quality Standards for waters of the State (Title 47, Series 2.16). Certain waters of the State are specifically designated as Trout Waters (Category B2) that are defined by West Virginia Code as "streams or stream segments which sustain year-round trout populations" (Title 47, Series 2.18). Currently, 7 streams in the Upper Greenbrier Watershed are designated as B2 Trout Waters and 7 additional streams are identified in a proposal that would add to this list. Brook trout have been identified in nearly all named streams in the Upper Greenbrier Watershed, although the health of these populations varies considerably by stream.

Annual and seasonal variation of habitat conditions such as stream flows and stream temperature can bring about shifts in species distribution as aquatic organisms migrate to seek more favorable habitat conditions. The ability for aquatic populations to move between habitats in response to environmental conditions or other instinctive behavior is dependent on the accessibility of these habitats. Results from surveys of artificial barriers to aquatic organism passage indicate road stream crossings (1 road stream crossing for every mile of road) are fragmenting aquatic habitats.

Aquatic habitat fragmentation is likely contributing to impaired health of aquatic populations and possibly localized extirpation of isolated aquatic populations.

There are an estimated 263 miles of mapped streams in the Upper Greenbrier Watershed and 22 acres of an artificial impoundment (Lake Buffalo). Stream habitats within the Upper Greenbrier Watershed remain in an impaired condition as a result of the combined effects from historic and present day activities. Aquatic habitat composition is highly skewed toward simplistic shallow habitats that are typically characterized as riffles. In-stream large woody debris is notably scarce across the watershed. Stream sedimentation rates are generally elevated to levels that can negatively influence the reproductive success of aquatic organisms and adversely alter the composition and productivity of aquatic benthic communities. Chemical analysis of stream water samples collected in the watershed indicates that current water chemistry is not likely playing a significant role in limiting the productivity of the aquatic environment at this time. Nonetheless, the condition of other aquatic habitat conditions in the watershed is likely impairing the structure and productivity of aquatic communities.

Aquatic habitat and populations in the Upper Greenbrier Watershed reflect the long-lasting residual effects of human-induced and natural events that have altered hillslope hydrology, compromised stream channel integrity, degraded in-stream habitat, impaired riparian areas, introduced non-native aquatic species, and fragmented aquatic habitat. Though aquatic habitat and populations have been compromised in relation to reference conditions, many aquatic habitat and population characteristics have likely improved since the mid-1900s. Facilitating a trend toward improved aquatic health is largely dependent upon sustaining or advancing recovery trends for critical watershed and stream processes. The Forest Plan provides direction that can assist with achieving desired conditions for aquatic habitat and populations.

Riparian and Wetland Habitat

Riparian resources within the Upper Greenbrier Watershed are primarily those associated with riparian and streamside management zones along streams, and mapped wetlands that are typically adjacent to streams. Numerous emergent, scrub/shrub and forested wetlands of small to moderate size occur throughout portions of the watershed, and total an estimated 660 acres. Blister Swamp is an emergent wetland (wet meadow) of better than 10 acres size, mostly on private land in the extreme headwater of the East Fork. Additional wetland lines the East Fork channel downstream on private and NFS lands. Many tributaries of both the East and West Forks have wetland habitat adjacent to the stream channels. Land and shallow water immediately surrounding Lake Buffalo is also considered riparian/wetland habitat (Figure 1-1).

There are an estimated 6,322 riparian area acres within the Upper Greenbrier Watershed (7.4 percent of the total watershed area). Some of this calculated riparian acreage overlaps with the wetland habitat acreage. This is a substantial underestimate of actual streamside riparian area, however, because riparian areas along un-mapped channels were not counted.

Riparian areas are largely in a forested condition, with 5,647 forested riparian acres calculated (89 percent of the total riparian acres). Much of that is fairly intact riparian forest that provides a range of riparian benefits to streams (shade, nutrients, large wood, etc). But large woody debris

recruitment potential to all streams is much below what it should be because riparian forest age is still too young to provide an abundant and continuous supply of large wood to streams.

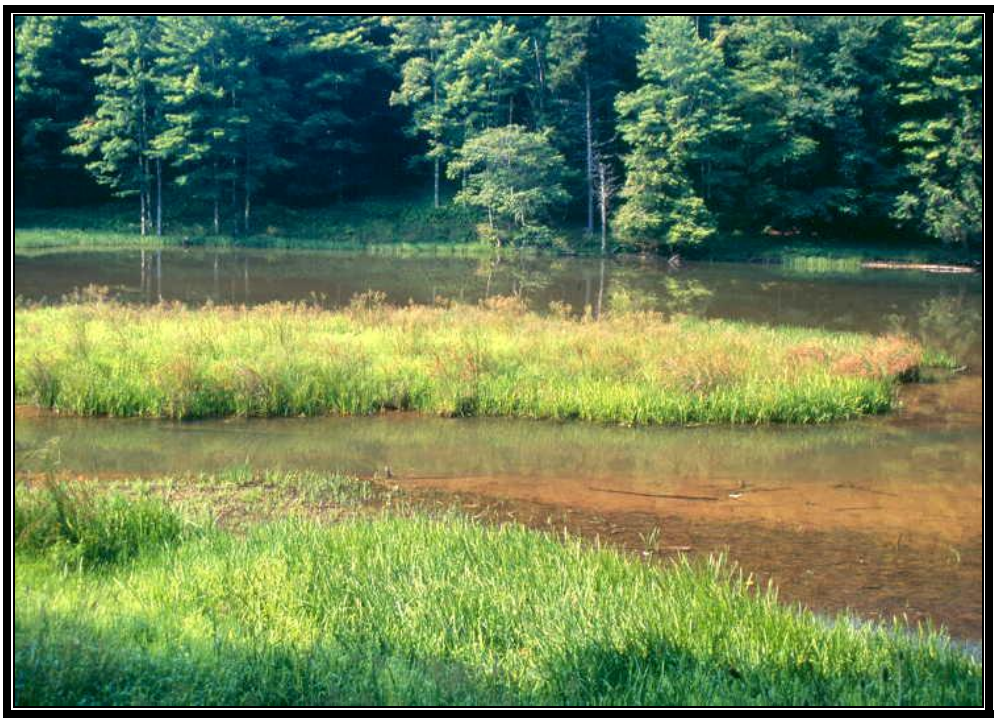


Figure 1-1. Lake Buffalo Shallows

Substantial riparian acreage is inadequately forested; however, some of that acreage is in wetland habitat. Some streamside riparian areas that are not wetland are lacking riparian forest or in a severely degraded condition. Numerous streams in the West Fork drainage in particular have extended channel lengths with little or no riparian forest, which is affecting stream health and water temperatures. These streams include Mikes, Fox, Elklick, Gertrude, Mill and Cove Runs, and Little River. Numerous roads occupy riparian areas or streamside zones and cross stream channels, further degrading riparian conditions throughout the watershed.

Vegetation

Forest Types

Over 95 percent of the Upper Greenbrier Watershed is forested. 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. At least 20 commercial tree species and more than 30 non-commercial trees can be found in the Upper Greenbrier Watershed.

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. 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.

Oak communities are currently in decline due to changes in stand density, structure, 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. 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.

Age Classes

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.

A comparison of current and desired age class conditions in Management Prescription areas 3.0, 4.1, and 6.1 indicates that there is both a need and opportunity to regenerate stands 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 these prescription areas provides for this type of activity.

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) treatments can select which trees will live and prosper in a given stand. 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). Numerous young stands of trees 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 thinning, 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 - Most of the watershed, however, is considered to be in Fire Regime 5, Condition Class I, with fire return intervals of 200+ years. There are approximately 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. 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 MP 6.2 areas where there are restrictions on mechanical disturbance and road construction.

Threatened, Endangered and Sensitive Plants

Based on field surveys of proposed activity areas and existing records, one (running buffalo clover) of the four threatened and endangered plant species is known to occur within the Upper Greenbrier Watershed. Potential habitat may occur for two other species, Virginia spirea and small-whorled pogonia, although the likelihood of occurrence is relatively low.

Based on field surveys and existing records, three of the 54 Regional Foresters Sensitive Species (RFSS) on the Forest are known to occur within the Upper Greenbrier Watershed: Appalachian blue violet (*Viola appalachiensis*), butternut (*Juglans cinerea*), and rock skullcap (*Scutellaria saxatilis*). Based on a Likelihood of Occurrence assessment, potential habitat could occur for 30 additional RFSS plants.

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 would be protected through management requirements in the Forest Plan, and any additional mitigation measures identified at the project level.

Non-native Insects, Diseases, and Invasive Plants

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 in the watershed include:

- **Insects:** gypsy moth and hemlock woolly adelgid
- **Diseases:** beech bark disease and chestnut blight
- **Non-native Invasive Plants:** multiflora rose, autumn olive, tartarian honeysuckle, and purple loosestrife.

Many non-native invasive plant species are known to occur in the Upper Greenbrier Watershed. 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.

Openings and Grazing Allotments

An estimated 2,164 acres of NFS lands in the watershed are in an open vegetative condition, such as pastures, meadows, bogs, or clearcut areas. This acreage represents 3 percent of the NFS land in the watershed. There are nearly 500 acres of grazing allotments within the Upper Greenbrier Watershed, located in three allotments: Elk Mountain, Widney, and Allegheny Battlefield. Allegheny Battlefield is also a Civil War site on the National Register of Historic Places. Roughly 70-80% of these areas are suitable for cattle grazing, with the remaining land dominated by forest or brush. Current concerns include encroachment of hawthorn and non-native invasive species, primarily Canadian thistle. Livestock distribution could be improved by providing additional water sources.

Ecological Areas

One Ecological Area exists in the watershed; the Max Rothkugel Plantation. 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. 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.

Wildlife

This watershed contains a diversity of habitat types including forests, rivers, wetlands, beaver ponds, a lake, and open/shrubby field areas. The landscape is dominantly (>95 percent) forested uplands, with minor inclusions of agricultural fields, pastureland, wetlands, roads, water, and developments. The elevation range of this area, from 2,700’ to 4,450’, may preclude the presence of some species that commonly occur at lower elevations, such as bullfrog and northern copperhead. High elevation spruce forests add to the variety of forest types, providing habitat for species such as red-breasted nuthatch, snowshoe hare, and saw-whet owl (Stephenson 1993).

Threatened and Endangered Species

The four federally T&E terrestrial animal species on the Forest are: Virginia big-eared bat, Indiana bat, West Virginia northern flying squirrel, and Cheat Mountain salamander. All four species are known to occur in the Upper Greenbrier Watershed. Forest Plan and other direction would protect these species and their habitats, but there are also opportunities to proactively enhance habitat conditions to aid in recovery of these imperiled species. Recommendations for habitat maintenance and improvement are described in Chapters 3 and 4 of this assessment.

Sensitive Species

Nine species on the Regional Forester's Sensitive Species (RFSS) list have confirmed occurrence within the watershed, including the southern water shrew, Allegheny woodrat, southern rock vole, northern goshawk, olive-sided flycatcher, red-headed woodpecker, golden-winged warbler, timber rattlesnake, and hellbender. Other RFSS wildlife that have potential habitat within this watershed are the eastern small-footed bat, Henslows sparrow, vesper sparrow, green salamander, columbine duskywing, a noctuid moth, and cobweb skipper.

Bald eagle and riparian area direction in the Forest Plan should help protect streamside and lakeside vegetation to maintain or provide for future eagle nesting and perching trees. Recommendations for watershed and riparian restoration in this assessment (see Chapter 4) would also provide improved habitat conditions over time for species such as the hellbender and southern water shrew.

Spruce and spruce-hardwood forests appear to be gradually recovering within the watershed. Further recovery, whether through natural processes or active management, would benefit the northern goshawk, southern rock vole, olive-sided flycatcher, and a noctuid moth.

Where passive restoration is emphasized, forested stands will continue to move toward late successional stage and uneven-aged structure, with an increase in features such as snags, large logs, and humus. This trend will provide more habitat for species such as Allegheny woodrat, southern water shrew, and green salamander. Where active management is emphasized, more shrub/sapling habitat will be created for species like golden-winged warbler. Mixed hardwood and oak forests can be managed to promote oak species that benefit species like the red-headed woodpecker. Important habitat features, like snags and selected large trees, can be retained.

Relatively large open grass/shrub areas occur in three grazing allotments in the watershed. However, openings are slowly being encroached by hawthorn, trees, and non-native species. These areas should be managed to restore and maintain open habitat for species such as Henslow's sparrow, vesper sparrow, columbine duskywing, and cobweb skipper.

Localized disturbance is probably the greatest threat to species like the timber rattlesnake and northern goshawk. For this reason, surveys that can help locate nest or den sites prior to project-level planning are very important. Indeed, additional wildlife surveys will be needed prior to any proposal that involves vegetation or ground disturbance.

Management Indicator Species

All four MIS for the Forest are known to occur within the Upper Greenbrier Watershed. The brook trout is addressed in the Aquatic Resources section of this assessment, and the West Virginia northern flying squirrel is addressed under Threatened and Endangered Species. Therefore, only cerulean warbler and wild turkey are addressed in this section.

Mid-late and late successional mixed hardwood forests are most likely to contain key structural features that are believed to be important for breeding populations of cerulean warblers. Currently, mixed hardwood forests cover an estimated 55 percent of the Upper Greenbrier Watershed, and approximately 70 percent of those forests are believed to be in mid-late successional stage. While cerulean warblers do not necessarily inhabit all of this area, and may inhabit other areas not included in this forest cover type, it is believed to contain the best potential habitat for this species. The primary areas that can serve as natural refugia for this type of forest are the two MP 6.2 roadless areas, which comprise about 22 percent of the NFS land in the watershed. An 11,000-acre refugia also lies just to the north of the watershed in the Laurel Fork North and South Wildernesses. Forest management could also be beneficial in creating desired vertical structure and canopy openings in appropriate settings in the watershed.

The indicator chosen for optimum turkey habitat is oak and pine-oak forests of optimum mast-producing age, plus openings, within MPs 3.0 and 6.1. The optimum mast-producing age range for the oak and pine-oak forest type groups was considered to be 50 to 150 years. Currently only about 7 percent of the entire Upper Greenbrier Watershed is considered to be oak or oak-pine forests, and only part of that is on NFS land in MPs 3.0 or 6.1. However, oak does exist as a component in the mixed hardwood stands that comprise 55 percent of the watershed. Most of these stands are within the optimum mast-producing age range now, but there is little oak regeneration occurring at present. Also, less than 2 percent of the watershed is considered openings, with even less considered herbaceous openings. For these reasons, it is recommended that silvicultural practices in oak and mixed hardwoods stands within MPs 3.0 and 6.1 promote oak regeneration and crop tree release, as well as the creation and maintenance of herbaceous openings. These practices would help increase optimum habitat for wild turkey in the watershed.

Species of Interest

Species of Interest for this assessment are white-tailed deer and black bear. Because a substantial percentage of NFS land will remain forested under any possible management scenario, cover and hard mast are not likely to limit deer populations over the short term. However, mast production will begin to diminish as mature trees become over-mature and die, unless mast-producing trees are regenerated to replace them. Within the range of management activity that is likely to occur, an increase in young mast-producing forest and openings and edge would increase the habitat capability for deer over time. Thus, the opportunities to increase foraging habitat for deer would be similar to those described for wild turkey, above.

Black bear population densities in the Appalachians are inversely related to road densities (SAMAB 1996). The open road density for NFS lands over the entire watershed is currently only 0.5 mile per square mile, so open roads are not likely having significant effects on bear

populations in terms of vehicle-related disturbance. Black bears also depend heavily on hard mast as a fall food source for successful over-wintering and reproduction (Pelton 1989). Optimum mast-producing areas include oak and pine-oak forest types in the optimum oak mast age range of 50 to 150 years. Within those MPs, only about 4,500 acres are mixed oak forests, mostly in MP 6.1. However, there is an oak component in the mixed and northern hardwood forests that comprise much of the watershed. These areas should provide opportunities to help maintain and restore the oak component in watershed stands.

Birds of Conservation Concern

Recovery of spruce and hardwood forests within the watershed should benefit many of the birds of conservation concern, particularly as more of the area is allowed to develop the characteristics of late-successional or old growth forests. An increase in uneven-age structure, with associated vertical complexity, snags, small natural canopy openings and large downed woody debris will benefit a variety of species. Cavity nesters (*e.g.*, the saw-whet owl, yellow-bellied sapsucker, red-headed woodpecker) will benefit from both an increase in natural cavities and, like several other forest-associated birds of concern, an increase in prey base (be it small mammal or insect) associated with the downed woody debris and increased humus layer. Bird species associated with riparian and wetland habitats (*e.g.*, waterthrush, prothonotary warbler, and sedge wren) also should benefit, as water quality conditions improve through Forest Plan direction associated with those resources. Additionally, opportunities exist to create and restore wetlands within the watershed to enhance opportunities for these and other wetland-associated bird species.

In areas of active forest management, a variety of techniques can be used to maximize habitat suitability for birds of conservation concern. For example, red-headed woodpeckers and yellow-bellied sapsuckers, both cavity nesters that prefer open woodlands, could benefit from thinning and snag creation within oaks, mixed hardwood or other deciduous stand types; whip-poor-whills and other species that have experienced population declines due to a decrease in open woodland habitat also could benefit from thinning or selective cuts. Snag creation also could occur within stands that are not subject to harvest, but currently have a paucity of available cavities. Forest management designed to encourage spruce restoration would be beneficial to species such as the northern saw-whet owl and olive-sided flycatcher, by providing additional, contiguous habitat for these species associated with northern hardwood/spruce-fir forests.

Existing grass/low shrub habitats in grazing allotments currently provide potential habitat for bird species during both the breeding season (*e.g.*, golden-winged warbler) and non-breeding season (*e.g.*, short-eared owl, upland sandpiper, and Bewick's wren). Management of these areas to maintain a mix of grassland and shrub habitat should occur to ensure continued habitat for these species. Consideration should be given to developing additional long-term, early-successional habitat within the watershed for species such as the Bachman's sparrow and golden-winged warbler, with the design of such areas taking into consideration the species' habitat size needs (*e.g.*, territory sizes and minimum viable populations sizes) as well as desired vegetation and the management schedule required to maintain suitable habitat.

Forest Fragmentation

Over 95% of the Upper Greenbrier Watershed is forested. Furthermore, a review of WV GAP Analysis LULC data, in conjunction with digital orthographic quadrangle (DOQ) photos, indicates that the forested habitat within the watershed also is relatively unfragmented, with non-forested areas generally clumped, such that forest patches are fairly contiguous. However, temporary fragmentation, such as that resulting from timber harvest, is an issue that will still need to be addressed. In some situations, particularly where T&E species like the Cheat Mountain salamander may be at risk, avoidance of fragmentation may be the only alternative. In other situations, maintaining some type of habitat connectivity can help offset potential impacts and maintain local population viability for some species, while providing additional forest and edge habitat for other species.

Human Uses

Recreation

Many forms of recreation are available in the Upper Greenbrier Watershed. Hiking, mountain biking, horseback riding, camping, picnicking, fishing, hunting, viewing scenery, and driving for pleasure are all popular activities. Horseback riding opportunities are somewhat limited, and off-road vehicle use is not allowed due to the current absence of designated routes. There are no congressionally designated Wilderness areas or Wild and Scenic Rivers; however, there are two Inventoried Roadless Areas (MP 6.2 backcountry areas) within the watershed.

There are nearly 60 miles of recreational trails in the Upper Greenbrier Watershed. Hiking opportunities range from an easy 0.5 mile interpretive loop in the Gaudineer Scenic Area to a 21-mile section of the state-wide Allegheny Trail (701). In addition, hiking, horseback riding and mountain bicycling on the seventeen miles of the West Fork Rail Trail are popular, as is use of several other multiple purpose trails.

Camping occurs in the developed Island Campground, as well as dispersed sites along the Little River (Figure 1-2) and the West Fork Greenbrier River. The dispersed areas offer free camping and provide for base camps during hunting and fishing seasons. Picnicking and family gatherings are popular at Old House Run Picnic Area, Gaudineer Scenic Area and Picnic Area, and Lake Buffalo.

Lake Buffalo is stocked with trout several times throughout the year and is a popular destination for anglers. The East and West Forks of the Greenbrier River and Little River are also stocked with trout. Several tributaries contain native brook trout for the more adventurous fisherman.

Hunting occurs mostly in the spring, fall, and early winter months. Game species include black bear, white-tailed deer, turkey, fox and gray squirrels, ruffed grouse, rabbit, and raccoon.

Viewing scenery occurs throughout the watershed and especially at the Gaudineer Scenic Area, which was designated by the Regional Forester in October 1964. Gaudineer Scenic Area is also

a Registered National Natural Landmark for its exceptional value as an illustration of the nation's natural heritage and its contribution to a better understanding of man's environment.

Driving for pleasure occurs throughout the watershed and especially along the Staunton-Parkersburg Turnpike Scenic Byway, which is located along/near US Route 250 and runs from the eastern state line to Beverly, WV and beyond to Parkersburg, WV. Driving along FR 14, FR 17 and FR 44 are also popular and allow access to the Gaudineer and East Fork of the Greenbrier Inventoried Roadless Areas, which are managed as backcountry areas. There areas offer semi-primitive opportunities to hunt, fish, hike, and just get away from it all.

Figure 1-2. Dispersed Campsite Parking Area along the Little River Road

The old CCC Camp Thornwood is located in the watershed and is under special use permit to the National Science Camp (Camp Pocahontas) as an organizational camp for youth.

Interpretive displays are located at the Greenbrier Ranger District office in Bartow, as well as the Gaudineer Scenic Area. Both interpretative displays could be updated and improved. The Rothkugal Plantation offers opportunities for research and interpretation. The watershed also falls within the Proposed Appalachian Forest Heritage Area, when designated, may become a source for partnerships.

Heritage Resources

The area is rich in upland resources that would have made it attractive to prehistoric peoples. These resources include numerous sources of fresh water, land and riparian transportation routes, access to lithic materials, game, and a wide variety of flora.

Historic Euro-American use of the landscape was focused primarily on logging activities that centered around several logging mills and communities along the West and East Forks of the Greenbrier River. These activities boomed in the first two decades of the 20th century, and diminished after 1920. Historic logging activities have significantly impacted the landscape, causing significant impacts to soil, water, vegetation, and habitats. Mineral activity began with coal mining along the western edge of the watershed, but has since been focused on natural gas exploration and development along two separate gas fields since the 1960s. National Forest management has occurred since the 1920s, and a wide variety of activities are described throughout this assessment.

Minerals

An estimated 11.3 percent of the watershed's NFS land has privately owned mineral rights, with the remainder being federally owned. However, this watershed has a fairly high amount of minerals-related activity compared to most other watersheds on the Forest. The primary minerals-related activity in this watershed has been the exploration and development of natural gas. Columbia Gas Transmission began developing the Glady Storage Field in 1964, and has been active in this area ever since. Work on the Horton Field, on the east side of the watershed, began in the 1960s as well. Cabot Gas & Oil started trying to expand the Field in 1999, but has had limited success.

About the southern half of the 50,000-acre Glady Storage Field is in the Upper Greenbrier Watershed. Under permit until 2013, the storage field runs roughly north and south between Durbin and Forest Road 35, and east/west between Forest Road 44 and Middle Mountain Road (FR14). The storage field consists of gathering pipelines which run to and from the storage wells to a compressor station outside the watershed. Twenty-three storage well sites, over 31 miles of access roads, and 7.5 miles of pipeline are currently in the Upper Greenbrier Watershed portion of the Glady Storage Field.

The Horton Field lies roughly in the area between US 250 east of Bartow and the confluence of Forest Road 106 and State Highway 28. The original plan was for Cabot to develop and produce natural gas from 22 wells in the Oriskany Sandstone and Huntersville Chert Reservoirs. Currently, there are 7 operating well sites, 10.8 miles of pipeline, and 3 abandoned/reclaimed well sites within the Horton Field, two of which are maintained by the DNR as wildlife openings.

Lands and Special Uses

Currently, an estimated 81 percent (69,300 acres) of the Upper Greenbrier Watershed is NFS land, with the remaining 19 percent (15,800 acres) in private ownership. Current uses on private lands include residential, agriculture, pastureland, forestry, and some commercial/industry in the Durbin-Bartow corridor.

There are an estimated 120 miles of common Forest Service/private boundaries in the watershed assessment area. Nearly 68 percent (80 miles) of those lines have been surveyed and marked to

standard. An estimated 12 percent (15 miles) have been identified as having a higher priority for survey due to the potential for management activities in the foreseeable future.

Current special uses authorized in the Upper Greenbrier Watershed include utility corridors for power lines (Monongahela Power) and telephone lines, rights-of-way to West Virginia Department of Transportation, private road access permits, water developments, an organizational camp, a manager residence area for West Virginia Division of Natural Resources, a weather station, and a gas pipeline.

Roads

Road access on NFS land generally consists of two components: Classified roads, which are typically part of the National Forest Road System or developed roads under other jurisdiction (generally federal and state highways or routes); and unclassified roads, also known as "woods roads", which are typically user-created roads that have never been designed, constructed, or maintained. There are an estimated 181 miles of Forest classified roads in the Upper Greenbrier Watershed, and an estimated 143 miles of unclassified roads. There are another 50.7 miles of State/Federal roads in the watershed that are considered classified roads by the Forest but are not under Forest jurisdiction.

Of the 117 classified roads in the watershed under Forest Service jurisdiction, 19 (16 percent) are open to public motorized use year-round. Of the 181 miles of classified road under Forest Service jurisdiction, an estimated 57 miles (31 percent) are open to public motorized use year-round. Of these open roads, 54 miles are arterial or collector, and only 3 miles are local roads. Another 12.5 miles (7 percent) of road are open seasonally to the public. Over 111 miles (62 percent) of classified roads are closed year-round to public motorized use.

The total amount of road mileage in the watershed—including Forest classified and unclassified roads, and private roads (36.6 miles)—adds up to an estimated 411.6 miles. Thus, the estimated road density for the entire 85,100-acre watershed is 3.09 miles per square mile. For NFS land within the watershed (69,300 acres), the total amount of Forest classified and unclassified roads is estimated to be 324.4 miles, with an overall road density of 2.99 miles per square mile.

Facilities

The Forest Service facilities that need attention within the Upper Greenbrier Watershed are associated with administrative and recreation sites. They include a number of buildings and utilities at the Greenbrier Ranger District Office site; toilets, bridges and a hand pump at Island Campground; toilets, a pavilion, and hand pump at Old House Run Picnic Area, and toilets, hand pump, lake, dam, and boat access ramp at Lake Buffalo. Chapter 4 includes recommendations to maintain, improve, or replace these facilities.

Research

The Upper Greenbrier Watershed has two areas with a strong connection to past or potential forest research. Both have 8.5 management prescription direction in the Forest Plan. These

areas are the Loop Road Research Area (800 acres) and the Red Spruce Candidate Research Natural Area (60 acres). The Loop Road area is managed by the Fernow Experimental Forest of the Northern Research Station, which is conducting at least two long-term studies on vegetation response there. The Red Spruce area is being managed by the Monongahela National Forest to conserve a relatively undisturbed example of the spruce-hardwood forest type.

Other

Vandalism – Some sites are vandalized every year. The most frequent vandalism is broken toilet building windows, graffiti, and vehicles destroying vegetation beyond roadways. Locks and pins on the gates of closed roads are often broken. Most of this vandalism occurs during hunting season.

Off-Road Vehicle Use – At this time there are no authorized areas for the use of off-road vehicles. Several areas of national forest land, adjacent to private property, show evidence of recent and frequent off-road vehicle use. Most of this use is limited to all-terrain vehicles (ATVs).

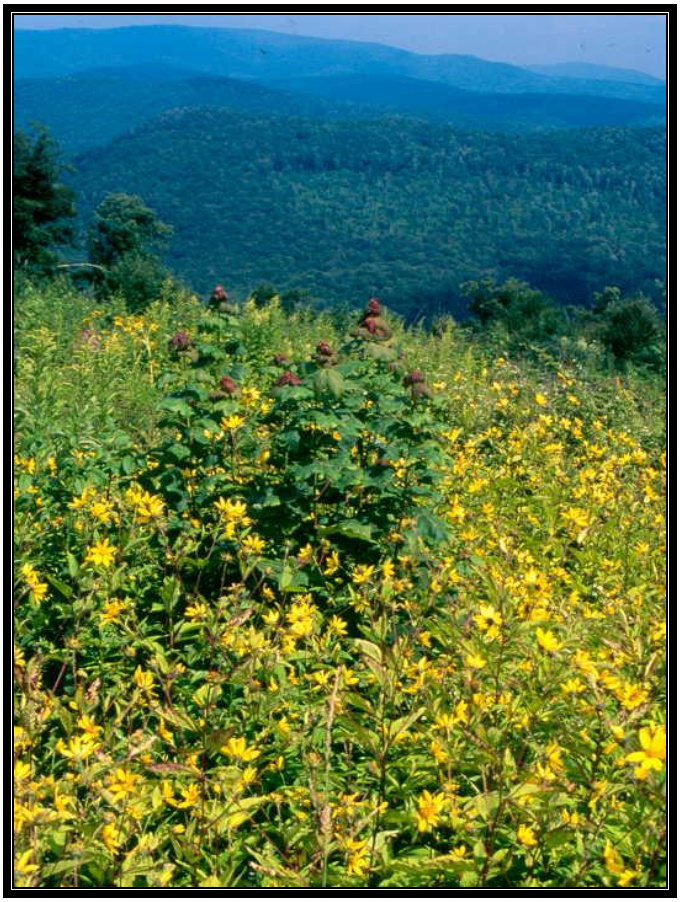


Figure 1-3. Upper Greenbrier Watershed From US Highway 250