Sustainable Forest Management Plan

For

Savage River State Forest

MARYLAND DEPARTMENT OF NATURAL RESOURCES

FOREST SERVICE

February 22, 2019

Dual Certified By

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Preface

The information contained within the Savage River State Forest Sustainable Management Plan was derived from a variety of sources including the 1992 *Savage River State Forest - Ten Year Resource Management Plan* and the 2010 *Sustainable Forest Sustainable Management Plan for Pocomoke State Forest*. Data presented in tables and charts that are specific to Savage River State Forest were generated from field data collected by the Maryland Forest Service, Maryland Fisheries Service and the Maryland Wildlife & Heritage Service from 2009 through 2018. Other information contained within this document is referenced as to its source.

Abbreviations

AMWI	Appalachian Mountain Woodcock Initiative
ATV	All-Terrain Vehicle
AWP	Annual Work Plan
BIBI	Benthic Index of Biotic Integrity
BMP	Best Management Practices
CAR	Corrective Action Requests
CBI	Combined Biotic Index
CCC	Civilian Conservation Corps
CFI	Continuous Forest Inventory
DNA	Deoxyribonucleic acid
DC	District of Columbia
DNR	Department of Natural Resources
DDT	Dichlorodiphenyltrichloroethane
ESA	Ecologically Significant Areas
FIBI	Fish-based Index of Biotic Integrity
FIDS	Forest Interior Dwelling Species
FSC®	Forest Stewardship Council®
GCN	Greatest Conservation Need
GIS	Geographic Information System
GPS	Global Positioning System
HCP	Habitat Conservation Plan
HCVF	High Conservation Value Forest
ID	Interdisciplinary
LAC	Limits of Acceptable Change
MBSS	Maryland Biological Stream Survey
MD	Maryland
NBPR	North Branch Potomac River
NHA	Natural Heritage Areas
NWR	National Wildlife Refuge
OGEMA	Old Growth Ecosystem Management Area
ORV	Off Road Vehicle
PA	Pennsylvania
PHI	Physical Habitat Index
RTE	Rare, threatened and Endangered
SFI®	Sustainable Forest Initiative®
SMG	Soil Management Groups
SMZ	Streamside Management Zones
SRSF	Savage River State Forest
SRT	Savage River Tailwater

US	United States
USDA	United State Department of Agriculture
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WSSC	Wetlands of Special State Concern

Chapter 1 - Introduction

1.1 Background and History of the Forest

Savage River State Forest is located in the north and northeastern part of Garrett County with a small section in Allegany County that lies in the Appalachian plateau physiographic province. Elevation ranges from 1400 to 3000 feet above sea level. The terrain is rolling hills to rather steep mountainous slopes. While the mountains lie generally in northeasterly/southwesterly direction, aspect is highly variable because of the number of deeply incised streams and creeks. The majority of the forest drains into the Potomac River and ultimately into the Chesapeake Bay, but several tracts are situated on the western side of the Eastern Continental Divide and drain into the Youghiogheny River, eventually flowing into the Gulf of Mexico.

Prior to European settlement, it is clear that Nomadic Indian tribes traveled to and through Garrett County. There is evidence suggesting that a few tribes stayed year round, especially along the Youghiogheny River. Forestry activities during this time consisted slash and burn activities used to clear areas for crops. Burning also improved the habitat for wildlife and made it easier for hunting and watching out for other hostile tribes. The likely effect on the forest was a mosaic of age classes, sizes and species.

As the early explorers arrived in the area, diseases greatly reduced the Indian population, much before conflict between the settlers and Indians reduced it even further. The likely effect of this population decrease was to reduce the diversity within the forests as the trees grew to large sizes without the practice of periodic cutting and frequent low intensity fires. Thus, when the settlers started to arrive in the area, the trees were much larger and denser than they had been during the times of large Indian populations. The settlers rapidly started clearing areas for permanent agricultural areas. Some of the readily accessible white pine and red spruce trees were cut out to provide masts for ships and building materials. Many of the hemlock stands in the county were not cut during this period because they were located in relatively inaccessible areas and many farmers wanted to save the hemlocks for future building materials.

In 1800, there were roughly 1000 settlers who lived in Garrett County. Cheap land, improved transportation and growth along the eastern seaboard led to a settlement boom. The national road was completed in 1818 and the railroad arrived in 1852. The transportation system better connected the resource rich Garrett County to the growth needs of the east. Increased quantities of lumber, coal and wheat were shipped to growing metropolitan areas. By the early 1900’s, narrow gauge railroads were used to facilitate logging on steeper slopes as the demand for wood products continued to increase.

The result was that Garrett County was heavily cut-over, essentially clear cut, within a 20-year period. Train engines frequently caused forest fires in the tops and slash that were left from the clear-cutting and as a result of the fires, a new forest was created. This legacy can be seen today

as most of our older forests are approximately 100 years old. In part, as a reaction to the rapid cutting of trees and the burning that was taking place, the Garrett Brothers gave 2000 acres to the state in 1906 with the proviso that an agency would be created to manage the property and to institute scientific forestry - this led to the birth of the Maryland Forest Service. The rapid exploitation of the forests came to an end by the 1930s and logging companies moved west or converted to coal mining.

On January 8, 1929, the state purchased 9,352 acres of cut-over forest land from the N.U. Bond Company. This was the beginning of Savage River State Forest. Since that time, there have been numerous acquisitions, expanding the land base to 55,281 acres.

In the 1930s, the Civilian Conservation Corps assisted the forest service with fire suppression efforts, tree planting, and constructing facilities for recreational activities. The CCC boys helped with the early snow skiing activities on the forest – later to become New Germany State Park. They helped build many trails where hiking, biking, horseback riding, and ORV riding are still taking place.

Coal mining has also been a part of the County's heritage for the last two centuries. There is no current strip mining on state forest land and only one deep mine that is active. A number of reclaimed strip mines and some old deep mines can be found throughout the forest. Natural gas exploration and storage began in what is now Compartment 13 near Accident, MD in 1964.

Exotic invasive pests, including diseases, insects, and plants, have become an ever increasing management issue across the forest landscape. Most notably, the introduction of Chestnut blight in the 1930's effectively eliminated the American chestnut from eastern forests. Recently, a sizable part of the oak forests has been lost due to gypsy moth defoliation and subsequent attack by opportunistic insects and diseases. One of the serious challenges for future forest management involves oak regeneration in the presence of gypsy moth and other potential exotic pests.

1.2 State Forest Planning & Sustainable Forest Management

The resources and values provided from state forests reach people throughout the state and beyond. These resources and values range from economic to aesthetic and from scientific to inspirational. The Department of Natural Resources is mandated by law to consider a wide variety of issues and uses when pursuing a management strategy for the forests. The importance of considering these factors is acknowledged in the Annotated Code, which establishes the following policy pertaining to state forests and parks:

> *"Forests, streams, valleys, wetlands, parks, scenic, historic and recreation areas of the state are basic assets. Their proper use, development, and preservation are necessary to protect and promote the health, safety, economy and general welfare of the people of the state. It is the policy of the state to encourage the economic development and the use of its natural resources for the improvement of the local economy, preservation of natural beauty, and promotion of the recreational and leisure interest throughout the*

state." (Annotated Code of Maryland, Natural Resources Article §5-102)

The Department recognizes the many benefits provided by state forests and has established a corresponding management policy in regulation.

> *"The state forests are managed to promote the coordinated uses of their varied resources and values for the benefit of all people, for all time. Water, wildlife, wood, natural beauty and opportunities for natural environmental recreation, wildlands experience, research demonstration areas, and outdoor education are major forest benefits. "(Code of Maryland Regulations 08.07.01.01)*

To ensure that benefits are realized and resources are protected for future generations, a statewide system of renewable resource planning has developed. These plans are the foundation for the many activities which can and should occur on state forest lands.

> *"The Department shall develop a system for long-range renewable forest resources planning. The public and private forest land resources of Maryland, including, but not limited to, wood fiber, forest recreation, wildlife, fish, forest watershed, and wilderness potential, shall be examined and inventoried periodically. As part of the forest planning process, the Department periodically shall develop, review and revise a resource plan that should help to provide for a sustained yield of forest resource benefits for the citizens of Maryland. The forest resource plan shall be made available for public and legislative review and comment.* "(Annotated Code of Maryland, Natural Resources Article §5-2l4)

The Sustainable Forest Management Plan for Savage River State Forest has been prepared in consideration of these many uses and benefits. The concept of Sustainable Forest Management will be the guiding principle behind the management of Savage River State Forest. Sustainable Forestry is defined in COMAR Regulations 08.01.07.01

> *"Sustainable forestry" means the stewardship and use of forests and forest lands in a way, and at a rate, that:*
> *a) Maintains their biodiversity, productivity, regeneration, capacity, vitality, and potential to fulfill, now and in the future, relevant ecological, economic, and social functions at local and regional levels; and*
> *(b) Does not cause damage to other ecosystems.*

1.3 Planning Process

The new Sustainable Forest Management Plan for Savage River State Forest has been developed to replace the former ten-year Resource Management that was developed in 1992. The initial draft of the SRSF Sustainable Plan was crafted from sections of the former ten-year plan and from information contained in the Sustainable Forest Management Plan for Pocomoke State Forest. The information utilized in the draft was originally prepared by an interdisciplinary planning team with assistance from the Savage River State Forest Citizens Advisory Committee. The SRSF Sustainable Plan has been reviewed by representatives from the following agencies with the Maryland Department of Natural Resources:

- Maryland Forest Service
- Maryland Park Service
- Maryland Wildlife & Heritage Service
- Freshwater Fisheries Division
- Land Acquisition & Planning

The original planning process for the ten-year plan included extensive opportunity for public participation and relied on public feedback in the refinement of management goals and implementation strategies. The new sustainable plan will adhere to a similar policy. One of the benefits of the new plan format is that it will be open for continual updates as additional resource information is developed. As updates are completed, the revised plan will be reviewed by the Citizens Advisory Committee.

1.4 Purpose and Goals of the Plan

The Sustainable Forest Management Plan for Savage River State Forest updates and expands the previous ten-year resource management plan. This plan is intended to provide guidance and direction for forest staff to base management decisions upon. The plan also provides direction to the Forest Manager in the preparation of the Annual Work Plans and to DNR staff in the preparation of related resource protection guidelines for sensitive habitats.

Included within the appendices are forest modeling projections of growth rates and sustainable harvest levels, as well as several detailed sections outlining planning and management tools which support the proposed management direction and strategies.

The primary goal of the Savage River State Forest Sustainable Management Plan is to demonstrate that an environmentally sound, sustainably managed forest can contribute to local and regional economies while at the same time protecting significant or unique natural communities and elements of biological diversity.

This will be pursued subject to the following resource goals for the Forest:

A) Manage the wetlands, waterways and floodplains of the forest to protect valuable water resources.

That the quality of the water flowing through the forest will not be impaired due to any actions on the land and in many cases will be improved. Where feasible, wetlands and riparian areas will be the site of watershed improvement practices specifically aimed at improving the quality of water entering the Chesapeake Bay.

B) Provide sustainable levels of diverse recreational fishery opportunities through management strategies which emphasize protection and enhancement of aquatic resources and forested riparian buffers.

Monitor proposed projects within Savage River State Forest that may potentially result in blockages to fish passage and recommend design changes that will allow continued fish passage during all stream flow conditions. Continue to identify existing blockages to fish passage and make recommendations for providing access to upstream habitat.

C) Protect and enhance biological diversity native to Savage River State Forest and perpetuate indigenous natural communities and habitats of species which are rare, threatened, endangered, or in need of conservation.

Insure that management policies and actions are consistent with state and federal requirements for protecting and managing rare, threatened and endangered species of plants and animals. The Department will identify locations of rare, threatened and endangered species habitat and forest conditions associated with the habitat requirements of these species. Management actions will consider opportunities to enhance existing habitats and provide for corridors. Abundance and distribution goals for common species will be periodically updated through DNR based resource assessments. Habitat goals for common species will be reflected in forest management activities.

D) Through Sustainable Forestry practices maintain and improve the timber resource, while at the same time protecting other resource values consistent with responsible forest management.

Forest harvest levels will comply with targets established by a long-term sustainable harvest plan. To the extent possible, harvest and thinning activity levels will produce reasonably uniform flows of products and contractor activities year-to-year. Short-term deviations due to natural disturbances, operational logistics or unusual events are anticipated, but exceptions for an extended period will require re-evaluation of the sustainable harvest level. Spatial and timing constraints will prevent thinning or harvesting operations from concentrating impacts in any watershed or visual scene in violation of water quality goals, habitat diversity and connectivity goals or the green-up requirements imposed by the Sustainable Forestry Initiative® (SFI®) Standard (See Appendix C). The plan will be re-evaluated periodically and updated as changes occur.

The Department makes use of the best available data to determine what activity levels are consistent with the sustainability of the forest ecosystems so that harvests will not decrease the ability of the forests to continue that average level of yield. Ecosystem sustainability means, in addition to the factors listed in goals listed above, no net loss in soil
fertility and no loss of non-target species due to on-site forestry practices. Future harvests will be based on data collected in the intensive stand level inventory that was completed in 2016.

E) Provide opportunities for the enjoyment of the natural resources on the Forest by

making

appropriate areas available for resource-based, low impact recreational activities and environmental education programs that are consistent with the resource values of the Forest.

Forest recreational and educational opportunities will be provided as appropriate and are consistent with the above goals. Recreational and education program opportunities available on the forest will be integrated with those available within New Germany State Park and be consistent with Garrett County's Land Preservation, Parks and Recreation Plan. The Department will determine the appropriate levels of recreational activities on the Forest as part of its ongoing evaluation and monitoring process.

1.5 Future Land Acquisition Goals for Savage River State Forest

The addition of new parcels to Savage River State Forest could alleviate a number of management issues as described below and also build upon a network of well-managed forest lands that would perpetually contribute to the goals for protecting and restoring the Potomac River and the Chesapeake Bay. All potential acquisitions are based on a Stewardship review that scores each property on their ecological, cultural and recreational values. Currently, several potential acquisitions are being considered that would enhance management opportunities.

Guidelines to be considered when pursuing new properties not currently in state ownership for addition to Savage River State Forest:

1. The property is an in-holding within a Savage River State Forest Compartment and/or the parcel connects additional Savage River Forest properties thereby creating a larger contiguous management unit.
2. The property contains significant natural resources as identified in this plan that would help contribute toward their management and protection. Examples of such resources would be economically important forest resources as described in Chapter 5, Water Quality Areas (Riparian areas and wetlands) as indicated in Chapter 6, Ecologically Significant Areas (ESAs) as identified in Chapter 7 or Wildlife Habitat resources described in Chapter 8.
3. The property improves on or provides additional access to a Savage River Forest parcel, thereby improving on the implementation of management activities and or providing additional public access.

Chapter 2 - Garrett County Resource Assessment

2.1 Garrett County

Garrett County is the westernmost county in Maryland. It is bordered by Grant County, West Virginia, to the south, Preston County, West Virginia to the west, Fayette County and Somerset County, Pennsylvania to the north and Mineral County, West Virginia and Allegany County, Maryland to the east. Garrett County is found on the Appalachian Plateau with elevations ranging from 1,000 feet above sea level to a maximum of 3,360 feet above sea level. The topography of the region consists of gently rolling upland accented by steep ridges.

The climate is a warm-summer humid continental type averaging 47.5 with 47.83 inches of annual rainfall and 107 inches of snowfall. The average growing season is about 122 days and can vary by as much as two weeks depending on the location within the county and the availability of water. This climate is conducive to growing crops such as hay, corn, small grains, and vegetables. According to the 2012 Census of Agriculture hay was produced on approximately 23,922 acres, corn for grain was grown on 6,152 acres, and 2,312 acres was dedicated to corn for silage.

Garrett County is a natural resource-rich county, with approximately 90 percent of the County comprised of resource lands—primarily forest and agricultural land (Table 2.1 and Figure 2.1). The Forest Products Industry is the largest industry in Western Maryland, and the fifth largest industry in Maryland with 15,432 people employed statewide with earnings of over $420 million dollars. Over 18 million board feet of timber is harvested each year in the county. Agricultural revenues generated from milk and milk products totaled 9.9 million dollars. Livestock sales of cattle and calves, hogs, sheep and goats grossed 10.2 million dollars.

Major Land Cover Category	Total Area	Percent
Urban & Developed	36,522	8.7%
Agriculture	89,142	21.2%
Forest	**285,508**	**68.0%**
Wetland	2,663	0.6%
Water	5,795	1.4%
TOTAL	**419,630**	**100.0%**
Source: 2011 Garrett County Comprehensive Plan		

Table 2.1: Land use on Garrett County

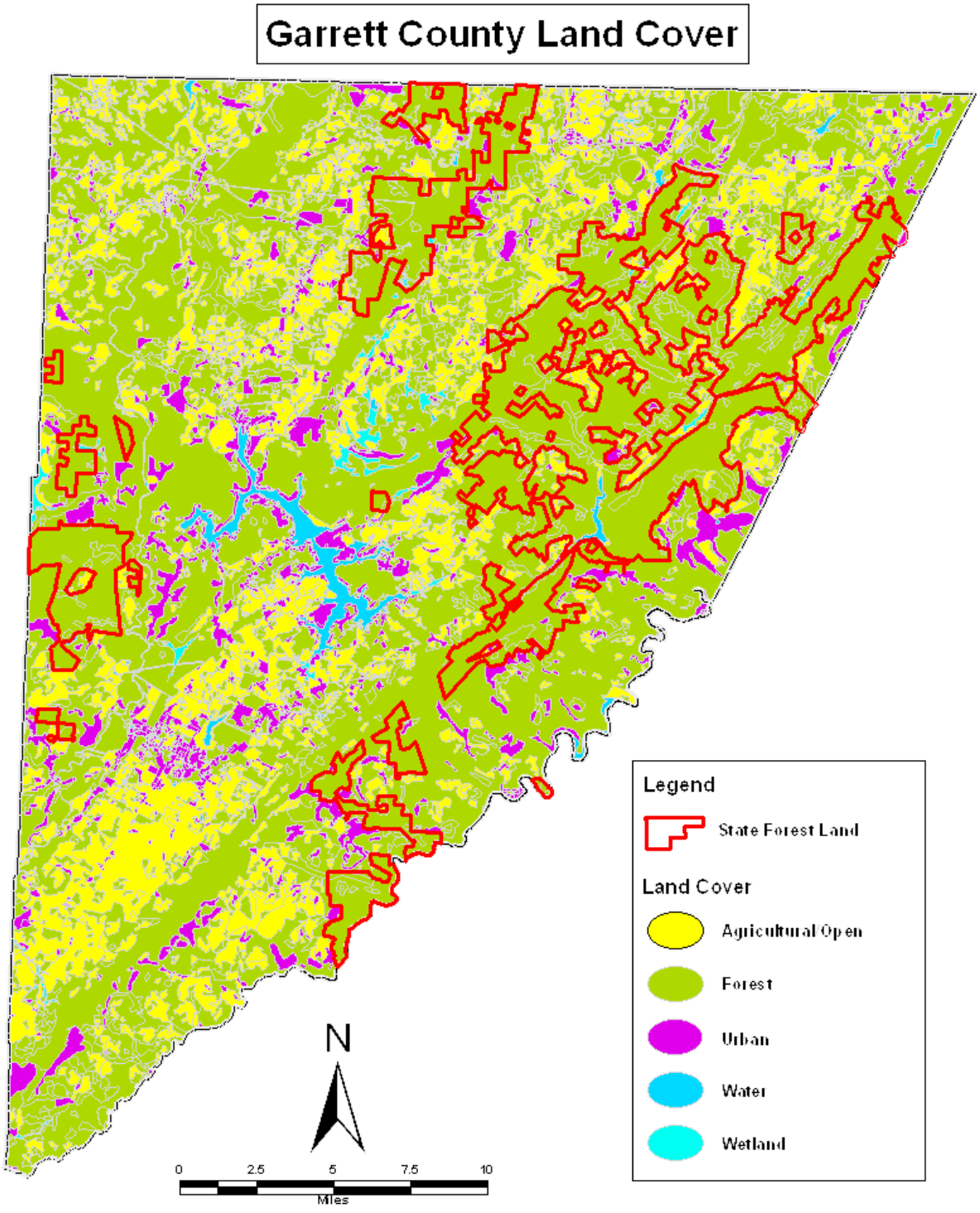


Figure 2.1: A complex mix of agricultural lands surrounds the State Forests

Much of the land in Garrett County had been cleared for farming or used as woodlots before the establishment of a state forest system. During the depression era many farmers suffered economic hardships, resulting in the sale and trade of vast tracts of land to the Federal Government. In the mid to late 1930's, the state began purchasing lands for management activities and in 1954 the Federal government deeded its holdings, approximately 33,526 acres, to the state. The state continues to purchase in-holdings and adjacent lands as a way to prevent further loss of forest cover to development and to avoid fragmentation of the remaining intact blocks of forest in the region as well as preserving the timber based portion of the regional economy.

2.2 General Geology and Soils

The county is situated entirely within the Appalachian Plateau. The average altitude of the county is 2,200 feet above mean sea level. The lowest point is found at the mouth of the Big Savage River at an altitude of 960 feet and the highest point is located at Hoye's Crest on Backbone Mountain with an elevation of 3,360 feet. The most prominent ridges are Backbone Mountain, Big Savage Mountain, Meadow Mountain, Negro Mountain and Winding Ridge. Backbone and Meadow Mountains are part of the north trending eastern continental divide that separates areas that drain into the Chesapeake Bay from those that drain into the Gulf of Mexico.

The topography is gently rolling upland, deeply incised by streams and valleys. Some of the gently sloping to moderately sloping hills are comprised mainly of moderately deep, well drained, non-stony soils that are highly useful in farming. Most of the soils in Garrett County are naturally low in plant nutrients and tend to be acidic. Soils that are cultivated annually become deficient in nitrogen, phosphorus and potassium if these elements are not replenished and lime applications are generally needed every three years.

Poorly drained meadows, locally called "glades", occur at the headwaters of many streams. Soils found in these valleys are useful for farming, but they are limited in capability by wetness and are used mostly for forage crops and pastures. In some areas of the county, the soils are steep or very stony, or both, and are better suited as woodlands or for wildlife habitat and recreation.

2.3 Water Resources

The high elevation, rolling hills and mountainous areas create close contact between human land use activities and aquatic systems, making this region a focal point for water quality issues. Aquatic systems can be grouped into three categories: groundwater, wetlands and streams.

2.3.1 Groundwater

Groundwater is an important natural resource of Garrett County. Groundwater is derived from the weathered zone and the upper part of the consolidated rock. When saturated, the soil and

subsoil supplies water to springs and shallow dug wells. Natural groundwater quality throughout the watershed is variable, but concentrations of iron, calcium and manganese tend to be high, often exceeding recommended limits for potable use. Below a depth of 800 - 1,000 feet, ground water may be too saline for potable supplies.

2.3.2 Wetlands

Nontidal wetlands are freshwater areas that are covered by water or have saturated soils for at least brief periods during the growing season. The term "nontidal wetlands" encompasses a variety of environments such as marshes and swamps, bottomland hardwood forests, wet meadows, springs and seeps, inland bogs and the shallow areas of lakes and ponds.

Some nontidal wetlands, such as freshwater marshes and shrub swamps, are very obvious. However, many nontidal wetlands, such as bottomland forests, wet meadows or vernal pools are not as easily recognized because they are dry for some time during the summer. Three characteristics are used to identify nontidal wetlands: hydrology, soils and vegetation.

Nontidal wetlands form where the land is inundated or has a near surface ground water level. There are at least 73 soil types in Maryland that are known to occur in nontidal wetlands. These soils are known as hydric soils. Plants growing in nontidal wetlands, known as hydrophytic vegetation, are capable of living in hydric soils for at least part of the growing season.

2.3.3 Streams

The Maryland Biological Stream Survey (MBSS) has conducted stratified random samples of streams within Garrett County. The MBSS uses randomly selected sites to provide a statistically rigorous representation of Maryland's stream conditions. Round Four involves re-sampling a subset of randomly-selected stream sites that were sampled previously, a widely accepted design. This process will take five years. Sites that were sampled in 1995, 1996, and 1997 will be re-sampled 20 years later (in 2015, 2016, and 2017). A separate set of sites that were sampled in 2000, 2001, 2002, 2003, and 2004 will be sampled beginning in 2014 - 14 years later. The Fourth Statewide Round of the MBSS will run from 2014 to 2018.

Based on the three ecological health indicators used by the MBSS, the overall condition of Garrett County streams during 2000-2004 was fair. The Family Level-Benthic Index of Biological Integrity (FIBI) results indicate that 21% of the streams in the county were in good condition, while 39% rated good using the Benthic Index of Biological Integrity (BIBI). In contrast, 46% of the streams in the county scored as poor or very poor using the Combined Biotic Index (CBI), while 23% scored as good and 32% scored as fair. Within the county, the greatest concentration of streams rated in good condition was the area in and around Savage River State Forest. Another area with predominantly good sites was the lower portion of the Youghiogheny drainage, near the Pennsylvania border. The largest concentration of streams in very poor condition was the area around Deep Creek Lake. The highest rated stream in Garrett County using the CBI was Crabtree Creek, while the lowest rated streams included Three Forks Run, Cherry Creek, the North Branch Casselman River and Millers Run. Based on Stream Waders volunteer data, conditions were generally good for benthic macro invertebrates in the Youghiogheny and Savage River watersheds and poor or very poor in the area around Deep

Creek Lake. Four MBSS Sentinel sites were located in Garrett County. These streams included: the Savage River mainstem, Crabtree Creek, Bear Creek and Double Lick Run. Sentinel sites were chosen to provide a representation of the best remaining streams around the state and track natural variations in stream health. Where possible, Sentinel sites are located in watersheds with as much protected land as possible, or in areas projected to become degraded from development at a slower pace. More information about the MBSS Sentinel stream network is found in: 2000-2004 Maryland Biological Stream Survey Volume 11: Sentinel Sites (http:www/dnr/ Maryland.gov/ streams/pubs/ea05-8_sentinel.pdf).

Based on the Physical Habitat Index (PHI), 49% of the stream miles in Garrett County had minimally degraded habitat, 33% had partially degraded habitat, and 18% had degraded or severely degraded habitat. Similar to the distribution of sites with high biotic integrity, the highest concentrations of sites with minimally degraded PHI ratings occurred in and near the Savage River State Forest, followed by the lower Youghiogheny drainage above Friendsville. The southern part of the county had the largest number of sites with severely degraded physical habitat.

Over 82% of the stream miles in Garrett County were rated optimal for trash. In contrast, only 3% of streams were rated as being in marginal condition and none were rated as being in poor condition. Low amounts of trash were consistently seen in and around Savage River State Forest and generally on state-owned lands, as well as the lower portion of the Youghiogheny drainage in Maryland.

2.3.4 Water Quality Indicators

To provide a means to prioritize stream systems for biodiversity protection and restoration within each county and on a statewide basis, a tiered watershed and stream reach prioritization method was developed. Special emphasis was placed on state-listed species, stronghold watersheds for state-listed species and stream reaches with one or more state-listed aquatic fauna. Fauna considered included stream salamanders, freshwater fishes and freshwater mussels. Rare pollution-sensitive benthic macro invertebrates collected during the 1994-2004 MBSS were also used to identify the suite of watersheds necessary to conserve the full array of known stream and river biota in Maryland. A complete description of the biodiversity ranking process is found in: 2000-2004 Maryland Biological Stream Survey Volume 9: Stream and Riverine Biodiversity (http:www/dnr/Maryland.gov/streams/pubs/ea05-6_ biodiv.pdf).

Of the six watersheds found in Garrett County, the Casselman and Youghiogheny Rivers were classified as Tier 1, meaning that these watersheds serve as strongholds for one or more state listed aquatic species. It is also noteworthy that these two watersheds are among the top five in Maryland in terms of stream and river biodiversity. The Savage River was classified as a Tier 2 watershed, meaning that it serves as a stronghold for one or more non-state listed species of Greatest Conservation Need (GCN) and has state-listed aquatic fauna present. In stark contrast, the Georges Creek watershed was among the lowest ranking for stream and river biodiversity in the state (83rd of 84). Any reaches that had either state-listed or GCN species, or high intactness values were highlighted to facilitate additional emphasis in planning restoration and protection.

2.4 Wildlife Resources

Garrett County's rural landscape, with nearly 66% forest cover and 24% agriculture, provides a habitat quality that supports abundant wildlife populations and species diversity. This mixture of largely hardwood forests dominated by oak species and abundant agriculture serves to provide a rich and abundant source of nutrition for many keystone wildlife species such as white-tailed deer, wild turkeys and black bears. Garrett County supports a diverse wildlife community with an estimated 236 different species of reptiles, amphibians, birds and mammals documented compared to 528 species statewide.

There are several threats and concerns that may influence wildlife populations and future habitats in Garrett County. One of the greatest threats to wildlife, not only in the county but throughout the state, is loss of habitat from increasing development. The presence and attraction of Deep Creek Lake and the resort community increases the threat of commercial and residential development. As the community and businesses expand, there may be increased demand for uses that are non-compatible with conserving wildlife habitat.

Hunting is the primary recreational use of public lands in Garrett County. Pursuit of forest game species such as white-tailed deer (*Odocoileus virginianus)*, gray squirrels (*Sciurus carolinensis*), ruffed grouse (*Bonasa umbellus*) and wild turkeys (*Meleagris gallopavo*) provide the majority of hunter days. Hunting for upland wildlife such as American woodcock (*Philohela minor*) and eastern cottontails (*Sylvilagus floridanus*) is also popular. Opportunity for waterfowl hunting also exists, but is limited.

White-tailed deer is the most popular species hunted in Garrett County and throughout the state. Along with the positive recreational benefits and population management that deer hunting provides, it also provides significant economic benefits to Maryland. A 2011 survey conducted by the U.S. Fish and Wildlife Service found that deer hunting in generated over $221 million annually for the Maryland economy (retail sales plus multiplier effect). Deer hunting in Maryland supports nearly 2,400 jobs and generates $69 million in salaries, wages and business income, $17.5 million in state and local tax revenue and $19 million in federal tax revenue. It is anticipated that the demand for hunting forest game will continue and will likely increase as private land becomes less available to hunters.

2.5 State Listed Species of Concern in Garrett County

A summary of current and historically documented rare, threatened and endangered animal species potentially found on or within ¼ mile of Savage River State Forest lands according to Maryland DNR-Wildlife & Heritage Service is included in Appendix E.

2.6 Plants of Special Concern (Federally Listed)

There are no Federally Listed plant species known to occur in Garrett County. There are a number of species of plants listed as Rare, Threatened, or Endangered by the State of Maryland. These species are discussed in some detail in the Ecologically Significant Area portion of this document.

2.7 Plant Communities and Habitats of Special Concern

Vernal Pools: Vernal pools are typically flooded in winter to early spring or after a heavy rainfall, but are usually dry during summer and many are filled again in autumn. Substrate is typically dense leaf litter over hydric soils. Vernal pools typically occupy a confined basin (i.e., a standing water body without a flowing outlet), but may have an intermittent stream flowing out of it during high water. This community includes a diverse group of invertebrates and amphibians that depend upon temporary pools as breeding habitat. Since vernal pools cannot support fish populations, there is no threat of fish predation on amphibian eggs or invertebrate larvae.

Characteristic animals of vernal pools include species of amphibians, reptiles, crustaceans, mollusks, annelids and insects. Vernal pool species can be categorized as either *obligate* (species that depend upon vernal pool habitat for their survival), or *facultative* (species that are often found in vernal pools, but are not dependent on them and can successfully reproduce elsewhere). Obligate vernal pool amphibians include spotted salamander (*Ambystoma maculatum),* Jefferson salamander (*A. jeffersonianum*) and wood frog (*Rana sylvatica*). Fairy shrimp (Anostraca) are obligate vernal pool crustaceans, *Eubranchipus spp.* being the most common. Facultative vernal pool amphibians include four-toed salamander (*Hemidactylium scutatum*), red-spotted newt (*Notophthalmus viridescens*), spring peeper (*Pseudacris crucifer*), gray treefrog (*Hyla versicolor*), green frog (*Rana clamitans*) and American toad (*Bufo americanus*). Numerous species of insects, mollusks and annelids occur in vernal pools. Many of these are facultative, but further research would most probably document some vernal pool obligates among these groups.

Plants that occur in mountain vernal pools are predominately hydrophytic often growing along the edges of the water or in the basin after water levels drop later in the season. In this region most of these plants are emergent such as sedges, grasses, or bulrushes. A number of these species are uncommon in the region and a few rare species such as *Carex vesicaria* and *C. tuckermanii* have been documented in Garrett County vernal pools.

Several vernal pools have been documented on or very near SRSF. A subset of these pools support populations of the Jefferson salamander, a state-wide uncommon salamander. These habitats are afforded special management protection.

Mountain Peatlands: There are a number of wetlands on the Allegheny Plateau of Maryland. Many of these, referred to as bogs or fens, are reminiscent of wetland habitats found in the northern U.S. and Canada and are collectively known as peatlands. These wetlands often are dominated by several species of Sphagnum moss (*Sphagnum spp.*), various grasses, sedges and rushes, like *Calamagrostis canadensis, Glyceria striata, G. canadensis, Eriophorum*

virginicum, Rhynchospora alba, Carex stricta, C. utricularia, C. canescens, C. atlantica, Juncus spp., and Scirpus spp. to name a few. Other characteristic plants such as round-leaved sundew (*Drosera rotundifolia*), cranberry (*Vaccinium macrocarpon*), bog goldenrod (*Solidago uliginosa*), and narrow-leaved gentian (*Gentiana linearis*) occur in these bogs. Large sections of these wetlands are often dominated by various shrubs such as speckled alder (*Alnus incana*), arrow-wood (*Viburnum dentatum*), possum-haw (*V. nudum*), winterberry (*Ilex verticillata*), and mountain holly (*Nemopanthus mucronata*). Various plants that are rare in the State also occur in a number of these wetlands. Some of these that occur on or near SRSF include, wild calla (*Calla palustris*), yellow clintonia (*Clintonia borealis*), goldthread, (*Coptis trifolia*) and small cranberry (*Vaccinium oxycoccos*).

This habitat type also supports a number of uncommon or rare animals. The dragonfly diversity is high with a number of specialized species documented. Butterflies such as the two-spotted skipper (*Euphyes bimacula*), Harris' Checkerspot (*Chlosyne harrisii*), silver-bordered fritillary (*Boloria selene*) and the Baltimore Checkerspot (*Euphydryas phaeton*) are restricted to wetland habitats. Specialized birds such as the alder flycatcher (*Empidonax alnorum*), northern waterthrush (*Seiurus noveboracensis*), red-breasted nuthatch (*Sitta canadensis*), and Nashville warbler (*Vermivora ruficapilla*) often breed in these wetland habitats. Rare mammals such as the southern water shrew (*Sorex palustris punctulatus*) and the southern bog lemming (*Synaptomys cooperi*) have been found in some of these bogs. A large number of more common animals rely on or utilize this habitat type. Coupled with the large diversity of flora found here, these wetlands are truly hotbeds of biological diversity in the region. Any of these wetlands of significant size that occur on SRSF are in an ESA.

Spring Seepage Wetlands: There are numerous springs throughout SRSF. Many of these form small seepage wetlands that support unique vegetation. Characteristic vegetation includes skunk-cabbage (*Symplocarpus foetidus*), mannagrass (*Glyceria melicaria, G. striata*), seep sedge (*Carex prasina*), and rough sedge (*C. scabrata*) to name a few. Occasionally, these habitats support less common or rare plants such as grove meadow-grass (*Poa alsodes*), and large purple-fringed orchid (*Platanthera grandiflora*). Specialized odonates often utilize this habitat, as well.

Sandstone Rock Outcrops/Glades: There are three major types of special habitats on SRSF where the basis is some type of sandstone outcrop. The most dramatic are large rock outcroppings that often occur on the crests of the mountain ridges that run through the Forest. Occasionally these may exist on the flanks of a mountain rather than on the crest. A second type, which may be associated with larger outcrops or occur as isolated habitats, are described as rock bars or boulder fields. These moss covered rocky areas are most often under a forest canopy. A third type is described as a sandstone glade. These are formed over large sheets of bedrock and are often open to semi-open habitats.

There is some overlap in the flora and fauna that utilize these habitats, but there are some differences, as well. The large outcrops most often provide habitat for the State Endangered Allegheny woodrat (*Neotoma magister*). However, much of the habitat formally occupied by the woodrat no longer supports thriving populations. This species has been experiencing declines through-out its range. Other notable fauna that make use of this habitat are timber rattlesnakes (*Crotalus horridus*), winter wrens (*Troglodytes troglodytes*), ravens (*Corvus corax*), small-footed

bats (*Myotis leibii*), bobcats (*Lynx rufus*) and Appalachian cottontails (*Sylvilagus obscurus*). These habitats also support high densities of a number of small mammal species.

High concentrations of small mammals also occur in the forested rock bar habitats. A number of uncommon or rare species live in these habitats. The cool micro-habitat is important for the long-tailed shrew (*Sorex dispar*) and the smoky shrew (*S. fumeus*), two species often associated with this type of habitat. The very rare rock vole (*Microtus chrotorrhinus*) also prefers this damp, cool habitat but has yet to be documented from SRSF.

Sandstone glades represent a unique natural community type. Rather than the bedrock being broke up into fragments or boulders, the basis for this community is a large slab or sheet of bedrock with occasional boulders strewn about. The habitat is characterized by an abundance of heath type plants, stunted trees and overall sparse vegetation with an abundance of mosses and lichens. Timber rattlesnakes often utilize this habitat. Only one significant sandstone glade has been identified on SRSF and it is included within an ESA.

2.8 Important Wildlife Species

Maryland first began licensing hunters in 1916, with hunting license sales peaking at 180,000 in the early 1970's. Sales have since declined to about 135,000 now and today a smaller fraction (3-4%) of Maryland residents hunt. The current number of youth hunters has shown a 70% decline from peak numbers in the early 1970's. Maryland hunters are mostly males between the ages of 30-49 years of age. Most hunters live in urban settings. Residents of Baltimore County bought 11.9% of licenses sold statewide. Residents from the five lower shore counties accounted for 9.7% of hunting licenses sold statewide.

The majority of the Savage River State Forest acreage is open for public hunting, with the exception of safety zones and other similar areas. Hunting opportunities are primarily for white-tailed deer, but other species, depending upon the site, include bear, turkey and upland birds.

There are more than 40 species of game animals that occur in Garrett County. Hunting has been a time honored tradition that continues to provide recreation, food and quality of life in Garrett County. The large amounts of public land in the county makes it a popular destination for non-resident hunters and those from more urban areas where there is little hunting opportunity. The most popular species of game animals continue to provide most hunter recreation days in Garrett County.

White-tailed Deer – Harvest trends indicate that white tailed deer thrive in Garrett County. During the 2018-19 hunting season, Garrett County had the third highest reported deer harvest in the state of 4,973 animals. This is significant considering that most counties have a much more liberal bag limit and therefore, higher harvest potential.

Black Bear - Currently, Maryland has a breeding population of black bears in the four westernmost counties (Garrett, Allegany, Washington, and Frederick), with the highest bear densities found in Garrett County and western Allegany County (See Appendix K). In October 2004, DNR implemented Maryland's first bear-hunting season in 51 years and subsequent hunts have been held each year since. DNR established a harvest quota targeting an approximate 8 to

12% harvest mortality. This was based on the objective of achieving 20 to 25% overall mortality (seasonal plus non-seasonal mortality). Harvest quotas have ranged from 30 to 85 bears between 2004 and 2009. The harvest range for the 2010-2017 seasons was set at 65 – 90 bears. As of the 2018 bear season, the harvest quota has been eliminated and the season was held for an entire week to give hunters greater opportunity for a successful hunt. This strategy proved successful, as 135 bears were harvested in four counties including a 575-pound boar taken in Washington County.

Wild Turkey – Wild turkey populations have been strong in Garrett County since the rebound of suitable habitat conditions following the declines of the early 1900's and numbers have remained steady within Savage River State Forest. In Garrett County the turkey season is split with both a spring and a fall season. It is estimated that over 10,000 hunters pursue turkeys during the spring season statewide. In 2018, Garrett County ranked second in turkey harvests with 412 birds reported. Brood habitat (typically herbaceous openings and edges) is reported by the Department to be the main limiting factor affecting populations and development of additional brood habitats should be considered a management priority on Savage River State Forest.

Ruffed Grouse – Ruffed grouse inhabit the forested mountains of Garrett, Allegany, Washington, and Frederick Counties. They have been a traditional staple for Western Region upland game bird hunters for decades. In order to more accurately track grouse populations over time, the MD DNR Wildlife Service initiated the Ruffed Grouse Cooperator Survey in 2008. Participants in the survey record the number of grouse flushed per hour, which serves as an index to population levels. Results from the 2015-16 Ruffed Grouse Cooperator Survey suggest that ruffed grouse populations in Garrett County have remained relatively stable. The Garrett County flush rate of 1.09 flushes per hour was above the county average of 0.91. The DNR's most recent Hunter Mail Survey estimates that approximately 500-1000 hunters spend an average of 3 days afield and harvest fewer than 1 bird per hunter. In the 1980's, an average of 7,500 hunters pursued grouse with significantly higher success rates. Public land grouse hunting opportunities are limited to three state forests and wildlife management areas which support the vast majority of grouse hunting in Maryland. Hunter surveys show that approximately 80% of grouse hunts take place on public hunting areas.

Furbearers – The diverse ecosystems of Garrett County support a rich and varied assemblage of furbearer species that range from the solitary fisher of spruce and hemlock forests to the wetland inhabiting beaver and river otter to the ever adaptable coyote. Maryland's citizens enjoy a variety of ecological, recreational, economic, and cultural benefits from these valuable resources. The 13 resident furbearers found in Garrett County yield many user days of recreation, while also providing the nucleus for many traditionally based rural activities. The fur harvest industry is a multibillion-dollar enterprise nationally and offers significant contributions to Maryland's economy.

2.9 Migratory Birds of Special Concern

Waterfowl Associated with Wetlands – Important waterfowl areas occur throughout Garrett County. Bottomland hardwood floodplains, beaver impoundments, lakes, farm ponds and wooded wetlands serve as wood duck, mallard, teal and black duck habitat.

American Woodcock – Spring singing ground surveys coordinated by the U.S. Fish and Wildlife Service suggest that American woodcock numbers have been declining by an average of 1.9 percent per year since these surveys were started in 1968. However, population estimates have been stable over the last decade. Most woodcock biologists suspect that alterations of habitat, losses to development and changes due to maturation of abandoned farmland are the cause of the population decline. Woodcock use areas of State River State Forest as breeding and wintering habitat. Woodcock prefer moist soil areas with dense seedling/sapling cover and rich humus layers because earthworms, their primary food, are most plentiful in these habitats. State Forest lands are important to woodcock as breeding and nesting areas.

Neo-tropical migrants – Many neo-tropical migrants breed, nest or migrate through the region. One of the largest conservation concerns in the region with migratory birds is the fragmentation of forest blocks. Other conservation concerns within the region include the loss of wetlands, loss of habitat due to development and loss of habitat due to intensive agriculture.

2.10 Fish Species of Special Concern:

Brook Trout **-** Brook trout are Maryland's only native freshwater trout species and have been a popular recreational angling resource since European colonization of North America. Brook trout in Maryland are valuable for aesthetic, recreational, economic and biological reasons. Because of their habitat and life history requirements, brook trout are typically found in the pristine, aesthetically pleasant areas of Maryland. While there is no commercial fishery for brook trout, recreational angling has been occurring for centuries, and there is increasing local and national recognition of the uniqueness and quality of fishing for native brook trout. Anthropogenic alterations to Maryland's environment over the last several centuries, including clear cutting of forests, establishment of large agricultural areas and urbanization have resulted in the extirpation of brook trout from 62% of their historic habitat in Maryland. Of the remaining 151 populations, more than half are found in Garrett County, the westernmost, mountainous, and least developed area of Maryland. The vast majority (82%) of the remaining populations are classified as "greatly reduced," meaning that within the sub-watersheds where they occur they occupy only 1% to 10% of the area that was historically inhabited. A major difficulty in managing the brook trout resource is that only 11% of all brook trout streams and stream miles are fully within state lands, the vast majority of habitat is on private land and a mix of private/ public lands. Of the immediate threats to brook trout populations in Maryland, urbanization is the most serious. In watersheds where human land use exceeds 18%, brook trout populations cannot survive and if impervious surface area is greater than 0.5% in a watershed, brook trout will typically be extirpated. There are also long-term threats, of which global warming is the most serious. Current predictions indicate that warming water temperatures over the next 100 years

could eliminate brook trout populations statewide except for western Maryland (Garrett County) by the year 2100.

Rare Fishes **-** Stonecat is the only known rare fish in Garrett County. Kline and Morgan estimate "that a population of approximately 660 stonecat are present in the fourth order reaches of the Casselman River in Maryland. While no other populations of stonecats are known to exist in Maryland, this population extends downstream into the Pennsylvania portion of the Casselman River." Little is known about the environmental or human caused factors limiting the abundance (acid mine drainage is thought to be a contributing factor) of this species, but it is logical to assume that strict adherence to BMP's will help to lessen any impacts.

Species	Status	Recent Record	Historical Record
Stonecat (*Noturus flavus)*	S1, Endangered	X	

Rare fish recorded in the waters of the Casselman River: Source MD DNR Fisheries Division

2.11 The Forests of Garrett County

Historic land cover shows the region dominated by mixed hardwood forests with varying amounts of red spruce, white pine and hemlock. American Indians cleared small patches and burned the forest for hunting and gathering. Early settlers cleared areas for agriculture. Harvesting of the conifer component was initially done to provide building materials for housing and marine uses during the development of the east coast. Hemlock was also harvested to provide bark in the tanning industry. With the advent of railroad logging, essentially all of Garrett County was clear-cut and burned. The fires were due in part to ignitions caused by errant sparks from train engines as well as arson. During the 1930's and 1950's, many open areas that were degraded were planted with conifers, including red pine, Norway spruce, larch and Scot's pine. These plantations were established as nurse crops to rehabilitate abandoned and depleted farm fields, with the long term goal of conversion back to native hardwoods.

Practically no virgin forests remain in Garrett County and most forests have been cut over several times. Many areas, including many that are once again in forest, have been cleared for conversion to agriculture in the past. Most of the forests are now even-aged and dominated by mixed oaks and some northern hardwood types as Table 2.12 illustrates. As Table 2.12 also illustrates, non-industrial private owners own the majority of the forests in Garrett County.

Table 2.12: Area of timberland by forest type and ownership group

Garrett County		*(thousands of acres)*	
Forest Type	**All Owners**	**Public**	**Private**
White/red/jack pine group	14.7		14.7

Exotic softwoods group	5.9	5.9	
Softwood total	20.6	5.9	14.7
Percent of Total Softwoods	100.0%	28.6%	71.4%
Oak-Hickory	179.3	66.7	112.6
Maple-Beech-Birch	76.1	14.8	61.3
Non-stocked	1.2		1.2
Hardwood total	256.6	81.5	175.1
Percent of Total Hardwoods	100.0%	31.8%	68.2%
All forest types	277.1	87.3	189.8
Percent of Total All Types	100.0%	31.5%	68.5%

Source: USDA Forest Service FIA data 2008.

Streams: Several of the State Forest lands fall within stronghold watersheds for aquatic biodiversity, specifically parts of the Casselman River and Savage River Watersheds. Stronghold watersheds are those that are deemed most important for the protection of Maryland's aquatic biodiversity and they contain the highest abundance of threatened or endangered freshwater fish, amphibians, reptiles, or mussel species. Special protection of these watersheds is necessary to ensure the persistence of these imperiled fauna. Additionally, parts of these watersheds are High Quality Waters (Tier II waters). States are required by the Federal Clean Water Act to develop policies, guidance and implementation procedures to protect and maintain existing high quality waters and prevent them from degrading to the minimum allowable water quality. Tier II waters have chemical or biological characteristics that are significantly better than the minimum water quality requirements. All Tier II designations in Maryland are based on having healthy biological communities of fish and aquatic insects. These are areas that have high biological integrity and are afforded additional protection under MDE's Anti-degradation regulations.

2.12 Forest Management in Garrett County

Most of the forests in Garrett County are privately owned and most are managed for multiple objectives, including habitat creation and maintenance to support wildlife-related recreation and for generating revenue from the sale of timber. The forests in Garrett County are well suited to meet these objectives because of their ability to provide valuable products and diverse habitats.

As described in Section 2.11, the forests tend to be dominated by mixed oaks, northern hardwoods or conifers. Most of the forests are even-aged, having regenerated from the abandonment of agricultural land or from previous clear-cut timber harvests. Some areas have probably been harvests for several centuries, as both Native Americans and early European settlers cleared land and harvested wood for a myriad of uses.

Management of forests in Garrett County is done in two ways: extensive versus intensive. On private lands, extensive management frequently consists of a harvest operation when the need or opportunity arises with very little thought given to regenerating the next forest. On public land and most industrial land, intensive management is practiced. This entails implementing management strategies across the entire forest that effectively utilize the available resources in the present and ensures that those resources will be available for future use as well.

In Maryland from 1976 to 1989 the number of private forest owners grew from 95,800 to 131,000, increasing by about 2.7% per year. That calculates out to about 2,600 more owners each year. In 1976, 55% of the owners held less than 10 acres of forest; by 1989 that proportion had grown to 65%. What can be inferred from these trends is that over 2/3 of the forestland owners are now essentially large-lot homeowners who will seldom be able to or desire to manage their forest for timber production. Some properties will be managed for wildlife and recreation value, but small, fragmented pieces are limited in their capacity to produce similar values.

Convincing private landowners to manage forests on a long-term, sustainable plan is affected by the rapid turnover of forest properties. This produces a constantly changing clientele for forestry education and a constantly shifting set of land management objectives that can disrupt or destroy long-term planning.

To assist the landowner with the management of their forest, there are a variety of forestry services and sources of information available. The Maryland Department of Natural Resources - Forest Service maintains foresters to assist landowners in all counties of the state. Many landowners rely on them for impartial advice concerning timber sales, the development of forest stewardship plans and the carrying out of forest management activities such as reforestation after a timber sale. In addition, there are several private consulting foresters who assist landowners with all aspects of forest management. Most of the management activities, such as road building, site preparation, tree planting and harvesting are contracted out to separate businesses. Garrett County has access to many of these types of contractors, but not in the quantity that characterize other areas of commercial forestry. Consequently, some specific management practices have not been feasible because there has not been sufficient demand to support an operator.

2.13 The Forest Products Industry

Of the many commercial products that forests in Garrett County generate, the most valuable is hardwood veneer and sawtimber. There is typically a strong market for these products as a result of local sawmills producing dimensional lumber for the cabinet and furniture industries. There are some secondary wood industries that also provide employment to a number of regional workers.

There is also a hardwood pulpwood market and to a lesser extent, a softwood pulpwood market that is driven by the Luke paper mill in nearby Allegany County that produces specialty paper products. There are also a number of niche markets for items like fence railing, fence posts, mine posts, pallets, railroad cross-ties and firewood. These markets have persisted for decades, enduring major market fluctuations. Recently, a number of mills have reduced outputs leading to

a reduction of work shifts and others have ceased all operations. On a positive note, there is some evidence that the markets are beginning to rebound.

The forest industry is the fifth largest industry in the State. It is estimated that more than 15,000 people statewide depend on the forest products industry for their livelihood equating to earnings of over $420 million. In Garrett and Allegany Counties, it is the single largest employer and on the Eastern Shore, it is the second largest. Maryland's forests supply wood for homes, furniture and paper products. Today more acres are producing wood for homes, furniture and paper products. Today more acres are producing wood fiber than 100 years ago.

In 2015, the forestry sector contributed nearly $3.5 billion to the state economy (14.9% of RBI total), supported 15,271 jobs (16.15% of RBI total), and added just over $132.5 million in combined state and local tax revenue (14.7% of RBI total). Breaking these total impacts down (see Table 9), the forestry sector generated over $2.5 billion in “direct” economic output in 2015. This equals the value of all of the output of the forestry sector plus the value of the Maryland-based supply chain needed by Maryland forestry producers to produce their lumber and paper products. For example, if a timber worker requires outside machinery or repairs to said machinery in order to produce quality wood products, these supply-chain expenditures would be included in the “direct” output figure. However, in order to provide these necessary inputs, supply-chain vendors in-turn need to purchase additional inputs from their supply chains. Continuing with the above example, if a machinery supplier needs to provide more products, they will need to purchase more steel, fuel, insurance services, etc. This second-order (or ripple) effect, whereby input providers themselves purchase more inputs, is known as “indirect” economic output. In 2015, the activities of the forestry sector were responsible for an “indirect” economic output of nearly $574.8 million. Finally, the above direct and indirect economic effects ignore how the employees in the affected firms/industries spend their additional income. This household spending results in an additional “induced” economic effect.

In 2015, the activities of the forestry sector Economic Impact of Select Resource Based Industries in Maryland 18 Conducted by BEACON at Salisbury University were responsible for “induced” economic output totaling over $365 million. Summing these economic impacts, Maryland forestry contributed over $3.46 billion in total state economic activity. With respect to jobs, the “direct” economic impact of the forestry sector supported 8,358 jobs in 2015. The resulting ripple-effect of these activities supported 4,006 jobs due to “indirect” economic effects, and an additional 2,907 jobs due to “induced” economic effects. Summing these economic impacts, Maryland forestry supported a total of 15,271 jobs. Breaking-down the economic impact of forestry by region, Western Maryland contributed nearly $1.23 billion to the state economy (35.4% of state forestry impact), supported 5,313 jobs (34.8% of state forestry job impact), and added over $46.1 million in combined state and local tax revenue (35% of state forestry tax impact) (Chambers, et al 2018).

2.14 People and Forests in Garrett County

2.14.1 Historic Settlement and Forest Use Patterns

Approximately 11,000 years ago, the most recent glacier moved north causing the dominant conifer cover to gradually decrease and hardwoods to become more dominant. There are still some unique bog areas that are typical of more northern climes, one of which is located in central Garrett County north of Compartment 67 off State Route 495 within the Pleasant Valley Recreation Center that is managed by the University of Maryland.

Prior to European settlement, historical evidence confirms that Nomadic Indian tribes traveled to and through Garrett County. There are indications that a few tribes stayed year round, especially along the banks of the Youghiogheny River. Forestry activities during this time consisted of clearing areas for crops and regularly burning woodlands to produce conditions conducive for growing fruits and berries. Burning also improved the habitat for a variety of wildlife species and provided advantages for hunting success. These activities most likely created a mosaic of age classes, sizes and species that provided a wealth of resources necessary for survival.

As the early explorers arrived, they brought with them numerous diseases that the natives had no immunity to, resulting in a significant reduction in the Indian population - much before conflict between the settlers and Indians reduced it even further. The likely effect of this population decrease was a reduction in species diversity within the forests as they matured in the absence of periodic harvesting and frequent low intensity fires. Forest conditions were markedly different compared to when large Indian populations occupied the region, with dense stands of large diameter mature trees. Settlers rapidly cleared expanses of forest land for permanent agricultural areas and the establishment of communities and associated infrastructure.

Some of the readily accessible white pine and red spruce stands were cut out to provide masts for ships and building materials. Many of the hemlock stands in the county were not cut during this period because they were located in relatively inaccessible areas and many farmers opted to save the hemlocks for future building materials.

In 1800, there were roughly 1000 settlers in Garrett County, but as cheap land became available and modes of transportation improved along with growth along the eastern seaboard, a resulting settlement boom dramatically increased the European population. The national road was completed in 1818 and the railroad arrived in 1852. The transportation system better connected the resource rich Garrett County to the growth needs of the east, which increased the quantities of lumber, coal and wheat being shipped to the population centers of Atlantic seaboard. By the early 1900’s narrow gauge railroads were used to facilitate logging on steeper slopes in order to meet the ever increasing demand for timber and wood products.

As a result, Garrett County was heavily cut-over, essentially clear cut, within a 20-year period. Errant sparks originating from train engines frequently caused forest fires in the tops and slash piles that were left from the clear-cutting. Another source of fires included arson, which was commonly used as a means of retribution between disputing parties. These activities on the forests effectively created a new age class. This legacy can be seen today as most older forests are approximately 100 years old.

In response to the rapid cutting of trees and extensive burning that was occurring throughout the county, the Garrett Brothers of Baltimore gifted 2000 acres to the state in 1906 with the proviso that an agency would be created to manage the property, institute scientific forestry practices and contribute to the local economy by properly maintaining a long term sustained yield of forest products. The Maryland General Assembly created a Board of Forestry under the University of Maryland to oversee the management of the forest which eventually developed into the Department of Natural Resources from which the Maryland Forest Service was spawned.

On January 8, 1929, the state purchased 9,352 acres of cut-over forest land from the N.U. Bond Lumber Company that included large tracts of Meadow Mountain and the western tributaries of Savage River. This initial acreage represented the beginning of Savage River State Forest. The forest continued its expansion in the early 1930s when the state acquired several large parcels of timber land from John Dimeling. From the time of the first acquisition, state foresters have allowed the timber growing stock to build up, planted open spaces, initiated timber stand improvement practices and harvested poorly stocked and economically mature stands. Forestry management practices provided protections from fire, insects, disease and grazing.

In the 1930s, the Civilian Conservation Corps camps were established throughout the county. Camps were located at Savage River, New Germany, Swallow Falls State Park, Potomac Camp and Big Run. The men in the camps assisted the forest service with fire suppression efforts, tree planting and constructing facilities for recreational activities. The CCC crews helped with the early snow skiing activities on the forest in the area that later became New Germany State Park. Their efforts helped build numerous cabins, pavilions and trails that throngs of visitors still benefit from today.

2.14.2 Recent Population and Development Trends

Garrett County, while remaining largely rural, represents a considerable attraction for the surrounding urban populations of over 11 million people from within Maryland as well as from adjacent states including Pennsylvania, Virginia and West Virginia. The result is intense pressure to convert farm and forestland to developed uses. While the full-time population of Garrett County has remained fairly steady (Table 2.15.2), the pressure has come from vacation/second home buyers.

Table 2.14.2: Population characteristics of Maryland and Garrett County

STATE	Population 2010	Population 2017	Increase %	Age–17 or less % of total, 2017	Age– 18 to 64 % of total, 2017	Age– 65 + % of total, 2017
Maryland	5,773,552	6,042,718	4.8%	22.3%	62.8%	14.9%
Garrett County	30,097	29,233	-3.0%	18.8%	59.4%	21.8%

Source: US Census Bureau (www.census.gov)

2.14.3 Maintaining Working Forests in an Urban-Affected Region

Urban populations require a constant inflow of natural services, such as food, fiber and freshly

cycled water and air. These needs create economic incentives to use undeveloped land for farming and forestry to produce these goods. But many of the natural services, such as cycling of water and air or wildlife habitat, are not priced in a market where landowners can be financially rewarded for keeping land in forests. This lowers the ability of forest owners to compete as landholders when areas become more urbanized.

Urbanization also creates large outflows of influence that tend to push land uses such as farming and forestry further away. Used water, air, waste materials are exported from the urban areas to cheaper rural land. Farming, forestry and other open space uses are generally out-priced when push comes to shove and a large population center needs to expand. The lands then move into higher priced uses that generally feature more houses, more highways and other developed amenities. As land use changes radiate outward, the industries, such as forest products manufacturing, experience supply reductions as well as growing urban attitudes that discourage or even legislate against activities like logging, trucking, or manufacturing. Where business leaders sense that the future of the industry is limited, they begin to limit investment in new facilities, and the future of the industry can become locally tenuous.

This situation is clearly affecting Garrett County and, while the Potomac-Garrett State Forest and Savage River State Forest can resist the pressures to be converted to other uses due to their status as public lands, the management of the lands will be affected by the fate of the private lands around them as well as the future of community factors such as the forest products industry and the pressures for outdoor recreation.

Knowledgeable estimates indicate that land in the Garrett County is attracting market prices that are two to five times higher than the land's agricultural or forest value. The higher that ratio becomes, the more vulnerable the land is to conversion. By comparison, some Maryland watersheds on the Western Shore close to the Baltimore-Washington corridor have price ratios as high as 10 to 15.

Land prices cut both ways in a situation like this. High prices near the urban areas mean high taxes and commodity producers are squeezed out of production because they can't afford to pay development-price taxes on farm or forestland. They are then forced to sell to protect their family's asset value. Garrett County, while not in the immediate high-pressure zone, is close enough to allow developers to think that distance is not as much a problem as price, so they are encouraged to build on the cheaper, more remote lands.

Vacation home and resort development is increasing. The fact that these uses are currently expanding in the county means additional focus will be on the area as a recreation destination. This spells more visitors, more traffic and more residential development in the coming decades. Some of this growth will take agricultural land as well as forests. The future of agricultural land is important to forestry, because as agricultural land gets developed and agricultural cultural values are replaced by urban values in the region, the pressures against production forestry will mount. That trend is already well underway and seems destined to continue in the future.

In Garrett County, populations are older and less affluent than the averages for the state (U.S. Census, 2017). This sets the stage for significant amounts of land turnover, fragmentation and land use change in the coming decades. And it leads to considerable concern for the future of rural lands as development pressures spread from Washington D.C., Baltimore, MD and

Pittsburgh, PA.

2.15 Landscape Considerations

2.15.1 Shifting from Stands to Landscapes

In the past, management of forests was done primarily on a stand-basis and as stands within specific property holdings. From an ecological perspective, the stand is understood to be a unit that could be accessed independent of others. Economic considerations, such as the desire to have a consistent product to sell from year to year and to minimize costs of treatments, linked the management of different stands. Otherwise it is assumed that a stand, by definition, is a management unit on which treatments can be scheduled independently of all others.

In recent years, there has been a strong movement toward management at a landscape level. Landscape level considerations means that the status of any specific stand, and what forestry treatments are applied to it, depend not only on its internal conditions including stand age, structure, site index, etc., but on the condition of other stands in a region. The landscape-level perspective leads to a view of stands within landscapes. The condition of other stands includes not only their stand age and structure, but also the frequency distribution of stands on the landscape of different kinds and stages. Landscape considerations also take into account land holdings by other landowners and government agencies. The management of a stand is perceived within a regional context.

All of the major goals of management need to be examined from a landscape-level perspective, and decisions made in light of this perspective. Among the factors that are leading in the direction of management from a landscape level perspective are: the requirements of the Endangered Species Act; the Clean Water Act; the habitat needs of migratory species that make use of forest stands; the habitat needs of game species and other species of recreational value; the perception that recreational uses can benefit from a variety of stand types, not just from the existence of a certain kind of stand.

There are a number of examples that illustrate the landscape perspective. Recent approaches by Boise-Cascade, a North American manufacturer of wood products and distributor of building materials, illustrate landscape level forest management as a result of concerns with endangered species. Boise-Cascade has holdings in the southeast that are habitat of the Red-cockaded woodpecker. The company has taken the position that, while it can affect habitat for this species within its own holdings, it cannot be held responsible for the status of the species, specifically for the population abundance of the woodpecker. Instead, Boise-Cascade has initiated voluntary, cooperative agreements with other landholders and with government agencies so that planning for forest use is done on a regional basis. In this case, the decision about how a specific stand will be treated is influenced by more than the condition of that stand, and more than the holdings of Boise-Cascade. That treatment depends on the availability of habitat for the woodpecker in an entire region, and, by voluntary action, the corporation chooses to harvest stands under its own control to meet the regional needs of the endangered or threatened species, as well as to meet its

corporate needs. A similar approach dealing with the endangered Delmarva fox squirrel is underway on the lower eastern shore of Maryland. The Blackwater NWR in conjunction with Maryland DNR and other partners are in the process of developing a Habitat Conservation Plan (HCP) for management of the fox squirrel for the entire peninsula.

Similarly, the desire to have clean water leads to a consideration of water quality within a region, as well as within a specific ownership. Water quality is affected by the condition of water in our rivers and bay, on lands that are in agriculture and housing, as well as on the forestland, making clean water a landscape issue.

Thus, a landscape-level perspective is intrinsic in forest planning in Garrett County and is likely to become increasingly important in the future. As the experiences and practices of Boise-Cascade illustrate this level of planning and management can be done on a voluntary, cooperative basis and can be driven by market forces. Landscape-level planning means that a stand is seen within a regional context, but this does not require that planning be done from an external or regulatory perspective.

2.15.2 Watersheds as a Landscape Issue

Regional attention to water quality in the Chesapeake Bay and its tributaries has led to concern for some of the resource management activities in use in Garrett County. Declining water quality in the Bay has resulted in major interstate efforts, many of which have identified the treatment of the land within the watershed as the primary factor in reversing the decline and restoring the Bay's aquatic environments.

In its Clean Water Action Plan, the State of Maryland identified 138 "8-digit" watersheds, averaging about 75 square miles each, as the unit of analysis most suited to identification of watershed condition and treatment priorities. The "Unified Watershed Assessment Report" published by the State, evaluated clean water and other natural resource goals on these watersheds. The clean water goals were based largely on the State's biennial water quality report, prepared in response to Section 305(b) of the Federal Clean Water Act. Waters that were reported to have violated water quality standards were assigned to "Category 1," as "in need of restoration." In addition, watersheds that were not in violation of water quality standards, but which were shown to need restoration in order to meet two or more natural resource goals, are also placed in Category 1.

Category 2 watersheds are those that meet current water quality and natural resource goals, but need preventative actions to sustain existing water quality. Category 3 is high quality pristine watersheds where protection was a high priority. In selecting water quality indicators that might be most affected by forest management within the watersheds, nutrient loading ranks highest. See chapter 3 for additional characterization of Watersheds on the State Forest.

2.15.3 Climate Change and Maryland Forests

Research has speculated how forests and their management could be affected by a changing climate. While much of the research has been somewhat general, some researchers have focused their attention to the Mid-Atlantic region that includes Maryland (McKenney-Easterling et al.:

Climate change impacts on forests in the Mid-Atlantic Region, Climate Research Vol. 14: pages 195–206, 2000).

Species Migration
According to some of these studies, there are two major forest-related shifts that may result from the common climate-change scenarios. One, resulting warmer temperatures will likely cause a species distribution shift. Within this scenario some species may benefit while others will experience a range reduction. Certain forest-types such as oak-hickory, oak-pine and southern pine forest types, would probably benefit from dryer conditions while those requiring a wetter site will not.

> *"Large increases in some species of oak and pine, particularly those better adapted to warmer and dryer ecosystems. Consequently, those species preferring more moist conditions, such as elm-ash-cottonwood and maple-beech-birch forest types may be reduced from some landscapes, "results generally show warm-temperate mixed forest/ evergreen forest moving northward, displacing temperate deciduous forest in the southern part of the MAR, and cool temperate mixed forest (such as maple-beech-birch) disappearing completely from the region."* (McKenney-Easterling et al.: Climate change impacts on forests in the Mid-Atlantic Region, page 204.)

Forest-Type Changes
The forest-type distribution in Maryland varies greatly--from the coastal plain to the Allegany Mountains, ecosystems are quite different and the expected responses to climate changes would differ as well.

Eastern Shore
The silviculture and ecosystems of the eastern shore are dominated by southern yellow pine and pine-hardwoods. It would be expected that this forest-type will largely be unaffected in most of these scenarios.

> *"The southern pine types remain fairly stable even though individual southern pine habitat increases to the north for many pines. The explanation for this pattern is that the oak species also generally increase so that the proportions stay similar, or even favor oak-pine over loblolly pine for a portion of the current southern pine habitat."* (L.R. Iverson et al. / Forest Ecology and Management 254 (2008) 390–406, p 401)

Western Maryland
The oak-hickory forest type may actually benefit from a warmer climate. Oak regeneration has been less than desirable for several decades due to the reduced occurrence of fire on the landscape, primarily due to human intervention. One study suggests that some disturbances promoted by climate change may open the canopy to actually enhance the probability for oak regeneration. This may not only increase the chance of gaining a larger oak component but also increase the populations of wildlife that benefit from that forest-type.

> *"Several of these species are currently important commercial species of oak (Quercus) or pine (Pinus). Increased habitat for oak could indicate an increased commercial and wildlife resource (especially in the northern part of the country), but oaks currently are undergoing a regeneration crisis in the absence of fire or other agents that can partially open the canopy* (Loftis and McGee, 1993; Iverson et al., 2004b)." (L.R. Iverson et al. / Forest Ecology and Management 254 (2008), pages 403-404).

Disturbance Increase

A secondary effect resulting from increased average temperatures is the increased incidence of insects, disease and fire. This will affect not only the composition of the forests but will also complicate their management. Recently, Maryland State Forests have been plagued by gypsy moth, southern pine bark beetle, hemlock wooly adelgid and emerald ash borer. A variety of other damaging agents threaten the integrity of the forests, including sirex wood wasp, oak wilt, spotted lantern fly and Asian long-horned beetles.

Increased Severe Weather

The second response identified is the result of more severe weather events and the forest management implications that would result from these events.

> *"Second, we used a survey to gather information on the types of extreme weather events that are currently problematic for forest land managers, and the types of impacts they cause to forests and forestry operations. Respondents indicated that high winds and precipitation-related events have been more problematic than extreme temperatures alone, based on experiences over the past decade. Types of major impacts include operational impacts (in particular, altered access to forest areas) as well as structural impacts (direct damage to trees) and biological impacts (mortality, and increased problems with insects, disease and fire). This information, in conjunction with our results from the tree species distribution modeling, was used to make inferences about the potential impacts of extreme events in the future. We note that climate change may lead to alterations in the frequency, severity and duration of extreme events such that the past is an imperfect predictor of the future."* (McKenney-Easterling et al.: Climate change impacts on forests in the Mid-Atlantic Region, page 205.)

Sea-level Rise

Updated predictions for sea level rise in Maryland have been presented by a collective of sea-level rise experts in fulfillment of requirements of the Maryland Commission on Climate Change Act of 2015 and published in the 2018 report entitled Sea Level Rise: Projections for Maryland. This report provides updated projections of the amount of sea-level rise relative to Maryland coastal lands that is expected into the next century. The framework for these projections is explicitly tied to the projections of global sea-level rise included in the Intergovernmental Panel on Climate Change Fifth Assessment (2014) and incorporates regional factors such as subsidence, distance from melting glaciers and polar ice sheets, and ocean currents. The probability distribution of estimates of relative sea-level rise from the baseline year of 2000 are provided over time and, after 2050, for three different greenhouse gas emissions pathways:

Growing Emissions (RCP8.5), Stabilized Emissions (RCP4.5), and meeting the Paris Agreement (RCP2.6). This framework has been recently used in developing relative sea-level rise projections for California, Oregon, Washington, New Jersey, and Delaware as well as several metropolitan areas. The Likely range (66% probability) of the relative rise of mean sea level expected in Maryland between 2000 and 2050 is 0.8 to 1.6 feet, with about a one-in-twenty chance it could exceed 2.0 feet and about a one-in-one hundred chance it could exceed 2.3 feet.

Later this century, rates of sea-level rise increasingly depend on the future pathway of global emissions of greenhouse gases during the next sixty years. If emissions continue to grow well into the second half of the 21st century, the Likely range of sea-level rise experienced in Maryland is 2.0 to 4.2 feet over this century, two to four times the sea-level rise experienced during the 20th century. Moreover, there is a one-in-twenty chance that it could exceed 5.2 feet. If, on the other hand, global society were able to bring net greenhouse gas emissions to zero in time to meet the goals of the Paris Climate Agreement and reduce emissions sufficient to limit the increase in global mean temperature to less than 2°Celsius over pre-industrial levels, the Likely range for 2100 is 1.2 to 3.0 feet, with a one-in-twenty chance that it would exceed 3.7 feet. The difference in sea-level rise between these contrasting scenarios would diverge even more during the next century, with the failure to reduce emissions in the near term resulting in much greater sea-level rise 100 years from now. Moreover, recent research suggests that, without imminent and substantial reductions in greenhouse gas emissions, the loss of polar ice sheets—and thus the rate of sea-level rise - may be more rapid than assumed in these projections, particularly under the Growing Emissions scenario. These probabilistic sea-level rise projections can and should be used in planning and regulation, infrastructure siting and design, estimation of changes in tidal range and storm surge, developing inundation mapping tools, and adaptation strategies for high-tide flooding and saltwater intrusion.

Agency Response
The State of Maryland has been addressing the threats of global warming and climate change through varies committee studies and reports.

In the Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change, Chapter 5, one of the key recommendations, in which DNR State Forests can have a role, was:

> *Retain and expand forests, wetlands, and beaches to protect us from coastal flooding. Identify high priority protection areas and strategically and cost-effectively direct protection and restoration actions. Develop and implement a package of appropriate regulations, financial incentives, and educational, outreach, and enforcement approaches to retain and expand forests and wetlands in areas suitable for long-term survival. Promote and support sustainable shoreline and buffer area management practices.*

The Maryland DNR Forest Service response to these factors will be to maintain an adaptive management approach considering current research and regular forest and other resource inventories, monitoring and assessments and by proper staffing to maintain the ability to respond to these potentially destructive forces. Western Maryland State Forests have completed a five-

year forest inventory project which provides baseline data to monitor forest changes and allow adaptive forest management approaches.

Additional information:

Sea-Level Rise and Coastal Habitats of the Chesapeake Bay: A Summary
(National Wildlife Federation, 2008)
http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/NWF_ChesapeakeReportFINAL.ashx

Climate Change in Maryland: https://climatechange.maryland.gov/

Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change Phase I: Sea-level rise and coastal storms (2008)
https://dnr.maryland.gov/ccs/.../Comprehensive_Strategy.pdf

2.16 Water Quality Issues

Forests play a pivotal role in water quality in the Chesapeake Bay. Forestlands provide a steady source of clean water to streams and tributaries. Forests act as nutrient sinks across the landscape, absorbing more nutrients than they supply. Additionally, Potomac-Garrett State Forest and Savage River State Forest contain a large amount of land in Garrett County and therefore are critical to the viability of the timber industry and consequently to the forest cover in the region. Without the infrastructure of the timber industry, forestlands may be converted to other more polluting land uses. Finally, the location and landscape position of the state forests provides opportunities to capture additional nutrients and sediments traveling across the watershed.

Nutrients are the largest water quality concern in Garrett County due to their negative impact on the Chesapeake Bay and its tributaries. Forests are estimated to contribute only 2 pounds of nitrogen per acre per year while receiving 9.5 pounds of nitrogen per acre per year from the atmosphere. The majority of streams in Garrett County have nitrate-nitrogen levels within the range found in typical forested streams within Maryland. An estimated 70% of stream miles were below the 1 mg/l threshold level and no streams had values which exceeded the 5 mg/l threshold for biological effects. There is no geographic trend in the distribution of sites with elevated nitrate-nitrogen in the county.

Similar to nitrate-nitrogen, 86% of the stream miles in Garrett County had total phosphorus levels in the range of those observed in typical forested Maryland streams. No streams had total phosphorus levels above the threshold associated with biological effects. Sites with elevated levels of phosphorus tend to be concentrated in the southern portion of the county.
See Chapter 3 for additional characterization of water quality.

2.16.1 Potential Water Quality Impacts of Forestry Operations

Timber operations have the potential to create unacceptable impacts on water quality and the undulating topography of Garrett County may increase the risk of causing significant water quality impacts. However, with proper best management practices, these impacts are generally minimal and temporary. See Chapter 5 for additional information on mitigating impacts from forestry operations.

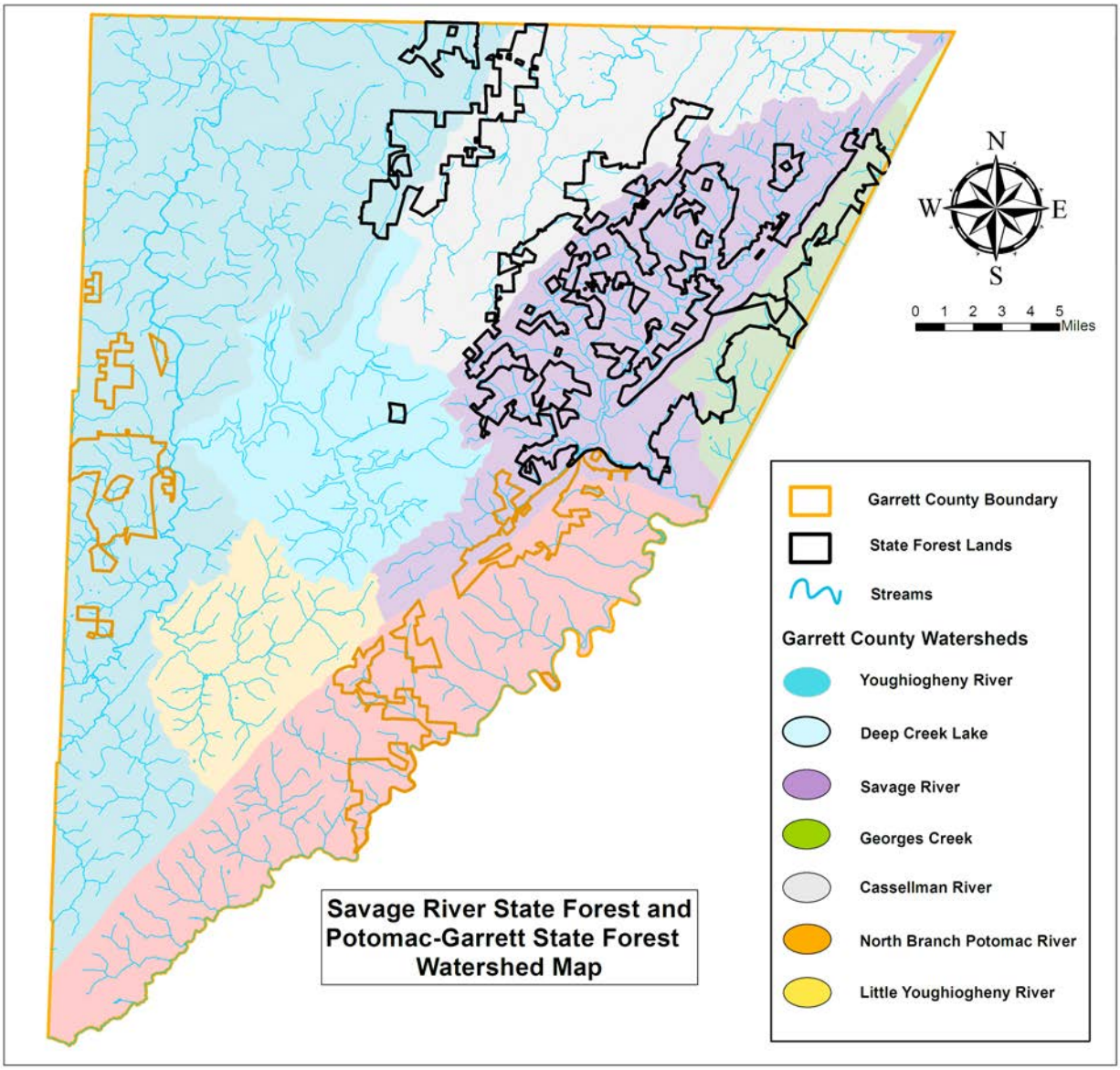


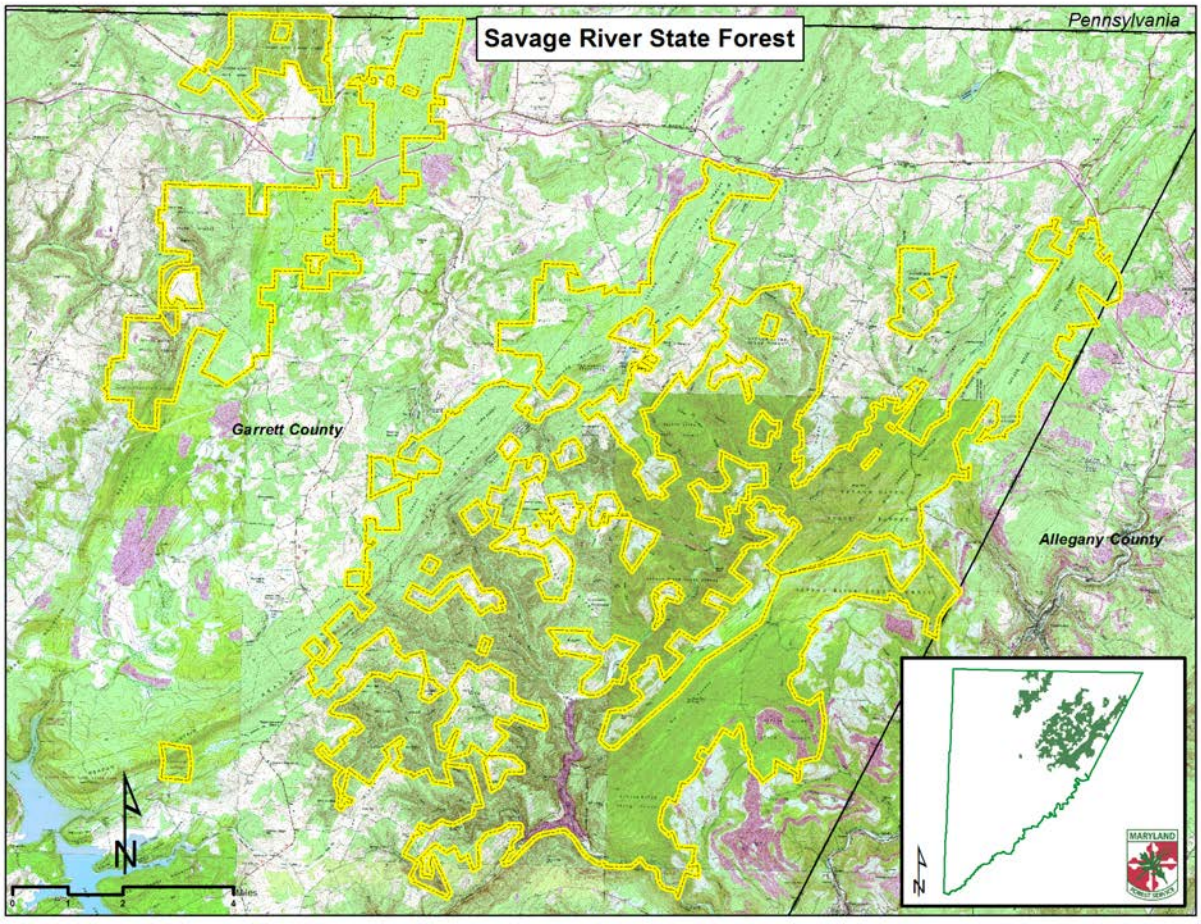
Figure 2.16.2: Watersheds in Garrett County

Chapter 3 - Resource Characterization

Chapter 3

Savage River State Forest – Resource Characterization

Figure 3.1 Savage River State Forest – Garrett County, Maryland



3.1 The Forests

The Savage River State Forest covers approximately 55,281 acres of land in Garrett and Allegany Counties (Figure 3.1). Mature mixed oak and northern hardwood forests comprise a large proportion of the Savage River State Forest, as illustrated in Table 3.1. In general, sixty-six percent of the area is composed of older, more mature forests, while thirty-four percent are younger and smaller. Table 3.1 lists the diameter classes and suggests a diversity matrix that provides a current baseline from which future changes in age structure or forest type diversity can be assessed for potential habitat or biodiversity effects. The following are forest resource characterizations including forest type, size class and forest productivity for Savage River State Forest based on historic CFI data and SILVAH data.

Structure Stage	Seedling	Sapling	Pole-timber	Small Saw-timber	Large Saw-timber	Total	Standard Error	% Total
Forest Type								
Hemlock	0.0	0.0	314.5	1,572.7	209.7	**2,097.0**	21.9	3.8
Northern Hardwood	524.2	733.9	1,887.3	4,927.9	1,048.5	**9,202.3**	9.8	16.6
Hardwood Hard Pine	0.0	0.0	104.8	0.0	0.0	**104.8**	100.0	0.2
Mixed Oaks	629.1	629.1	7,758.8	16,880.6	4,193.9	**30,314.9**	3.9	54.8
Cove Hardwoods	104.8	419.4	1,363.0	2,516.4	524.2	**4,927.9**	13.9	8.9
Red Maple	0.0	524.2	838.8	1,258.2	104.8	**2,726.1**	19.1	4.9
Black Locust	0.0	209.7	629.1	314.5	0.0	**1,153.3**	29.9	2.1
Hardwood White Pine	0.0	0.0	314.5	0.0	0.0	**315.5**	57.6	0.6
Plantations	419.4	104.8	838.8	1,467.9	0.0	**2,830.9**	18.8	5.1
Total	**1,677.6**	**2,621.2**	**14,049.7**	**29,085.5**	**6,342.7**	**53,672.7**	0.4	100.0
Standard Error	24.6	19.5	7.4	4.1	12.4	0.4		

Table 3.1: Forest Diversity Analysis: Acres of forest type and forest structure by structural groups, with percentage of total area in each forest type/structure group combination (Total acres do not equal to 55,281 due to sampling error and omission of non-forested acreage).

3.2 Old Growth Forest

Old growth forests have generally been defined as forests in existence since pre-settlement times and lacking any significant Euro-American disturbance. The definition can differ according to climatic and eco-regional perspectives and the growth characteristics of specific native forest systems. In Maryland, an old growth forest is defined as a minimum of five acres in size with a preponderance of old trees, of which the oldest trees exceed at least half of the projected

maximum attainable age for that species and that exhibits most of the following characteristics:

1. Shade tolerant species are present in all age/size classes.
2. There are randomly distributed canopy gaps.
3. There is a high degree of structural diversity characterized by multiple growth layers (canopy, understory trees, shrub, herbaceous, ground layers) that reflect a broad spectrum of ages.
4. There is an accumulation of dead wood of varying sizes and stages of decomposition, standing and down, accompanied by decadence in live dominant trees.
5. Pit and mound topography can be observed, if the soil conditions permit it.

It is also important to recognize that old-growth forests are not static and may not be a permanent fixture on the landscape. The forests and trees within and around them change continuously. This would be true even if human influence could be eliminated. All forests, including old-growth, succumb to natural, destructive disturbances and regenerate over time. A functional old-growth ecosystem includes the loss of old trees due to natural disturbances and the death of old trees. An old-growth system is not static, nor is it always dominated by old trees. Natural processes dictate the age composition at any time. The important factor in this process is that the trees have the opportunity to reach old age if natural disturbances do not intercede.

Savage River State Forest has seven remnant areas of Old Growth Forest. These areas with a 300-foot buffer total 1,758 acres and tend to be found in remote areas that escaped prior harvesting. Larger Old Growth Forest management areas are being created around these small remnant patches that are referred to as old growth ecosystem management areas (see map appendix I-1). This process is fully described in the *Policy and Procedures Handbook for Western Maryland Forests,* Appendix E, “Management Guidelines for the Conservation and Protection of Old-Growth Forest”. Also see Chapter 5 for management guidelines for the identified “nearly old growth forest areas”.

3.3 Forest Production

Savage River State Forest has been managed for industrial forest production for decades and has been a major contributor to the region’s forest products industry. Numerous sawmills and the Verso paper mill operations of Luke, MD provide outlets for both timber and pulpwood products from local forests.

Savage River State Forest makes up about 20% of the productive forests in the Garrett County area, see (Table 3.3). However, Potomac-Garrett State Forest is managed in a similar manner as Savage River State Forest and these two state properties comprise almost 26.4% of forest in the county.

Table 3.3: Savage River SF and Potomac-Garrett SF as a Percentage of Garrett County

	State Forest	SF as % of	SF as % of

State Forest	Acres	County Area	County Forest
Savage River	55,281	13.8%	20.0%
Potomac-Garrett	18,242	4.3%	6.4%
Totals	73,523	18.1%	26.4%

Source: USDA Forest Service-Forest Statistics for Maryland

3.4 Water Quality

The rural nature and high proportion of forest land in Garrett County has helped sustain the excellent water quality of surface water runoff. The geology and topology of the area provide a relatively continuous base flow of clean, cool ground water to the streams. Water quality protection is a major environmental concern, which the Savage River State Forest management plan comprehensively addresses through the fostering of healthy, growing forests that will maximize nutrient uptake, proper implementation of BMPs on all harvest activities as well as the reduction of soil impacts where the risk of direct nutrient transport into shallow groundwater or surface waters is high.

3.5 Watersheds

The Savage River State Forest is located within six (6) of Maryland's 8-digit watersheds including Savage River, Upper North Branch of the Potomac and George's Creek in the Chesapeake Bay Drainage and the Casselman River, Youghiogheny River and Deep Creek Lake in the Ohio River Basin. The majority of the forest is located within the Savage River watershed (57.8%) with smaller amounts in George's Creek (12.7%), Casselman River (17.9%) and Youghiogheny River (10.7%) watersheds. Small areas of the forest are located in the Deep Creek Lake (0.4%) and Upper North Branch of the Potomac (0.6%) watersheds. The number of stream miles according to the Strahler stream order and grouped by major drainage is presented in Table 3.5.1.

Table 3.5.1: Strahler Stream Order by Watershed

	Stream Order (Miles)				
Watershed	1st	2nd	3rd	4th	5th
Georges Creek	55.8	15.1	12.9	0	0
Potomac River U N Branch	90.6	22.1	7.5	33.1	0

Savage River	96.2	21.8	16.8	5.0	0
Chesapeake Bay	**242.6**	**59.0**	**37.2**	**38.1**	**0**
Casselman	61.0	22.2	13.1	0	0
Deep Creek Lake	24.4	2.9	1.7	0	0
Youghiogheny River	166.8	52.5	30.0	7.1	19.8
Ohio River	**252.2**	**77.6**	**44.8**	**7.1**	**19.8**
Total	494.8	136.6	82.0	45.2	19.8

3.5 Watersheds

3.5.1 Stream Condition

The Maryland Biological Stream Survey (MBSS) has randomly sampled streams across the state of Maryland to assess stream ecological condition. Stream condition is measured two ways; by using information collected from (1) fish and (2) benthic macro invertebrate communities. This information is analyzed and reported in one of four categories; good, fair, poor or very poor. The results for the six Savage River State Forest watersheds are presented in Table 3.5.1.1 for fish and Table 3.5.1.2 for benthic macro invertebrates.

Table 3.5.1.1: Estimated Number of Stream Miles by Category; Fish Index of Biotic Integrity

Watershed	Good	Fair	Poor	Very Poor	Not Rated
Savage River	57	29	7	0	7
Georges Creek	20	20	60	0	0
Potomac River Upper North Branch	10	20	40	30	0
Casselman River	10	30	50	10	0
Youghiogheny River	19	31	50	0	0
Little Youghiogheny/Deep Creek Lake	0	10	70	20	0
STATEWIDE	26	25	21	19	9

Table 3.5.1.2: Estimated Number of Stream Miles by Category; Benthic Index of Biotic Integrity

Watershed	Good	Fair	Poor	Very Poor	Not Rated
Savage River	86	7	7	0	0
Georges Creek	40	20	30	10	0
Potomac River Upper North Branch	20	40	30	10	0
Casselman River	30	20	30	20	0
Youghiogheny River	38	25	25	13	0
Little Youghiogheny/Deep Creek Lake	10	60	20	10	0
STATEWIDE	26	28	30	16	0

3.5.2 Aquatic Biodiversity

The Savage River State Forest is located within portions of 14 of the 159 Stronghold Watersheds described for Maryland. Stronghold Watersheds are the 12-digit watersheds that are the most important for the protection of Maryland's aquatic biodiversity. More information on Stronghold Watersheds can be found on the MBSS website: https://dnr.maryland.gov/streams/Pages/streamhealth/Maryland-Stronghold-Watersheds.aspx.

These stronghold watersheds in the Savage River State Forest are important for the conservation of several state rare, threatened, or endangered species that include the Johnny darter, striped shiner, mottled sculpin, brook trout, stonecat and hellbender. The Savage River watershed also contains the most intact and connected population of brook trout in Maryland. The Casselman River watershed is the only known watershed with recent records for the stonecat and hellbender.

The MBSS has also collected information on non-native aquatic species. Seven non-native fishes have been found on or in close proximity to the forest including fathead minnow, brown trout, rainbow trout, smallmouth bass, rock bass, pumpkinseed and bluegill.

The MBSS has a long-term monitoring network called the Sentinel Site Network. This is a network of 27 sites used to monitor the natural variability of streams and to investigate the possible effects to streams due to global climate change. These sites are the highest-quality sites identified by the MBSS with the least amount of anthropogenic influence in the upstream catchments. Eight of the 27 Sentinel Sites are located on or adjacent to Savage River State Forest.

3.6 Soils

The soils on the forest are strongly dissected by natural drainage patterns. The soils are often steep, stony or both and are ideally suited for woodlands, wildlife habitat and recreation. In the process of plan development, the soils on the forest were classified into eight Soil Management Groups (SMG) based on soil characteristics directly affecting forest management. (See Appendix: D for a listing of soil types with symbols used by soil survey reports and soil management groups. The eight Soil Management Groups are defined as follows:

SMG 1 – Very poorly drained to poorly drained mapping units with moderate limitations affecting construction of haul roads and log landings.

SMG 2 – Very poorly drained to poorly drained mapping units with severe limitations affecting construction of haul roads and log landings.

SMG 3 – Somewhat poorly drained to moderately well drained mapping units with moderate limitations affecting construction of haul roads and log landings.

SMG 4 - Somewhat poorly drained to moderately well drained mapping units with severe limitations affecting construction of haul roads and log landings.

SMG 5 - Well drained mapping units with slight to moderate limitations affecting construction of haul roads and log landings.

SMG 6 - Well drained mapping units with severe limitations affecting construction of haul roads and log landings.

SMG 7 - Soil mapping units that are variable and have no defined drainage class with moderate limitations affecting construction of haul roads and log landings.

SMG 8 - Soil mapping units that are variable and have no defined drainage class with severe limitations affecting construction of haul roads and log landings.

To facilitate plan development and future management, digital soils data were prepared for all the areas of the Savage River State Forest. When the current land cover was compared to the soil survey data, it was clear that the majority of Savage River State Forest soils occur on SMGs 5, 6 and 8; with stony land, steep (SrF) being the largest single mapping unit. The distinctions within this soil are quite variable, and there is often considerable slope and aspect differences that make accurate identification and classification difficult, making accurate assessments by experienced field personnel vital to the process.

3.7 Compartments

3.7 Compartments

To facilitate management planning of the Savage River State Forest, the forest was divided into compartments. A compartment is defined as contiguous area made up of individual stands that make sense to be managed as one unit. The resulting management units provide a very useful tool for developing individual operating plans that comprise the annual work plan on the forest. Table 3.7.1 and figure I-2 reflects the identification and distribution of the eighty-two compartments.

The majority of the land base is in contiguous blocks (Table 3.7.2).

Table 3.7.2: Compartment Statistics by Size

Size Class	Count	Ac Sum	Ac Avg.	Min	Max
0-400	21	4,239	201	51	375
401-600	21	10,384	494	401	584
601-900	19	13,531	712	606	895
901 +	22	26,467	1,203	927	2,179

Adjoining land uses, such as agriculture or development, may constrain certain forest management activities. These forests provide needed habitat and aesthetic diversity as well as the opportunity for water quality improvement projects to buffer the impact of surrounding lands. The Department must weigh the effects of various management activities as they may affect adjoining properties and seek to maintain good relationships with neighboring landowners.

Private forest landowners are under increasing economic pressure to develop their land as populations grow and industries expand. Maintaining local economic uses and technical resources that help individuals keep their land in forests is crucial to maintaining or expanding the amount of forestland in Western Maryland. Thus, the concern for the economic effects of this plan and the value of these forests for transferring technical knowledge to other owners are central to the management of Savage River State Forest. By maintaining these working landscapes and contributing to the timber industry, local markets and infrastructure including logging crews, mills, etc. will be available to private landowners, reducing the need to convert land to other uses.

Table 3.7.1: Savage River State Forest Compartments

Compartment	Total Acres	Compartment	Total Acres
1	528	39	170
2	562	40	726
3	500	41	470
4	813	42	493
5	734	43	1069
6	754	44	330
7	777	45	553
8	485	46	174
9	986	47	943
10	643	48	289
11	1288	49	575
12	374	50	516
13	482	50A	711
14	930	51	2179
15	1167	52	643
16	988	53	808
17	1119	54	1009
18	638	55	794
19	243	56	616
19A	99	57	458
20	188	58	1584
21	516	59	1445
22	408	60	721
23	606	61	135
24	438	62	584
25	895	63	927
26	1018	64	270
27	263	65	251
28	1077	65A	51
28A	447	66	123
29	1135	67	153
29A	375	68	153

30	1246	69	521
31	518	70	635
32	1049	71	188
33	500	72	644
34	285	73	692
35	1025	74	401
36	683	75	172
37	1873	76	944
38	1470	77	197

Chapter 4 - Land Management Guidelines

4.1 Land Management

Due to the diverse landscape of the Savage River State Forest, this plan will not make specific prescriptions for each tract. Rather, the planning team identified specific areas based on physical attributes that will be emphasized in future management decisions.

Figure 4.1 illustrates the sequence of identifying these areas for planning purposes. First, the general forest management area is first constrained by identifying the ecologically significant areas where a particular site requires special management attention. This is followed by riparian forest buffers or wetland buffers. Next, wildlife habitat areas will be established where a special combination of management recommendations are required by a species or suite of species. Finally, attention must be paid to the visual impact of a practice, considering its location in regard to viewscapes as well as adjoining landowners. Recommendations for each area have been developed and are listed in this plan and they serve to provide guidelines to field managers, who will need to address each situation on the basis of accurate inventory, analysis and planning methods. Additionally, there are special sites within each of these areas that fall into the High Conservation Value Forest (HCVF) designation, these are areas to be managed and protected because of identified unique conservation values. See chapter 5 for additional information.

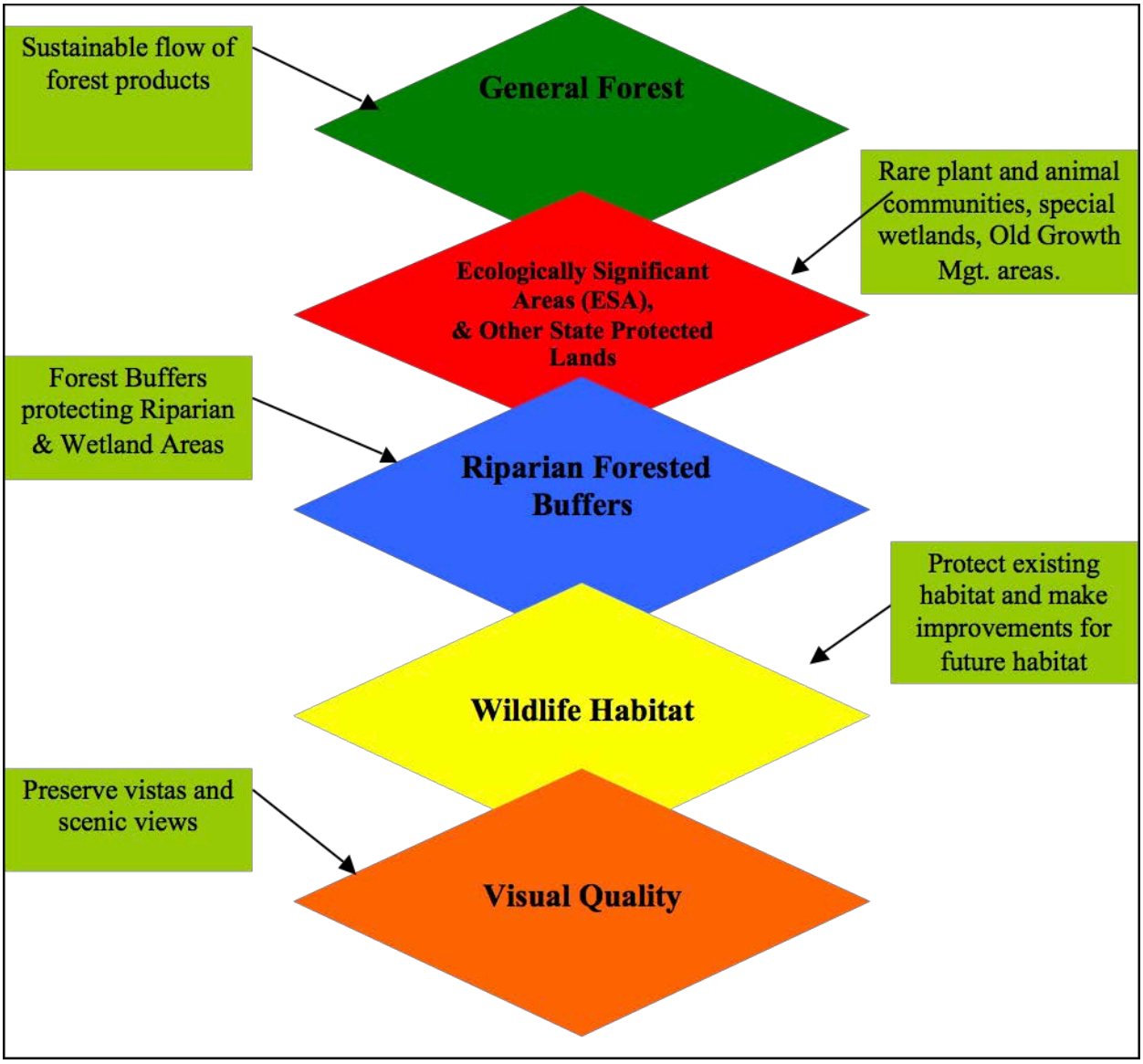


Figure 4.1: Schematic of Land Management Area guidelines

4.2 General Forest

The goals of this project are to maintain an economically sustainable forest and contribute to the local economy by providing forest-related employment and products. The majority of Savage River State Forest consists of mixed hardwood stands (See Chapter 5).

4.3 Ecologically Significant Areas (ESA) & Other State Protected Lands

Sites containing rare plant and/or animal communities are identified and managed for their unique qualities. It is the charge of the Wildlife & Heritage Service to assure that special sites are properly delineated, inventoried and managed and that detailed records are created and

maintained for each site. Specific prescriptive management recommendations need to be developed for each site. A listing of the descriptions for these special sites that have been identified on Savage River State Forest can be found in Chapter 7.

Other State Protected Lands: A majority of these areas fall under the ESA designation, but those that do not fall within one of the following classifications: State designated Heritage Area, State Wildland, Wetland of Special State Concern (WSSC) and Old Growth Ecosystem Management Area. Some of these sites fall under state protection provided through legislation.

4.4 Forested Riparian Buffers

Fifty-foot (50 ft.) no-cut riparian buffers will be established and maintained along according to the guidelines listed in Chapter 6. All management activities within these areas will be designed to preserve or improve the ecological functions responsible for protecting and enhancing water quality and wildlife habitat. Long-term goals involve creating a mosaic of habitats on the landscape including mature mixed forest stands, early successional areas, transitional corridors and riparian zones. Boundaries for these sensitive areas will be clearly marked in order to prevent negative soil impacts and to protect the integrity of streams and wetlands. Where appropriate, riparian areas may be managed to provide or retain optimum environments for habitat specialists such as woodcock or alder flycatchers. These areas will be regenerated during winter when substrates are frozen in order to lessen impacts on soil and water quality. Some of these riparian areas serve as yarding areas where deer populations concentrate during significant snow events or extended periods of extreme winter weather. In some cases, it may be prudent to conduct regeneration harvests in order to supply browse for over-wintering deer.

4.5 Wildlife Habitat Areas

The rich diversity of wildlife species located within Savage River State Forest, including both endangered and common species, requires a wide array of traditional and adaptive management strategies to address a variety of ecological needs. Wildlife habitat is greatly enhanced by providing a variety of habitat types that include young and mature forest, open habitats, as well as riparian forest buffers and transitional corridors. Streamside forest buffers provide protection for water quality and the important habitat and life zones associated with riparian areas. Chapter 8 outlines the goals and guidelines for these areas. Forest harvests designed to maintain a mosaic of age classes ensure that valuable cover and edge habitat are available for a suite of species, from the most common to those in decline. Prescriptions will be developed to establish the early successional habitat required for various life stages of target species.

4.6 Visual Quality Areas

These areas are managed to serve as visual and sound buffers along public roads and adjacent properties and to protect existing scenic vistas, where appropriate. Buffers protecting views of

the land from the water should also be addressed in the establishment of riparian forest buffers.

4.7 Non-Forested Lands

These lands are not classified as a unique area in the management plan, but they cover an estimated 3.0% of Savage River State Forest. They consist primarily of roads, transmission lines, wildlife openings, bogs and swamps. Some of these areas may need to be maintained in non-forest vegetation to allow management activities on the forest or to meet legal easement requirements. They can provide important wildlife habitat elements, including grassy areas and food plots, which benefit game species management and do not interfere with forest management. These areas may be especially valuable as brood habitat for wild turkeys and ruffed grouse and as foraging areas for other species. As this is the least abundant cover type on Savage River State Forest, it may be important to consider creating additional open habitat areas by planting and maintaining existing log landings, implementing regeneration harvests or preventing the invasion of woody vegetation on former agricultural areas.

Chapter 5 - Forest Management

5.1 High Conservation Value Forest (HCVF)

Every acre of Savage River State Forest has been categorized by specific resource objectives formulated for a particular area. These categories were determined through analyses performed by the Maryland Forest Service, Freshwater Fisheries Service and the Wildlife & Heritage Service in early 2010. These analyses resulted in the identification of High Conservation Value Forest (HCVF) areas composed of Wildlands, Ecologically Significant Areas (ESA), Riparian Buffers, Wetlands of Special State Concern, Old Growth and Old Growth Ecosystem Management Areas.

The concept of HCVF is to ensure that existing fragile and unique ecosystems maintain their identified conservation attributes. The identification of unique values for each priority management/HCVF area along with prescriptive management protocols was a collaborative effort between the Maryland Forest Service and Wildlife and Heritage Service personnel. In most cases, areas designated as HCVF do not prohibit timber harvest activities, but instead utilize forestry management operations to enhance the designated high conservation value. The unique high conservation value for each of the priority management areas indicated must be protected or enhanced by the activity (See Table 5.1 and Map I.3). The total acreage in the table does not equal the total area of the forest due to intersecting and overlapping areas. The remaining acreage on SRSF not designated as HCVF falls into a category that is less restricted to particular types of management.

5.2 Savage River State Forest – Mapping

Savage River State Forest Tract Maps are provided in Appendix I. Forest Compartment and Stand maps are approximate and subject to minor revisions by the DNR Interdisciplinary Team (ID Team) as dictated by on-site conditions verified by field review. Similarly, changes and additions to priority management acreages will be subject to ID Team and Advisory Committee review. The boundaries for each area are maintained in a GIS database and are just one tool and source of information to guide the forest manager as to what is best for the resources at a particular site.

Table 5.1: Savage River State Forest Management Layers

Management Layers Designation	Savage River State Forest Area	
	Acres	% of SRSF Total Area
General	35,704	64.6

Wildlands	13,716	24.8
Ecologically Significant Areas	3,887	7.0
Wetlands of Special State Concern	202	0.3
Forested Riparian Buffers	1,772	3.6
Old Growth Ecosystem Management Areas	13,199	23.8
Total SRSF Area: 55,281 Acres		

5.3 Forest Types and Silvicultural Practices – Savage River State Forest

Acreages listed for each forest type are an approximation based on current forest inventory data and survey information. Acreages for each forest type will continually change over time as areas are identified and established and new forest inventory data are provided.

5.3.1. Non-Forested Lands

Included in non-forested lands are 497 acres of open marsh & swamps, and 291 acres of power lines. The Savage River Forest road system includes 77.2 miles of main access roads and side feeder roads, which amounts to approximately 111 acres of open land.

5.3.2. Eastern Hemlock Type

This forest type is just over 5,700 acres and is predominately eastern hemlock mixed with varying amounts of hardwoods. This timber type is typically found along river/stream borders with northern aspects. The management goal for this timber type is maintaining mature stands for stream protection and preserving water quality. This type can be managed with uneven aged management techniques such as single tree selection. Major problems associated with this timber type are infestations of hemlock woolly adelgid and overbrowsing by deer. The adelgid has become established throughout this forest type and large populations pose a serious threat to the survival of the hemlocks. Also, regenerating these stands can be difficult when large numbers of deer are present, as hemlock seedlings are a preferred food species. A large percentage of these stands are found in the High Conservation Value Forests.

5.3.3. Pine – Hardwood Type

This forest type, which totals just over 500 acres, will be managed toward mature stands of mixed hardwood and pine species. Herbicides will be used sparingly, limited to ground applications to achieve specific goals in improving species balance or removing invasive species. HCVF areas within this forest type that contain sensitive species will be managed to protect and/ or enhance the habitat needs of the target species. Prescribed burning applications may be used in these forest types to manage for a particular species, such as pitch pine. Natural regeneration will be used within harvest sites, possibly supplemented with planting of native hardwoods and/or native conifers.

5.3.4. Conifer Plantations

Conifer plantations, which total approximately 3,000 acres, are made up primarily of white pine, Norway spruce and red pine interspersed with small components of Scotch pine, balsam fir, red spruce and Japanese larch. Many of these stands were established to restore degraded soils with the intention of reverting them back to native hardwood stands. However, given the small amount of conifer cover on the state forest, these stands will be maintained in conifer cover. Any non-native conifers will gradually be replaced with native conifers such as white pine and red spruce. Silvicultural activities within these stands will involve commercial thinning operations followed by regeneration harvesting utilizing various methods including seed tree retention, shelterwood harvests or clearcutting.

5.3.5. Northern Hardwoods

This forest type, which totals just over 9,000 acres, will be managed towards the establishment of large diameter mature trees. The tree species in this type, such as sugar maple and American beech are suitable for uneven aged management systems. These forest types are frequently found on northern aspects and adjacent to streams and are often associated with valuable ecosystem features. While uneven aged management has not been frequently used on the forest, it is appropriate to use in this forest type in order to protect valuable ecosystem features.

5.3.6. Cove Hardwoods

Cove hardwoods total approximately 5,000 acres and will be managed primarily for mature large diameter trees. This forest type is generally located on moist fertile sites and contains a variety of high value timber species including black cherry, walnut, sugar maple and red oak. Silvicultural treatments in this type will be even aged management systems. With typical site locations in ravines in association with riparian corridors, many areas of the cove hardwoods fall within High Conservation Forest and will be managed for specific objectives associated with the designated sites.

5.3.7. Mixed Hardwoods

Totaling over 30,000 acres, this forest type dominates the landscape of Savage River State Forest. Oaks are a dominant component of larger canopy trees and are at risk to a number of insect and disease problems. Also, oak regeneration in all cohorts is lacking in the understory as a result of the presence of undesirable interfering vegetation, overbrowsing by deer and a lack of fire related influences that historically facilitated the establishment of competitive regeneration. Frequently, silvicultural treatments are designed to reduce the oak component of a stand as a safeguard against insect and disease outbreaks while creating favorable understory conditions for future cohorts to occupy the sites.

5.4 Cultural Heritage and Indigenous Peoples

A number of special areas on Green Ridge State Forest have been identified, that require special consideration when developing management prescriptions. Old home sites, research areas and small cemeteries are common throughout the forest. Cultural Heritage Areas may also include historical, cultural or spiritually significant sites for indigenous peoples. Once a site has been identified and located in the field, its location and description are loaded into the forest GIS

database. Protection levels can then be assigned and incorporated into the future planning efforts of forest activities. Most Special Management Areas require some form of preservation or protection. Any proposed activity or management within the vicinity of these special areas will be identified and reviewed as part of the Annual Work Plans (AWP) process. Managers are expected to make diligent field inspections to identify additional sites that may currently be located within the other management layers and consider these areas as part of planning whatever work is planned.

Performance measures to judge the adequacy of those plans, and the subsequent management actions, should include:

a. a) Each identified special area is appropriately marked on the ground and documented in the data set.
b. b) Each plan is sufficient to protect the special values identified for each area.
c. c) Field examination and monitoring reveals that the plan is being implemented properly and that the special values are, in fact, protected or enhanced as the plan indicated.

The Department has a commitment to recognize and respect the rights of Indigenous Peoples. It is the mission of The Maryland Commission on Indian Affairs to "promote the awareness and understanding of historical and contemporary American Indian contributions in Maryland." The role of the State Forest management in promoting this state mission is through the following practices:

a. understand and respect traditional forest-related knowledge;
b. identify and protect spiritually, historically, or culturally important sites;
c. address the use of non-timber forest products of value to American Indians on state forests; and
d. respond to American Indians' inquiries and concerns received.

5.5 Forest Management Guidelines

The aforementioned forest types have been categorized into two different forest management classifications - High Conservation Value Forest and Regular Conservation Value Forest. These management classifications take into account all ecologically significant areas on the forest. Acreages listed under the classifications of are only estimates that will change over time as field evaluations determine the appropriate category for areas under review. High Conservation Value Forest includes the following areas: Ecologically Significant Areas (ESA), Wildlands, Riparian Buffer Areas, Wetlands of Special State Concern, Old Growth and Old Growth Ecosystem Management Areas.

5.6 General Management Areas

Regular Conservation Value Forests or General Management areas are those sites not impacted

by specific restrictions of High Conservation Value Forests (in the five special management areas as outlined below).

In the designated general management areas, the forest will be managed on longer rotations (10 % longer than optimum financial maturity) thereby encouraging greater biodiversity. The goal is to grow larger trees and hold them longer on the landscape. Regeneration harvests will occur at various rotation ages based on the specific forest type.

It is important to note that production of forest products in no way precludes the contribution from these lands to other forest functions, such as recreation, wildlife habitat or water quality.

All forest types within these management areas will be managed to produce a rapidly growing, vigorous and healthy forest. This management will support local natural resource based industries, and at the same time, protect water quality through adherence to Best Management Practices.

The annual growth rate in this area based on continuous forest inventory data from 2000 is 6.5 million board feet. The average annual harvest rate since 2008 is 945,211.5 board feet. The annual harvest volumes since 2008 are as follows:

Fiscal Year	*Bd. Ft. Vol. Harvested*
2008	**1,032,193**
2009	**1,714,735**
2010	**1,244,076**
2011	**850,561**
2012	**144,349**
2013	**863,049**
2014	**521,526**
2015	**1,286,994**
2016	**941,285**

2017	**853,347**
2018	**1,152,074**

5.7 High Conservation Value Management Areas

5.7.1 Ecologically Significant Areas (ESA)

Several portions of the ESA management areas overlap State Wildlands, Wetlands of Special State Concern (WSSC), Old Growth Ecosystem Management Areas and Riparian buffers. However, management prescriptions will focus on enhancing and protecting the designated ESA. Each ESA area has specific management prescriptions (See Chapter 7 of the plan for detailed explanations on the type of management activity recommended for each area and for the specific definition and prescription for each ESA category).

5.7.2 State Wildlands

State Wildlands are designated by the Legislature of Maryland as natural areas that receive minimal disturbance from human activity. Therefore, no intensive management is planned for these areas. The South Savage Wildland has been specifically designated by law to allow for approved research activities.

5.7.3 Wetlands of Special State Concern (WSSC)

These wetlands contain prime examples of unique habitats. No intensive management activities will take place within these areas.

5.7.4 Riparian Forest Buffers

These buffers are 50 foot no-cut areas on either side of streams and rivers and are designed to protect water quality as well as to improve the habitat for native brook trout and other riparian dependent wildlife.

5.7.5 Old Growth and Old Growth Ecosystem Management Areas

The relatively few acres of old growth forest that have been identified on Savage River State Forest will be protected via the Old Growth Management Policy. No silvicultural activities will be planned within these areas and monitoring for invasive species will be conducted with suppression efforts being implemented where appropriate.

Currently, old growth forests in Maryland are located in patches that are limited in size, connectivity and forest vegetation type. To achieve the desired vision of enhancing old growth ecosystem functionality, the current patch arrangement of old growth needs to be developed into a larger, connected network of old growth forests across the landscape. On Savage River State Forest there are several patches of old growth forest along with several identified patches of potential or nearly old growth forest.

Nearly old-growth forests are those forests which are approaching old-growth status. They exhibit many of the characteristics of an old-growth forest, but the age of the oldest trees is slightly lower than half their maximum lifespan. For the purposes of old-growth forest conservation, DNR defines nearly old-growth forest as a stand with a minimum of five acres and a preponderance of old trees. See Policy and Procedures Manual for details on the characteristics of nearly old growth forest.

Conservation of functional old-growth forest ecosystems is a priority management goal. Simply protecting patches of old-growth forest does not result in a functional old-growth ecosystem. A functional system provides a multitude of values and is the desired outcome of DNR for old-growth forests. While patches of old-growth forest contain essential elements of an old-growth system, DNR will manage old-growth ecosystems in units of approximately 1,000 acres or more whenever practical. Emphasis should be given to those old-growth forests that will most likely become functional old-growth ecosystems. Some old-growth stands will be too isolated to function as an ecosystem and will be protected at the stand level.

The following guidelines are intended to protect old-growth forests while conserving and enhancing the functionality of the forested ecosystem within which the old-growth occurs:

- Designated old-growth forest will be excluded from timber harvest, including salvage, or other physical alterations.
- Designated old-growth forest will be excluded from protection from natural disturbance factors, such as native insect infestations or wild fire, unless such disturbance is introduced by an unnatural cause (e.g., exotic forest pests or invasive species) or will seriously jeopardize the continued existence of the old-growth ecosystem or significant resources adjacent to the old-growth forest.
- Control of the white-tailed deer population will be encouraged to maintain herd size at a level that does not adversely affect regeneration of trees in the understory.
- A no-cut buffer will be established to a width of at least 300 ft from the edge of the designated old growth. This buffer may be expanded based on specific site conditions or threats. The buffer will be excluded from timber harvest or other physical alterations. Any non-forested conditions within the buffer should be reforested, whenever feasible. Salvage harvesting should not occur within this buffer.
- Management zones will be established that includes the old-growth forest(s) and its primary buffer(s). This management zone will be approximately 1,000 acres in size or greater, whenever feasible. This management zone should incorporate as many designated old-growth and nearly old-growth sites as possible. The shape should minimize edge to area ratio and be as contiguous as possible. Silvicultural treatments within this zone should be techniques that have as their primary objective the fostering of old-growth conditions, and would include practices such as uneven-aged management and limited even-aged management, extended rotations, techniques that more closely mimic the natural disturbances found in old-growth forests, structural complexity enhancement practices, or techniques that result in retention of at least 70% of the canopy

trees. Standing snags and downed coarse woody debris will be retained. Any non-forested conditions within the secondary zone should be reforested, whenever feasible. Salvage harvesting is allowable with the retention of at least 33% of dead or dying snags (not damaged live trees) and coarse woody debris. At all times, the majority of the management zone shall be in the sawtimber size class, preferably a minimum of 75%. Areas within the management zone not designated old-growth or nearly old growth at the time of initial assessment/inventory will not necessarily be managed as if they are designated old-growth.

- Nearly old-growth forests within the management zone should be managed as if they were designated old growth. Timber harvest or other alterations will be excluded. Protection of natural disturbance factors, such as insect infestations or wild fire, will be excluded unless such disturbance is introduced by an unnatural cause or seriously jeopardize the continued existence of the old-growth ecosystem or significant resources adjacent to the old-growth forest. Salvage harvesting should not occur within this forest.
- Passive recreational and educational use of old-growth forests and their buffers will be allowed, including hiking and hunting. No trails or roads will be built to access the old growth. Existing trails or roads will be managed to minimize impacts to the old-growth ecosystem or should be retired, whenever feasible. No campfires are allowed.
- An aggressive invasive species monitoring, prevention and control program should be developed and implemented.

5.7.6 Other Special Management Areas

Several special areas exist on Savage River State Forest that require special consideration when developing management prescriptions including old home sites, research areas and cemeteries. Special Management Areas may also include historical, cultural or spiritually significant sites for indigenous peoples. Once a site has been identified, its location and description are loaded into the forest GIS database. Protection levels can then be assigned and incorporated into the future planning efforts of forest activities on or near these sites. Most Special Management Areas require some form of preservation or protection and any proposed management within the vicinity of these special areas will be identified and reviewed as part of the Annual Work Plan (AWP) process.

Performance measures to judge the adequacy of those plans and the subsequent management actions should include:

a) Each identified special area is appropriately marked on the ground and documented in the database.
b) Each plan is sufficient to protect the special values identified for each area.
c) Field examination and monitoring reveal that all activities are being implemented properly and the special values of the site are protected or enhanced as described in the plan.

5.8 Forest Management Activities

5.8.1 Regeneration & Site Preparation

After a harvest is completed, natural regeneration is the preferred method by which the forest is reestablished. In rare instances, artificial regeneration tactics may be employed to ensure that a site is occupied by desirable species. Surveys of regeneration before and after the harvest will be used to determine the appropriate method on each site. The land manager is responsible for developing a regeneration strategy outlining what practices will be used with each timber harvest, based on the specific conditions involved. Pre and post-harvest data, as well as establishment surveys and Best Management Practices (BMP) compliance data will be collected and evaluated to measure the success of each regeneration project.

There will be situations where artificial regeneration along with site preparation techniques would improve seedling growth and survival. Site prep methods will be limited to prescribed fire, herbicides and other less intensive mechanical prescriptions, followed by a combination of natural regeneration and hand planting of seedlings.

5.8.2 Vegetation Control

Chemical control of competing hardwoods, herbaceous vegetation and exotic invasives may be used to enhance survival and growth of new regeneration. Vegetation control can be done with chemical application with no adverse environmental impact, given that label directions and best management practices are followed. However, the Department will work to minimize the use of chemical control by exploring the effectiveness of lower application rates of herbicides and the benefits of prescribed burns. Research plots will be established to monitor the effectiveness of various herbicide rates.

5.8.3 Pre-commercial Thinning

Pre-commercial thinning in 10 to 15-year old naturally regenerated stands is a form of density control that is used to concentrate growth on larger stems, control species composition and maintain an even distribution of trees across the site. This work is typically performed by hand crews and involves a limited usage of machinery in order to harvest a stand.

5.8.4 Commercial Thinning

Commercial thinnings are performed several times during the life of a stand in order to extract value early in stand development and concentrate growth on more desirable, larger diameter stems. Commercial thinning intensity is determined by the stocking and growth rate of the stand.

5.8.5 Forest Buffer Thinning

Riparian and wetland buffers and visual buffers are identified and established at the time thinning projects are planned and marking of buffers is done to establish boundaries in the field. Thinning activities within buffer areas are designed to enhance buffer quality and function under the guidelines contained in Chapter 6 of this plan. For example, these activities may vary from no thinning where desirable vegetative conditions are well established to heavy thinning in areas where dense pine stands inhibit desirable hardwood development. When mechanized thinning is done within the buffer areas, special care will be taken to prevent rutting or other soil damage that could interfere with buffer capacity or alter water quality. Individual buffer prescriptions are proposed by the land manager and reviewed by the Interdisciplinary Team as part of the Annual

Work Plan Review.

5.8.6 Regeneration Harvest

Regeneration harvests will vary with the species being regenerated. The selection method may be used with northern hardwoods, the clear-cut method may be used in cove hardwoods and conifer plantations and the shelterwood method may be used when regenerating oak. Each of the harvest methods will be subject to acreage regulations and will include green tree retention areas pursuant to Forest Stewardship Council® (FSC®) standards. Guidelines for clear-cut harvest larger than 40 acres will be based on forest health, economic and ecological necessity. Hardwood regeneration areas using even-aged techniques without retention will be 10 acres or less and when using uneven-aged techniques, will have canopy opening less than 2.5 acres. Conifer regeneration harvests will be limited to a maximum of 40 acres. Harvest boundaries should follow natural boundaries on land to encourage irregular shapes that help diversify wildlife habitats and improve aesthetics. In keeping with the SFI and FSC standards, clear-cut harvests will not be done until adjacent stands have reached a minimum age of five years or have an average tree height of ten feet. The shelterwood method will be utilized in some areas based on ecological needs of the site with the intention of developing a new forest stand through natural regeneration.

5.8.7 Green Tree Retention

Traditionally, forest managers used locally developed Habitat Retention Areas to define forested areas and/or single trees that were set aside inside a harvest area for long-term protection. The designation, Habitat Retention Area, has been replaced in the Savage River State Forest Sustainable Forest Management Plan with the nationally recognized terminology Green Tree Retention.

Green Tree retention will vary greatly with each harvest site and depend heavily on factors such as riparian areas, soil types, ecologically significant areas and legacy trees. In designing final harvest areas on Savage River State Forest, it is DNR Forest Service policy to retain an appropriate amount of green tree retention within the harvest area. The stated goal is to retain an area of five percent or more of the harvested area on all regeneration harvests of 10 acres or greater. This retention area can be in riparian forest buffers and buffers around ecologically significant species or in addition to designated HCVF.

Portions of forest stands within a regeneration harvest site will be set aside as retention areas if soil types are such that logging activities could potentially cause considerable site damage. The retention areas will be flagged prior to logging and will be retained through the next stand rotation. Other Green Tree retention would occur if a legacy tree or a group of legacy trees are identified within the harvest site. Legacy trees are trees that have been spared during past harvests or have survived stand-replacing natural disturbances and will be retained for their habitat values. Ideally, these trees would be buffered to afford them added protection during the harvest and would be retained through the next stand rotation.

Green Tree Retention will be planned into larger regeneration harvest areas by laying out irregular harvest boundaries allowing for peninsulas or islands of unharvested trees. These undisturbed forest sites can function as habitat corridors or refugia, enabling species that are

sensitive to disturbance in an area to persist until the surrounding landscape is able to regenerate.

5.8.8 Prescribed Burning

The local forests were historically shaped by a regime of frequent, low-intensity wildfires. Fire can reintroduce ecological processes such as seed release and nutrient cycling that may not be possible in its absence and can have beneficial effects on wildlife habitat through the redistribution of nutrients and vegetation. With the urbanization of the surrounding landscape, reintroducing fire into the regular management regime of Savage River State Forest may prove difficult and will require careful planning. Land managers will need to designate areas where significant introductions of prescribed fire can be tested and results can be measured. Such projects can provide a variety of regular training opportunities for fire management staff from the implementation of a simple fire line to the use of specialized equipment. All prescribed burning applications will be implemented using smoke management practices. Prescribed burns will not take place unless smoke conditions can be mitigated around sensitive areas such as roads, airports, hospitals, homes or schools and will be kept at least 1000 feet from any occupied building, unless otherwise prescribed as necessary for reducing fuel loads. Special areas that might be destroyed or damaged, such as cemeteries or historic structures, will be protected from burning activities and fire line construction will follow State BMPs.

5.9 Forest Harvesting Equipment

When planning a forest harvest, the forest manager should consider the soils, weather, seasonal restrictions, necessary harvesting equipment and other factors that may influence successfully harvesting the site.

In-woods equipment used on forest harvest operations may include: whole tree chippers, processors, feller-bunchers, grapple skidders, cable skidders, cut-off saws and forwarders.

Normally, bidding on forest harvest contracts are not restricted or limited by the equipment available to bidders. This is to maintain competitive fairness to all sized operations. However, forest harvest operations are closely monitored by the state forest staff to ensure compliance with the contract and use of Best Management Practices.

If necessary, the state forest manager can restrict the type of machinery required or allowed on the harvest site. The state forest manager has the authority to temporarily close a forest harvest operation if the conditions become too wet to prevent excessive rutting and damaging of forest soils. Seasonal restrictions may apply during late winter and early spring as the frozen soils begin to thaw. Certain sensitive areas may require specialized equipment such as dual-wheeled skidders, high floatation tires or other specialized equipment.

5.10 Chemical Use

No products on the FSC list of Highly Hazardous Pesticides will be used (see FSC-POL-30-001a EN FSC Pesticides policy 2017 or most recent equivalent) unless a derogation has been successfully awarded. The Pesticide Use Tracking Form will be used to document the identification of an area to be treated, the procedures that will be followed and who will be doing the application, including their qualifications.

The *FSC Guide: To integrated pest, disease and weed management in FSC certified forests and plantations* (FSC Technical Series, No. 2009-001) to be reviewed by the state forest manager and the Core Decision Key, the Pesticide Decision Key and Decision Recording Sheet attached to each pesticide use report with the Decision Recording Sheet having been completed by the state forest staff or contractor.

All pesticides used to control pests and competing vegetation are used only when and where non-chemical management practices are: a) not available; b) prohibitively expensive, taking into account overall environmental and social costs, risks and benefits; c) the only effective means for controlling invasive and exotic species; or d) result in less environmental damage than non-chemical alternatives. If chemicals are used, the forest manager will use the least environmentally damaging formulation and application method practical.

As opportunities are available, the state forest will employ and encourage the creation and maintenance of habitat that discourages pest outbreak; that encourages natural predators; will work with cooperating agencies to evaluation pest populations and control options; the diversification of species composition and structure; use of low impact mechanical methods; use of prescribed fire; and the use of longer rotations.

Chemicals and application methods are selected to minimize risk to non-target species and sites under the guidance of cooperating agencies such as Maryland Department of Agriculture and DNR Natural Heritage Program.

Whenever chemicals are used, the Pesticide Use Tracking Form will be used to prepare a written prescription to describe the site-specific hazards and environmental risks, and the precautions that workers will employ to avoid or minimize those hazards and risks, and includes a map of the treatment area.

Chemicals are applied only by appropriately trained and licensed workers according to State requirements.

When chemicals are used, the effects are monitored and the results are used to determine the measure of success and if treatment modifications can be employed, such as reduced application rates. Records are kept according to State requirements.

5.11 Financial Returns

The long-term goals for the Savage River State Forest should provide sustainable economic performance as well as contribute to water quality protection and wildlife habitat enhancement. However, if future policy changes are made to the levels of environmental protection and additional acreage is converted from general management to special zones, then significant impacts on financial returns could result. Future financial projections will depend on specific parcels, stand conditions and timber markets. Yearly harvest volumes are determined through a combination of forest modeling and data analysis from the most recent forest inventory.

5.12 Forest Modeling

5.12.1 Modeling Long-term Sustainability

Achieving the goal of a sustainable and economically self-sufficient forest requires the use of long-term projections that illustrate the probable effect of management activities on key forest qualities. Indicators must be identified that can be tracked over time to determine trends and relationships. Tracking requires that each indicator can be measured, monitored or modeled in a consistent and feasible manner.

5.12.2 The Indicators

At this stage, the forest managers have identified the following indicators (others may be added as the ability to track them becomes available):.

- The amount of hardwood timber available for harvest;
- The amount of hardwood forest ready for final harvest;
- The age and species distribution of the forest trees;
- The amount of forest with sufficient established regeneration for successful regeneration of the stand;
- The protection of critical habitat areas such as those adjoining streams, swamps or other unique areas;
- The maintenance of a generally stable flow of economic opportunities (jobs, timber sales, etc.) from the forest; and,
- The generation & maintenance of stable economic flows back to the state and counties.

5.12.3 The Forest Planning Model

The Maryland DNR Forest Service and Vision Forestry, a contract land manager, studied available forest modeling systems and ultimately chose the Remsoft Spatial Woodstock model for development of long-term projections on the Chesapeake Forest and Pocomoke State Forest. Remsoft models were deemed adequate for modeling Savage River State Forest as well, despite having a distinctly different suite of species and growing conditions in comparison to the two aforementioned forests. Ultimately, a functional model was created using the basic framework of the Chesapeake Forest model. Information on the model is available at www.remsoft.com.

Spatial Woodstock is integrated with the Savage River State Forest Geographic Information System so that a single master database can be maintained to serve ongoing forest planning, management and information needs. The model runs 100-year projections within the estimated 200 to 300-year life span of the priority tree species involved.

Modeling Savage River State Forest requires that the forest be divided into discrete stands that have similar soils, vegetation, age and other characteristics. A detailed growth model utilizing the current forest database was run using a 100-year time frame and the results can be found in Appendix H.

5.13 Inventory and Monitoring

A high quality inventory and monitoring program that is linked to a GIS-based data management system is the key to a successful adaptive management program. It is, however, one of the often-neglected or under-funded parts of a land management program. The successful implementation of this plan rests on the capacity of the Department to find the resources needed to support the necessary monitoring program across all the areas listed below (*See Chapter 10 – Savage River State Forest Monitoring Plan*). An inventory and monitoring program is also one of the important aspects of the Forest Certification program (*See Forest Certification below*).

The land manager is responsible for developing and maintaining an interactive data collection and management system to facilitate field management as well as document activities, results, yields, etc., to provide data input to the planning models. A statistically valid and multi-tiered sampling procedure has been developed to provide data on growth rates and yield responses to management practices such as thinnings and associated environmental impacts such as water quality or habitat changes.

Monitoring for forest sustainability will require attention to the parameters listed in Chapter 1. Required items to be monitored include:

- Forest health – as it pertains to insect and disease outbreaks.
- Soil quality – through regular soil testing, particularly on plantations where more intensive forest management is practiced.
- Biodiversity – information is needed that ties species or suites of species to particular areas, soil types, or vegetative structural conditions so that trends can be predicted under various management options and population or species increases or declines can be detected.
- Water quality, particularly as it relates to nutrient and sediment loads that can be attributed to specific forest management practices.
- Ecologically Significant Areas – an updated inventory of special areas, by type, location, and condition should be maintained to assure that none are being adversely affected by forest management activities.
- Economic performance – Data for long-term trend analysis, as well as quarterly

reporting, should be developed and maintained.

- Desired response to management, i.e. condition of regeneration, insect pest control monitoring.

5.13.1 Water Quality Monitoring

Due to the special attention on water quality in the Chesapeake Bay, the near pristine native brook trout streams and the need to document more clearly how commercial forest management affects water quality, Savage River State Forest can serve as a living laboratory for those interested in this particular field of study. Independent third-party partners such as universities and non-profit organizations like the Chesapeake Bay Foundation are welcome to pursue a monitoring scheme, conduct research and utilize the results of management actions as part of an ongoing scientific experiment.

5.13.2 Timber Harvests

The land manager will ensure that for each harvest operation a pre-harvest plan is developed and a post-harvest BMP inspection report is prepared and maintained on file. Another important aspect in protecting water quality on timber harvest sites is to ensure that a certified Master Logger carries out the harvest operation. A minimum weekly inspection will be conducted on all active harvests to monitor for BMP compliance. Activities exceeding these standards will be suspended and issues will be promptly corrected. During periods of exceedingly wet weather, site inspections will occur more frequently to ensure the integrity of a site.

Savage River State Forest was one of seven state land sites included in a study of BMP implementation conducted in 2004 and 2005 as part of developing a Northeastern Area Regional BMP Assessment Protocol. The study revealed that statewide, sediment movement into water courses was avoided on 81% of the sites. The study was conducted by an independent contractor, Sustainable Solutions, LLC, and funded by the USDA Forest Service Northeastern Area State and Private Forestry.

5.13.3 Herbicide Applications

Herbicide applications are becoming a more prominent management tool on Savage River State Forest. When management conditions warrant their use, the land manager will maintain pesticide application records and monitor their effectiveness. Herbicide applications are principally being utilized to control interfering understory vegetation and rhizomatous fern populations that may significantly impact the regeneration efforts of desirable hardwood species including all oaks and black cherry. Applications are being performed prior to thinning and shelterwood harvests in order to maximize the regeneration potential of targeted species on a site. Post-harvest spraying may also be implemented depending on the regeneration response of the stand. Currently, private contractors are hired to complete herbicide projects on larger tracts and work on smaller areas is often completed by forestry staff. Staff also administers treatments on variety of non-native and invasive species as part of the ecosystem restoration and protection projects as outlined in the state forest annual work plan. Rapid response protocols are followed in the event of any newly identified occurrences of non-native and invasive species in order to limit their impact on the forest landscape.

The typical application methods for herbicides are backpack spraying, broadcast spraying from tracked vehicle and stem injection. The particular chemical used will depend on the particular plant to be controlled and label directions will be strictly followed. Application will be done under the pesticide certification of appropriately licensed forestry staff.

5.14 Forest Certification

A primary objective of Savage River State Forest is to become a national model for certified sustainable forestry. The first step in that direction was achieved in the spring of 2011 when Savage River State Forest received dual certification under both the Sustainable Forestry Initiative (SFI) standard and the Forest Stewardship Council (FSC) standard. Compliance with certification is monitored through annual surveillance audits and a comprehensive standard audit that occurs every five years. See Appendix: B & C for details on the two certification programs.

5.14.1 Certification Guidelines Premise

It is the belief of the Department that an independent review and certification of all state forest management plans and practices has the potential to improve the management of the forest and build public confidence in the quality of that management.

The preliminary thrust of the combined SFI/FSC certification process started on the Chesapeake Forest Lands, which received dual certification in June 2004. The initial certification evaluation for Savage River State Forest occurred in the spring of 2011. As part of the process of maintaining dual certification, surveillance audits/inspections will occur annually following the initial granting of certification with a full standard audit to be carried out every five years. An annual Senior Management Review will also be conducted, as per SFI requirements (see "Appendix F – Policy for SFI Management Review and Continual Improvement"). The Maryland DNR Forest Service remains committed to maintaining SFI/FSC certification by resolving any/all issues that may jeopardize the current status of the department.

5.15 Practice Scheduling

Field surveys, GIS-based forest and habitat maps and associated databases and forest models such as Remsoft Spatial Woodstock or Oak SILVAH will be used for the long-range management of the forest and for scheduling the harvests and thinnings prescribed in the annual work plans (see Chapter 10).

5.16 Non-Silvicultural Forest Management Activities

A variety of activities beyond silvicultural treatments are required to maintain the health and productivity of the forest. External property boundary lines will be marked and maintained either

by painting and/or posting using approved procedures. This is required to protect the property from inadvertent trespass and to maintain evidence of ownership and management. Existing roads will be maintained to provide access for silvicultural activities, emergency response, fire suppression and recreational activities. Additional temporary road construction may be necessary in support of silvicultural operations and upon harvest completion the roads will be closed. Wildlife management activities will involve both the protection of existing habitat and the creation of new habitat for a host of animals from common game species to rare, threatened and endangered fauna (See Chapters 7 & 8).

5.16.1 Roads

Roads are an integral part of forest management, providing the means to extract natural resources, to implement silvicultural and wildlife management projects, to maintain forest boundaries and to create public access for recreational activities. Existing roads and trails will be used and maintained in a manner that minimizes erosion and reduces debris. They should also be maintained to blend with the natural topography and avoid blockage of drainage systems. All new road construction, including temporary access trails, will follow State BMP guidelines. Care will be taken in constructing logging entrances along public roads and while using public roads during harvesting operations. Damage to roadbeds, shoulders, ditches, culverts and buffer strips will be avoided and any issues that do arise will be promptly repaired. Roads within riparian forest buffers or wildlife areas should be closed and revegetated using approved seed where practical. Other roads should be reviewed periodically and those deemed unnecessary for forest/ wildlife management purposes or access should be considered for closure.

5.16.2 Forest Health

One of the key aspects for maintaining forest health is to keep it actively growing. This can be accomplished by implementing a thinning program that releases selected trees for rapid and vigorous growth. This will improve forest health by reducing plant competition for moisture, light and nutrients. By maintaining actively growing trees, stands are less likely to be severely impacted by forest insect infestations or disease outbreaks and reducing stand density through thinning will lead to lower intensity wildfires resulting in minimal damage to the stands.

There are a number of insect and disease problems in the forest that are localized and affect individual trees. However, exceptions exist that have the potential to create serious widespread problems. The exotic insect gypsy moth (GM) has been a forest nuisance since the late 1980's. Ongoing monitoring of this species is conducted by the Maryland Department of Agriculture – Forest Pest (MDA) division that involves annual autumnal egg mass surveys. The results of these surveys determine where population outbreaks are likely to occur and where pesticide applications via foliar spraying, are recommended or warranted. The preferred method for gypsy moth involves bio-control with the bacteria *Bacillus thunbergii* (Bt), a naturally occurring organism that is specific to moth and butterfly caterpillars. The high cost of this control is a major disadvantage evidenced during a recent infestation, where funding was not adequate to treat the entire forest, resulting in substantial tree mortality. In response to the defoliation and subsequent mortality, salvage harvests were implemented to reduce possible outbreaks of fungal diseases and curb the number of secondary pests infiltrating an affected stand.

More recently hemlock woolly adelgid (HWA) was discovered in the forest and has proven to be

a serious pest. At the present, the MDA advises that the adelgid is not spreading or reproducing as rapidly in western Maryland as it elsewhere. The MDA, the USDA-Forest Service (USDA-FS) and cooperating universities are experimenting with exotic predatory beetles as a means to control the adelgid. Several beetle releases over the past five years have occurred on SRSF and ongoing monitoring is being conducted to determine if beetle populations are becoming established and affecting adelgid numbers. In addition to bio-control methods for HWA, pesticide injections and soil drenches are being conducted in priority hemlock stands throughout the forest. Annual evaluations of hemlock health concluded that these methods provide an estimated 2-5 years of protection from the adelgid.

Emerald ash borer (EAB) has become established throughout western Maryland and has decimated the ash population. MDA is actively monitoring the pest and is working with the USDA-FS on various control measures including pesticides and bio-control. At the present time there are no effective means to stopping the destruction inflicted by this invader.

Also of concern is the beech bark disease complex that is found in West Virginia and Pennsylvania. MDA has discovered the exotic beech scale in southern Garrett County and the existence of the nectria fungus associated with the scale has been confirmed in neighboring West Virginia. Pesticide applications to control the disease are not practical, but there is hope that native beetles and fungi will help control the disease complex. Without control, this disease complex could cause substantial disruptions within riparian forests.

5.17 Forest Stewardship Council (FSC) – Guidelines & Principles

5.17.1 Invasive Plant Species Control

A detailed invasive plant species control plan will be developed in conjunction with the Wildlife and Heritage Service. All stands that are being proposed for management activities will be examined for invasive species and control action will be taken prior to any treatment, where practical. Priority will be given to invasives that actively inhibit ecosystem function and/or silvic response. Site locations will be mapped and incorporated into the GIS database. Treatment recommendations will be researched and monitored for effectiveness.

Invasive species that occupy a large area may need to be addressed through the ID Team field review process. Specific techniques and control measures will be timed to the biology of the individual invasive plant species in order to maximize control efficacy and minimize spread and propagule production.

5.17.2 High Conservation Value Forest (HCVF) Definition Guidelines

High Conservation Value Forests as identified within FSC Principle 9 will constitute the definition for HCVF on Savage River State Forest. They are:

- (HCV1) Forest areas containing globally, regionally or nationally significant

concentrations of biodiversity values (e.g. endangered species on SRSF are in the ESAs).

- (HCV2) Forest areas containing globally, regionally, or nationally significant large landscape level forests (e.g. Wildlands & OGEMAs)
- (HCV3) Forest areas that are in or contain rare, threatened or endangered ecosystems. (e.g. Old Growth Forest, Natural Heritage Areas, & Wetlands of Special State Concern)
- (HCV4) Forest areas that provide basic services of nature in critical situations (e.g. watershed protection, Riparian Forest Buffers).

Refer to FSC Principle #9 (HCVF) in Appendix B.

5.17.3 Representative Samples of Existing Ecosystems

Representative Sample Areas (RSAs) are designated on the forest for the purpose of: establishing and/or maintaining an ecological reference condition; to create or maintain an under-represented ecological condition; to serve as a set of protected areas or refugia for species, communities and community types not captured in the High Conservation Value Forests. RSAs have been designated and mapped on Savage River State Forest and are protected in their natural state. Additional RSAs will be designated to address above criterion not already established within the High Conservation Value Forests. Most RSAs will be fixed in location while others may move across the landscape as natural forest succession condition change or are manipulated to maintain a desired condition.

Chapter 6 - Water Quality Areas Riparian Forest Buffers and Wetlands

6.1 Introduction

Water quality areas are dominated by land-water relationships that include streamside forests, stream banks, flood plains, wetlands and other areas that are the contact points between land and water (see Map I.4). Their management is critical to not only preventing water pollution, but to restoring water quality through the filtering of sediments, the uptake of nutrients and the stabilization of water temperature and flow conditions. In addition, these areas are some of the most biologically rich portions of the landscape, functioning as habitat for the widest variety of plants and animals, both aquatic and terrestrial. It is for these reasons that these areas have been designated as High Conservation Value Forest (HCVF). They also provide connectivity from Savage River State Forest through other public and private forestlands to the Chesapeake Bay. The identification and maintenance of High Conservation Value Forest fall under Principle 9 of the Forest Stewardship Council (FSC) guidelines see appendix “B & C” for information on this certification program.

There are over 1,700 acres of riparian forests that extend through all of the existing management areas identified in Chapter 5. The riparian acreage is a general estimate and will need to be adjusted as field examination provides additional data and as forested non-operational wetlands are added into the riparian forest buffer totals. Field personnel will identify and establish RFBs, mark boundaries and provide GPS coordinates for updating the GIS data system.

Generally, the management of these areas relies primarily on natural processes, such as natural establishment and succession. Management activities within these areas will be designed to maintain or improve the ecological functioning of the forest, wetland and stream systems. Any timber or fiber production from these lands will be ancillary to other management needs.

6.2 Riparian Forest Buffers: High Conservation Value Forest (HCVF)

The primary goal of HCVF riparian forest buffers is to maintain and improve the quality of water flowing into the streams and rivers that ultimately feed into the Chesapeake Bay from Savage River State Forest. Riparian forests also provide critical habitat that is an essential element of the associated aquatic ecosystem and the diversity of wildlife that utilizes riparian areas. Therefore, the management goals for riparian forest buffers are:

1) To remove sediments, nutrients and other potential pollutants from surface and groundwater flows;
2) To maintain shade cover for streams and aquatic systems to regulate temperature and dissolved oxygen;
3) To provide a source of detritus and woody debris for aquatic systems;
4) To provide riparian habitat and travel corridors for wildlife;
5) To maintain or establish native plant communities;
6) To allow these areas to revert into Old Growth Forest; and
7) To provide early successional moist soil and browse areas for wildlife

In order to achieve these goals, the following management objectives will be used as criteria to more specifically evaluate and design potential management activities:

1) Minimize disturbance to soil structure or duff layer;
2) Avoid exposed mineral soils;
3) Prevent all rills, gullies or ruts that may channel water flow and short circuit surface flow paths;
4) Protect mixed hardwood or mixed hardwood/conifer forest community;
5) Maintain mature forest conditions adjacent to stream;
6) Encourage the development of a diverse, uneven age forest community in terms of species, canopy levels and diameter class;
7) Where appropriate, regenerate alder and hardwood forest to provide dense cover with moist soils; and
8) Where appropriate, regenerate small areas to provide important winter browse and cover.

6.2.1 Stand Composition

Riparian forests will be managed to encourage a mixed hardwood or mixed hardwood/conifer community with a combination of diverse herbaceous, mid-story and overstory plants. Hardwood species will be encouraged to ensure maximum functions for denitrification, canopy diversity, woody debris and nutrient uptake. Diversity in species and forest structure will be encouraged as a strategy to maintain forest function and resilience in the event of a major disturbance or the introduction of a new pest or pathogen. Many pests or pathogens are limited to certain types of species or tree condition and disturbances, such as windstorms or fire, can affect different species to varying extents.

6.2.2 Vegetation Management

According to management goals and objectives, any vegetation management must be designed to improve the ecological functioning of the riparian forest and stream system. If a silvicultural treatment or management prescription is conducted, it should be limited to addressing management concerns to improve or ensure the health of the riparian forest or adjacent stands. Such concerns include insects, disease, fire, wind throw, ice damage, threatened and endangered species, critical habitat, native plant communities, invasive/exotic species, hazard fuel reduction and prescribed burning. There will be no planned clear cuts conducted within a riparian forest area. Any management activities should use equipment designed to minimize impact, follow best management practices (BMPs) and comply with all state and local regulations.

6.2.3 Roads

Roads should avoid riparian forests to the maximum extent possible and any existing roads within riparian forests should be evaluated for closure. If road construction is necessary in a riparian forest, all related BMPs for road construction must be followed including:

1) Perpendicular alignment to riparian forest to minimize impact,
2) Utilizing temporary stream crossings when possible,
3) Adequate sizing of crossing to avoid affecting flow and
4) Discarding slash and debris from right-of-way clearing, outside of stream area.

6.2.4 Herbicide Use

Aerial application of herbicides is not permitted within riparian forests. If aerial spraying is planned for stands adjacent to a riparian forest, the riparian forest must be clearly designated and GPS-established to protect the area from the application or drift. Chemical applications within riparian forests will only be permitted for purposes of improving the ecological function of the riparian forest or its management goals and will be limited to spot applications on the target plant species.

6.3 Non-Operational Wetlands

Wetlands are defined as areas that are sufficiently saturated or inundated to influence soil characteristics and to support wetland plant communities. The general forest management guidelines address some of the special management considerations required for forested wetlands.

In some instances, wetland areas are not suitable for timber production and therefore require their own management guidelines. These non-operational wetlands include all areas designated in the stand classification system as non-operable and described as bogs or swamps, but may not be included in riparian forest buffers. Non-operational wetland management guidelines will also apply to wetland buffers, which extend 100 feet from the edge of freshwater non-operational wetlands to provide upland habitat for amphibians.

6.3.1 The Management Goals of wetland areas will be as follows:

1) Provide high quality wetland systems including associated upland ecotones,
2) Maintain or enhance any unique biological communities that may be present,
3) Maintain or restore hydrologic and water quality functions of wetlands, including flood storage, groundwater recharge, denitrification, nutrient uptake and sedimentation and
4) Maintain or establish a native wetland plant community.

In order to achieve these goals, the following management objectives will be used as criteria to more specifically evaluate and design potential management activities:

1) Minimize disturbance to soil structure or removal of duff layer,
2) Encourage development or maintenance of a native wetland plant community and
3) Prevent further ditching in order to avoid altering the hydrology of the wetland.

6.3.2 Vegetation Management

Within non-operational wetland areas, management activities should encourage the establishment of native wetland plant communities. Within the wetland buffer, management activities should encourage a healthy forest with a diversity of species, canopy levels and diameter classes. Any vegetation management must be designed to improve the ecological functioning of the wetland system according to management goals and objectives. There should be no planned clear cuts conducted within a wetland area unless one is deemed necessary to re-establish or favor native wetland species. If a silvicultural treatment or management prescription is conducted, it should be limited to addressing management concerns that threaten the health of the wetland, the wetland buffer or adjacent stands. Such concerns include insects, disease, fire, wind throw, ice damage, threatened and endangered species, critical habitat, native plant communities, invasive/exotic species, hazard fuel reduction and prescribed burning. Any management activities should use equipment that will minimize impacts, follow best management practices (BMPs) and comply with all state and local regulations.

6.3.3 Stand Composition

Within wetland areas and wetland buffers, emphasis will be placed on maintaining and encouraging a diverse community of native wetland plants. Particular emphasis will be placed on maintaining any unique biological communities present at a site. In forested wetland areas and buffers, emphasis will be on maintaining or encouraging native species to maximize denitrification and to provide leaf litter and woody debris as food and cover for aquatic wildlife.

6.3.4 Herbicide Use

Aerial application of herbicides will not be done within wetlands. If aerial spraying is planned for stands adjacent to a designated wetland, the wetland must be clearly designated and GPS-established to protect the riparian forest from the application or drift. Chemical applications within wetlands will only be permitted for purposes of improving the ecological functioning of the wetland to meet management goals, and will be limited to spot applications and direct application to the target plant with products approved for aquatic usage.

6.3.5 Roads

Roads should avoid wetland areas and wetland buffers to the maximum extent possible, and any existing roads within wetland areas should be evaluated for closure. If road construction is necessary in a wetland area, all related BMP's for road construction must be followed including:

1) Align to minimize impact;
2) Discard slash and debris from right-of-way clearing outside of wetland areas;
3) Avoid impacts to wetland hydrology.

6.4 Riparian Forest Buffer Delineation for High Conservation Value Forest

Riparian forest buffers have been designated as High Conservation Value Forest (HCVF) that extends 50 feet from the edge of all blue line streams as indicated on USGS topographical maps. Other riparian areas not identified as blue line streams will be evaluated for stream function to determine if a buffer is necessary. Actual buffer layout must be done in the field, in response to

the unique soil, topographic and vegetative conditions encountered at individual sites. Operational buffers of 50’ plus an additional 4’ for each percent slope will be created prior to any silvicultural treatment. These buffers will be managed for the creation of mature mixed hardwood forests, preservation of water quality and the establishment of habitat and travel corridors for forest interior wildlife.

6.5 Management and Function of Riparian Forest Buffers

Riparian buffers will be managed to enhance and maintain the ecological function of the aquatic system, including enhancing the function of the forest in the removal of nutrients from overland flow and shallow underground aquifers. The first 50 feet from the stream bank will be designated as a no-cut area regardless of current species composition in order to avoid destabilizing stream banks. The remaining 50’ plus 4’will be a limited harvest area and management activities will encourage the creation and maintenance of mature mixed forests. Tree removals, will be done only to improve riparian forest function. Periodic monitoring of forest health and regeneration levels should be conducted to ensure that riparian forests are being perpetuated and that they are in a condition to maintain the expected functions of stream shade, woody debris inputs for aquatic habitat and nutrient assimilation and to protect the litter layer and soil organic matter. This will have the added benefit of producing interior forest habitat for wildlife. No herbicides or fertilizers will be used in any area of the riparian buffer, except when necessary to control invasive species.

6.6 Significant Vernal Pools

Vernal pools are defined by the MD Nontidal Wetland Protection Act (Annotated Code of Maryland §8-1201) and associated regulations (COMAR 26.23.01.01) as *a nontidal wetland in a confined depression that has surface water for at least two consecutive months during the growing season and:*

a) Is free of adult fish populations;
b) Provides habitat for amphibians; and
c) Lacks abundant herbaceous vegetation.

For the above definition the growing season in Garrett County refers to the period from April 15-September 15, with annual variations.

The Maryland Wildlife Diversity Conservation Plan (MD DNR 2005) defines vernal pools as small, nontidal, palustrine forested wetlands with a well-defined, discrete basin and the lack of a permanent, above ground outlet. The basin overlies a clay hardpan or some other impermeable soil or rock layer that impedes drainage. As the water table rises in fall and winter, the basin fills, forming a shallow pool. By spring, the pool typically reaches maximum depth following snowmelt and the onset of spring rains. By mid-late summer, the pool usually dries up completely, although some surface water may persist in relatively deep basins, especially in years with above average precipitation. This periodic, seasonal drying prevents fish populations

from becoming established, which is an important biotic feature of vernal pools. Many species of plants and animals have evolved to use these temporary, fish-free wetlands. Some are obligate vernal pools species, so called because they require a vernal pool to complete all or part of their life cycle. While we typically associate vernal pools with forested habitats, they can also occur in other landscape settings, both vegetated and unvegetated (Calhoun and deMaynadier 2004), such as meadows, pastures, clearcuts and agricultural fields.

Vernal pool basin substrate typically consists of dense mats of submerged leaf litter and scattered, coarse woody debris. During dry periods, the presence of a vernal pool is often denoted by blackened leaf litter, a sign of seasonally anaerobic conditions, and stained tree trunks. Herbaceous vegetation is usually absent or sparse, in and around the basin, although small sphagnum patches may occur along the basin edge. A dense shrub layer may occur along the shoreline or in small patches within the basin (MD DNR 2005).

A statewide vernal pool mapping exercise was conducted in GIS during preparation of the Maryland Wildlife Diversity Conservation Plan (MD DNR 2005). All palustrine wetlands - emergent, scrub-shrub and forested - with NWI water regime modifiers of temporarily flooded, seasonally flooded, seasonally flooded/saturated, saturated and semi-permanently flooded were included (Cowardin et al. 1979). A concerted effort is still needed to ground-truth the existing map and to survey for significant vernal pools that have been missed. Presence of obligate and certain facultative vernal pool species could also be used to help identify these wetlands. Calhoun and deMaynadier (2004) used the following NWI wetland classification codes to initially screen for potential vernal pools: PUB/POW (open water), PSS (scrub shrub), PFO (forested wetland), and PEM (emergent wetland), though the latter were less likely to be vernal pools due abundant herbaceous vegetation. A GIS vernal pool mapping exercise should be conducted that is a combination of methods used by the 2005 DNR effort and those of Calhoun and deMaynadier (2004).

Many states have developed vernal pool certification programs with criteria for determining “in the field” whether a wetland is truly a vernal pool. Based on these and other sources, it is recommended that the following criteria be adopted for use in determining the presence of significant vernal pools on Savage River State Forest. The first 3 criteria must be met, #4 must be met if there are no obligate species present, and either criteria 5 or 6:

1) A depression confined to a relatively small area with no permanent above ground outlet (look for blackened leaves and staining on trees);
2) Presence of surface water for 2 months or more during the growing season (pond depth is usually at its maximum just prior to tree leaf out);
3) Lack of herbaceous vegetation or it is limited to the basin edges, typically sparse (less than 50% cover), with or without sphagnum moss;
4) Lack of established and reproducing fish population(s);
5) Evidence of breeding **obligate or indicator vernal pool species** (require a vernal pool to complete all or part of their life cycle). On SRSF these include 5 amphibians and a crustacean group, the fairy shrimp (at least four species in the Order Anostraca; Brown and

Jung 2005). Amphibians include marbled salamander (*Ambystoma opacum*), spotted salamander (*A. maculatum*), eastern tiger salamander (*A. tigrinum*. state endangered), wood frog (*Lithobates sylvaticus*), and eastern spadefoot (*Scaphiopus holbrookii*). Eggs, egg masses, larvae, transforming individuals, juveniles and adults all would serve as positive evidence of a significant vernal pool.

6) The presence of rare or state-listed **facultative vernal pool species**. Facultative species are vertebrate and invertebrate species that frequently use vernal pools for all or a portion of their life cycle, but are able to successfully complete their life cycle in other types of wetlands. They serve as indirect indicators of vernal pool habitat. On SRSF facultative species include 16 amphibians, one reptile, and 17 invertebrates (Brown and Jung 2005), However only three of these, all amphibians, are rare or state-listed: barking tree frog (*Hyla gratiosa*; state endangered), eastern narrow-mouthed toad (*Gastrophryne carolinensis*; state endangered), and carpenter frog (*L. virgatipes*; watchlist). Eggs, egg masses, larvae, transforming individuals, juveniles and adults all would serve as positive evidence of a significant vernal pool.

Identifying and mapping all significant vernal pools on Savage River State Forest is a daunting task that will require a concerted, well-funded effort for GIS mapping and ground truthing, plus opportunistic data collection by forestry staff, consultants and other DNR staff and partners. Brown and Jung (2005) as well as the Vernal Pool Association's website (www.vernalpool.org) should be used as primary references. A data sheet has been developed for these opportunistic surveys based on the MD Vernal Pool Task Force draft 2008 datasheets.

6.6.1 Vernal Pool Conservation and Management Prescriptions

Due to their complex bi-phasic life history, vernal pool breeding amphibians are biologically linked to both their aquatic breeding habitat and terrestrial habitat in which they forage, aestivate, and hibernate. Their population dynamics also are dependent on landscape connectivity as they operate as metapopulations. Major threats include anthropogenic destruction and alteration of their aquatic and terrestrial habitats. Management strategies require conservation of a diversity of wetland habitats that vary in hydroperiod and their surrounding terrestrial habitats (Semlitsch 2003). Semlitsch (1998) concluded that a buffer zone encompassing 95% of pond-breeding salamander populations would need to extend 534 feet from the wetland edge.

Semlitsch and Bodie (2003) observed that the 50-100 foot buffers used to protect wetlands in most states were inadequate for amphibians and reptiles. They summarized results of 40 papers describing biologically relevant core habitats surrounding wetland breeding sites and recommended that three conservation zones be established around amphibian breeding ponds. Zone 1 was the wetland and an Aquatic Buffer that extended 100-200 feet from the wetland edge. Zone 2 was the Core Habitat which extended 465-950 feet from the wetland edge. Zone three was a Terrestrial Buffer for Core Habitat and extended 165 feet from Zone 2. At a minimum these three zones comprise 630 feet to greater than 1100 feet at the maximum. However, Semlitsch and Bodie (2003) did not make recommendations on what activities could occur in these areas, only that managers needed to be aware that these were biologically relevant buffers.

Calhoun and deMaynadier (2004) also recommended three conservation zones. Zone 1 was the Vernal Pool Depression in which no disturbance should be allowed. Zone 2 was the Vernal Pool Protection Zone, a 100 foot buffer around the vernal pool in which limited timber harvesting could be allowed but only if greater than 75% canopy cover was maintained, harvest occurred only when the ground was frozen or dry, heavy machinery use was minimized, and abundant coarse woody debris was retained. Zone 3, or the Amphibian Life Zone was a 400-foot buffer from Zone 2 (extends to 500 feet from vernal pool) in which partial timber harvest could occur, but only if greater than 50% of the canopy was maintained, no openings greater than one acre were made, harvest occurred only when the ground was frozen or dry and abundant coarse woody debris was retained.

Semlitsch et al. (2009) concluded that removal of only a portion of the canopy (less than or equal to 50%) minimized negative impacts to amphibians associated with select harvests and clearcuts. They noted trade-offs between either harvest method and that clearcuts should be small (less than 5 acres) and only used when remaining habitat was high-quality for amphibians.

Based on these papers and mindful of the need to balance conservation with sustainable forestry, the following conservation and management prescriptions are recommended for mapped significant vernal pools on Savage River State Forest:

Zone 1: includes the significant vernal pool and extends into terrestrial habitat to 100 feet from the high-water mark. This will be called the **Amphibian Protection Zone** (Fig. 6.6.1)**.**

Management*:* This is a non-operable area with no herbicide or nutrient applications allowed. No new roads will be constructed and no heavy equipment should traverse this area except for during restoration activities, which should be minimized and only occur when the ground is frozen or dry. Site-specific restoration plans may be developed by Heritage with possibility of a "one-time only" harvest of some areas by Forestry, but this will be on a case-by-case basis.

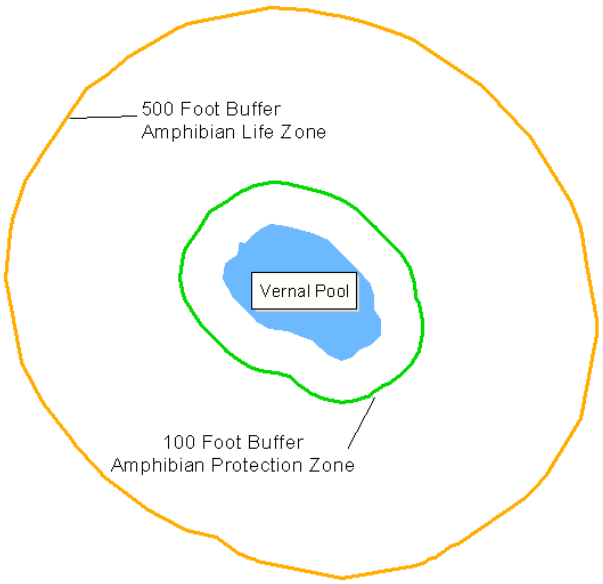


Figure 6.6.1: Amphibian buffer zone around a vernal pool

Zone 2 (Forestry responsible for management with input from Heritage): This area will be called **Amphibian Life Zones** (Fig. 6.6.1) – from Zone 1 to 500 feet from the wetland edge.

Management:

1) Saw timber rotations maintaining at least 50% canopy closure. A patch clearcut of less than or equal to 1 acre would be allowed in this area, but select harvests are preferred with retention of coarse woody debris and leaf litter. Natural regeneration is the preferred method; however, the planting of native genotype hardwoods where appropriate, may be conducted after consultations between the Forest Manager and Heritage on species selection during the Annual Work Plan review process.

2) Management of Zone 2 will be done in such a way that 75% of the area contains large pole timber and saw timber age classes (10" DBH and greater) which will be managed for longer stand rotations (50+ years). Forest Management activities such as commercial thinning in these stands shall maintain a minimum of 70 sq. ft. of BA with the goal that at least 50% of the stand composition will be comprised of hardwood species. When regeneration harvests occupy 25% of Zone 2, then natural regeneration must reach large pole timber size (10" DBH) before additional regeneration harvesting occurs.

3) There will be no mechanical site preparation. Prescribed burning will be allowed as a management tool. No new roads should be built in this area.

4) Harvests and heavy equipment should be conducted only when the ground is frozen or very dry.

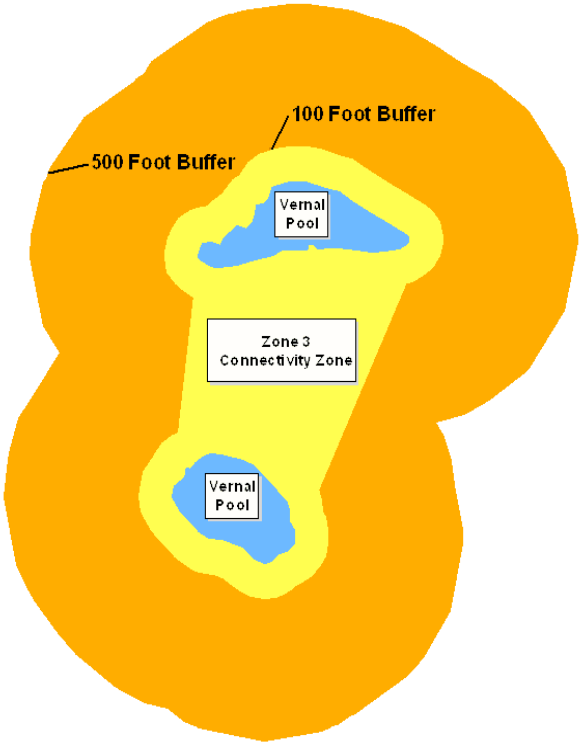


Figure 6.6.2: Vernal Pool connectivity zone for amphibian conservation

Zone 3 (Forestry responsible for management with input from Heritage): This will be called the **Vernal Pool Connectivity Zone – Special Case** (Fig. 6.6.2): from Zone 2 to 1000 feet from the wetland edge. This area is primarily to ensure that adjacent vernal pools have some habitat connectivity between them, providing microhabitat and allowing movement between breeding ponds. This Zone will only be used when two breeding ponds are less than 1000 feet from each other and readily encompasses the Zone 1 of each pond and connecting area. An inoperable area should be established between the two ponds that is the width of the diameter of the largest of the ponds.

Chapter 7 - Ecologically Significant Areas and Other State Protected Lands

7.1 Ecologically Significant Areas (ESA) Defined

This plan uses the term Ecologically Significant Area to identify unique sites that have special environmental significance. These areas have been specifically delineated (see Map I.5) and must be given careful management consideration. ESAs are areas that harbor or could potentially harbor rare, threatened or endangered (RTE) species and/or unique natural community types.

On Savage River State Forest these areas are also designated as High Conservation Value Forest (HCVF). Rare threatened or endangered species and/or unique natural community types fall under two categories of our HCVF definition, they are: *(HCV1) Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endangered species) and (HCV3) Forest areas that are in or contain rare, threatened or endangered ecosystems.*

In addition to the main criteria used for establishing ESAs, other criteria were also used to assist in determination of ESA boundaries. These included: topography and geomorphology (based on U.S. Geological Survey topographical quads and geology maps); hydrology (based on National Wetland Inventory and State wetland maps); soil types (based on U.S. Department of Agriculture soil surveys); stream buffers and water quality; wetland buffers for conservation of amphibian life zones; existing Wetlands of Special State Concern (WSSC) and associated buffers; existing Natural Heritage Areas (NHAs) as designated by state law; surrounding land uses (houses, farms, etc.); and wildlife travel corridor linkages. HCVF include areas identified as old-growth and nearly old-growth forests according to criteria developed by the DNR Old-Growth Forest Committee.

Following a thorough analysis, ESA boundaries were delineated using ArcView, a geographic information system (GIS) software program. Digital geo-referenced layers for most of the above criteria were used. The ESA boundaries are part of the Savage River State Forest database used for planning and review purposes. In addition to the GIS exercise, a wide range of species experts also evaluated the alignment of the established ESA network to ensure that the ecological criteria were accurately applied. The Natural Heritage Program conducted an exercise to develop management zones and prescriptions for ESAs (Smith & Knapp 2006) to simplify management designation for each acre of Chesapeake Forest (CF) so that each management category on the entire CF would have distinct, non-overlapping map units. This layer and associated document have not been completed for SRSF. The forthcoming layer will be similar to the one created for CF but due to vastly different land use history and current forest condition the types and

frequencies of management will be markedly different.

ESAs presently comprise approximately 3,887 acres or about 7 % of the entire forest. Some ESA boundaries will expand over time or entirely new ESAs will be delineated, both based on the discovery of new rare resources. Conversely, some ESAs may be removed based on new knowledge or changed legal status of a particular species. ESA boundaries in many cases overlap other management areas. Timber management is still possible in most ESAs, but in some cases, may be a singular occurrence or irregularly timed and only in the context of managing for sensitive resources. Implementation of this management regime will achieve the definition of a sustainable forest, providing balanced ecological and economic benefits.

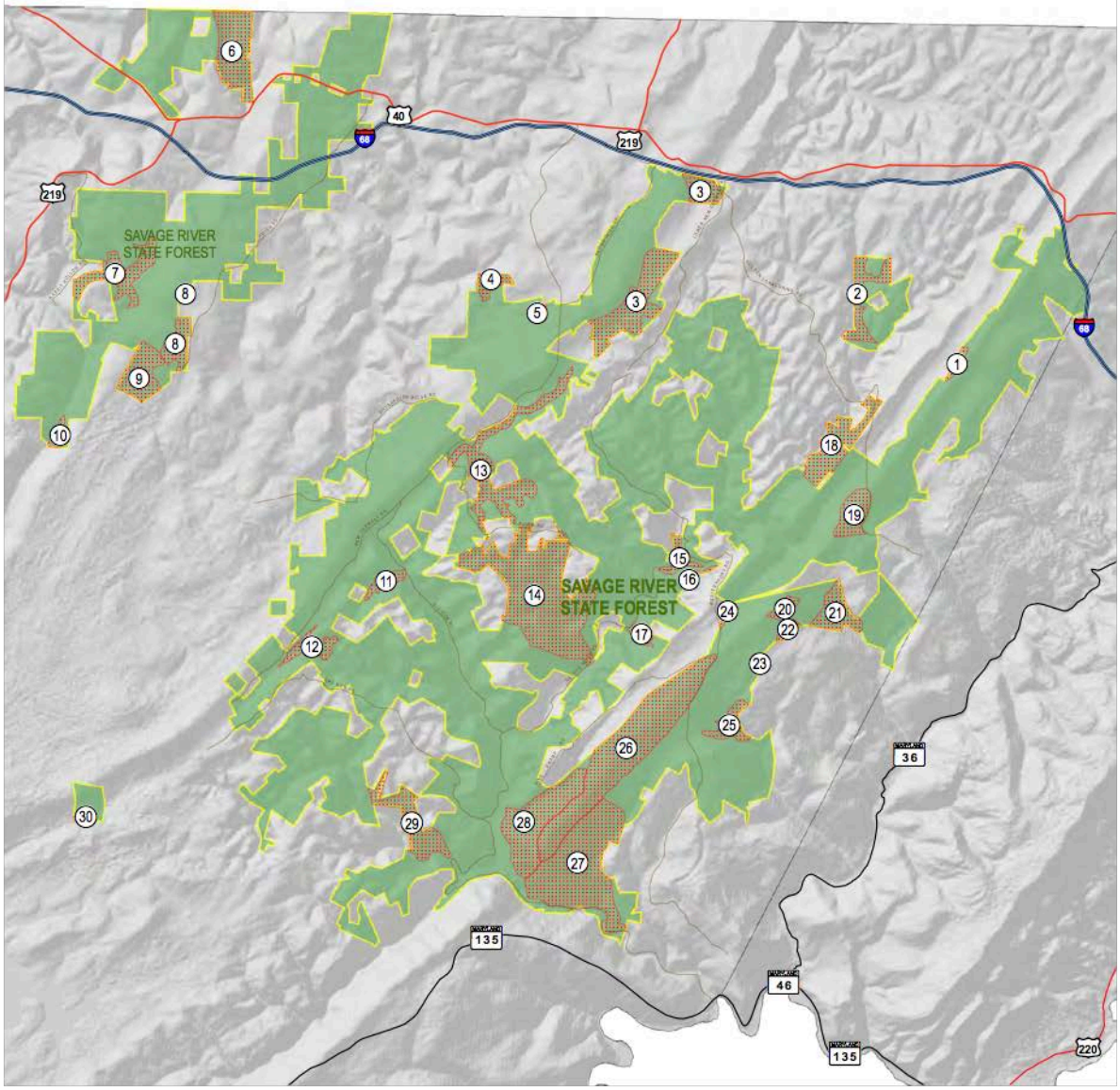
7.2 State Protected Lands

Most of the land designations listed below fall under some type of state protection through legislation. Most of these areas are overlapped by the ESA layer, however, some sections are not and as such are listed here as a separate layer. There are four areas described here: Natural Areas (Heritage Areas); Ecologically Significant Areas; State Designated Wildlands; Historic and Archaeological Areas. The borders of these layers may overlap one another.

7.3 ESA Management

The goals of ESA management include maintaining existing rare species habitat, restoring additional habitat for the further enhancement of RTE populations and natural communities as well as protecting ecosystem function at the landscape level. ESAs were classified by major natural community type or other landscape category that support RTEs.

Ecologically Significant Areas (ESA) of Savage River State Forest



LEGEND

ESA — Interstate Highway — US Highway — State Highway — State Forest Lands

N W E S

0 Miles 2

ESA NAME				
1. Callahan Swamp	5. Big Laurel Run Woods	11. Upper Big Run	17. Warnick Point Southwest (New)	24. Pine Swamp East
2. Mudlick Run	6. Puzzley Run	12. Upper Monroe Run	18. Savage Ravines	25. Mill Run Rocks
3. Wolf Swamp	7. Little Bear Creek	13. Upper Poplar Lick (New)	20. Upper Cucumber Hollow	26. High Rock (New)
3. Poplar Lick Headwaters/Wolf Swamp	8. Amish Road Swamp	14. Bear Pen Run (New)	21. Cucumber Hollow	27. Coleman Hollow/South Savage (New)
4. Big Laurel Run	9. Negro Mountain Bog	15. Savage River-Warnick Run (New)	22. Russell Road Bog (New)	28. Savage Reservoir Woods (New)
	10. Bear Creek Springs/Upper Bear Creek	16. Warnick Run Hilltop (New)	23. Russell Road Pool	29. Middle Fork
				30. Warren's Grove

7.4 ESA Description & Prescriptions

The ESA descriptions are largely driven by the database, inventories and mapping maintained by the Maryland Heritage Service. Prescriptions and boundaries of the ESA are the result of collaboration between the forest staff, Maryland Wildlife Service and the Heritage Service with the Heritage Service taking the lead.

Callahan Swamp

Description: Currently, all of Callahan Swamp is privately owned. It is a large wetland complex of sphagnum bog, shrub swamp, and sedge/grass swale that supports a large number of uncommon, rare and State-listed species. It is a top acquisition priority and a number of different landowners have been contacted over the years concerning the conservation of this important area. This ESA represents that portion of State Forest that is within a secondary protection boundary of this valuable wetland.

Prescription: This secondary protection zone is not necessarily a 'hands-off' buffer. However, any land use proposals within it should be scrutinized carefully, and, if carried out, be done so in a sensitive manner. There are a number of springs originating from this ESA that feed Callahan Swamp. These areas in particular should be treated with the utmost sensitivity.

Mudlick Run

Description: This ESA provides habitat for four State-listed plants, two of which are State Endangered and two of which are Threatened. One State Threatened damselfly also occurs here. A small population of a State sensitive reptile occurs here, as well. Another notable feature is an excellent riparian hemlock-northern hardwood forest along Mudlick Run. This forest provides breeding habitat for at least three regionally uncommon birds. There are several oxbow pools along Mudlick Run that support two vernal pool obligate amphibian species. This ESA is adjacent to and part of Mount Etna ESA which provides breeding habitat for an area-sensitive State Endangered raptor.

Prescription: There are several management issues associated with this ESA. One is the presence of the hemlock wooly adelgid in Garrett County and the threat it may pose to the riparian hemlock forest. Field reconnaissance is recommended in the near future to determine if the adelgid is present and if it has caused any damage. This may have already been done by MDA. One of the State Endangered plants, a sedge, is under pressure from deer browsing. This occurrence should be monitored regularly to assess the status of the population. The status of the other State-listed plants has not been updated in over 10 years. This is something that should be attempted soon. Another issue is the presence of a restaurant/lodge on a private in-holding in the middle of this parcel of State Forest. The lodge uses the State Forest for recreation such as hiking, biking, skiing, etc. Future management issues may be expected to be encountered.

Poplar Lick Headwaters/Wolf Swamp

Description: Because of land ownership patterns, this ESA will appear as two areas on

our State Forest maps. However, ecologically, they form one large ESA and would appear as such if the State owned the properties in between. This extensive wetland/headwater stream complex boasts a number of exemplary sphagnum dominated bog/fen communities, grass/sedge swales interrupted by occasional beaver activity, shrub dominated bogs, forested bogs, forested spring seeps, and vernal pools. With such a diversity of habitats it is no surprise that this area supports a large number of uncommon, rare, and State-listed flora and fauna. Two State Endangered plants and two State Threatened plants have been documented, to date. One of these listed plants is represented by a historic record that has not been re-located in recent attempts. Several other plants that are not officially listed, but considered rare in the State, also occur here. Three animals listed as State Endangered have been recorded from here, as well as two State Threatened and three In Need of Conservation species. These listed animals consist of four butterflies, one amphibian, one bird, and two mammals. Other regionally rare or uncommon birds are probable breeders here, as well. The odonate fauna is diverse with several uncommon or localized species documented. A rare troglobitic amphipod and a flatworm possibly new to science have been found in a spring head within this area. This ESA truly represents a biological diversity 'hotspot' for our State. A very interesting geomorphic feature known as the Eastern Continental Divide is quite evident between the south end of Wolf Swamp and the headwaters of Poplar Lick Run. Near this divide, water can be observed flowing both north and south not far from one another. The drainage into Wolf Swamp flows north into the Ohio system and Poplar Lick flows south into the Atlantic Slope drainage. There are several ecologically significant vernal pools located in the general area of this divide.

Prescription: There are several management issues associated with this ESA. One is the continued unauthorized ATV use within the area. Illegal trails originate off the East Shale Road ORV trail and cross over Meadow Mountain into the ESA. Other access points originate on adjacent private land. Sections of these trails are environmentally degrading. One of the main trails over Meadow Mt. completely changed the drainage pattern of the headwaters of a small stream. Another section goes through a wet area near the aforementioned divide resulting in a muddy quagmire. Other wet areas have been compromised, too. The Department is in the process of addressing ATV issues on western region State Forests. Whether this specific issue will be addressed in that effort remains to be seen. If not, it is an issue that needs attention. Past logging operations have taken place within some of the tributaries on the east side of Poplar Lick. The proper management of this sensitive area should preclude any future timber harvests from occurring anywhere within this ESA. Any private land that goes up for sale within or adjacent to the State-owned parcels should be high on the acquisition priority list. This is particularly true for the area in between the two State parcels and the property south of the ESA in Poplar Lick Swamp. The presence of the hemlock wooly adelgid in Garrett County is a threat to the hemlock forest present in much of this ESA. An evaluation to assess this threat should be undertaken.

Big Laurel Run ("Asa Durst")

Description: This site provides habitat for a State Threatened plant and two State rare plants. Additionally, there is an exemplary northern hardwood forest community that is quite old and could be near old growth. This forest type remains to be analyzed by the Natural Heritage Community Ecologist, but the exceptional diversity of canopy tree species is different from any forest yet discovered on SRSF. The herbaceous layer of much of the site is also of interest,

supporting a large diversity of species.

Prescription: The State Threatened plant is a species that has been compromised by high populations of deer at most sites where it occurs. The impact of deer at this site has not been fully evaluated in quite some time. The status of the State rare plant that was impacted by a past timber harvest should also be updated. During this past harvest, Japanese stilt grass was introduced to the area. It occurs on some of the forest roads at this time. Two roads which head in the direction of the ESA should be evaluated for the advancement of this weed.

Big Laurel Run Woods

Description: This ESA provides critical habitat for a State Threatened plant. It is considered a very good occurrence for the species.

Prescription: The rare plant occurrence needs updated since it has not been done in quite some time.

Puzzley Run

Description: There are a number of outstanding attributes associated with this ESA. The area provides habitat for a variety of sensitive flora and fauna. Puzzley Run represents a relatively large tract of forest that has remained free of major anthropogenic disturbance for over 130 years. The area also offers exemplary examples of several forest community types, most of which are near old growth. To date, two State Threatened plants and two rare plants have been documented. Because of the underlying geology (which is different from much of SRSF) the soil of much of the area is quite rich. This situation allows for an exceptionally diverse herbaceous flora. The stream continues to exhibit excellent water quality, but sediment and erosion problems are not entirely absent. This aquatic habitat supports a number of odonates, three of which are considered uncommon or rare in the State. The stream also supports a State Endangered mammal and a sensitive species of fish. Two State rare birds and a rare butterfly complete the list of sensitive species documented within this ESA, so far. For some reason not fully understood, the forest communities on the slopes of Puzzley Run seem particularly susceptible to disturbances generated by high winds. The steep slope certainly has something to do with this, but does not seem to be the only factor. In any event, the result is a dynamic system with a large number of downed or damaged trees. The resulting coarse woody debris, snags, and light gaps have produced old growth characteristics in this forest at an earlier age than would normally be expected. Since much of the area is near old growth in age, Puzzley Run will continue to evolve into not only one of the most extraordinary forests on Savage River, but in all of Maryland.

Prescription: Perhaps the most pressing issue with this ESA is a proposal to drill wells to supplement the drinking water of the nearby town of Grantsville. Concerns voiced over whether these wells will impact the flow and quality of Puzzley Run seems to have been addressed in a recently published hydrological assessment. The results appear to claim no impact will occur, though this author is incapable of evaluating such a report. A concern that has not been adequately addressed to date is the impact of the access road to the wells. Currently, this access is an old narrow road that would seem to require a serious upgrade to function in the needed capacity. The old road cut has ‘healed’ to the point of supporting local vegetation and has several spring seeps crossing it. One of these spring seeps now supports a small population of a

State Threatened plant and any disturbance in that area will destroy this occurrence. The concerns regarding this access road will undoubtedly be addressed in the near future. Another concern for this ESA is an unauthorized ATV trail that runs the length of the stream. Use seems highest during hunting seasons, but is not restricted to that time period. This issue remains to be addressed. Given the rich nature of much of the soil, an updated evaluation of the invasive plant situation should be done.

Little Bear Creek

Description: The primary features of this ESA include outstanding examples of northern hardwood and hemlock forest, spring seep plant communities that show a more neutral or slightly basic water chemistry, excellent populations of various salamander species associated with springs and small streams, a population of a State rare dragonfly and a population of a sensitive species of fish. The 'northern hardwood forest', which probably represents more than one forest community type, is near old growth in much of the area. A small pocket of probable old growth was recently discovered, as well. A number of uncommon plants have been documented here.

Prescription: Field evaluation of the boundaries in relation to the unique forest communities should be completed to insure the integrity of the resources we wish to protect within this ESA. Given the rich nature of much of the soil, an evaluation of the invasive plant situation should be done. The hemlock wooly adelgid poses a threat to the hemlock forests here. Field reconnaissance is recommended to determine if the adelgid is present. This ESA would extend in several directions if the State owned the land. Several private parcels in the area represent important acquisition priorities.

Amish Road Swamp

Description: The primary feature of this ESA is a high quality headwater stream flowing through a mosaic of boggy openings, hemlock/red spruce swamp, and northern hardwoods. A decidedly northern bird fauna is present with several uncommon species breeding here. There is a diverse small mammal community with the potential for several rare species. An excellent naturally open cranberry bog, known as Flanagan Bog, occurs on private land in between the two State parcels that form this ESA. The main branch of the upper headwaters is on private land, as well. Ecologically, these features are part of the ESA and would be reflected as such if the State owned the land.

Prescription: The most important stewardship issue with this ESA is to acquire the land necessary to protect the integrity of the area. As such, the private land within and to the northeast of this site represent high acquisition priorities should they come up for sale.

Negro Mountain Bog

Description: This ESA features the finest northern bog/fen system on SRSF. There is a mosaic of open sphagnum communities, old beaver ponds, shrub swamp and forested wetland. A number of uncommon bog plants grow here as well as two State rare species. The odonate diversity is particularly high, with four State rare species documented, so far. A State rare

butterfly has also been documented, and several uncommon northern birds are known to breed here. The area provides excellent cover habitat for secretive animals such as the black bear and bobcat. An acquisition that borders this ESA to the south by The Nature Conservancy, which is centered around a number of bogs, fens and swamps, results in the protection of a large, wetland complex along the east flank of Negro Mountain. There is potential to discover a State rare reptile within this ESA since it has been documented in similar habitat not too far away.

Prescription: An area of private land to the west, 'sandwiched' between this ESA and another section of State Forest, represents a prime future acquisition. Many springs emerging at the base of Negro Mt. feed this extensive wetland system. Currently, the fate of some of these water sources is out of our hands.

Bear Creek Springs/Upper Bear Creek

Description: This ESA highlights a protection area along Bear Creek established for the presence of a globally rare land snail. In addition, at the southern end of the area protection is provided for an excellent spring seepage wetland that supports a State Threatened plant. An unusual plant association exists in this wetland. The land snail, which has a global rank of G3, was documented during a county-wide inventory conducted a number of years ago. The species was found at four different locations along Bear Creek within the ESA. Because of the underlying rock strata, many of the springs feeding Bear Creek have a pH that approaches neutral, thereby influencing the plant communities that exist here. This is the case for the wetland that supports the State Threatened plant. Another plant that thrives in spring seeps with this type of water chemistry, and is considered uncommon in Maryland, occurs in good numbers within this ESA. The geology and resulting soil also influences the land snail community of a given area. Additionally, there is a diverse spring/small stream-dwelling salamander community here, as well.

Prescription: Field reconnaissance of this area is highly recommended to determine the relationship between what land is needed to adequately protect this ESA, and what land should be available for timber management. The invasive plant situation should be evaluated because the area provides the type of growing conditions preferred by many of them. This area is another on the forest where unregulated ATV activity occurs. The current status of this issue needs evaluated.

Upper Big Run

Description: The upper reaches of Big Run, including Whiskey Hollow and Miller Run, has several important features contributing to it being designated an ESA. First, it provides critical habitat for a State Endangered mammal. This secretive, semi-aquatic small mammal requires streams of high water quality and abundant cover. In addition, a northern species of dragonfly, rare in the region, has been documented living along these headwaters. Furthermore, this headwater system offers one of the finest examples of an Allegheny Plateau stream-side salamander community. All of the species expected to be here have been documented, and they occur in good population numbers. These headwaters also provide excellent spawning habitat for brook trout. A State rare plant occurs within this ESA, as well.

Prescription: The number one management issue with this area is keeping the potential insults that may occur in the extreme upper reaches of the streams to a minimum. A number of

timber operations have occurred within the watershed over the years, resulting in an influx of sediment. Also, much of the extreme upper reaches occur on private land where we have little control of land use activities. Furthermore, water management of New Germany and Big Run Roads has caused impacts in the past and has the potential to cause more in the future. Keeping these adverse events to a minimum is of obvious importance. The hemlock wooly adelgid has been documented in the vicinity. The hemlock cover is an important component to this ESA and the special resources within it. Monitoring the impact of the adelgid, and hopefully being able to manage those impacts, are important to the future integrity of this area.

Upper Monroe Run

Description: The features of this ESA are two-fold. It represents habitat for a State Endangered mammal and it represents an excellent example of Allegheny Plateau salamander communities, both stream-side and terrestrial. The diversity of stream dwelling salamanders is as high as it can be, as all species expected to be here have been documented. An unusual situation exists on one of the hillsides adjacent to the stream. Three species of *Plethodon* have been found co-existing in the same area. Two of these, the redback salamander and the ridge & valley salamander, rarely occur together. This is particularly true farther east in the heart of the ridge & valley salamander's range. The ridge & valley salamander's range encroaches on the Allegheny Plateau and the full extent of its occurrence in this physiographic province is not known. The occurrence of these two species together is of scientific interest since the redback salamander is absent from the Ridge & Valley province.

Prescription: Minimizing disturbances that affect water quality is the main management recommendation. The aging of the forest will improve the salamander habitat.

Upper Poplar Lick

Description: The features of this section of Poplar Lick include the presence of a State Endangered mammal and a fresh water mussel listed as In Need of Conservation. Both of these species depend on having good water quality.

Prescription: Any lake management issues of New Germany Lake that may affect Poplar Lick's water quality should be carefully scrutinized. Additionally, any increase to the volume of the New Germany State Park's sewage treatment facility, which empties into Poplar Lick, should be reviewed carefully.

Bear Pen Run

Description: The heart of this ESA is the Bear Pen Wildland. The ecological boundaries of the ESA encompass all of the drainage into the Bear Pen watershed and include adjacent private land. This is to indicate the importance of these properties as acquisition priorities if they ever go up for sale. Bear Pen Run is an important tributary to the Savage River and its protection as a Wildland secures a number of important features. It represents excellent forest interior bird habitat and includes a number of patches of old forest. The area supports a population of a State Threatened plant and a State sensitive reptile. The area offers excellent habitat for salamanders and a high diversity of species occur here. The entire area has had a history of gypsy moth defoliation. On one hand the mortality has created more structure to the forest and added old growth forest characteristics sooner than normally expected. On the other hand, some patches of

old growth suffered serious mortality and many of the large, old trees were killed. Overall the area now exhibits a structurally diverse forest with a large amount of snags and coarse woody debris. In the long-term, the entire area will evolve into old growth.

Prescription: There are some invasive plant issues within this ESA. For the most part, the major problems occur along the stream and its floodplain and follow some of the tributaries. Japanese spiraea and garlic mustard are the two major culprits. Currently, a cooperative effort to manually remove the Japanese spiraea is underway and has been for a number of years. This plant's main pathway to invasion is via headwater areas, often from private land. The public's main access into this area is from Savage River Road, near Bear Pen Run's confluence with Savage River. Invasive plants like garlic mustard make their way into the area mainly from this access point. The aggressive invasive Japanese stilt-grass is now in the region and represents a threat to this area, if it has not already arrived there. Monitoring and management of invasive plants will be an ongoing issue with this Wildland/ESA. Acquisition of any bordering properties, particularly in the headwaters, is of prime importance to the long-term integrity of the area.

Savage River-Warnick Run

Description: This ESA identifies a section of Savage River where three State rare odonates and two uncommon ones have been documented. Of the State rare species, two are dragonflies and the other is a damselfly. The damselfly is State-listed as Threatened.

Prescription: Water quality and streamside habitat are both important for odonates. The State Threatened damselfly is known to have specific streamside habitat needs. Advice from our State Zoologist may be necessary to determine any future management needs.

Warnick Run Hilltop

Description: This ESA is designated because of a site for a State Endangered plant and a rare breeding bird. The area also has habitat supporting two mammals listed as In Need of Conservation. The general habitat consists of a diverse mature forest with several scattered rock outcrops. At least half of this ESA is on private land.

Prescription: No known management needs at this time. However, the occurrences for the endangered plant and the rare bird need updated since the last observed dates are a number of years ago.

Warnick Point Southwest

Description: This ESA lies within the Big Savage Wildland. Its features include a site for a State Endangered plant and a State rare plant.

Prescription: No known management needs at this time. However, the occurrences for both of these plants needs updated.

Savage Ravines

Description: This ESA lies entirely within the Savage Ravines Wildland. The attributes of this Wildland/ESA are without parallel. There have been more rare species documented here than in any other ESA on SRSF. Eight rare plants, six of which are State-listed as Threatened or Endangered, have been documented from this ESA/Wildland. Eleven rare animals, six of which are State-listed as In Need of Conservation, Threatened or Endangered, have also been found

within the area. Several patches of old growth and near old growth forest are known. An excellent vernal pool community is present. A site known as Avilton Woods, which is now part of the Wildland, joins the northern edge of this site and is included within the ESA.

Prescription: A major management issue is the continued unauthorized use of ATVs in significant portions of this ESA/Wildland. A recent effort to address the general issue of ATV use on western State Forests has been undertaken. Hopefully, the issue will be specifically addressed on this area. A nearby proposed industrial wind 'farm' on private land would have a negative impact on the character of this Wildland. The acquisition of an adjoining property with frontage along the Savage River known as the Owens tract is extremely important to the ecological integrity of this area. If acquired, this property should be included in this ESA, if not added to the Wildland.

Big Savage-Mt. Zion

Description: This ESA lies within the Savage Ravines Wildland. The primary features are habitat for a State-listed salamander and habitat for a State-listed tiger beetle. The salamander is listed as In Need of Conservation and the tiger beetle is listed as Endangered. In addition, a patch of old growth forest has been documented.

Prescription: Unauthorized ATV use occurs within this area, specifically along the powerline. Since the Endangered tiger beetle's habitat is on the powerline, this use needs monitored if it cannot be stopped altogether. An evaluation of the impact of the most recent gypsy moth invasion on the old growth should be undertaken.

Upper Cucumber Hollow

Description: The primary feature of this ESA is an outstanding example of a natural community type known as a sandstone glade. Sandstone glades are quite rare in Garrett County and this is the finest example of such a community on SRSF. Named after its co-discoverer, it is known as Jesse's Glade. The ESA also provides habitat that supports a rare mammal which is State-listed as In Need of Conservation, and provides habitat for a State sensitive reptile.

Prescription: The sandstone glade is scheduled to receive a prescribed burn as part of a larger management prescription in an adjacent gypsy moth ravaged woods.

Cucumber Hollow

Description: The primary feature of this ESA is a stand of old growth forest embedded within near old growth. Portions of this ESA are structurally complex and as it ages it will someday represent one of the finest old forest tracts on SRSF.

Prescription: In the aftermath of the most recent gypsy moth defoliation event, nearby oak forests suffered extremely high mortality. The old growth at Cucumber Hollow does contain oaks, but it is more of a mixture of species than the nearby sites that received this mortality. None-the-less, the old growth and near old growth of this ESA should be evaluated to document what impacts this latest gypsy moth event created. During the first wave of gypsy moth in the mid-1980s, the area within this ESA experienced moderate mortality. The overall effect of that event was the creation of some old growth characteristics in the near old growth and younger stands within the ESA. This event appeared to contribute to the overall structural complexity of the area, and from an ecological perspective seemed to have a fortuitously positive outcome.

However, for some reasons not easily understood, some stands of old growth on SRSF have been seriously impacted by gypsy moth infestations to the point of near total mortality of the old trees. Proactive spraying with Bt may be necessary in an attempt to protect some of our old growth stands in the face of future gypsy moth infestations.

Russell Road Bog

Description: This ESA features occurrences for two State Endangered plants and a State Endangered butterfly. The most important aspects of this area are on adjacent private land and most of the ESA is off of State Forest. However, one of the Endangered plants, which is considered a prairie relic, occurs on the powerline crossing State Forest. The management to keep the powerline open appears to have fortuitously allowed the continued existence of this plant. An important component to the life history of the butterfly is also present on the powerline crossing State Forest. Therefore, this section of the powerline should be considered part of the overall habitat for this Endangered species.

Prescription: The conditions responsible for the existence of the Endangered butterfly are the result of past disturbances that may be hard to re-create. A plant required by this species appears to have spread (perhaps from the powerline) and thrived in the aftermath of a past strip mining reclamation effort. The site has been monitored periodically since its discovery and succession appears to be occurring very slowly. Cattle grazing has occurred on and off over the years, possibly assisting in the slowing of succession. At some point in the future it may be necessary to intervene to keep the habitat suitable. The cooperation of the landowner will be necessary. The Endangered plant which is in the actual wetland portion of this ESA is a tenuous occurrence and its status is in need of an update. Whatever the management of the powerline has been seems to foster the continued existence of the other listed plant. However, it would be prudent to keep abreast of the future management techniques employed on this powerline.

Russell Road Pool

Description: This ESA identifies an ecologically significant vernal pool community. Three vernal pool obligate amphibians use the site for breeding habitat. One of these is considered uncommon in the State. A thriving invertebrate community exists, including an excellent occurrence of fairy shrimp. *Glyceria septentrionalis*, a grass that occurs State-wide but is infrequent on SRSF also occurs here. In the mountainous region of Maryland, this grass is most associated with vernal pool communities.

Prescription: Management recommendations for the conservation of vernal pools and their amphibian populations are included in a specific section of this plan.

Pine Swamp East/Pine Swamp Pools

Description: The majority of this ESA is on private land, but two important features are separated by Westernport Road. To the southwest is Pine Swamp, an ecologically significant mountain bog. Portions of the secondary protection boundary are within the borders of State Forest. Two State-listed plants, one Endangered and the other Threatened, have been documented from this bog. A bird State-listed as In Need of Conservation also has been documented. Other uncommon plants occur here and there is an excellent chance of other rare flora and fauna being discovered. It is known as Pine Swamp East to distinguish it from Cranesville Swamp which is

also known as Pine Swamp. The other important feature of this ESA is the presence of a series of vernal pools east of Westernport Road. The two main pools lie just off of State Forest and are two of the most ecologically significant vernal pools discovered in Garrett County. A primary protection zone for these pools includes State Forest land. In other words, a percentage of the amphibian populations that utilize these pools for breeding occur on State Forest. At least seven species of amphibians utilize these pools, including a salamander considered uncommon in the region. A complex aquatic invertebrate community thrives here, as well. A sedge listed as State Threatened also occurs in one of the pools. It is the only known location for this sedge in Garrett County.

Prescription: Both Pine Swamp and the Pine Swamp Pools have been acquisition priorities for quite some time. Even though it makes sense ecologically to include them as one ESA, Pine Swamp Pools are significant enough to stand alone as an important acquisition. Management recommendations for the conservation of vernal pools and their amphibian populations are included in a specific section of this plan.

Mill Run Rocks

Description: Two small mammals (both shrews) that are State-listed as In Need of Conservation occur on this ESA. Both require special habitat and one in particular has more specialized needs. Significant sections of Mill Run Rocks offer an outstanding example of this specialized habitat. Forested, moss-covered rocks offering a cool micro-habitat are the primary feature of this habitat. A State rare plant also occurs in portions of this habitat. This plant, which is a regional endemic, would be State-listed if it were not for some unresolved taxonomic questions. Finally, a patch of old growth forest has been documented on this ESA.

Prescription: No obvious management issues are known for this ESA at this time. However, it has been a number of years since this site was last visited. It is recommended that field reconnaissance be done soon to evaluate any current issues.

High Rock

Description: High Rock ESA extends into portions of two Wildlands, the High Rock Wildland and the Big Savage Wildland. Most of the attributes of this ESA are associated with the extensive ridge crest sandstone outcrops that occur on Big Savage Mountain. Four State-listed mammals have been documented from this ESA. Two of these are listed as Endangered and two are listed as In Need of Conservation. One of these mammals is declining through-out its range and this ESA provides core habitat to a meta-population within an extensive area on this section of Big Savage Mountain. The over-all decline is not totally understood, but if this species cannot persist within this area it may not have a chance to persist anywhere else in Maryland. In addition, three State rare birds have been recorded breeding within this ESA, and the area supports a population of a State sensitive reptile. Several springs on the northeast facing slope of Big Savage Mountain support occurrences for a State rare troglobitic amphipod that is listed as In Need of Conservation. Furthermore, several stands of old growth and near old growth have been documented. This ESA is part of an extensive area made up of other ESAs and Wildlands on the south end of Big Savage Mountain that represent an extremely important core area for Forest Interior Dwelling Birds. The rock outcrops on this ESA are significant from a geologic point of view, as well.

Prescription: One issue revolves around an access road to the High Rock fire tower. How this road is managed is an issue that should be taken up by the Interdisciplinary Team. The rock outcrop near the tower was used for climbing by an Outward Bound program for a number of years. In hindsight, the impacts brought to the area from this use were not compatible with the resources there. Future use of this kind should be prohibited. This area is a long-term monitoring site for a State Endangered mammal and should continue as such.

Coleman Hollow/South Savage

Description: The majority of this ESA lies within the South Savage Wildland. Along with supporting populations of several rare species, this area has some of the largest stands of old growth forest documented in Maryland. Two State-listed plants, one Endangered the other Threatened, are known to occur within the ESA. Other notable species include a very rare land snail, three State-listed mammals, and sites for a State sensitive reptile. One of the mammals is Endangered and declining through-out its range. This area in conjunction with the High Rock ESA and Savage Reservoir Woods ESA represent a meta-population conservation area for this mammal. The site for the Endangered plant represents its only occurrence in Garrett County See comments regarding Forest Interior Dwelling Birds under High Rock description.

Prescription: The old growth forest stands should be monitored to document the extent of impacts from the recent gypsy moth eruption. Future gypsy moth events may warrant spraying this area with Bt to protect the oldest trees. An access road made for a timber harvest prior to this area being designated a Wildland has enabled several invasive plants to make their way into the site. The extent to which these invasives have made it into the adjacent forest should be evaluated.

Savage Reservoir Woods

Description: This steep, rugged ESA lies within the Big Savage Wildland and supports populations of four State-listed plants. Two of these are listed as Endangered and two are considered Threatened. Additionally, there are several stands of old growth forest and habitat for a State sensitive reptile. Three of the four rare plants occur here because of the unique geology of the area. There is a band of limestone that outcrops on the slope allowing for plant associations different from most that occur on Big Savage Mountain. The remote and rugged character of this site has resulted in a general lack of inventory work. Because of this, it is expected that other uncommon or rare flora will be found here in the future.

Prescription: Because sections of this area have soil characteristics preferred by many non-native invasive plants it is recommended that this situation be evaluated in the near future. A recent infestation of the gypsy moth may have impacted this area. The ESA should be evaluated for any impacts and recommendations formed for any future eruptions of the moth.

Middle Fork

Description: This ESA is a large watershed-based area with its core as the Middle Fork Wildland. The watershed boundary consists of much private land and represents an ideal protection boundary for the Middle Fork watershed. For the purposes of current State land management, the ESA is the Wildland plus an eastern extension of State forest land not designated as Wildland. The varied topography and slope aspects of this area result in a large

number of different forest associations. It represents a core area of forest that will eventually evolve into old growth. There are several pockets of old growth that have already been identified. As a large tract of continuous forest Middle Fork represents excellent Forest Interior Dwelling Bird habitat. In addition, a butterfly listed as State Endangered and a plant listed as State Threatened have been documented from the area. The many small streams and springs support excellent salamander populations with a good diversity of species. This stream system is very important for a State sensitive fish. Finally, the area has habitat important to a State sensitive reptile.

Prescription: A road built into this area along Waters Run prior to it being designated a Wildland has contributed to some management issues. This road now allows access to an area that was previously very hard to get to. It is an entry-way for ATV use, and the troublesome weed, Japanese stilt-grass, has spread down this road. An evaluation of the extent of the stilt-grass invasion should be undertaken soon. Unauthorized ATV use occurs in several areas bordering private land, and to varying degrees along Middle Fork itself. An evaluation of the impact of the most recent gypsy moth invasion on the old growth stands should be undertaken. Finally, any private land that borders the State Forest that goes up for sale should be an immediate acquisition priority.

Warrens Grove

Description: This small site represents a forest type not typically seen on SRSF, including a stand of very old beech trees. This site was suggested as a special area by the former forest manager of Savage River State Forest, Warren Groves.

Prescription: The site should be visited and the condition of the old beech trees evaluated.

7.5 Prescribed Burning within ESAs

Some mechanical fire line construction may be necessary within an ESA in order to conduct prescribed burns within fire safety guidelines and in accordance with state burning regulations. All fire lines proposed within an ESA will be reviewed by Heritage for recommendations regarding type and location. Forestry personnel will contact Heritage at least 48 hours in advance of implementing a prescribed burn on an ESA.

7.6 Use of Herbicides/Pesticides within ESAs

Chemicals may be used in ESAs to control invasive species only after consultation with the Heritage Service. This also includes control of invasive animal species, particularly potentially damaging insects, such as the Hemlock wooly adelgid. The expected damage from the pest outbreak to the ESA and surrounding habitat should be greater than the potential negative effects on rare species populations if the area is treated. In the latter case, consultations would also include the MDA Forest Pest Specialist. Furthermore, chemicals may be used to maintain or enhance the elements that define the ESA.

7.7 Annual Work Plans

Concerns for ESAs will also be addressed during Annual Work Plan (AWP) reviews by the ID Team. All actions necessary to protect, restore or enhance affected ESAs will be considered during the AWP reviews.

7.8 Wildlands

7.8.1 The Maryland Wildlands Preservation System

The Maryland Wildlands Preservation System is Maryland's counterpart to the federal Wilderness Preservation System and consists of all those properties owned and managed by the Maryland Department of Natural Resources which were designated as State Wildlands by the Maryland General Assembly.

Statutory Definition

"Wildlands are limited areas of land or water which have retained their wilderness character, although not necessarily completely natural and undisturbed, or have rare or vanishing species of plant or animal life or similar features of interest worthy of preservation for use of present and future residents of the State. This may include unique ecological, geological, scenic, and contemplative recreational areas on State lands " (Natural Resources Article, §5-1201).

Background and History

The Maryland Wildlands Act established the State Wildlands Preservation System in 1971. The first official Wildlands in Maryland, the Big Savage Mountain Wildlands in Savage River State Forest, was officially designated by an act of the General Assembly in 1973. As of 2018, thirty-eight separate Wildlands have been designated on over 65,956 acres of State Park, Wildlife Management Areas and State Forest lands.

Wildlands at Savage River

There are presently seven designated Wildlands within Savage River State Forest: Big Savage Wildlands (2,879 acres), Bear Pen Wildlands (1,517 acres), Puzzley Run Wildlands (457 acres), Middle Fork Wildlands (2,932 acres), High Rock Wildlands (650 acres), Savage Ravines Wildlands (2,893 acres) and South Savage Wildlands (2,400 acres) (see map I.6). The Wildlands boundaries overlap some of the above described ESAs.

7.9 Historic and Archaeological Areas

This category features areas in which historical or archaeological artifacts or sites are known or are suspected to exist. There are presently 22 archeological sites and one archeological survey on Savage River State Forest (See Appendix M for complete list). The management goal within these areas is protecting the integrity of the sites. Education or display of artifacts may or may

not be featured within a site or potential archeological sites as the promotion of access to such sites may not be desirable. Using these surveys as references will guide the future site acquisition necessary to safeguard historical and archeological resources.

While there are 22 archeological sites in SRSF, only a small area within the forest has been surveyed for archeological sites. One parcel was surveyed in 1988 (Curry) and small sections were part of three additional archeological surveys that included the Wall Survey of the coal region cited above, a statewide survey oriented toward the historical road system (Wesler et. al.), and one local survey (Lee 1967).
Archeological surveys:

Archeological study of the Western Maryland coal region: the prehistoric resources.
Author: Wall, Robert D.
Call Number: GA 9B
Location: Main
Publisher: 1981

Archeological study of the Western Maryland coal region: the historic resources.
Author: Lacoste and Wall.
Call Number: GA 9C
Location: Main
Publisher: 1989
Note: The Maryland Coal Region survey produced a two-volume set, one for historic resources and one for prehistoric resources.

Archeological reconnaissance of Savage River State Forest Parcel.
Author: Curry, Dennis C.
Call Number: GA 18
Location: Main
Publisher: 1988

The M/DOT archeological resources survey. Volume 4: Western Maryland.
Author: Wesler, Kit W. et al.
Call Number: MD 1 Vol. 4
Location: Main
Publisher: 1981

Archeological survey of the Savage II project.
Author: Hanson, Lee H., Jr.
Call Number: GA 11
Location: Main
Publisher: 1967

Most of the sites were recorded as part of the Maryland Coal Region Survey. Savage River State

Forest has the potential to contain many additional prehistoric and historic period sites that have yet to be recorded. Additional archeological surveys would be needed to identify those sites. Native American Indian sites and burial grounds will not be disturbed the Maryland Commission on Indian Affairs and the Maryland Historic Trust will be notified upon discovery of any sites.

Chapter 8 - Wildlife Habitat Protection and Management

8.1 Introduction

The rich diversity of wildlife species located within the Savage River State Forest requires the use of a wide array of adaptive and proven management techniques. The objective is to utilize appropriate management to address the ecological needs of this diverse assemblage of wildlife species and habitat types, including different successional stages of forest, (e.g., distribution, size, composition, and juxtaposition of forest patches), riparian buffers, corridors and interior forest habitat as well as young forest and open grassland areas. This approach requires management prescriptions that are anchored in the ecological principle that all of the habitats function in relationship to each other. This is not a definitive prescription, rather an adaptive attempt to best serve the species utilizing these lands.

8.2 Invertebrates

In general, invertebrates have been poorly inventoried, and therefore, little is known about them on the Savage River State Forest. However, several groups have received enough research attention to allow some assessment of the situation in the forest.

Butterflies are one such group with at least 60 species found on or on lands adjacent to Savage River State Forest. Approximately 20 recorded species can be considered uncommon or rare on the forest and six other species are officially listed as In Need of Conservation, Threatened or Endangered in Maryland. Like many insects, butterflies are often associated with particular food plants.

Tiger beetles have also garnered the attention of researchers in recent years. In particular, one species of tiger beetle that is listed as State Endangered has been documented on SRSF near the recently completed St. Johns Rock ORV Trail. The original design of the trail directly impacted the known habitat of the beetle and was therefore rerouted to limit any effects on the population.

A large number of dragonflies and damselflies occur on SRSF, several of which are uncommon or rare species. Status evaluations are an ongoing process for this group and three species that are officially State listed occur on the Forest.

Aquatic, cave-adapted invertebrates are a unique collection of uncommon organisms found in SRSF. These eyeless and unpigmented creatures are most often found in caves but, occasionally, they are found at the heads of springs that are interconnected with the regional groundwater

aquifer. One species of cave-adapted crustacean, an amphipod, has been documented from the Savage River State Forest. It is currently listed as In Need of Conservation in Maryland. Furthermore, a troglobitic flatworm that is new to science and has yet to be formally described, was found at the same location as the amphipod. The diversity of other invertebrate groups is expected to be quite high on Savage River State Forest and more unusual species may be documented within the special habitats found here.

8.3 Nongame Birds

The variety of habitats supports numerous nongame bird species. Recently 119 species were documented as breeding on the forest and surrounding properties. Many of these species are migratory, breeding on the forest and then migrating south for the winter. Other migratory species utilize Savage River State Forest for feeding and nesting during migration, while others winter here and breed further north. Approximately 187 nongame bird species may occur on the forest at some time during the year. These species include marsh and wetland birds, raptors, songbirds and forest interior breeding birds.

8.3.1 Marsh and Wetland birds

A number of water associated nongame birds use the wetlands, open waters and stream habitats found within the state forest. These include loons, grebes, herons and sandpipers. They use the water and wetland habitats as feeding and resting areas during migration. Maintenance of appropriate habitat and good water quality are necessary to support these birds. Management efforts commensurate with watershed protection should adequately address the needs of this group.

8.3.2 Raptors

Raptors found on Savage River State Forest include hawks, owls and occasionally bald eagles and osprey. The northern raven functionally acts like a bird of prey and is included under this category of nongame birds. Many of these species nest in the forest, usually in mature stands. Ravens will nest on cliff sites as well as in large trees. Rare breeders include the northern goshawk and saw-whet owl. The goshawk is officially listed as Endangered in Maryland and efforts are being made to create suitable breeding habitat in order to attract the species back to traditional nesting sites. The saw-whet owl, one of the smallest owls native to North America, is associated with bogs and swamp habitats and tends to nest farther north, but will occasionally breed in Garrett County. The forest also supports populations of wintering raptors including red-tailed hawks, barred owls and sharp-shinned hawks.

8.3.3 Songbirds

Numerous species of songbirds occur in the forest throughout the year. As expected, the vast majority of species are associated with forest habitats. All forest types and size classes are utilized by songbirds, with certain species found only in certain types or size classes. Management strategies are as varied as the number of songbird species found on the forest. Given that some songbirds depend on early successional stages, while others need mature forests, a mix of size classes throughout the entire forest will be necessary to maintain a wide

diversity of species. Savage River State Forest is of particular importance to two groups of songbird species, namely forest interior birds and Garrett County endemic breeders.

8.3.4 Forest interior Breeding Birds

This group of species requires large contiguous tracts of forest to sustain viable breeding populations. Acreages in excess of 100 acres are considered desirable. In addition, many of these species prefer older forests with a closed canopy. A mixture of hardwood species is important for maintaining species diversity as it provides a myriad of habitat niches within one area. A greater diversity of forest interior breeders occurs where streams or wetlands are found within forested tracts. Forest interior species include many warblers, vireos, scarlet tanagers, pileated woodpeckers, Acadian flycatchers and whip-poor-wills. Two raptor species; red-shouldered hawks and barred owls, are also considered forest interior breeders. Permanent fragmentation of large, contiguous tracts and the overall loss of forestlands present the most serious problems for these species.

8.3.5 Garrett County Endemic Breeders

Garrett County supports several nongame bird species that breed nowhere else in the state. Most of these species are more common breeders farther north and are typically associated with boreal habitats. Remnants of these habitats are found in the Savage River State Forest that include bogs and spruce/hemlock forests. The breeding birds of concern are the alder flycatcher, olive-sided flycatcher, golden-crowed kinglet, blackburnian warbler, mourning warbler, Canada warbler, dark-eyed junco, purple finch, winter wren, northern goshawk, red-breasted nuthatch and Nashville warbler.

8.4 Non-Game Small Animals

Approximately thirty-two species of small mammals inhabit Savage River State Forest. These include shrews, bats, woodland mice, chipmunks, flying squirrels and porcupines (see Appendix E). As a group, habitat requirements and population status of these species are not well known. There are several species known to be quite common on the forest and considerable effort has been made to document some of the rare species that are expected to occur here. Forested rock bars and outcrops and unpolluted first and second order streams are primary habitats for the rarest species including the rock vole, long-tailed shrew and water shrew. Caves and abandoned mine shafts serve as bat hibernacula. The small-footed bat, a species recently listed as Endangered in Maryland, has been found in ridge-top rock outcrops within the forest. Porcupines have been documented in the state forest at the southern periphery of their range and are considered uncommon, but their numbers appear to be gradually increasing.

8.5 Reptiles

Approximately eighteen species of reptiles may occur in Savage River State Forest. While the population status for some of these secretive creatures is not well understood, it is generally

known which species are common and which are not. A state-wide Herp Atlas project that recently began will help provide needed distributional information. Reptiles use a variety of habitats throughout the forest. Beaver ponds, wetlands and streams are important for turtles and some snakes. Openings associated with wetlands, power lines and other disturbances attract a number of different snake species. Downed woody debris provides a favorite haunt for snakes and the occasional lizard. Rock outcroppings provide suitable habitat for a number of snakes, including timber rattlesnakes. The timber rattlesnake is a species of concern on the forest and their important habitat features such as over-wintering dens and rookery areas receive special protection. Only two species of lizard occur in Garrett County and one, the five lined skink, has been recorded on the forest.

8.6 Amphibians

Twenty-five species of amphibians may occur on the forest or on adjacent lands. Amphibians, as a group, are primarily associated with moist environments. These environments do not necessarily have to be permanent bodies of water. Vernal pools and wetlands provide ideal breeding habitats for some species, while springs, seeps and first order streams provide the appropriate habitat for others. Still several species survive in moist forested environments and do not have an aquatic stage. Permanent bodies of water that support fish populations are of less value to most amphibians. Protection of non-tidal wetlands, vernal pools and stream corridors is an essential element for maintaining the majority of these species in the forest. In contrast, woodland salamanders prefer old growth forest conditions.

Little is known about the population status of some species on the forest, but it is generally known which species are common and which are not.
Several state listed species are found in the forest including the hellbender, mountain chorus frog, Wehrle’s salamander and Jefferson salamander. The hellbender, listed as endangered, has been documented on a stream system that occurs on SRSF, but populations of this aquatic salamander have been restricted to sections of the stream that are not on the forest. The mountain chorus frog, also listed as Endangered in Maryland, has been documented on SRSF, but the species is rapidly declining and may have already disappeared from Garrett County. Wehrle’s salamander, State listed as In Need of Conservation and the Jefferson salamander, considered uncommon in Maryland, have both been documented on the forest. A recent state-wide herpetological atlas project will provide additional distributional data on this group allowing for management strategies to be implemented that target the habitat needs of specific species in an effort to maintain viable amphibian populations across the forest landscape.

8.7 Forest Game Birds and Mammals

Forest game birds and mammals include the following species: white-tailed deer, ruffed grouse, gray squirrels, fox squirrels, red squirrels, black bear wild turkey, coyote, as well as 12 species of furbearers. Due to the fact that 99% of the Savage River State Forest is classified as forestland, these species are common residents of the forest ecosystem. The following is a brief status report

for each individual species:

8.7.1 White-tailed Deer

White-tailed deer are a highly adaptive species and survive in nearly all forest types as well as in non-forest conditions. Regeneration and intermediate cuts produce abundant browse and herbage that deer feed on throughout the spring and summer months. Their home range seldom exceeds 300 acres where food, cover and water are interspersed (U.S. Dept. of Agriculture, 1974). During severe winter conditions, deer concentrate in "deer yards." These areas have been identified on the Savage River State Forest and will be incorporated into the habitat management units. Deer populations are stable and within carrying capacity on Savage River State Forest and adjacent private properties. The present effects of the gypsy moth defoliation and mortality may continue to increase deer habitat by producing cover and browse. However, the loss of oak sprouting and acorn mast may have negative effects on deer and other species populations over the long term. Savage River State Forest continues to be a favorite destination for deer hunters. In 2017-18 hunting season, 467 deer were reported harvested from Savage River State Forest, accounting for 8.7% of the total countywide harvest. Harvest numbers have remained steady over the last several years.

8.7.2 Ruffed Grouse

This game bird prospers in the early stages of forest succession, but uses mature stands as well. Grouse use fruit, seed, catkins, buds and green parts of over 300 plants for food. Broods require insects from late May through July. Thickets, vine tangles and dense shrub growth provide reproductive or drumming habitat and for escape cover. Nesting cover is usually open understories near drumming logs and openings or old logging roads that serve as brood range. Home range is 40-50 acres (U.S. Department of Agriculture, 1974). Ruffed grouse populations generally benefit from most silvicultural practices that encourage early successional stage forest habitat. They particularly benefit from regeneration harvests in even-aged stands. As with the white-tailed deer, the present effects of gypsy moth could have a positive impact on grouse habitats. Populations tend to be less cyclic in the Appalachian Region, which includes Potomac-Garrett State Forest. Loss of habitat to maturing forest has resulted in the decreased population and hunting success in western Maryland over the last few decades. Ruffed grouse populations have likely also declined on Potomac-Garrett State Forest.

Although the number of grouse hunters has declined in recent decades, Potomac-Garrett State Forest continues to be a primary destination for grouse hunters in Maryland. Garrett County has maintained the highest populations of grouse in the state. The continued harvest of timber provides the necessary regeneration for good grouse reproductive habitat. The high stem density that occurs 10-15 years after a regeneration harvest provides optimum habitat for grouse. This combined with grape thickets and good mast production found on PGSF provides important cover and food that allow grouse to persist and provides a popular hunting destination for grouse enthusiasts throughout the tri-state area.

As seen in a section refered to as important wildlife species…

Ruffed grouse **-** Ruffed Grouse inhabit the forested mountains of Garrett, Allegany, Washington, and Frederick Counties. Data suggest that the abundance and range of ruffed grouse in Maryland has declined since the mid-1980's. The rate of decline has been even more pronounced in the last 5 years. These trends parallel declines in other Mid-Atlantic States. Long-term declines are believed to be primarily due to early successional habitat loss via maturing forests, but research is currently underway to determine the impact of diseases such as West Nile Virus as well.

Grouse have been a traditional staple for Western Region upland game bird hunters for decades, but participation and success has declined in parallel with population trends. The DNR's most recent Hunter Mail Survey estimates that approximately 500-1000 hunters spend an average of 3 days afield and harvest fewer than 1 bird per hunter. In the 1980's, an average of 7,500 hunters pursued grouse with significantly higher success rates. Public land grouse hunting opportunities are limited to three state forests and wildlife management areas which support the vast majority of grouse hunting in Maryland. Hunter surveys show that approximately 80% of grouse hunts take place on public hunting areas.

8.7.3 Gray Squirrel

The gray squirrel inhabits hardwood and mixed coniferous-deciduous forests dominated by mast producing trees. Its abundance is dictated by seed crop productivity rather than by a specific plant community. Gray squirrels require partial hardwood stands with trees old enough to produce mast and provide dens. Habitats include tree species such as oak, hickory, beech, maple, poplar and walnut. The primary food source of the gray squirrel is hard mast - acorns, hickory nuts, beechnuts, walnuts, and hazelnuts (Merritt, 1987). Berries, soft mast, buds, seeds and fungi serve as supplemental food sources.

Since 85% of the Savage River State Forest is comprised of immature to mature hardwood forest, it presently provides excellent gray squirrel habitat. Any severe hardwood mortality resulting from gypsy moth defoliation will have a negative effect on gray squirrel populations. Conversion of the tree species complex on Savage River State Forest through harvest regeneration that favors maple and cherry over oak, or loss of oak species through gypsy moth defoliation, will result in poorer gray squirrel habitat over time. Gray squirrel numbers are heavily influenced by the amount and diversity of acorns that are produced in the forest.

8.7.4 Fox Squirrel

Like the gray squirrel, the fox squirrel resides in deciduous forests, characterized by an abundance of mast producing trees. Unlike gray squirrels, the fox squirrel prefers open woods or forest edges with a poorly developed understory. Small woodlots with park-like conditions adjacent to cultivated fields or orchards are favored habitats for the fox squirrel (Merritt, 1987). The fox squirrel is uncommon on the Savage River State Forest due to a lack of preferred habitat. Increasing the number and timing of intermediate timber harvests could improve and/or expand fox squirrel habitat.

8.7.5 Red Squirrel

Although the red squirrel reaches maximum abundance in mature, closed-canopy, coniferous

forests of white pine and hemlock, it can also be found in mixed forests and pure deciduous woodlots. In the mixed forests of Savage River State Forest, both the red and gray squirrels may co-exist, but in this situation, the red squirrel tends to be restricted to coniferous growth, while gray squirrels select deciduous areas in the same forest (Merritt, 1987). Due to the scattered stands of hemlock and pine plantations that exist on the Savage River State Forest, the red squirrel is locally common within these conifer stands.

8.7.6 Black Bear

Currently, Maryland has a resident, breeding black bear population in Garrett, Allegany, Washington, and Frederick counties. Bears are considered common throughout all of Garrett County and utilize all areas of Savage River State Forest. The prevailing characteristic of black bear habitat is forest cover interspersed with small clearings and early stages of forest succession (U.S. Department of Interior, 1987). Mixed stands of conifers and hardwoods supporting a dense, brushy understory in close proximity to wetlands represent optimal black bear habitat. The extent of forestland and variety of age classes, such as that found in Savage River State Forest provides excellent black bear habitat. A major management consideration is the large home ranges of bears as compared to other wildlife species that spend their entire lives within the boundaries of the forest. The annual home range size of female black bears is approximately 13 square miles and the annual home range size of male black bears may range to more than 50 square miles. Black bears are habitat generalists and will generally benefit from most common silvicultural practices.

8.7.7 Wild Turkey

Good turkey habitat contains mature stands of mixed hardwoods with relatively open understories, groups of conifers, scattered clearings and well-distributed water supplies. The home range for turkeys is typically one square mile. Turkey diets consist primarily of grass and weed seeds in the fall, mast and forage in winter and spring and forage and insects in the summer. Acorns, dogwood berries, clovers and pine seeds are preferred foods.

The Wildlife and Heritage Service along with partners like the Wild Turkey Federation have been working to ensure that Savage River State Forest offers premier wild turkey habitat. The lack of open land represents the greatest limiting factor in the development of optimum turkey habitat. Openings are essential to brood range (U.S. Department of Agriculture, 1974), but only 120 acres of the Savage River State Forest are maintained in permanent wildlife openings. An additional 415 acres of utility rights-of-way provide marginal turkey brood habitat. Some of this lack of open land area is compensated for by nearby openings on private lands. A cursory GIS exercise shows that there is some limited potential for brood habitat within the annual range of turkeys throughout the forest. The large wildlands areas are most lacking in available brood habitat. Converting reclaimed log landings to permanent herbaceous cover would improve brood habitat for turkeys in many areas of the state forest.

If large scale hardwood mortality occurs due to gypsy moth defoliation, this will have a negative effect on the wild turkey population, as would any habitat change that would reduce mast production. The long-term decline in oak species regeneration following harvest or gypsy moth

defoliation will also prove to be detrimental to turkey populations. Any management prescription intended to maintain healthy oak stands will benefit wild turkeys.

8.7.8 Coyote

Coyotes are associated with forested and upland or agricultural habitats with abundant prey. Coyotes are known to be an extremely adaptable species and can use practically any habitat type including those in close proximity to human activity and development. Optimum habitat occurs wherever prey species are most abundant. This may include brushy forested areas and the edge habitats where agriculture and forest come together. Although the coyote has no closed season for hunting, populations are high and likely growing throughout western Maryland.

8.8 Upland Game Birds and Mammals

For the purpose of the Savage River State Forest planning efforts, the following wildlife species are described as upland game: eastern cottontail, New England cottontail, snowshoe hare, American woodcock and mourning dove.

8.8.1 Eastern cottontail

The eastern cottontail resides in various habitats. Although no single plant community is preferred, optimal habitats include brushy areas with profuse herbaceous vegetation such as cut-over forests, thickets and agricultural areas. They are less numerous in dense forests with poorly-developed ground covers of herbaceous plants and in very open grassland (Merritt, 1987).
The eastern cottontail is not a common wildlife species to be found throughout Savage River State Forest because 85% of the forest is immature to mature forestland. It is probably locally common adjacent to the open land habitats that exist on the forest or in recently cut-over areas. Areas with severe gypsy moth mortality may provide a short term increase in eastern cottontail populations. There are a few sites on Savage River State Forest where there is potential to conduct more intensive management for this once popular game species. Most notable are the Margraff Plantation near Accident, the reclaimed strip mine site along Amish Road and the reclaimed dump site along West Shale Road. As preparation progresses toward operational strategies and specific work plans, more specific habitat alterations will be implemented in these areas to target early successional habitats for eastern cottontails.

8.8.2 New England Cottontail

The New England cottontail prefers dense forests, both coniferous and deciduous, that are generally found at higher elevations (Merritt, 1987). Chapman et. al., 1973, reported that the New England cottontail is not common to Maryland and their status is not clearly known. Chapman found no locations of New England cottontail in either Allegany or Washington County. However, in Garrett County, a small population was found in Savage River State Forest. This site was characterized as a northern hardwood forest, but contained large tracts of conifers, rhododendron and mountain laurel. Very little is known about the New England cottontail and virtually nothing has been developed in the way of management criteria (Chapman, et. al., 1978). It should be considered rare in the forest.

8.8.3 Snowshoe Hare

The snowshoe hare is indigenous to boreal forests throughout North America. In Pennsylvania, it is most common in mountainous sections in the northern part of the state where it inhabits high ridges marked by mountain laurel and rhododendron. Although suitable habitats are present in the Appalachian Plateau of southwestern Pennsylvania, the snowshoe hare is rare there (Merritt, 1987). There is historical data for snowshoe hare in Garrett County and Savage River State Forest, and a small remnant population may exist. There is no current documentation or survey data to indicate a surviving population, though some attempt at reintroduction was made in the 1970's. The snowshoe hare is still listed as a game species in Maryland with a closed season.

8.8.4 American Woodcock

The American woodcock is a migratory game bird wintering in the warmer southeastern Atlantic and Gulf Coast states and breeds primarily in the northern Midwest and northeastern states (Sanderson, 1987). The breeding range overlaps much of the winter range with Maryland near the southern limit of the breeding range. During the breeding season, woodcock become fairly common in the Appalachian Mountain region of Maryland including Savage River State Forest. Woodcock habitat in Maryland is generally associated with the early stages of forest succession, thickets or open stages of shrubs and small trees adjacent to damp or wet areas. Woodcock prefer areas with little or no vegetation covering the ground (Sanderson, 1977).

Although woodcock continue to exist statewide, total population numbers, as estimated by the United States Fish and Wildlife Service, have shown a decline in breeding density since the early 1970s (Bortner, 1990).

Some habitat does exist for American woodcock in Savage River State Forest, but it is only a small percentage of the total forest, given that the majority of the forest exists as immature to mature stands. Any silvicultural efforts creating early successional stage habitats near wetlands or moist soil and flood plains would benefit woodcock populations.

8.8.5 Mourning Dove

The mourning dove is a migratory game bird common throughout Maryland's agricultural areas. They use hedgerows, wood margins, woodlots and residential areas as nesting and rearing sites. Food for adult doves consists of seeds of most weeds and waste grains from corn and wheat fields as well some insects during the summer. Due to its habitat requirement, the mourning dove is not a common resident of Savage River State Forest. Low populations may exist adjacent to open land habitats or on private agricultural lands in close proximity to the forest.

8.9 Waterfowl

Aquatic habitats located within and surrounding Savage River State Forest support several species of waterfowl. Open water areas include the Savage River Reservoir, New Germany Lake, as well as several swamps. Numerous species of waterfowl use the aquatic habitat of the Savage

River State Forest for nesting, foraging and as stopovers during migration. Ducks, geese and swans have been observed sporadically throughout these habitats.

Wood ducks and mallards are the most common resident species. Wood ducks nest in tree cavities and man-made structures along wooded shorelines and upland areas. Young birds feed exclusively on animal matter, including aquatic and terrestrial insects. As the birds mature, their diet shifts to vegetable matter, primarily acorns and other forms of hard and soft mast. Mallards nest in marshy areas and along protected shorelines using cattails, grassy areas and fallen logs for cover. Mallards are highly adaptive feeders that use numerous native and agricultural foods. Native plant materials include wild millets, grasses, smartweeds and rushes. Agricultural foods consist of numerous types of waste grain including corn, wheat, barley and oats.

Several species including black ducks, hooded mergansers and Canada geese may occasionally nest in Savage River State Forest (Win. Harvey, per comm.). Black ducks nest in a variety of habitats, but are dependent on dense ground cover. Hooded mergansers, like wood ducks, are cavity nesters and utilize similar habitats. A breeding flock of resident Canada geese exists on adjacent private property and breeding activity appears to be isolated from the state forest, but periodic use of the area is expected.

Current management of waterfowl in the Savage River State Forest is limited to the placement and maintenance of wood duck nesting boxes. Management commensurate with watershed protection should adequately address the needs of this group.

8.10 Aquatic & Semi-Aquatic Furbearers

Aquatic & semi-aquatic furbearers on the state forest include beaver, muskrat, mink and river otter. This group, though taxonomically diverse, are commonly dependent upon aquatic habitats. Historical management strategies have centered on habitat protection and regulated trapping for recreational and economic opportunities.

8.10.1 Beaver

The beaver is America's largest rodent, which is known for its valuable fur. Unregulated trapping during the nineteenth century significantly reduced beaver populations. Aided by modern wildlife management and its own prolific breeding habits, the beaver has successfully repopulated much of its former range.

Beavers are found throughout Western Maryland and are highly concentrated in the remote sections of Savage River State Forest. They are dependent upon plentiful, constant sources of water with nearby woody vegetation. They quickly modify their environment using rocks, sticks and mud to build dams and protective lodges. Entirely vegetarian, they prefer soft plant foods including grasses, ferns, stems and leaves of aquatic and terrestrial plants. They also eat the bark, twigs and buds of aspen, maple, willow, birch, alder and cherry trees.

8.10.2 Muskrat

Muskrats live on or near still or slow moving water of ponds, marshes, streams, rivers and to a lesser extent, faster mountain streams. They build lodges of vegetation or burrow into stream banks and dams. Both lodges and burrows have underwater entrances. Muskrats feed primarily on the roots and stems of aquatic plants, including cattails and bulrushes, as well as a small amount of animal protein, such as crayfish, fish and mussels. Exhibiting high reproductive rates, mature females may produce two to four litters per year. Muskrat habitat in the forest appears to be sub-optimal and as a result, population levels range from low to moderate.

8.10.3 Mink

The mink is a semi-aquatic member of the weasel family that can be found in Savage River State Forest. Mink live at the edge of lakes, streams and rivers in forested areas. Studies indicate an individual mink requires approximately three miles of stream and riverbank habitat. They hunt along the riparian areas and dive to locate aquatic animals. Prey includes muskrats, mice, birds, rabbits, shrews, fish, frogs, crayfish, insects, snakes and waterfowl. Due to the shy, secretive nature of minks, little is known about the population on Savage River State Forest.

8.10.4 River Otter

The presence of river otters in Garrett and Allegany counties is the result of a reintroduction program that took place throughout the 1990s. River otters are now considered common throughout Garrett County and Savage River State Forest. River otters are semi-aquatic and utilize healthy wetland systems, ranging from trout streams to beaver ponds and marshes. River otters feed predominantly on fish, but will also consume crustaceans, mollusks, amphibians, reptiles and other small animals when locally abundant.

8.11 Upland Fur Bearers

8.11.1 Striped Skunk, Raccoon and Opossum

Due to the generalized habitat requirements, omnivorous and opportunistic food habits and adaptability to human encroachment, these species are generally abundant throughout Savage River State Forest. In spring and summer months, all three species prefer to reside near streams, spring seeps, ponds and edges to seek aquatic prey, but can be found utilizing a wide range of habitat types including rock outcrops and snags.

8.11.2 Spotted Skunk

Garrett County is near the northeastern limit of the spotted skunk in North American and sightings only occasionally occur in Maryland. The eastern spotted skunk resides in oak forests mixed with hickory, locust and pine marked by dense tangles of wild grape. Although this species has not been documented to date, the preferred habitat type exists in Savage River State Forest which may be occupied by the skunk in the future.

8.11.3 Red Fox

The red fox is associated with brushy early successional areas such as old fields, pasture borders and rolling farmland, usually close to water. Some of these habitat types occur on private inholdings (power lines, gas wells, etc.) in Savage River State Forest with a few are found on the forest. Due to the limited acreage of preferred habitat, the red fox is present in small numbers.

8.11.4 Gray Fox

The gray fox is closely affiliated with hardwood forest typified by rock terrain and abundant, brushy cover. Its feeding habits are similar to the red fox with rabbits, mice, rats and other wild mammals contributing up to 75% of its diet. Other food items vary according to seasonal availability. As most of Savage River State Forest provides this type of habitat, the gray fox is generally common and well distributed throughout the forest.

8.11.5 Fisher

The fisher is associated with large tracts of mixed hardwood and coniferous forests. It dens in hollow trees or logs, in abandoned animal dens or under large boulders. Fisher populations have been growing throughout the county and can be found throughout Savage River State Forest. Fishers were reintroduced to West Virginia and Pennsylvania and have expanded throughout western Maryland from these relocations. Trappers from throughout the state travel to Garrett County and Savage River State Forest for an opportunity to catch fishers. Maintaining a variety of habitat types within a forest ecosystem will ensure quality habitat for fishers.

8.11.6 Long-tailed Weasel

The long-tailed weasel utilizes a variety of habitats including woodlands, marshland, intermittent grassland, and rocky outcrops. It is highly carnivorous and shows a preference for small animals, which make up 95% of its diet. Although population status has not been determined, wildlife biologists believe it to be common and well-distributed throughout Savage River State Forest.

8.11.7 Bobcat

Optimal bobcat habitat is woodland interrupted by brushy thickets, old fields and rocky outcrops. Interspersed openings including swamps, bogs, clearcuts and other early successional sites are key components of preferred bobcat habitat. A bobcat population study conducted in 1986-87 by the DNR indicated that this feline will use all habitat types in Savage River State Forest. Sightings have been documented throughout forest. Beginning in May 2018, personnel from the University of Delaware will be conducting research that will provide baseline data about the current abundance and population dynamics of bobcats within the forest. Hair snares, camera traps and scat transects will be employed to determine the density of the reclusive felines.

8.12 Management Objectives and Strategies

The DNR commonly regulates and manages wildlife in broad categories based on the habitats that they prefer. Game species, as mentioned, include forest game such as white-tailed deer, black bears, gray and fox squirrels, ruffed grouse and wild turkeys; upland species such as eastern cottontail, American woodcock and mourning dove; and wetland species such as aquatic furbearers and waterfowl. Habitats for these groups of species can be managed to provide all the requirements of the group. Though some species have very specific habitat requirements, many of the species will use similar habitat components that are beneficial for the group. The objectives and strategies listed will provide both the specific and general habitat requirements of the species within the groups.

8.12.1 Forest Game Species

Objective 1: Create and maintain 20% of manageable area in early successional forest habitat.

Strategies:

- Regularly use silvicultural forest management practices, either commercial or non-commercial, to maintain early succession forest habitat.
- Target regeneration of aspen stands and maintain them in the sapling stage by cutting and regenerating pole size trees to promote root sprouts.
- Focus early succession habitat maintenance along edges of fields, permanent wildlife openings, powerline rights-of-way and road edges.

Objective 2: Maintain diverse age classes and species across the forest that provides habitat for a variety of wildlife species.

Strategies:

- Use Best Management Practices to maintain forest cover and protect soils from erosion on steeper slopes.
- Use BMP’s and appropriate silviculture techniques to maintain various age classes of forest habitat from seedling-sapling to older forest.

Objective 3: To manage older forest habitat for long term wildlife food production and promote acorns and other hard mast production.

Strategies:

- Complete comprehensive and detailed forest inventory and maintain a significant oak component throughout the forest.
- Conduct timber harvest and site preparation to focus on improving the oak component and ensuring oak regeneration in future stands.
- Conduct crop tree management to improve oak survival and improve hard and soft mast production throughout. This will also improve understory regeneration, cover, and vertical structure beneficial for a variety of forest wildlife species.

Objective 4: Maintain and protect the spring seeps, drainages and water quality for invertebrates as well as to provide winter habitat for turkeys and other

species that will benefit from the springs in the area.

Strategies:

- Delineate and maintain adequate buffers along all springs and drainages to protect their ecological integrity.
- Utilize Best Management Practices for forest harvest operations.
- Seek opportunities to acquire property, easements, or work with landowners and municipalities to prevent watershed degradation.
- Monitor water quality conditions, invertebrate populations and threats, and adjust plans as necessary.

8.12.2 Upland Habitat

Objective 1: Create and maintain upland and early successional habitat.

Strategies:

- Maintain the open herbaceous cover and crops beneficial to wildlife. A variety of crops should be used to benefit different species of wildlife at different times of the year. Perennial grass and clover plantings should be a priority to provide soil stabilization, forage, and game bird brood habitats. Plantings should include annual grains that will remain available in winter and stand up under snow.
- Throughout spring and summer, mow and maintain strips of herbaceous cover at less than 6-8 inches in height. Mowing will begin prior to nesting season and be maintained throughout summer to provide breeding habitat for Eastern cottontails.
- Maintain warm season grasses for Eastern cottontail nesting and escape cover and wildlife habitat demonstration.
- Continually monitor and maintain early succession edge habitat around field edges.
- Rotational mowing.
- Maintain and expand aspen and hawthorn thickets by releasing and regenerating as necessary.
- Regularly use forest management practices, either commercial or non-commercial, to maintain early succession forest habitat at field edges.
- Complete routine annual assessments of plantings and available cover crops and adjust annual work plans accordingly.
- Monitor and coordinate habitat programs with the Appalachian Mountain Woodcock Initiative.
- Consider management actions to enhance habitat for nesting Golden-winged Warbler.

Objective 2: Maintain upland field edge habitat and orchards.

Strategies:

- Release and prune apple trees to encourage fruit production.
- Maintain “soft” field edges by cutting back field edges 50-75 feet.
- Continue to rotationally plant and mow herbaceous openings.
- Evaluate plantings and edge effects and adjust plans as necessary.
- Consider management actions to enhance habitat for nesting Golden winged Warbler.

8.12.3 Habitat Management Units

In order to address more specific habitat needs of various wildlife species on Savage River State Forest further planning will be done. Habitat Management Units (HMU) will be delineated to facilitate more specific habitat goals and objectives. Habitat unit plans will address management needs to improve or maintain desired conditions for individual species or groups of species that are targeted within each HMU. A detailed inventory of current habitat conditions and potential management opportunities will need to be completed to prepare more specific habitat recommendations.

Objective 1: Develop area specific wildlife habitat plans for the State Forest to guide management and showcase wildlife best management practices (BMP).

Strategies:

- Complete inventory and analysis of State Forest Compartments and develop ecological habitat management units (HMU).
- Develop HMU specific habitat goals and plans to target desired habitat conditions with specific guidelines for species composition, age class and permanent wildlife openings.

8.12.4 Recreation Objective

Objective 1: Provide quality access for wildlife dependent recreation.

Strategies:

- Conduct regular maintenance to roadways, parking areas and signboards.
- Seek critical maintenance funding when available.
- Coordinate with Engineering and Construction for road maintenance specifications.
- Limit motorized access to the period of highest user demand.

8.13 Rare, Threatened, and Endangered Wildlife Species

See Appendix E

8.14 Populations Estimates

See Appendix E

8.15 Fisheries Resources

Introduction

The Savage River Watershed supports native reproducing brook trout (*Salvelinus fontinalis)* populations as evidenced by the presence of multiple year-classes of wild trout. Brook trout populations are also found within the Youghiogheny River drainage of the Savage River State Forest. The brook trout is listed as a "Species of Greatest Need of Conservation" in the Maryland Department of Natural Resources' Wildlife Diversity Conservation Plan.

The fish species assemblage found in the Savage River and Youghiogheny River watersheds are considered coldwater/coolwater communities (Tables 8.15.1 and 8.15.2). The Savage River downstream of the Savage River Reservoir is a coldwater-release tailwater supporting a high quality wild trout fishery as well as associated coldwater stream fish species (Table 8.15.3). The Savage River Reservoir is considered a "two-story" fishery, supporting both coldwater and warmwater fish species (Table 8.15.4).

A Savage River Watershed native brook trout.
Photo by Andrew Miller

8.15.1 Savage River Watershed streams and rivers.

The Savage River watershed upstream of the Savage River Reservoir is Maryland's only un-

fragmented brook trout resource, consisting of 16 named streams and numerous unnamed tributaries, comprising over 120 miles of interconnected streams. The Savage River system accounts for 25% of all brook trout stream miles statewide, supports the highest densities statewide, and is located in the mountainous portion of Maryland that is predicted to be least affected by global warming. The majority of stream lengths are on public land within the Savage River State Forest. Because of the unique nature and value of this resource, and the increasing pressures on the watershed surrounding this resource (particularly the headwater streams), a specific management plan to conserve and restore this resource is being worked on as outlined in the Maryland Department of Natural Resources' *2006 Maryland Brook Trout Fisheries Management Plan*. State acquisition of private lands in the watershed is an important measure for long-term protection and enhancement of fisheries resources. In order to protect and enhance the brook trout population, a special trout management area was established in 2007.

Upper Savage River Watershed Fisheries Management - Brook Trout Zero Creel Limit Area. Brook trout populations have declined across the eastern seaboard, and Maryland populations are no exception. The Savage River watershed above the dam is the last remaining stronghold of well-connected streams with strong brook trout populations in Maryland. However, even these brook trout populations were declining based on population surveys, and both numbers and sizes of adults were depressed near easy access areas. The trend of declining populations prompted the Fishing and Boating Service to implement regulations designed to protect brook trout in the Savage River watershed before their populations reach a point of deterministic decline. Regulations were implemented in which only artificial lures could be used to fish for brook trout in waters above the Savage River Reservoir (except the mainstem Put and Take Trout Fishing Area), and brook trout could not be harvested. A long-term assessment program in was initiated in 2006 to determine: 1) if the ease of angler access has an influence on brook trout population characteristics; and 2) if the new no-kill regulations increase the numbers of adult brook trout as well as increase the numbers of large (> 8 inches) brook trout in the population. The brook trout population has responded to the new regulations with increased number to brook trout in the population as well as increased numbers of fish exceeding eight inches throughout the watershed. The Brook Trout Zero Creel Limit Fishing Area within the Savage River State Forest has become a fishing destination for Maryland's resident and visiting anglers.

A happy angler with a gorgeous brook trout caught in the
Savage River State Forest's Brook Trout Zero Creel Limit Fishing Area.
Photo courtesy of Andrew Miller

Specific fishing regulations are as follows:

A Zero Creel and Possession Limit for brook trout has been established in this area whereas regulations apply to the mainstem Savage River upstream of Poplar Lick and tributaries, and to all tributaries of the Savage River Reservoir upstream of the Savage River Dam.

Harvest of brook trout is prohibited. Harvest of brown and rainbow trout is allowed under general statewide regulations (2 trout per day in aggregate/4 trout possession limit).

Angling can be done only with artificial lures (including artificial flies). Possession of any bait is prohibited.

Open season: January 1 through December 31, inclusive.

Upper Savage River Put and Take Trout Fishing Area.

A five-mile portion of the mainstem Savage River from the Savage River Reservoir upstream to the confluence with Poplar Lick is managed as a special Put and Take Trout Fishing Area, where about 7,450 adult rainbow trout are stocked on an annual basis in the spring and an additional 500 rainbow trout in the fall.

Fishing regulations include:

5 trout daily creel limit/10 trout possession limit.

No minimum size.

No bait restriction.

Fishing season is subject to the #2 Closure Period during the last week in March.

Savage River Trophy Trout Areas.
The Savage River Tailwater is a 4.5 mile reach of the Savage River between the Savage River Reservoir Dam and its confluence with the North Branch Potomac River. The Savage River Tailwater supports at least eight fish species (Table 8.14.3). The trout fishery is managed under Trophy Trout regulations implemented in January 1987 and further modified in 1991. The current regulation strategy includes a Fly-fishing Only Trophy Trout Management Area located in the section of the river from the Savage River Reservoir downstream approximately 1.3 miles to the Allegany Bridge. A Trophy Trout Management Area, restricted to the use of single hook artificial lures or flies, is located between the Allegany Bridge and the mouth of the river, a distance of 3.2 miles.

Additional regulations for both Trophy Trout Management Areas include:

Open season: January 1 through December 31, inclusive.

A 12 inch minimum size limit for brook, an 18 inch minimum size limit for brown trout and a 2 trout daily creel/4 trout possession limit. There is no minimum size limit on rainbow trout in either area. The stocking of hatchery rainbow trout in the river was discontinued after 1990.

Today the Savage River Tailwater area is arguably one of the premier wild trout fisheries in the Eastern US, wild adult trout densities exceeding 1,000 trout per mile in a scenic forested setting.

A trophy wild brown trout from the Savage River Trophy Trout Fishing Area.
Photo by Alan Klotz

8.15.2 Savage River Reservoir.
The Savage River Reservoir is a 350 acre, 150 feet deep, impoundment on the Savage River

located within the Savage River State Forest. The watershed upstream of the dam is about 105 square miles, mostly within the Savage River State Forest. The Savage River Reservoir, operated by the Upper Potomac River Commission, was completed in 1952 for flood control and domestic water supply. The Savage River Reservoir is a popular fishing destination, and public access is allowed around the entire shoreline, except along the dam and spillway. Public boat launches are located at Big Run State Park, Dry Run, and near the dam. Boats are limited to electric motors. The Savage River Reservoir supports at least eighteen fish species including warmwater, coolwater, and coldwater fish species (Table 8.14.4). Warmwater game fish and panfish are managed under Maryland's statewide regulations and trout are managed under Put and Take regulations as described in the Maryland Guide to Fishing and Crabbing. The lake was completely drained in the winter of 2009 – 2010 in order to complete necessary dam repairs. Many of the fish species re-colonized or were stocked into the reservoir starting in 2010, and a recreational fishery has been re-established. About 3,450 adult rainbow trout are stocked in the reservoir each spring. Also, about 50,000 walleye fry are stocked in the reservoir each spring to supplement the fishery.

Savage River Reservoir smallmouth bass.
Photo by Alan Klotz

18.15.3 Youghiogheny River Watershed Streams.

The Casselman River watershed was historically a high-quality brook trout fishery, originating in the northern half of Garrett County, Maryland, and flowing north into Pennsylvania. However, the legacy of land use within the watershed is one of coal mining and mixed agricultural practices. This legacy has led to problems such as sedimentation, increased water temperatures, and acid mine drainage (AMD). These problems persist today and have subsequently reduced the amount of quality brook trout habitat present in the watershed. Likewise, brook trout populations exist in only a fraction of their historic distributions. The Maryland Department of natural Resources' *2006 Maryland Brook Trout Fisheries Management Plan* has an overall goal to restore and maintain healthy brook trout populations. The Casselman River Watershed has

restoration potential to realistically achieve this goal.

In 2007, the Youghiogheny River Watershed Association was awarded a grant by the Chesapeake Bay Trust to investigate and prioritize sub-watersheds within the Casselman River Watershed for potential AMD remediation and brook trout restoration. The Canaan Valley Institute worked collaboratively with Maryland Department of the Environment – Abandoned Mine Lands Division and Maryland Department of Natural Resources Fishing and Boating Service to complete these tasks. These agencies proposed to address the acid mine drainage and acid deposition problems in the Casselman River Watershed using passive acid neutralization technologies with low operation and maintenance requirements at targeted high priority sites within the watershed on within the Savage River State Forest. The treatment systems of limestone sand dumps and limestone leach beds were designed to address Total Maximum Daily Load impairments for low pH. These systems add critical alkalinity to low buffered and acidified streams, eliminate the impact of acid loading, and raise the ambient pH in the impaired tributaries. The long-term goal is to remove the Casselman River Watershed from the Maryland 303(d) list for pH impairment and restore the population of native brook trout to the affected areas of the watershed. Water quality improvements with respect to increased pH and alkalinity in the Casselman River Watershed have been documented by the Maryland Department of the Environment. As a result in these water quality improvements, brook trout populations have responded favorably by showing increases in total numbers of adult trout, standing crops, and reproductive success. The installation of the limestone leech beds and limestone sand dump sites in the headwaters of these streams appear to have strengthened existing brook trout populations, as well as increase the total stream miles suitable for brook trout survival. Additionally, an improvement in the Casselman River Watershed's brook trout population has created additional recreational opportunities for anglers. Brook trout population increases have been documented in Spiker Run, Big Laurel Run, Little Laurel Run, and the South Branch of the Casselman River within the Savage River State Forest. Several streams including Tarkiln Run, Alexander Run, and the upper reaches of Big Laurel Run were fishless prior to the water quality improvement project. Recent fish population surveys now show these streams support naturally reproducing brook trout populations.

Puzzley Run and Bucks Run are within the White Creek sub-basin of the Youghiogheny River Watershed and support high quality brook trout populations within the Savage River State Forest. Bear Creek and Little Bear Creek, direct tributaries to the Youghiogheny River, support naturally reproducing brook trout populations as well as other native coldwater stream fish species within the Savage River State Forest.

All the streams within the Youghiogheny River basin of the Savage River State Forest are managed under statewide trout fishing regulations. Trout fishing regulations include:

Open season: January 1 through December 31, inclusive.
Two trout daily creel limit and a four trout possession limit.
No minimum size restriction.
No bait restriction.

Native brook trout from Little Bear Creek within the Savage River State Forest.
Photo by Alan Klotz

18.15.4 Fish Population Monitoring

Fish populations will be monitored within the Savage River State Forest to ensure healthy, robust populations continue to exist for Maryland's citizens and visitors to enjoy.

Specifically, the following management areas will have scheduled fish population surveys:

Brook Trout Zero Creel Limit streams will have selected study streams surveyed on an annual basis and remaining streams surveyed once every five years.
Savage River Trophy Trout Fishing Area, a station within the Fly Only Area and a station within the Artificial Lure and Fly Area will be surveyed annually.
Casselman River tributary streams that are being remediated to improve pH will be surveyed biannually.
The Savage River Reservoir will be surveyed once every five years.

All reports on the surveys' results will be available to the Savage River State Forest Manager.

Electrofishing survey in the Savage River for trout population monitoring studies.
Photo by Alan Klotz

Table 8.15.1. A list of common and scientific names of fish species collected in the Savage River Watershed within the Savage River State Forest, 2019.

Common Name	**Scientific Name**
central stoneroller	*Campostoma anomalum*
rosyside dace	*Clinostomus funduloides*
cutlips minnow	*Exoglossum maxillingua*
common shiner	*Luxilus cornutus*
river chub	*Nocomis micropogon*
blacknose dace	*Rhinichthys atratulus*

longnose dace	*Rhinichthys cataractae*
creek chub	*Semotilus atromaculatus*
white sucker	*Catostomus commersoni*
northern hog sucker	*Hypentelium nigricans*
yellow bullhead	*Ameiurus natalis*
margined madtom	*Noturus insignis*
rainbow trout	*Oncorhynchus mykiss*
brown trout	*Salmo trutta*
brook trout	*Salvelinus fontinalis*
Potomac sculpin	*Cottus girardi*
Blue Ridge sculpin	*Cottus caeruleomentum*
rock bass	*Ambloplites rupestris*
pumpkinseed	*Lepomis gibbosus*
smallmouth bass	*Micropterus dolomieu*
fantail darter	*Etheostoma flabellare*
yellow perch	*Perca flavescens*
Total species = 22	

Table 8.15.2. A list of common and scientific names of fish species collected in Youghiogheny River Watershed streams within the Savage River State Forest, 2019.

Common Name	**Scientific Name**
central stoneroller	*Campostoma anomalum*
striped shiner	*Luxilus chrysocecephalus*

common shiner	*Luxilus cornutus*
river chub	*Nocomis micropogon*
creek chub	*Semotilus atromaculatus*
western blacknose dace	*Rhinichthys obtusus*
longnose dace	*Rhinichthys cataractae*
white sucker	*Catostomus commersoni*
northern hog sucker	*Hypentelium nigricans*
brook trout	*Salvelinus fontinalis*
mottled sculpin	*Cottus bairdi*
rock bass	*Ambloplites rupestris*
pumpkinseed	*Lepomis gibbosus*
bluegill	*Lepomis macrochirus*
smallmouth bass	*Micropterus dolomieu*
fantail darter	*Etheostoma flabellare*
tessellated darter	*Etheostoma olmstedi*
Total species = 17	

Table 8.14.3. A list of common and scientific names of fish species collected in the Savage River Tailwater, 2019.

Common Name	**Scientific Name**
blacknose dace	*Rhinichthys atratulus*
longnose dace	*Rhinichthys cataractae*
white sucker	*Catostomus commersoni*
rainbow trout	*Oncorhynchus mykiss*
brown trout	*Salmo trutta*
brook trout	*Salvelinus fontinalis*
Potomac sculpin	*Cottus girardi*
blue ridge sculpin	*Cottus caeruleomentum*
Total species = 8	

Table 8.15.4. A list of common and scientific names of fish species collected in Savage River Reservoir, 2019.

Common name	**Scientific name**
golden shiner	*Notemigonus crysoleucas*
swallowtail shiner	*Notropis procne*
bluntnose minnow	*Pimephales notatus*
white sucker	*Catostomus commersoni*
yellow bullhead	*Ameiurus natalis*
brown bullhead	*Ameiurus nebulosus*
rainbow trout	*Oncorhynchus mykiss*
brook trout	*Salvelinus fontinalis*
rock bass	*Ambloplites rupestris*
redbreast sunfish	*Lepomis auritus*
green sunfish	*Lepomis cyanellus*
pumpkinseed	*Lepomis gibbosus*
bluegill	*Lepomis macrochirus*
smallmouth bass	*Micropterus dolomieu*
largemouth bass	*Micropterus salmoides*
black crappie	*Pomoxis nigromaculatus*
yellow perch	*Perca flavescens*
walleye	*Sander vitreus*
Total species = 18	

Chapter 9 - Public Use and Education

9.1 Background

Savage River State Forest is an integral component of a larger greenway system that connects other public and private forests and state parks. These sites, in addition to their natural, cultural and historic values, provide a variety of recreational opportunities. Decisions affecting public uses, i.e. recreational opportunities, on Savage River State Forest are integrated into management decisions that are consistent with the following resource goal as stated in Chapter 1: *"Provide opportunities for the enjoyment of the natural resources on the Forest by making appropriate areas available for resource-based, low impact recreational activities and environmental education programs that are consistent with the resource values of the Forest."*

9.2 Current and Future Public Uses

The demands for outdoor recreation, both nationwide and locally, indicate that activities such as hiking, horseback riding, wildlife viewing, hunting, fishing, off-road vehicle use, canoeing and kayaking continue to be popular. The public's pursuit of these activities continues to play a major role in Maryland's economic growth and the expansion of the local tourism industry. Therefore, all future public use proposals will be evaluated based on the resource goal stated above to determine their compatibility with:

- The implementation of sustainable forest management;
- The conservation of wildlife;
- The conservation of plant and animal habitats and other sensitive areas;
- The maintenance of water quality; and
- The protection of cultural resources.

The primary types of public use to be encouraged on the Savage River State Forest include activities such as hunting, trapping, fishing, hiking, birding, nature/wildlife observation, environmental education and access for canoeing and kayaking. In select cases, minimal development may be undertaken to provide and maintain mountain bike trails, hiking trails, horseback riding trails and disabled hunter access trails.

9.2.1 Hunting, Trapping and Fishing

Hunting has traditionally been the most common form of outdoor recreation on Savage River State Forest, which continues to be one of the most used public lands for both local and visiting hunters in Maryland. White-tailed deer is the most popular species hunted on Savage River State Forest. During the 2017-2018 hunting seasons, 307 antlered deer and 160 antlerless deer were harvested on Savage River State Forest.

Along with the positive recreational benefits and population management that deer hunting provides, it also provides significant economic benefits to Maryland. A survey conducted by the U.S. Fish and Wildlife Service in 2011 found that deer hunting generated over $221 million annually for the Maryland economy, which included retail sales plus multiplier effect. Deer hunting in Maryland supports nearly 2,400 jobs and generates $69 million in salaries, wages and business owner's income, $17.5 million in state and local tax revenue, and $19 million in federal tax revenue. It is anticipated that the demand for hunting forest game will continue and likely escalate as less private land is available to hunters.

Wildlife populations must be managed to ensure a healthy forest. Therefore, public hunting and trapping opportunities will be provided for public enjoyment, while at the same time limiting population growth of game species and ensuring the protection of wildlife habitats throughout the forest. With approximately 96% of the managed land area being comprised of forestland, the forest game group of wildlife species is common throughout, giving outdoor enthusiasts sufficient opportunities to engage in a variety of hunting pursuits. This plan attempts to identify the proper combination of hunting along with other appropriate recreational uses to accommodate a broad spectrum of stakeholders.

Upland game birds and mammals are not as widespread as the forest dwelling species, but do provide limited hunting opportunities. Small populations of eastern cottontail rabbit, mourning dove, and American woodcock can be found in recently cutover areas, open land habitats that exist on the forest, or near private agricultural lands adjacent to the forest.

Aquatic habitats located within and surrounding the forest support several species of waterfowl. Open waters include the Savage River and Savage River Reservoir, its tributaries and several swamps and bogs. Wood ducks and mallards are the most common species.

Hunting with rifles, handguns, shotguns, bows and muzzleloaders is permitted in all designated areas of the state forests in accordance with state and federal laws. Possession or use of weapons is prohibited outside of regular hunting seasons. Target shooting is prohibited except at the rifle range. Only game birds and game mammals with open seasons may be hunted. Tree stands or blinds are limited to those of a temporary nature, which must be removed or dismantled at the end of each day. The hunting seasons in state forests conform to standard hunting seasons adopted by state and federal regulations.

A rifle range, located on New Germany Road, provides opportunity to target practice and for sighting in firearms throughout the year. The range is open daily from sunrise to sunset and requires a service charge that can be paid via an honor box located on the site. Annual passes are available for individuals and families and can obtained at the forest headquarters.

9.2.2 Hiking, Biking, Horseback Riding, Nature Observation, Camping and Off Road Vehicles

Although hunting is the most popular activity, there is an extensive road and trail system on the Savage River State Forest that offers ample opportunities for hiking, biking, horseback riding, nature observation, camping and ORV usage.

9.2.3 Savage River State Forest Trail System

The trail system on Savage River State Forest is part of Maryland's effort to provide visitors an unparalleled outdoor experience. All new trail system proposals as well as maintenance work will be submitted and reviewed through the Annual Work Plan process. When necessary, funding provided through the National Recreation Trail Grant program will be utilized to improve the existing network of trails throughout Savage River Forest.

The following is an inventory of existing trails that may be hiked, biked or backpacked within Savage River State Forest. The trails that may be accessed by ORV use have a special statement in each description. Also, stated in the description is the trail length, degree of difficulty and unique features associated with each trail.

Meadow Mountain Trail 12 miles - moderate
Originally created for fire control, this rocky trail fluctuates in elevation. The 4-mile trail section near I-68, also known as East Shale Road, is open for off-road vehicle (ORV) use. The remaining 8-miles, southwest of New Germany Road, is closed to off-road vehicles, except for snowmobiles. This portion of the trail generally follows the crest of Meadow Mountain and provides an excellent eastward view at the Meadow Mountain Overlook.

Monroe Run Trail 4.2 miles - moderate
Crumbling bridge abutments are the only remaining evidence that this scenic trail was formerly a connection road built by the Civilian Conservation Corps (CCC) during the 1930s. There are plenty of chances to cool your feet along this trail, which has frequent stream crossings and no bridges. The trail ends near the Savage River Reservoir in Big Run State Park. To avoid an arduous uphill trek at the end of the outing, begin at the trailhead on New Germany Road. This trail is open to foot traffic only.

Negro Mountain Trail 8 miles - difficult
Stream crossings and uneven terrain make this trail challenging for hikers and mountain bikers. Winter sports lovers can enjoy adventurous snowmobiling on this trail.

Big Savage Trail 17 miles - difficult
This popular backpacking trail meanders through upland forests of oak and hickory, old farmsteads planted in pine and rocky terrain blanketed by wild azalea and rhododendron. At High Rock, the remnants of an old lookout cabin can be seen near the 90-foot tall fire tower. Before beginning your excursion, please plan ahead and pack plenty of water as there are few reliable water sources on or near this trail. This trail is open to foot traffic only.

Margraff Trails 7.5 miles - moderate
A series of gravel road circuits provide less technical hiking and mountain biking opportunities, while more advanced cyclists can test their skills on abundant and challenging single track trails scattered throughout the area. With an elevation of 2,800 feet, visitors can enjoy splendid views year round. Sections of this trail system are also open for snowmobile

use as well as horse-back riding

Mt. Aetna Tract Trails 7.6 miles - moderate
A detailed pocket guide for this scenic 700-acre area is available at the forest headquarters. Diverse loop trails offer opportunities for bird watching, mountain biking and hiking. In winter, this area provides opportunities for snow shoeing and cross-country skiing.

Asa Durst Trails 4.5 miles - moderate
Stands of pine and spruce, stream valleys rimmed in rhododendron and upland hardwood forests that have reclaimed former pastures and farmlands greet visitors to these trails. For those looking to get away from more heavily used trails at New Germany in the winter, a visit to this area for a backcountry snowshoe or cross-country ski experience is highly recommended.

Backpacker Loop 24 miles - moderate
Plan a multi-day backpacking trip on this connecting a series of trails and forest roads that include designated primitive campsites. The loop begins and ends at the state forest headquarters, using Meadow Mountain Trail, Monroe Run Trail, Savage River Road and Poplar Lick Trail. A backcountry permit for overnight guests is required.

Poplar Lick Trail 5 miles - moderate
The foot bed of this trail is a forested dirt/rock road that is the remainder of a CCC roadway constructed in 1934. The trail stretches between New Germany Road to the west and Savage River Road to the east. Visitors in July are rewarded with rhododendron blooms and colorful wildflowers. The trail has 13 stream crossings, but only five bridges - so be prepared to get your feet wet when hiking. This trail fords Poplar Lick Run which is a native brook trout stream several times. This trail is open to foot traffic only.

9.2.4 Camping

There are currently 71 designated primitive campsites within Savage River State Forest. Areas include Big Run Road, Savage River Road, Westernport Road (Elk Lick), Blue Lick Road, Poplar Lick Trail, Rabbit Hollow Road and the Whitewater sites located ¾ of mile south of the Savage River Dam. These are designated camping areas but the entirety of the forest is open to backcountry backpacking and camping trips. A camping pass is required and can be obtained at the state forest headquarters prior to beginning a trip.

9.2.5 Savage River State Forest Off Road Vehicle (ORV) Trails

St. John's Rock ORV Trail 13 miles – easy to difficult

The St. John's Rock ORV Trail is the first trail on Department lands ever designed specifically for ORV enthusiasts. Features include a multisite primitive campground designed to support ORV riders, children's riding trails within the campground, technical spur loops and hare scramble style trail sections for all terrain vehicles and motorcycles, a full-size rock crawl area

for jeeps and four-wheel drive vehicles, and miles of forest access roads for all purpose riding opportunities. The total trail system is approximately 13 miles in length with varying challenges for riders of all skill levels.

East Shale Road 4 miles - easy
Then northernmost four-mile trail section of Meadow Mountain Trail near I-68, also known as East Shale Road, is open for off-road vehicle (ORV) use. East Shale Road is an out-and-back trail free of obstacles that provides leisurely riding opportunities for beginners or families. From December 15 to March 15 the trail is open to snowmobiles only.

9.2.6 Water Access for Canoeing, Kayaking and Fishing

The Savage River and the Savage River Reservoir offer opportunities for canoeing, kayaking and fishing. For the experienced boater, the river offers white water opportunities in the spring and during several scheduled releases throughout the year. The reservoir offers flat-water boating for the novice or experienced canoeist. Gasoline engines are prohibited on the reservoir and only boats with electric motors are permitted.

9.3 Education and Public Outreach

A departmental goal for Savage River State Forest is for it to be a national model of sustainable forest management that increases public awareness concerning the importance of proper scientific management as it pertains to the health of the surrounding environment. The forest is seen as a living laboratory or an outdoor classroom where resource professionals and the public have the opportunity to learn about the plethora of natural resources found throughout the area.

A key requirement for the long term use and protection of forest is an educated user capable of understanding the extent of impacts on the resources and responding appropriately to mitigate further negative consequences. Natural resource literacy, in both policy development and sustainable use, will benefit users as well as the forest. In order to keep stakeholders abreast of new and relevant information concerning forest management, the Savage River State Forest website will be updated on a regular basis, brochures and other written material about the forest will be revised as needed and field tours or other public forums will be planned.

Research efforts will be prioritized and promoted within areas currently lacking sufficient information or understanding and areas important to forest management that involve local impacts associated with global issue. Most notably, climate change has the potential to affect management and special attention must be given to the possible local implications that may surface. Other areas of concern involve the surge of non-native and invasives pests and disease outbreaks throughout the forest and the strategies needed to control them, forest fragmentation and its consequences and the factors affecting regeneration potential in mixed oak stands.

9.3.1 Savage River State Forest Website

The website http://dnr.maryland.gov/forests/Pages/publiclands/western_savageriverforest.aspx is

an invaluable mechanism for communicating with the public. It has been used to share general information and annual work plan projects. Its future value is dependent on the availability of current relevant information regarding the management of the forest.

9.3.2 Educational Material, Tours and Forums

The Department is considering the placement of interpretive markers or informational kiosks at the public use area with the highest visitation rates, which would include maps and information on the forest as well as sustainable forest management. MD DNR also produce an educational trail guide that is updated annually with pertinent up to date information emphasizing sustainable forest management. In addition to printed and online materials, department sponsored forestry field days and informational tours have the potential to be effective tools for educating the public in the values of sustainable forest management and working landscapes. These activities would focus on the current approach to forest management and allow stakeholders to experience first-hand the myriad of factors that are considered in the management process. To encourage further public involvement, the Maryland Conservation Corps, local school groups, scouting organizations and local environmental groups would be given the opportunity to participate in the implementation of projects outlined in the state forest annual work plan.

9.3.3 Research

Cooperative research projects will remain an integral part of the Monitoring Plan as described in Chapter 10. Partners include Frostburg State University, West Virginia University, the University of Maryland – Appalachian Laboratory, Garrett College and private non-profit organizations including the Chesapeake Bay Foundation, the Nature Conservancy and local community service groups.

9.4 Implementation

As with the other management activities, recreational and educational activities will be included in the Annual Work Plan. These activities will be reviewed by the Savage River State Forest interdisciplinary team and the Savage River State Forest Advisory Committee. Once approved, the projects will be implemented as part of the AWP process. Public use activities will be monitored to avoid conflict with other management goals and to prevent any degradation of the sensitive resources found on the forest. Limits of Acceptable Change procedures and protocols will be used to monitor these public use activities (see Monitoring Plan – Chapter 10).

Chapter 10 - Monitoring Plan

10.1 Introduction

The primary goal of Savage River State Forest is to provide sustainable natural resources, including fresh water, fish and wildlife habitat, timber products and to provide educational and recreational opportunities while contributing to the conservation of the natural environment and providing positive contributions to the local economy. Concepts of sustainability are based on the international standards of sustainable forestry represented by the Montreal Process Criteria and Indicators, which can be accessed at: www.montrealprocess.org/The_Montreal_Process/Criteria_and_Indicators/index.shtml.

Maryland DNR participates in the National Roundtable for Sustainable Forests to further improve coordination and use of sustainable forestry practices. Information is available at http://www.sustainableforests.net/. Critical sustainability standards for Savage River State Forest include no soil deterioration or nutrient loss, no decline in water quality resulting from forestry activities, no loss or decline of species, the protection of special areas, an acceptable flow of jobs and revenue and stakeholder satisfaction with results.

Monitoring is crucial to the ability of the Savage River State Forest to supply its intended sustained yield of various forest resource benefits. At a minimum, the monitoring activities must meet current requirements for certification and reporting. Monitoring is necessary to document sustainable practices, provide information for adaptive management and carry out elements required for certification by the Sustainable Forestry Initiative (SFI) and Forest Stewardship Council (FSC). Monitoring data is needed to meet a number of SFI Core Indicators and FSC specifically identifies monitoring and assessment as one of its ten principles. Evaluation of the range of elements being sustained relies on an interdisciplinary plan that monitors a wide range of aquatic and terrestrial features. A monitoring project on this scale provides opportunities for scientific study, collaboration and external funding. It also provides challenges, such as the need for an efficient, coordinated hierarchy for the monitoring program and overcoming limits to the involvement of current staff in the project. This critical component of the Savage River State Forest Sustainable Plan will not be successful without continued support.

Initial stand data collection has been completed on the harvestable areas of the forest using the SILVAH Inventory System developed by the US Forest Service which incorporates intense surveys of both the overstory and understory to assist in the formulation of appropriate silvicultural prescriptions in specific forest types. The demand for this important data set is increasingly evident as special projects evolving out of demands placed by Forest Certification Standards utilize this data set for project planning including the Annual Work Plan and the Non-Native Invasive Species Inventory.

What had historically been carried out on a 10-year interval offering a snap shot in time view of

the forest, has evolved into an annual sampling approach that gives a more frequent look at overall forest condition throughout the years. This will allow a much closer watch on developing forest conditions and will facilitate more rapid and timely responses. This approach is especially valuable in light of the numerous and frequent introductions of foreign insects, diseases and invasive plants that can rapidly disrupt forest systems. The initial Stand Delineation and Inventory Project will be continued as a Forest Monitoring program as required under certification in order to allow for documented observations of changing conditions throughout the forest. Program focus will include: monitoring of developing regeneration sites allowing for the timely response to the investment in intensive silvicultural work such as herbicide control of invasive and interfering plants and prescribed fire; NNIS monitoring and control work; silvicultural results with respect to management objectives and outcomes and recreation/visitor impacts, etc.

10.2 Monitoring Plan

The monitoring plan supports the needs of the Savage River State Forest Project using a multi-tiered approach:

- Tier I: a landscape-scale inventory
- Tier II: a stand/compartment-level inventory, and
- Tier III: project-specific assessment and research.

In order to more efficiently use resources, data collection is coordinated as much as possible among the different staffing units. The exact number of points to be sampled will depend on the number of points falling within multiple strata and potentially on the cost/effort for sampling. Power analysis and community dynamics models will be used to help determine the appropriate number of samples, allowing trends in population changes to be detected. At the beginning of each section, the SFI Objectives and FSC Principles that are addressed by these elements of the monitoring plan are listed, with text descriptions supplied in Appendix B & C.

Data obtained from the monitoring will be used to update the Savage River State Forest Geographic Information System, and will be spatially integrated with the base ownership layer. DNR units and personnel have been assigned to manage the layers of information based on data source and unit expertise, including the Forest Service, Wildlife & Heritage Service, Land Acquisition & Planning, Ecosystem Restoration Services and Information Technology. New data is added to the GIS system through the data manager assigned for the respective layers.

10.3 Tier I: Landscape-scale, Long-term Monitoring

10.3.1 Objectives

The focus of Tier I monitoring is overall biodiversity and ecosystem health. It provides the basic inventory data for forest management, sensitive resources and water quality over terrestrial and hydrogeomorphic regions. Tier I monitoring provides the information base for Sustainable Forestry Initiative certification objectives 1, 3, 4, 5, and 6, and for Forest Stewardship Council certification principles 5, 6, 7, 8, 9, 10 (Objectives and Principles listed in Appendix B & C). Data layers inventoried include:

1) Forest overstory condition, including stand inventory, tree growth rates, and regeneration status, yielding information needed to determine sustainable levels of harvesting;
2) Forest understory condition, including height of canopy layers, species, diversity, and presence of invasive species;
3) Wildlife and habitat information, habitat features like snags, woody debris, stand size class, percent canopy, and vertical diversity; and
4) Water quality surveys of nutrient status, macro invertebrate populations, and aquatic habitat condition that supplement the Maryland Biological Stream Survey data, supplying water quality status and aquatic invertebrate species presence and diversity.

The inventory sampling approach assures representation of sensitive resource areas, ecologically significant areas and riparian areas. Special area boundaries that have been delineated around sensitive species protection and restoration areas and cultural resources such as ruins, graveyards, research plots or wells have been added to the GIS system. Inventories are scheduled for update every 10 years.

The definition of sustainability given above for the publicly owned Savage River State Forest includes stakeholder satisfaction with results. Existing processes, including public review of annual work plans, interdisciplinary team for management review and the Citizens Advisory Committee, all provide outlets for expression of stakeholder views. Information is provided on the DNR website: http://dnr.maryland.gov/forests/Pages/publiclands/western_savageriverforest.aspx, including the current sustainable forest management plan and annual work plans. These information sources will allow for timely stakeholder feedback, which will establish a baseline estimate of stakeholder satisfaction. Independent surveys of stakeholders may be undertaken if outside resources can be obtained to implement such projects.

10.3.2 Methods Overview

Strata for sampling were chosen for major factors of interest and to control for known variation. Stream and water quality sampling are organized around the geomorphic region and the stream network, while terrestrial sampling uses strata based on forest type and habitat for sensitive resources (Table 10.3.2.1). Geomorphic regions were established based on underlying geology and topographic characteristics, which typically contribute to differences in stream chemistry (e.g., acid or alkaline, base levels of nutrients). The stream network is stratified on position relative to state ownership and will correspond partially to stream order; streams originating entirely on state land are likely to be smaller (first, second, or third order), while streams passing through or bordering state lands are likely to be larger (third order or higher). Terrestrial strata

focus on major stand types and areas with rare species and natural communities. The majority of the areas supporting rare species and natural areas have been identified and are monitored regularly. The information base for the sampling is the Savage River State Forest GIS system.

Table 10.3.2.1: Strata for Long-term Monitoring on Savage River State Forest

Stream and Water Quality Sampling		**Terrestrial Vegetation and Species Sampling**	
Geomorphic Region	***Stream Location***	***Forest Composition***	***Sensitive Resources***
Surficial Confined	Originates in State Forest	Pine	Owls
Fine-grained Lowland	Passes through SRSF	Upland Hardwood	Forest Interior Dwelling Species & High Conservation Value Forest
Well-drained Upland	Passes through SRSF	Bottomland Hardwood	Ecologically Significant Areas & High Conservation Value Forest
Poorly Drained Upland		Mixed Pine-Hardwood	Riparian/Wetland Areas

10.3.3 Terrestrial Vegetation and Species Sampling

Vegetation structure and composition will be quantified using methods and protocol from Silvah-Oak. Plots are systematically sampled from a random grid overlaying the management unit. In addition, percent ground cover, tree regeneration, coarse woody debris, forest health indicators, data for invasive species, shrubs, and herbaceous plants will be collected. Data summaries for forest overstory include tree volume, number of trees, basal area, density and growth rates. All permanent sample points are expected to be sampled at least once every 10 years. In order to ensure that there are adequate samples to examine trends in the data, a minimum of 20 plots were placed in uncommon strata, particularly those designated as High Conservation Value Forest.

To gather detailed data on bird and reptile/amphibian abundance and habitat features, a subset of sensitive resource plots will be selected for additional data collection using multiple visits from spring to late summer to adequately sample seasonally available populations. Calculations for wildlife information will include diversity indices, relative frequency and relative abundance. Multivariate analyses are used to determine relationships between stand types, age classes, stand history and observed population characteristics. Vegetation information from the detailed wildlife habitat subset of plots may be analyzed using detrended correspondence analysis techniques to identify community types and other associations. Living organisms will be monitored with emphasis on sensitive species or indicators of ecosystem functions, including forest interior dwelling and other birds, reptiles and amphibians. Standard methods include constrained time searches, pitfall traps and call counts, each tailored to the habits of target species.

10.3.4 Stream and Water Quality Sampling, Procedures and Progress

For aquatic samples, points are chosen using stratified random sampling from mapped “blue-line” stream sections that are 150 m in length. Streams must traverse a minimum of 1000 feet on a SRSF parcel. These stream sampling points are re-randomized for each sampling event (at least

every five years) in order to more accurately capture the general condition of the aquatic resources.

Water quality monitoring will use procedures outlined in Boward and Friedman (2000) or current Maryland Biological Stream Survey sampling methods. Water samples are collected during base flow at all sites with water, standing or free flowing in a defined channel, avoiding the 24-hour period following a minimum of 0.5" of rain. Sampling includes flow (L/s), water temperature (^{O}C), dissolved oxygen (mg/L), pH and conductivity measurements at each site using field instruments (e.g., Hydrolab Surveyor II). Grab samples of whole water are collected just below the water surface at mid-stream and filtered in the field (0.45: pore size Gelman GF/C filter). To allow for analysis of nitrogen species, the samples are stored on ice and frozen the day of collection for later lab analysis. Analysis includes dissolved inorganic nitrogen (mg N/L of NO^3, NO^2, NH^4) and dissolved inorganic phosphorus (mg P/L PO^4). All analyses are conducted in accordance with US EPA protocols.

Aquatic benthic macro invertebrates are collected using methods developed for mid-Atlantic streams that are compatible with and comparable to Maryland Biological Stream Survey (MBSS) sampling protocols (Kayzak, 2001). Samples are collected only from free-flowing streams, avoiding inaccuracies associated with evaluating standing pools. Sample processing is done according to MBSS guidelines (Boward and Friedman, 2000). Habitat assessments based on US EPA methods for low gradient streams (Barbour et al., 1999) are completed at all macro invertebrate stations. Summary measures include the Benthic Macro Invertebrate Index of Biotic Integrity, Habitat score and percent of suitable habitat.

10.4 Tier II: Stand/Compartment-level Medium-term Monitoring

10.4.1 Objectives

This level of monitoring is used to give more specific information on:

- Occurrence and management needs for rare, threatened and endangered species or natural communities,
- Areas where invasive species threaten populations of rare species,
- Stands or compartments where more information is needed to support high production of wood fiber or other marketable product or
- Other species or areas of interest that occur across several stands.

Emphasis will be placed on sites that need to be protected, enhanced or restored to maintain healthy native communities. Factors assessed at this scale include water quality and sensitive resources, including species presence, richness, and diversity. In areas identified for high production of wood fiber or other marketable forest products, more frequent and more intensive forest stand data may be needed to inform management options. These monitoring activities will

occur more frequently and in focused areas compared to Tier I monitoring. Tier II monitoring supplies information needed to carry out or document SFI Objectives 1, 3, 4, 6, and 8, and FSC Principles 5, 6, 7, 8, 9, 10.

Forest communities of interest on the Savage River State Forest include: red pine, white pine and Norway spruce plantations. Overstory and regeneration will be monitored to determine if these less abundant pine types are being maintained in the current stands or other areas with suitable habitat. Monitoring of regeneration is designed to allow diagnosis of threats to these conifer forest communities and to allow management actions to be taken to increase abundance prior to the loss of parent trees. Other natural communities of interest with monitoring needs related to management and protection include: hemlock stands, old growth and nearly old growth forests and other High Conservation Value Forests.

10.4.2 Methods Overview

Sample points for sensitive resources will be selected using random sampling or, when necessary, stratified random sampling. Cluster sampling may be used for rare plants. For forest stand condition, systematic grid sampling proves most efficient. Data collection will occur more frequently than in Tier I monitoring, with the timing dependent on the organisms/habitat features to be monitored.

Standard methods available in federal or state manuals or published peer-reviewed research will be used to collect data for:

- Water quality indicators such as stream nutrient export, wetland condition, fish and aquatic macro invertebrate assemblages;
- Forest stand condition indicators such as vegetation structure and composition, invasive species, natural plant communities, insect and disease impacts, fuel loading, and stand density;
- Rare, threatened and endangered species presence, diversity and abundance; and
- Presence of invasive species that threaten the survival of rare, threatened, or endangered species;
- Natural community diversity metrics; and
- Other indicators of ecosystem recovery and function.

Impacts from trails including both hiking and All-Terrain Vehicle (ATV) routes, can be monitored in specific areas of concern using standard limits of acceptable change (LAC) procedures (Stankey et al., 1985; McCool and Cole, 1998) and procedures developed specifically to assess trail impacts (Marion and Leung, 2001). Methods to monitor populations of rare, threatened and endangered species in Ecologically Significant Areas and other areas of interest will depend on the organisms of interest. Protocols will generally follow standardized methods presented in Tier I. Power analyses will be used to help determine the appropriate number of samples to allow a trend to be detected. Unique natural communities will be monitored using standard plot methods for community classification. Forest stand information may include data for stand-level growth and yield modeling, soil sampling and overstory and understory composition.

10.4.3 Invasive Species

Information on general occurrences of invasive plants will be captured in the Tier I inventory and updated on the same cycle. More intensive monitoring and control will target those areas where the health and survival of rare, threatened or endangered species or natural communities may be compromised. Invasive species control plans will be developed in conjunction with rare species protection and restoration plans. Control plans will include actions to prevent or minimize reinfestation of problem species. Control options will be tailored to the situation and species and may include physical, chemical or biological controls. The spread of invasive plant species will also be minimized through the proper implementation of Best Management Practices for all management activities.

Problematic invasive species are sometimes identified in routine field operations, outside of rare species habitat. In these cases, staff will determine the potential to interfere with the survival, health or regeneration of native forest stands. Where the invasive species is a significant detriment, a management strategy for control will be developed and included in the annual work plan review. Chemical control is anticipated in many settings because of the general effectiveness and cost-effectiveness, although any effective option including physical or biological control will be considered. Species that have potential to interfere greatly with forest health and regeneration include multi-flora rose, mile-a-minute weed, Japanese knotweed, tree of heaven and Japanese stiltgrass.

10.5 Tier III: Management Activity-based Short-term Monitoring

10.5.1 Objectives

Monitoring at the Tier III level measures responses to management activities at a finer scale, including silvicultural treatments, restoration projects and public uses that may affect a portion of a stand or the whole stand. This level of monitoring includes updates of stand-level information to reflect recent management actions and some focused scientific studies, with monitoring occurring on both control and experimental areas before and after the manipulation. Long term monitoring of soil quality, water quality, species presence, richness and diversity will aid in determining if management activities are conducive to the sustainability of the forest. Tier III monitoring is needed to document compliance with SFI Objectives 1, 2, 3, 4, and 6 as well as FSC Principles 5, 6, 7, 8, 9, and 10 (Appendix B & C).

10.5.2 Methods Overview

Sample plots are chosen randomly or systematically within appropriate control and experimental areas to be manipulated. Where possible, at least three replicates are sampled for each type, with more than one sample taken in each plot. Potential experimental area treatments include prescribed burns, herbicide applications, harvest systems and practices, watershed restoration and improvement projects and ESA restoration activities. Measurements of stand health, biodiversity, productivity, soil fertility, water quality and species-specific responses are most appropriate for this level of monitoring.

10.6 Procedures by Forest Management Actions

Harvesting (For SFI Objectives 2, 3, 4, 5, 6):

All thinning and regeneration harvest operations are checked for compliance with Best Management Practices (BMP). Harvest Site Review checklist items include, haul roads\skid trails and landings, streamside management zones (SMZ), stream crossings, safety BMPs and aesthetics.

The harvest area selection process involves the review of recommended activities proposed by the state forest manager to be conducted by the MD DNR Interdisciplinary Team and the Citizens Advisory Committee. Stands are selected based on relative density, age, stocking levels and species composition. Consideration is given to size of the area to be harvested and its proximity to stands less than five years of age. Currently, most silvicultural prescriptions in mixed oak stands are being managed to ensure a sustainable oak component. Silvicultural prescriptions may be modified based on the following:

- Presence of rare species, Wetlands of Special State Concern, Threatened and Endangered species;
- Stream buffers;
- Cultural sites;
- Presence or absence of advanced regeneration.

10.6.1 Site Preparation

Natural regeneration is considered as the first option, so advanced regeneration is evaluated using plot counts to estimate seedlings/acre, with attention to distribution over the harvest area. Site preparation methods considered by the Interdisciplinary Team for the Annual Work Plan review include but are not limited to, prescribed burning, herbicide application and mechanical treatment.

10.6.2 Prescribed Burning

Prescribed burning is recommended for site preparation, controlling understory vegetation after the initial stand thinning and encouraging regeneration of desirable native plants. Procedures for establishing the prescription for a burn include evaluating the site for fuel load, determining site ability to sustain a burn, locating fire breaks and identifying potential hazards presented by smoke in regard to surrounding infrastructure, landowners and livestock. Prescribed burn plans are prepared by MD DNR fire staff, using guidance from “A Guide to Prescribed Fire in Southern Forests” (1989, USDA FS National Wildfire Coordinating Group publication PMS 431-2). Fire personnel evaluate all sites after burning to determine if the burn met the stated objectives. Heritage staff specialists evaluate selected sites with high potential for rare species for presence and abundance of target species following burn treatments. Understory burning to enhance oak regeneration will be considered where site conditions are conducive to effective fire implementation. Regeneration monitoring will be used to evaluate the level of success of this practice and identify factors to improve regeneration.

10.6.3 Herbicide Application

The use of herbicides is being minimized on Savage River State Forest, but there are instances where their use is appropriate to effectively shape the stand to its desired condition for forest products and/or habitat with minimal impact to soils. Herbicides are applied according to label restrictions, with spray buffers around flowing streams and open water. Applications are commonly done by broadcast sprayers mounted on tracked units with backpack application used where spot spraying is necessary. Due to the lack of wildfire, some native tree species have become problematic in the understories of hardwood stands, most notably red maple and black birch. Both have increased in density and frequency at the expense of other hardwoods, prompting the use of herbicide as a control method in the absence of wildfire. Oak species tend to be more resistant than other hardwoods to commonly used herbicides, making chemical applications an effective tool for promoting regeneration. Monitoring of regeneration density and type will allow evaluation of current practices in developing the desired mix of stand types.

10.6.4 Mechanical Treatment

Site preparation commonly involves the use of heavy equipment such as a bulldozer, which may be augmented by lighter equipment such as chain saws or brush saws. Riparian buffers are established to assure that machinery does not affect water bodies and sediment does not leave the site. Excessive rutting and soil compaction are avoided as required in Maryland Forest Harvesting BMPs which are monitored via the Harvest Site Review form. Mechanical site preparation is not a common practice used on Savage River State Forest.

10.6.5 Intermediate Operation

Commercial and pre-commercial thinning is planned for the Savage River State Forest. The same procedures as outlined for harvesting are followed, regarding site review, modification of operation for rare or sensitive species and BMP compliance. Fertilizer is rarely, but in the event of such an application, soil tests for nitrogen, phosphorus and pH before and after application will be conducted. Five years after the intermediate operation the stand will be re-examined to determine the efficacy of the treatment.

10.6.6 Special Area Projects for Water Quality

Watershed improvement projects will be chosen in locations where slowing water could reduce nutrient and sediment levels in water leaving Savage River State Forest. Projects require at least two critical elements: waterway and topography where water can be slowed and backed up to increase residence time without adversely affecting neighboring lands and a source of nutrients or sediment, such as from agricultural lands. Monitoring includes project baseline information and post-project assessment of water quality and vegetation.

Habitat Improvement Projects are chosen in areas with potential to support rare species or natural community types. The Maryland Natural Heritage Program is developing management plans for selected areas and restoration projects will be implemented as part of the annual work plan. Projects include clearing trees in areas where rare species depend on more open conditions, incorporating disturbance to mimic natural process, conducting prescribed burns and restoring hydrology where past drainage has reduced extent of wetland habitat. The presence and extent of rare species or appropriate habitat indicators will be recorded prior to and following project implementation.

10.6.7 Special Area Projects for Wildlife & Heritage

Annual bird surveys are conducted on portions of Savage River State Forest as part of statewide and regional count programs and the results are compiled as part of a national database. Other projects are periodically proposed to increase game and fisheries habitat, these projects are often done in conjunction with local college and universities.

10.6.8 Public Use and Recreational Activity

Outdoor recreational activities including horseback riding, bird watching and hiking are monitored through use agreements outlining terms and conditions of use for organized for-profit groups. For land open to public hunting, monitoring consists of periodic roadside vehicle counts during hunting season. The annual harvest report includes estimates for harvest by species: white-tailed deer, turkey, dove, quail, squirrel and rabbit. Public use data will be collected via checklist surveys, permit applications and other quantitative methods comparable to those used by the USDA Forest Service, US Fish and Wildlife National Refuge System and Maryland DNR Wildlife and Heritage Service. Ongoing survey efforts such as the national surveys for fishing and hunting and county recreational surveys will be used as additional information sources and context to allow for comparisons of use patterns on Savage River State Forest. Other methods such as online user forms and honor system surveys will also be used. Impacts on use areas may be monitored using limits of acceptable change (LAC) protocols, provided that sufficient funding is available (Stankey et al., 1985; McCool and Cole, 1998).

Chapter 11 - Annual Work Plan Process

11.1 Annual Work Plan

The Annual Work Plan (AWP) is the guiding document that assures sustainable forest management goals are being met and that the department is fully informed and supportive of the proposed management actions. The Savage River State Forest manager is responsible for preparation of the Annual Work Plan.

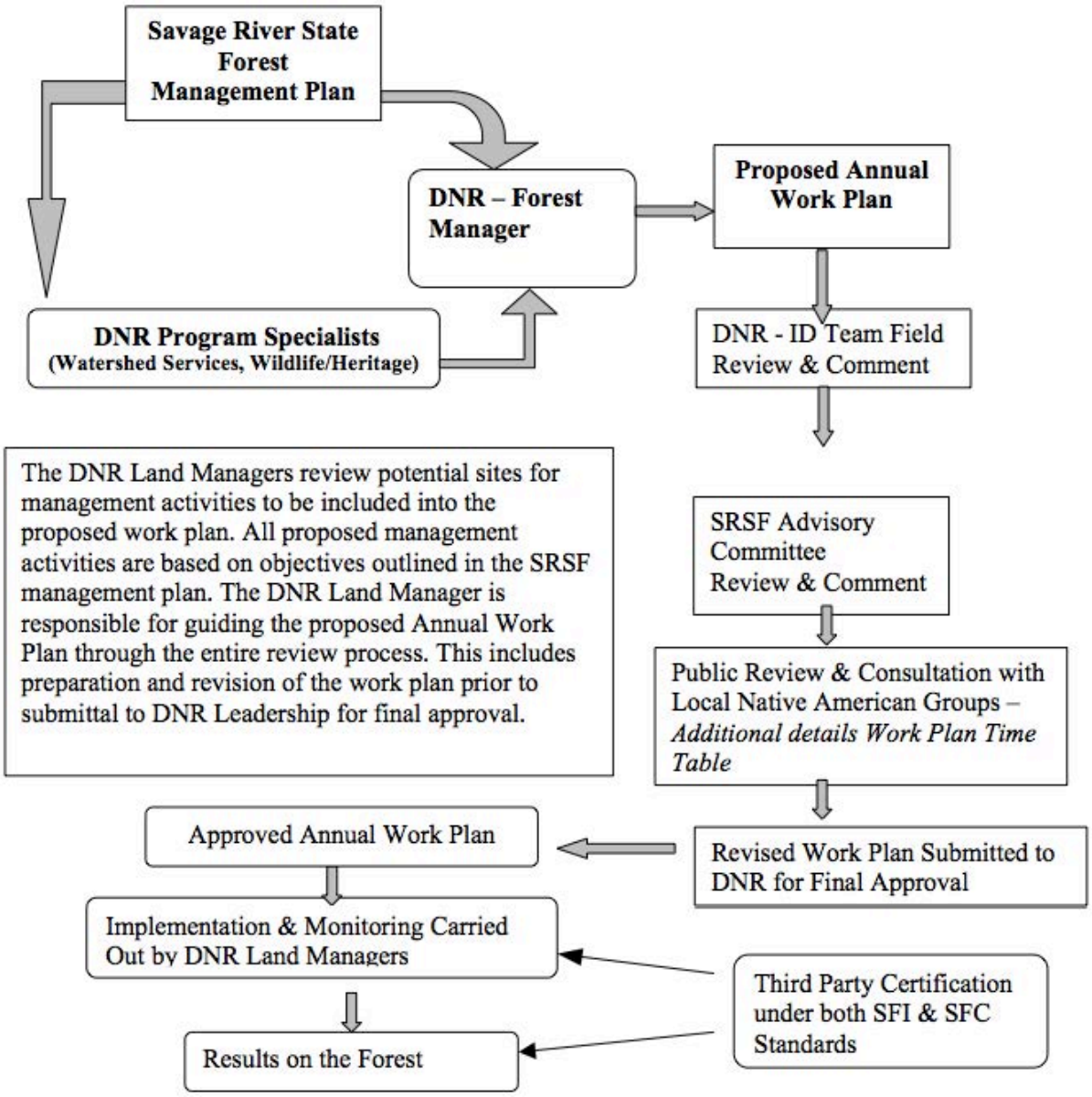


Figure 11.1: Annual Work Plan Development Process

The development of the annual work plan and timber sales is guided by the Timber Operation Order. This policy guidance document describes how annual work plans are developed, forest product sales, operational procedures, and the approval process.

The creation of an annual work plan that establishes the land management program for an entire year is an important key to successful implementation of sustainable forest management on Savage River State Forest. It will be the responsibility of the forest manager to oversee day to day operations in the implementation of each Annual Work Plan. The land manager must be well versed in resource logistics and be adaptable to changing environmental conditions that require

shifting priorities in order to effectively implement all of the management activities outlined in the annual work plan. Figure 11.1 illustrates how achieving sustainable management goals requires the cooperation of multiple entities, all with different roles vital to the success of the annual work plan process. Ultimately, the land managers are responsible for implementing the annual work plan in an environmentally and fiscally responsible manner.

Implementing the Savage River State Forest annual work plan involves an adaptive management strategy, where research and monitoring are given a high priority and where new information is perpetually integrated into the development of future management objectives. Project results will be verified by a third party certification process, which will be conducted through surveillance audits each year. Certification is done to compare the achieved results with the planned outcomes of the management prescriptions contained in this plan and the annual work plan. The independent third party auditors compile their findings and any noted field or operational deficiencies will be addressed and plans for corrective action will be developed within the timeframe stipulated by the auditing bodies. The audit report and documentation of any subsequent actions taken to rectify any nonconformance will be available to the public.

11.2 Annual Work Plan Time Table

Annual Work Plan (AWP) development along with the necessary environmental and regulatory reviews will strive to adhere to the following process/time lines:

1. The land managers begin fieldwork to review sites to be included in the next annual work plan from January through June.
2. The land manager drafts a proposed work plan and sends it for ID Team review in mid-August.
3. The ID Team reviews the proposed plan, a field review of proposed activities in the work plan is scheduled and comments returned to the land manager by mid-September.
4. The DNR land manager presents the proposed work plan to the Savage River State Forest Citizens Advisory Committee for comment and review by December 30.
5. AWP is put on the web for public review and comment, process to be completed by February 22.
6. This above process includes consultation/review with local Native American Groups and the Maryland Commission on Indian Affairs concerning potential sites of special cultural, ecological, economic, or religious significance, where appropriate.
7. The land manager reacts to needed changes and submits a revised plan to DNR Headquarters by March 1.
8. MD DNR obtains final official approval of the Annual Work Plan, as revised, by July 1.
9. The land managers begin implementing the approved work plan July 1.
10. Independent third-party auditing for forest certification occurs annually in April.

11.3 Contents of the Annual Work Plan will include:

Forest Overview
Includes an overview of the forest; history, size, location, special features, etc.

AWP summary
Includes number of sales, total harvest acres, acres by harvest method, estimated harvest volume and other important features of the work to be performed during the next year.

Maintenance and Operation Projects
Includes boundary maintenance, road maintenance, building maintenance, etc.

Recreation Projects
Includes projects such as campsite improvements, hunting programs, special recreational activities, ATV and bike trail construction, hiking trail maintenance, trail grants, signage, etc.

Special Projects
Includes activities for maintaining third party forest certification, creating and maintaining GIS databases

Silvicultural Projects
Includes forest harvesting, prescribed fire programs, fertilization, reforestation, herbicide applications and other such projects. This section must include the following:

Final Silvicultural Activities:

1. Location/Site Map
2. Forest Community Type and Condition
3. Stand Data
4. Interfering Elements
5. Historic Conditions
6. Rare, Threatened and Endangered Species
7. Habitats and Species of Management Concern
8. Water Resources
9. Soil Resources
10. Recreation Resources
11. Management and Silvicultural Recommendations

Review Process:

1. Review Summary
2. Interdisciplinary Team Comments
3. Advisory Committee Comments
4. Public Comments

Watershed Improvement Projects
Includes special projects to enhance water quality, wetland restoration and other such activities.

Ecosystem Restoration Projects
Includes projects to manage exotic invasive species and efforts to restore natural habitats.

Monitoring
Includes inventory projects being conducted on the forest, watershed monitoring, timber harvest monitoring for BMP compliance and other such projects.

Research
Includes descriptions of all research projects being conducted on the forest.

Budget
Includes a proposed budget specific to the management of the forest.

The land manager will be responsible for overseeing all activities to ensure the desired environmental and silvicultural results, while maintaining cost effectiveness and targeted economic returns.

Chapter 12 - Operational Management

12.1 Introduction

This section of the plan is designed to cover the annual cost and revenues associated with the operational management of Savage River State Forest. It is the Department's intent that the majority of revenues generated from the forest will be reincorporated into the operational budget of the forest. As stated in Chapter 1 of this plan, "*The primary goal of the Savage River State Forest Sustainable Management Plan is to demonstrate that an environmentally sound, sustainably managed forest can contribute to local and regional economies while at the same time protecting significant or unique natural communities and elements of biological diversity."* The numbers presented in this section represent estimates of annual expenses and revenues. These numbers will fluctuate each year based on management prescriptions, project type and size, timber market fluctuations and overall economic conditions that influence public use of the forest.

12.2 Savage River State Forest Revenue

Estimated: $300,000 to $400,000

Revenues generated from Savage River Forest are deposited into the Department's Forest Reserve Fund. In order to cover expenses from this fund, an operational budget must be developed a year in advance as a part of the statewide DNR budget. It then goes through a legislative review process along with all other state operating budgets in order to be approved. Once adopted, the budget goes into effect on July 1, the first day of the new fiscal year.

The majority of revenue generated on the state forest is derived from the sale of forest products, which are procured from harvests outlined in the annual work plan. Traditional forest products include pulpwood and sawtimber harvested during silvicultural activities. Due to the volatility of timber markets, the revenue generated from timber harvests can fluctuate significantly from year to year. Other revenue streams for the state forest are generated from the sale of shooting range passes and firewood collection permits, map and brochure sales, camping receipts, royalties generated from natural gas storage facilities located on state property and proceeds from easements and right of way agreements.

12.3 Operational Cost

Estimated Annual Expenses: $646,235
Operational expenses are those costs paid directly out of the Savage River State Forest revenues. These costs are only estimates and will vary each year with some of the costs tied directly to the amount of revenue generated each year.

12.3.1 Staffing Cost

Estimated Classified Employee Salaries, Wages and Benefits $383,018
This cost is associated with Departmental contractual staffing and State Personnel classified salaries. This staff is responsible for developing annual work plans, managing the daily activities on the forest, including boundary line work, road and gate repairs, timber marking, harvest implementation and monitoring, budget analysis, customer service and database maintenance.

Estimated Contractual Employee Wages: $92,597
This cost is associated with contractual staffing associated with operations of the state forest. Contractual personnel are responsible for conducting work outlined in the annual work plan, managing the daily activities on the forest, including boundary line work, maintenance of trails, forest roads, maintaining primitive campsites, a public shooting range, overlooks, wildlife habitat areas and implementing all maintenance, recreational, silviculture and ecosystem restoration projects.

12.3.2 Land Operation Cost

Estimated: $170,620
This includes expenses for office and field equipment, vehicles, gates, gravel, signs, boundary paint, roadwork contracts and construction, trash removal from illegal dumping, boundary line maintenance and surveying, tree planting, site preparation, control of invasive species, pre-commercial thinning and other forest management practices. These costs have the potential to vary greatly from year to year based on the activities identified in the Annual Work Plan.

12.4 Other Revenue/Funding Sources

Annual Amounts Vary
Other budgetary funding that is utilized on an annual basis in the management of Savage River Forest comes several sources. The first source is the revenue generated by the forests. These funds are deposited in the Department of Natural Resources Forest or Park Reserve Fund and must be appropriated by the General Assembly through the annual budgeting process before being spent. The state forest budget is prepared approximately one year before the beginning of the fiscal year in which it will be spent. The budget then goes through the legislative approval/

review process along with all other state operating budgets. Once adopted, the budget goes into effect July 1, the first day of the fiscal year. Income generated by the state forest is designated as special fund revenue.

Special funds may be provided by the Department of Natural Resources Forest or Park Reserve Fund that are not generated from the state forest or there may be a lesser amount of special funds shown in the budget compared to what was actually generated. There are also General Funds, which are state tax revenues provided annually to primarily pay Savage River Forest staff salaries and a small percentage is used to meet expenses associated with the operational budget.

Currently, there are five full-time employees, including forest manager, assistant forest manager, forest technician, maintenance supervisor and administrative specialist. Seasonal contractual staff are hired throughout the year to assist with the implementation of the annual work plan. Staffing numbers fluctuate in response to the size and complexity of forest projects as well as the availability of funding. Other funding comes in the form of grants through state and federal sources and is primarily utilized for the maintenance of motorized vehicle trails. These grants are competitive and are generally limited to $80,000 per year per grant and are designated as reimbursable funds. The source of this funding is the Federal Department of Transportation administered through the Maryland Department of Transportation, State Highway Administration Recreational Trail Grant Program.

12.5 Summary

This is the general breakdown on Revenues and Operational Cost associated with the Savage River State Forest. As described, these figures will vary from year to year. A more detailed picture on revenues and operational cost will be provided within each annual work plan. This generalization of the operating budget illustrates the importance of maintaining stable income levels in order to achieve the goal of sustainability as set forth in the annual work plan.

Appendix A - Citizens Advisory Committee

Appendix A

Savage River State Forest – Citizens Advisory Committee

The Citizens Advisory Committee (CAC) provides an opportunity for management plan review by local individuals with a working familiarity of the state forest, representing a wide array of natural resource based interests. Seven particular areas of interest will be represented by the board. These include fishing, hunting, ecology, conservation, business, recreation, timber, youth representation and wildlife, forestry and recreation professions.

The primary role of CAC Member is to review and comment on any/all resource issues and management proposals that affect the overall forest ecosystem and subsequently, its stakeholders as presented in the State Forest Annual Work Plan. Members ensure that all proposed management encompasses the needs of as many interest areas as possible and contains provisions to address the concerns of all user groups. As a follow-up to the Interdisciplinary Team Review, the CAC serves to eliminate possible omissions or oversights and to clarify misunderstandings that may arise during the management plan review process.
Meetings will be held a minimum of once per fiscal year. Additional meetings will be scheduled if warranted.

Appointments to the committee will be made by the Maryland State Forester. Members of the existing committee as well as natural resources professionals have the opportunity to nominate new members for replacement as vacancies occur. Imposed term limits for formally appointed members will be three years. Individuals serving on the committee in an informal capacity will have term a limit of one year. At the end of each term, formally appointed members will notify, in writing, their intent to continue participating as a member of the board or to vacate their position. Informal appointees and anyone interested in serving on the CAC must forward their interest to the forest manager in order to receive an application. After review, a recommendation for membership approval/denial will be determined and individuals will be informed of the decision via formal letter.

Groups represented on the CAC include:

- Recreation (e.g. hiking, horseback riding, bird watching, etc.)
- Sportsman (e.g. fishing, hunting)
- Wildlife Interest (e.g. Audubon, National Wildlife Federation, TNC, Ducks Unlimited, etc.)

- Conservation Interest (e.g. TNC, Trout Unlimited, National Turkey Federation, USFWS, etc.)
- Forest Industry (e.g. mill representative or logger)
- Socioeconomic Interest (e.g. local business or community/governmental representative)
- Forest Conservation District Board Member (e.g. Representative from County Board in the area of State Forest)

Appendix B - Forest Stewardship Council

Appendix B

FSC – Standards and Principles

FSC – US Forest Management Standard (v1.0)
(w/o FF Indicators and Guidance)

Recommended by FSC-US Board, May 25, 2010
Approved by FSC-IC, July 8, 2010

Principle #1: Compliance with laws and FSC Principles
Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.

Principle #2: Tenure and use rights and responsibilities
Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.

Principle #3: Indigenous peoples' rights
The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected.

Principle #4: Community relations and worker's rights
Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.

Principle #5: Benefits from the forest
Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

Principle #6: Environmental impact
Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.

Principle #7: Management plan
A management plan -- appropriate to the scale and intensity of the operations -- shall be written, implemented, and kept up to date. The long term objectives of management, and the means of achieving them, shall be clearly stated.

Principle #8: Monitoring and assessment
Monitoring shall be conducted -- appropriate to the scale and intensity of forest management -- to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

Principle #9: Maintenance of high conservation value forests
Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

Principle #10: Plantations
Plantations shall be planned and managed in accordance with Principles and Criteria 1 – 9 and Principle 10 and their Criteria. While plantations can provide an array of social and economic benefits, and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on and promote the restoration and conservation of natural forests.

For additional information go to the Forest Stewardship Council homepage at: https://us.fsc.org/en-us.

Appendix C - Sustainable Forestry Initiative

SFI 2015-2019 Forest Management Standard Principles

SFI Program Participants believe forest landowners have an important stewardship responsibility and a commitment to society, and they recognize the importance of maintaining viable commercial, family forest and *conservation* forestland bases. They support *sustainable forestry* practices on forestland they manage, and promote them on other lands. They support efforts to protect private property rights, and to help all private landowners manage their forestland sustainably. In keeping with this responsibility, *SFI Program Participants* shall have a written *policy* (or *policies*) to implement and achieve the following *principles*:

1. Sustainable Forestry

To practice *sustainable forestry* to meet the needs of the present without compromising the ability of future generations to meet their own needs by practicing a land stewardship ethic that integrates *reforestation* and the managing, growing, nurturing and harvesting of trees for useful products and *ecosystem services* such as the *conservation* of soil, air and water quality, carbon, *biological diversity, wildlife* and *aquatic habitats*, recreation and aesthetics.

2. Forest Productivity and Health

To provide for regeneration after harvest and maintain the productive capacity of the forestland base, and to protect and maintain *long-term* forest and soil *productivity.* In addition, to protect forests from economically or environmentally undesirable levels of wildfire, pests, diseases, *invasive exotic plants and animals*, and other damaging agents and thus maintain and improve *long-term forest health* and *productivity.*

3. Protection of Water Resources

To protect water bodies and *riparian areas*, and to conform with forestry *best management practices* to protect water quality.

4. Protection of Biological Diversity

To manage forests in ways that protect and promote *biological diversity*, including animal and plant species, *wildlife habitats*, and ecological or natural community types.

5. Aesthetics and Recreation

To manage the visual impacts of forest operations, and to provide recreational opportunities for the public.

6. Protection of Special Sites

To manage lands that are ecologically, geologically or *culturally important* in a manner that takes into account their unique qualities.

7. Responsible Fiber Sourcing Practices in North America

To use and promote among other forest landowners *sustainable forestry* practices that are both scientifically credible and economically, environmentally and socially responsible.

8. Legal Compliance

To comply with applicable federal, provincial, state and local *forestry* and related environmental laws, statutes and regulations.

9. Research

To support advances in sustainable forest management through *forestry* research, science and technology.

10. Training and Education

To improve the practice of *sustainable forestry* through training and education *programs.*

11. Community Involvement and Social Responsibility

To broaden the practice of *sustainable forestry* on all lands through community involvement, socially responsible practices, and through recognition and respect of *Indigenous Peoples*' rights and *traditional*

forest-related knowledge.

12. Transparency

To broaden the understanding of forest certification to the *SFI 2015-2019 Forest Management Standard* by documenting certification audits and making the findings publicly available.

13. Continual Improvement

To continually improve the practice of forest management, and to monitor, measure and report performance in achieving the commitment to *sustainable forestry.*

SFI 2015-2019 Forest Management Standard objectives

A Summary of the SFI 2015-2019 Forest Management Standard Objectives follows:

Objective 1. Forest Management Planning

To ensure forest management plans include long-term sustainable harvest levels and measures to avoid forest conversion.

Objective 2. Forest Health and Productivity

To ensure long-term forest productivity, carbon storage and conservation of forest resources through prompt reforestation, afforestation, minimized chemical use, soil conservation, and protecting forests from damaging agents.

Objective 3. Protection and Maintenance of Water Resources

To protect the water quality of rivers, streams, lakes, wetlands and other water bodies through meeting or exceeding best management practices.

Objective 4. Conservation of Biological Diversity

To manage the quality and distribution of wildlife habitats and contribute to the conservation of biological diversity by developing and implementing stand- and landscape-level measures that promote a diversity of types of habitat and successional stages, and the conservation of forest plants and animals, including aquatic species, as well as threatened and endangered species, Forests with Exceptional Conservation Value, old-growth forests and ecologically important sites.

Objective 5. Management of Visual Quality and Recreational Benefits

To manage the visual impact of forest operations and provide recreational opportunities for the public.

Objective 6. Protection of Special Sites

To manage lands that are geologically or culturally important in a manner that takes into account their unique qualities.

Objective 7. Efficient Use of Fiber Resources

To minimize waste and ensure the efficient use of fiber resources.

Objective 8. Recognize and Respect Indigenous Peoples' Rights

To recognize and respect Indigenous Peoples' rights and traditional knowledge.

Objective 9. Legal and Regulatory Compliance

To comply with applicable federal, provincial, state, and local laws and regulations.

Objective 10. Forestry Research, Science and Technology

To invest in forestry research, science and technology, upon which sustainable forest management decisions are based and broaden the awareness of climate change impacts on forests, wildlife and biological diversity.

Objective 11. Training and Education

To improve the implementation of sustainable forestry practices through appropriate training and education programs.

Objective 12. Community Involvement and Landowner Outreach

To broaden the practice of sustainable forestry through public outreach, education, and involvement, and to support the efforts of SFI Implementation Committees.

Objective 13. Public Land Management Responsibilities

To participate and implement sustainable forest management on public lands.

Objective 14. Communications and Public Reporting

To increase transparency and to annually report progress on conformance with the SFI Forest Management Standard.

Objective 15. Management Review and Continual Improvement

To promote continual improvement in the practice of sustainable forestry by conducting a management review and monitoring performance.

For additional information on the Sustainable Forestry Initiative go to the homepage at: http://www.sfiprogram.org

Appendix C

Sustainable Forestry Initiative®(SFI) Objectives and Principles

SFI 2015-2019 Forest Management Standard Objectives

A Summary of the SFI 2015-2019 Forest Management Standard Objectives follows:

Objective 1. Forest Management Planning

To ensure forest management plans include long-term sustainable harvest levels and measures to avoid forest conversion.

Objective 2. Forest Health and Productivity

To ensure long-term forest productivity, carbon storage and conservation of forest resources through

prompt reforestation, afforestation, minimized chemical use, soil conservation, and protecting forests from damaging agents.

Objective 3. Protection and Maintenance of Water Resources

To protect the water quality of rivers, streams, lakes, wetlands and other water bodies through meeting or exceeding best management practices.

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Objective 5. Management of Visual Quality and Recreational Benefits

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Objective 6. Protection of Special Sites

To manage lands that are geologically or culturally important in a manner that takes into account their unique qualities.

Objective 7. Efficient Use of Fiber Resources

To minimize waste and ensure the efficient use of fiber resources.

Objective 8. Recognize and Respect Indigenous Peoples' Rights

To recognize and respect Indigenous Peoples' rights and traditional knowledge.

Objective 9. Legal and Regulatory Compliance

To comply with applicable federal, provincial, state, and local laws and regulations.

Objective 10. Forestry Research, Science and Technology

To invest in forestry research, science and technology, upon which sustainable forest management decisions are based and broaden the awareness of climate change impacts on forests, wildlife and biological diversity.

Objective 11. Training and Education

To improve the implementation of sustainable forestry practices through appropriate training and education programs.

Objective 12. Community Involvement and Landowner Outreach

To broaden the practice of sustainable forestry through public outreach, education, and involvement, and to support the efforts of SFI Implementation Committees.

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To participate and implement sustainable forest management on public lands.

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To increase transparency and to annually report progress on conformance with the SFI Forest Management Standard.

Objective 15. Management Review and Continual Improvement

To promote continual improvement in the practice of sustainable forestry by conducting a management review and monitoring performance.

For additional information on the Sustainable Forestry Initiative go to the homepage at: http://www.sfiprogram.org

Appendix D - Soil Management Groups

Appendix D

Savage River State Forest – Soil Management Groups

This is a forest management grouping designed specifically for the Savage River State Forest plan, based on the soil series descriptions contained in the Soil Survey of Garrett County (USDA, 1974).

SMG 1 - Very Poorly Drained to Poorly Drained Mapping Units with Moderate Limitations Affecting Construction of Haul Roads and Log Landings
Ar, Armagh Silt Loam, 2.2 Acres, <1% of total
BrA, Brinkerton and Andover Silt Loams, 0 to 3 percent slopes, 47 Acres, <1% of total
BrB, Brinkerton and Andover Silt Loams, 3 to 8 percent slopes, 38 Acres, <1% of total
Ls, Lickdale very stony silt loam, 2 Acres, <1% of total
Acreage total of 88.6 Acres, <1% of Total Area

SMG 2 - Very Poorly Drained to Poorly Drained Mapping Units with Severe Limitations Affecting Construction of Haul Roads and Log Landings
An, Alluvial Land, 796 Acres, 1% of total
Ao, Alluvial Land, Very Stony 383 Acres, 1% of total
At, Atkins Silt Loam, 74 Acres, <1% of total
BsC, Brinkerton and Andover Very Stony Silt Loams, 0 to 15 percent slopes, 876 Acres, 2% of total
Acreage total of 2,128.9 Acres, 4 % of Total Area

SMG 3 - Somewhat Poorly Drained to Moderately Well Drained Mapping Units with Moderate Limitations Affecting Construction of Haul Roads and Log Landings
AbB, Albrights Silt Loam, 0 to 8 percent slopes, 43 Acres, <1% of total
AbC2, Albrights Silt Loam, 8 to 15 percent slopes, 93 Acres, <1% of total
CoB, Cavode silt loam, 0 to 8 percent slopes, 46 Acres, <1% of total
CoC2, Cavode silt loam, 8 to 15 percent slopes, moderately eroded, 47 Acres, <1% of total
CtB, Cookport channery loam, 0 to 8 percent slopes, 12 Acres, <1% of total
CtC2, Cookport channery loam, 8 to 15 percent slopes, moderately eroded, 1 Acres, <1% of total
CuD, Cookport and Ernest very stony silt loams, 8 to 25 percent slopes, 2,795 Acres, 5% of total
ErA, Ernest silt loam, 0 to 3 percent slopes, 13 Acres, <1% of total
ErB, Ernest silt loam, 3 to 8 percent slopes, 108 Acres, <1% of total
ErC2, Ernest silt loam, 8 to 15 percent slopes, moderately eroded, 106 Acres, <1% of total

ErD2, Ernest silt loam, 15 to 30 percent slopes, moderately eroded, 1 Acre, <1% of total
WhB2, Wharton silt loam, 0 to 10 percent slopes, 53 Acres, <1% of total
WhC2, Wharton silt loam, 10 to 20 percent slopes, 27 Acres, <1% of total
Acreage total of 3,344.8 Acres, 6% of Total Area

SMG 4 - Somewhat Poorly Drained to Moderately Well Drained Mapping Units with Severe Limitations Affecting Construction of Haul Roads and Log Landings

AgC, Albrights Very Stony Silt Loam, 0 to 15 percent slopes, 903 Acres, 2% of total
CuB, Cookport and Ernest very stony silt loams, 0 to 8 percent slopes, 2,804 Acres, 5% of total
Ph, Philo silt loam, 17 Acres, <1% of total
Acreage total of 3,723.8 Acres, 7% of Total Area

SMG 5 - Well Drained Mapping Units with Slight to Moderate Limitations Affecting Construction of Haul Roads and Log Landings

CaC2, Calvin-Gilpin-Ungers channery loams, 10 to 20 percent slopes, 188 Acres, <1% of total
CaD2, Calvin-Gilpin-Ungers channery loams, 20 to 35 percent slopes, 257 Acres, <1% of total
CaD3, Calvin-Gilpin-Ungers channery loams, 20 to 35 percent slopes, severely eroded, 96 Acres, <1% of total
CnC2, Calvin, Ungers, and Lehew channery loams, 10 to 20 percent slopes, 1,479 Acres, 3% of total
CnD2, Calvin, Ungers, and Lehew channery loams, 20 to 35percent slopes, 698 Acres, 1% of total
CnD3, Calvin, Ungers, and Lehew channery loams, 20 to 35 percent slopes, severely eroded, 265 Acres, <1% of total
CrB, Clymer channery loam, 0 to 10 percent slopes, 48 Acres, <1% of total
DbB, Dekalb channery loam, 0 to 10 percent slopes, 434 Acres, 1% of total
DbC2, Dekalb channery loam, 10 to 20 percent slopes, moderately eroded, 348 Acres, 1% of total
DbD2, Dekalb channery loam, 20 to 35 percent slopes, moderately eroded, 79 Acres, <1% of total
DgD, Dekalb and Gilpin very stony loams, 15 to 25 percent slopes, 3,024 Acres, 6% of total
DlD, Dekalb and Leetonia very stony sandy loams, 15 to 25 percent slopes, 1,928 Acres, 4% of total
GnB2, Gilpin channery silt loam, 0 to 10 percent slopes, 502 Acres, 1% of total
GnC2, Gilpin channery silt loam, 10 to 20 percent slopes, 976 Acres, 2% of total
GnD2, Gilpin channery silt loam, 20 to 35 percent slopes, 290 Acres, 1% of total
GnD3, Gilpin channery silt loam, 20 to 35 percent slopes, severely eroded, 22 Acres, <1% of total
LaD, Laidig very stony loam, 8 to 25 percent slopes, 197 Acres, <1% of total
McB, Meckesville silt loam, 0 to 8 percent slopes, 50 Acres, < 1% of total
McC2, Meckesville silt loam, 8 to 15 percent slopes, moderately eroded, 72 Acres, < 1% of total
MdD, Meckesville very stony silt loam, 8 to 25 percent slopes, 605 Acres, 1% of total
UcB, Ungers, Calvin, and Lehew channery loams, 0 to 10 percent slopes, 877 Acres, 2% of total
UnB, Ungers-Gilpin-Calvin channery loams, 0 to 10 percent slopes, 114 Acres, <1% of total
VsF, Very stony land, steep, 154 Acres, <1% of total

Acreage total of 12,703 Acres, 24% of Total Area

SMG 6 - Well Drained Mapping Units with Severe Limitations Affecting Construction of Haul Roads and Log Landings

ClE, Calvin and Lehew channery loams, 35 to 50 percent slopes, 872 Acres, 2% of total
DcC, Dekalb-Calvin-Lehew very stony loams, 0 to 15 percent slopes, moderately eroded, 870 Acres, 2% of total
DcD, Dekalb-Calvin-Lehew very stony loams, 15 to 25 percent slopes, moderately eroded, 1,946 Acres, 4% of total
DgC, Dekalb and Gilpin very stony loams, 0 to 15 percent slopes, 2,153 Acres, 4% of total
DlC, Dekalb and Leetonia very stony sandy loams, 0 to 15 percent slopes, 2,192 Acres, 4% of total
LaB, Laidig very stony loam, 0 to 8 percent slopes, 28 Acres, <1% of total
MdB, Meckesville very stony silt loam, 0 to 8 percent slopes, 203 Acres, < 1% of total
VsD, Very stony land, rolling, 2,730 Acres, 5% of total

Acreage total of 10,993.5 Acres, 20% of Total Area

SMG 7 - Soil Mapping Units that are Variable and have no Defined Drainage Class with Moderate Limitations Affecting Construction of Haul Roads and Log Landings

Cv, Cut and Fill Land, 3 Acres, <1% of total
St, Strip Mines and Dumps, 145 Acres, <1% of total

Acreage total of 147.5 Acres, <1% of Total Area

SMG 8 - Soil Mapping Units that are Variable and have no Defined Drainage Class with Severe Limitations Affecting Construction of Haul Roads and Log Landings

Dam, 9 Acres, <1% of total
SrF, Stony Land, Steep, 20,433 Acres, 38% of total
Sw, Swamp, 53 Acres, <1% of total
W, Water, 374 Acres, 1% of total

Acreage total of 20,868.4 Acres, 39% of Total Area

Table D.1: Map Symbols used in County Soil Survey for Savage River State Forest

Map Unit Symbol	Soil Name	Acres	Percent
AbB	Albrights silt loam, 0 to 8 percent slopes	43	0%
AbC2	Albrights silt loam, 8 to 15 percent slopes, moderately eroded	92.8	0%
AgC	Albrights very stony silt loam, 0 to 15 percent slopes	903.4	2%
An	Alluvial land	796.1	1%
Ao	Alluvial land, very stony	382.6	1%
Ar	Armagh silt loam	2.2	0%
At	Atkins silt loam	74	0%
BrA	Brinkerton and Andover silt loams, 0 to 3 percent slopes	46.8	0%
BrB	Brinkerton and Andover silt loams, 3 to 8 percent slopes	38.1	0%
BsC	Brinkerton and Andover very stony silt loams, 0 to 15 percent slopes	876.2	2%
CaC2	Calvin-Gilpin-Ungers channery loams, 10 to 20 percent slopes	188.3	0%
CaD2	Gilpin-Ungers channery loams, 20 to 35 percent slopes	257	0%
CaD3	Calvin-Gilpin-Ungers channery loams, 20 to 35 percent slopes, severely eroded	95.6	0%
ClE	Calvin and Lehew channery loams, 35 to 50 percent slopes	871.8	2%
CnC2	Calvin, Ungers, and Lehew channery loams, 10 to 20 percent slopes	1479.2	3%
CnD2	Calvin, Ungers, and Lehew channery loams, 20 to 35 percent slopes	698.4	1%
CnD3	Calvin, Ungers, and Lehew channery loams, 20 to 35 percent slopes severely eroded	265.3	0%
CoB	Cavode silt loam, 0 to 8 percent slopes	45.5	0%

CoC2	Cavode silt loam, 8 to 15 percent slopes, moderately eroded	47.2	0%
CrB	Clymer channery loam, 0 to 10 percent slopes	48.3	0%
CtB	Cookport channery loam, 0 to 8 percent slopes	11.9	0%
CtC2	Cookport channery loam, 8 to 15 percent slopes, moderately eroded	0.8	0%
CuB	Cookport and Ernest very stony silt loams, 0 to 8 percent slopes	2803.5	5%
CuD	Cookport and Ernest very stony silt loams, 8 to 25 percent slopes	2795.4	5%
Cv	Cut and fill land	3	0%
DAM	Dam	9.3	0%
DbB	Dekalb channery loam, 0 to 10 percent slopes	433.5	1%
DbC2	Dekalb channery loam, 10 to 20 percent slopes, moderately eroded	347.6	1%
DbD2	Dekalb channery loam, 20 to 35 percent slopes, moderately eroded	79.1	0%
DcC	Dekalb-Calvin-Lehew very stony loams, 0 to 15 percent slopes	870.1	2%
DcD	Dekalb-Calvin-Lehew very stony loams, 15 to 25 percent slopes	1946	4%
DgC	and Gilpin very stony loams, 0 to 15 percent slopes	2153	4%
DgD	Dekalb and Gilpin very stony loams, 15 to 25 percent slopes	3023.7	6%
DlC	Dekalb and Leetonia very stony sandy loams, 0 to 15 percent slopes	2192.1	4%
DlD	Dekalb and Leetonia very stony sandy loams, 15 to 25 percent slopes	1928.4	4%
ErA	Ernest silt loam, 0 to 3 percent	13.1	0%
ErB	Ernest silt loam, 3 to 8 percent slopes	107.9	0%
ErC2	Ernest silt loam, 8 to 15 percent slopes, moderately eroded	105.8	0%
ErD2	Ernest silt loam, 15 to 30 percent slopes, moderately eroded	1.1	0%

GnB2	Gilpin channery silt loam, 0 to 10 percent slopes	502	1%
GnC2	Gilpin channery silt loam, 10 to 20 percent slopes	975.9	2%
GnD2	Gilpin channery silt loam, 20 to 35 percent slopes	289.8	1%
GnD3	Gilpin channery silt loam, 20 to 35 percent slopes severely eroded	22.3	0%
LaB	very stony loam, 0 to 8 percent slopes	27.7	0%
LaD	Laidig very stony loam, 8 to 25 percent slopes	197.1	0%
Ls	Lickdale very stony silt loam	1.5	0%
McB	Meckesville silt loam, 0 to 8 percent slopes	49.8	0%
McC2	Meckesville silt loam, 8 to 15 percent slopes, moderately eroded	71.5	0%
MdB	Meckesville very stony silt loam, 0 to 8 percent slopes	203.3	0%
MdD	Meckesville very stony silt loam, 8 to 25 percent slopes	605.2	1%
Ph	Philo silt loam	16.9	0%
SrF	Stony land, steep	20432.8	38%
St	Strip mines and dumps	144.5	0%
Sw	Swamp	52.6	0%
UcB	Ungers, Calvin, and Lehew channery loams, 0 to 10 percent slopes	877	2%
UnB	Ungers-Gilpin-Calvin channery loams, 0 to 10 percent slopes	113.8	0%
VsD	Very stony land, rolling	2729.5	5%
VsF	Very stony land, steep	154.2	0%
W	Water	373.7	1%
WhB2	Wharton silt loam, 0 to 10 percent slopes	52.9	0%
WhC2	Wharton silt loam, 10 to 20 percent slopes,	27.4	0%

Appendix E - State Listed Species of Concern

Appendix E

State Listed Species of Concern Documented on Savage River State Forest

Plants:

Climbing Fumitory, *Adlumia fungosa*	T
Porter's Reedgrass, *Calamagrostis porteri*	E
Wild Calla, *Calla palustris*	E
Long-stalked sedge, *Carex pedunculata*	E
Maple-leaved Goosefoot, *Chenopodium gigantospermum*	E
Standley's goosefoot, *Chenopodium standleyanum*	E
Purple Clematis, *Clematis occidentalis*	E
Yellow Clintonia, *Clintonia borealis*	T
Goldthread, *Coptis trifolia*	E
Bunchberry, *Cornus canadensis*	E
Fraser's Sedge, *Cymophyllus fraserianus*	E
Leatherwood, *Dirca palustris*	T
Stiff Gentian, *Gentianella quinquefolia*	E
Oak Fern, *Gymnocarpium dryopteris*	E
White-fruited Mountainrice, *Oryzopsis asperifolia*	T
Black-fruited Mountainrice, *Piptatherum racemosum*	T
Purple Fringeless Orchid, *Platanthera peramoena*	T
Large Purple Fringed Orchid, *Plantanthera grandiflora*	T
Mountain goldenrod, *Solidago roanensis*	E
Rose Twisted-stalk, *Streptopus roseus*	T
American Yew, *Taxus canadensis*	T

Please Note: There are a number of rare plant species tracked by the Maryland Natural Heritage Program that are not officially State listed that occur on SRSF.

Animals:

Mollusks:

Squawfoot, *Strophilus undulatus*	I

Crustaceans:

Franz's Cave Amphipod, *Stygobromus franzi*	I
Insects (Odonata):	
Superb Jewelwing, *Calopteryx amata*	I
Sable Clubtail, *Gomphus rogersi*	I
Spatterdock Darner, *Rhionaeschna mutata*	E
Insects (Coleoptera):	
Northern Barrens Tiger Beetle, *Cicindela patruela*	E
Insects (Lepidoptera):	
Pepper-and-salt Skipper, *Amblyscirtes hegon*	I
Frosted Elfin, *Callophrys irus*	E
Harris' Checkerspot, *Chlosyne harrisii*	T
Two-spotted Skipper, *Euphyes bimacula*	E
Compton Tortoiseshell, *Nymphalis vau-album*	E
Amphibians:	
Wehrle's Salamander, *Plethodon wehrlei*	I
Mountain Chorus Frog, *Pseudacris brachyphona*	E
Birds:	
Northern Goshawk, *Accipiter gentilis*	E
Henslow's Sparrow, *Ammodramus henslowii*	T
Blackburnian warbler, *Dendroica fusca*	T
Alder Fycatcher, *Empidonax alnorum*	I
Nashville warbler, *Vermivora ruficapilla*	I
Mammals:	
Porcupine, *Erethizon dorsatum*	I
Bobcat, *Lynx rufus*	I
Least Weasel, *Mustela nivalis*	I
Eastern Small-footed Bat, *Myotis leibii*	E
Allegheny Woodrat, *Neotoma magister*	E
Long-tailed Shrew, *Sorex dispar*	I
Smoky Shrew, *Sorex fumeus*	I
Southern Water shrew, *Sorex palustris punctulatus*	E
Appalachian Cottontail, *Sylvilagus obscurus*	I

Please Note: There are a number of rare animal species tracked by the Maryland Natural Heritage Program that are not officially State listed that occur on SRSF.

I = In Need of Conservation (designation for animals only)
T = Threatened

E = Endangered

Appendix F - SFI Management Review - Continual Improvement

Appendix F

Effective: July 19, 2005
Operation Order 2005-601 Annapolis, Maryland

Policy for Management Review & Continual Improvement

Objective
This order establishes the Maryland Department of Natural Resources Forest Service policy for a management review system to examine findings and progress in implementing the Sustainable Forest Initiative (SFI) Standard on those lands subject to the Standard, to make appropriate improvements in programs and to inform employees of changes.

Overview
The Sustainable Forest Initiative Standard Objective 13 requires landowners with lands subject to the Standard to promote continual improvement in the practice of sustainable forestry and monitor, measure and report performance in achieving the commitment to sustainable forestry.

Therefore:

1. Biannual reports will be filed by the state forest manager (with input by the management contractor, if applicable) to the state forester on progress of meeting SFI requirements, status of Corrective Action Requests (CAR) and suggested opportunities for continual improvement. The first report will be due within 60 days after the Sustainable Forest Initiative annual audit and the second report six months after that.
2. A summary of the biannual reports will be posted on the DNR Forest Service website and optionally other appropriate public outlets.
3. A meeting will be held annually to report on the progress of meeting SFI requirements, CAR status, opportunities for continual improvement on meeting SFI requirements and for the adjustment and establishment of new SFI implementation goals. This will require attendance by the forest manager, management contractor (if applicable), state forester and appropriate staff. This meeting should be in conjunction with the release of the second report and coordinated by the state forest manager, contractor (if applicable) and state forester.
4. This policy shall be included as a requirement in the agreement with any forest management contractors with DNR Forest Service the requirement to fulfill the above written policy conditions.

Appendix G - Glossary

Appendix G

Glossary

BIOLOGICAL DIVERSITY - The variety of life forms in a given area. Diversity can be categorized in terms of the number of species, the variety in the area's plant and animal communities, the genetic variability of the animals or a combination of these elements.

BUFFER STRIP - A narrow zone or strip of land, trees, or vegetation bordering an area. Common examples include visual buffers, which screen the view along roads and streamside buffers, which are used to protect water quality. Buffers may also be used to prevent the spread of forest pests.

DOMINANT [CO-DOMINANT]: The overstory life form or species in a plant community which contributes the most cover or basal area to the community, compared to other life form or species.

ECOLOGICAL TYPE (Habitat Type): A category of land having a unique combination of potential natural community; soil, landscape features, climate, and differing from other ecological types in its ability to produce vegetation and respond to management. Classes of ecological types include all sites that have this

ECOSYSTEM/COVER TYPE: The native vegetation ecological community considered together with non-living factors of the environment as a unit and, the general cover type occupying the greatest percent of the stand location. Based on tree or plant species forming a plurality of the stocking within the stand. May be observed in the field or computed from plot measurements.

EXTENDED ROTATION: Forest stands for which the harvest age is increased beyond the optimum economic harvest age [e.g., increasing the harvest age of an oak stand from 80-100 years (i.e., the "normal" economic harvest age for oak on most sites) to 150 or more years] to provide larger trees, wildlife habitat and other non-timber values.

INTERIOR FOREST: Habitat necessary for insulation from edge effects (e.g., noise, wind, sun, predation) which occurs within the interior of a patch.

LANDSCAPE LEVEL PLANNING: Planning of the distribution patterns of communities and ecosystems, the processes that affect those patterns, and changes in pattern and process over time.

LAND USE CLASS: The predominant purpose for which an area is employed. Classes include

Agricultural Land, Forest land, Rangeland, Wetland, Urban/suburban, and Utility/Transportation Corridors (Roads, Railroads, and Utility Corridors).

OLD GROWTH ECOSYSTEM FUNCTIONALITY: The ability of an ecosystem to produce the attributes and perform the continued operation of the plant and animal communities in an area together with the non-living physical environment that supports them. Functional Old Growth Ecosystems have physically defined boundaries, but they are also dynamic: their boundaries and constituents can change over time. They can import and export materials and energy and thus can interact with and influence other ecosystems. They can also vary widely in size.

OLD GROWTH NETWORK / MANAGEMENT COMPLEX: interrelated areas of Old Growth that import and export materials and energy and interact with and influence each other as ecosystems.

OLD-GROWTH STANDS: Ecosystems distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development which typically differ from earlier stages in a variety of characteristics that may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function. The age at which old growth develops and the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site conditions and disturbance regime. For example, old growth in fire-dependent forest types may not differ from younger forests in the number of canopy layers or accumulation of down woody material. However, old growth is typically distinguished from younger growth by several of the following structural attributes:

- Large trees for species and site.
- Wide variation in tree sizes and spacing.
- Accumulations of large-size dead standing and fallen trees that are high relative to earlier stages.
- Decadence in the form of broken or deformed tops or bole and root decay.
- Multiple canopy layers.
- Canopy gaps and understory patchiness.
- Young-Growth Stand: Any forested stand not meeting the definition of old growth.

SHADE-INTOLERANT TREES - Trees that cannot thrive in the shade of larger trees**.**

STAND AGE: The mean age of the dominant and co-dominant trees in the stand.

STAND CONDITION: A classification of forest stands based upon the age of maturity and

structure of the overstory and understory.

STRUCTURAL COMPLEXITY ENHANCEMENT: Silvicultural practices that promote old-growth structural characteristics such as multi-layered canopies, elevated large snag and downed log densities, variable horizontal density and a greater proportion of tree basal area in large diameter classes.

Appendix H - Modeling Long-term Sustainability

Appendix H

Savage River State Forest – Modeling Long-term Sustainability

Criteria used in this 100-year model run:

- Maximum age
    - Mixed Oak - 250
    - Northern Hardwood - 250
    - Cove Hardwood - 200
    - Hemlock – 300
    - Plantations - 150
    - Red Maple - 150
    - All other types - 250
- Yields/returns derived from year 2000 CFI data
- Harvests
    - Thinning
        - Mixed Oak – Age 35-60, no activity after thinning for 20 years
        - Northern Hardwood – Age 35-60, no activity after thinning for 20 years
    - Variable Retention Harvest
        - Mixed Oak – Age 80-150 (with or without thinning)
        - Northern Hardwood – Age 80-150 (with or without thinning)
- Death
    - All stands reset to age zero with the same cover type
- Model maximizes total dollar return over entire mo1del run

- Constraints
    - Total harvest area cannot exceed 2500 acres per year
    - Total Thin area cannot exceed 2000 acres per year
    - Total Variable Retention area cannot exceed 1500 acres per year
    - Even flow constraints
    - Total volume harvested cannot change from the maximum by more than 40%
    - No restriction on total thin area change
        - Total variable retention level cannot change more than 25% from max
        - Total standing inventory cannot change by more than 25% from the max

The following forest modeling graphs are derived from the current database for Savage River State Forest as of March 2011. The forest modeling projections below are estimates on what can be expected to occur over a 100-year time frame.

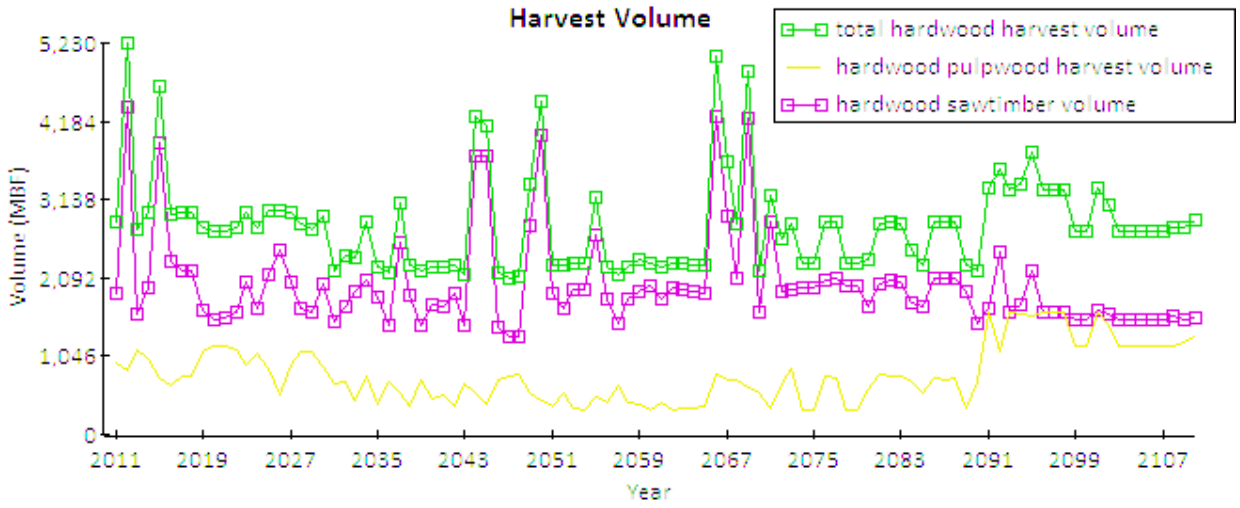


Figure H.1: Estimated Harvest Volume on SRSF based on 100-year projection.

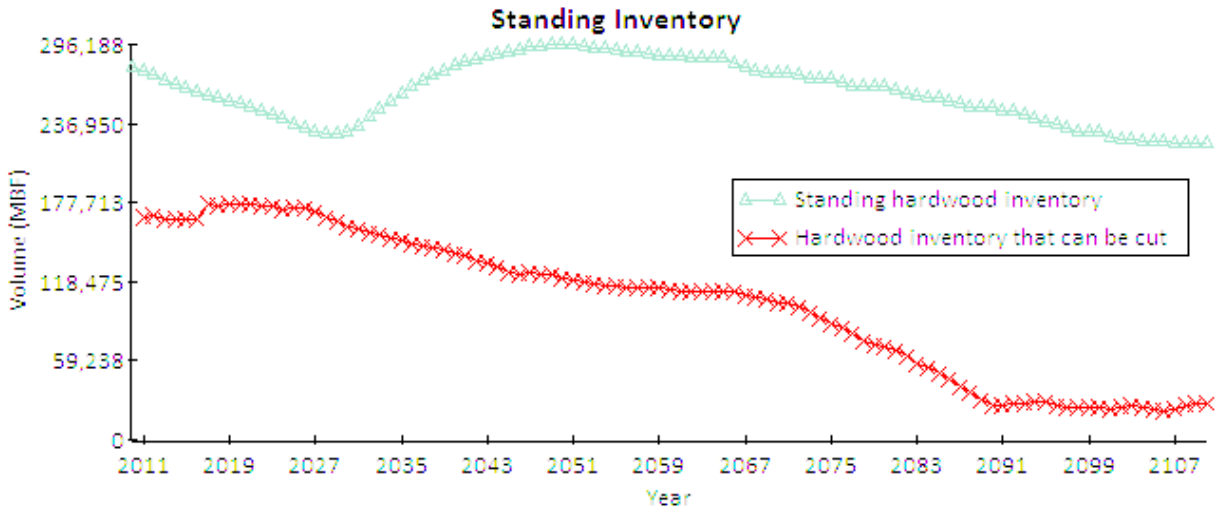


Figure H.2: Standing Inventory on SRSF based on a 100-year projection.

Figure H.3: Size Class Area in Acres on SRSF over 100-year projection.

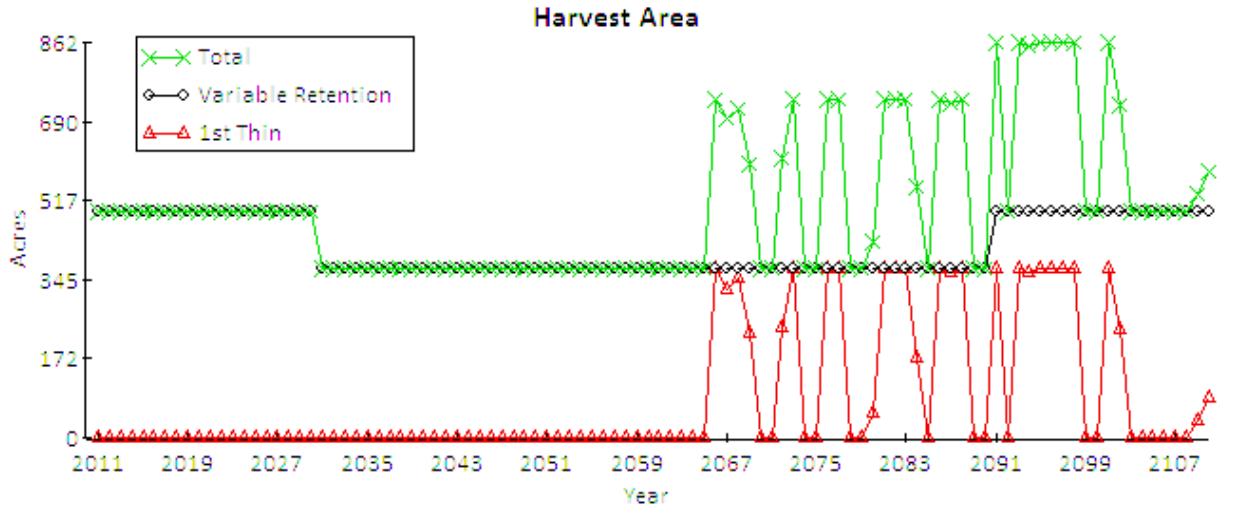


Figure H.4: Estimated Available Harvest Acres for Various Harvest Methods over a 100-year period.

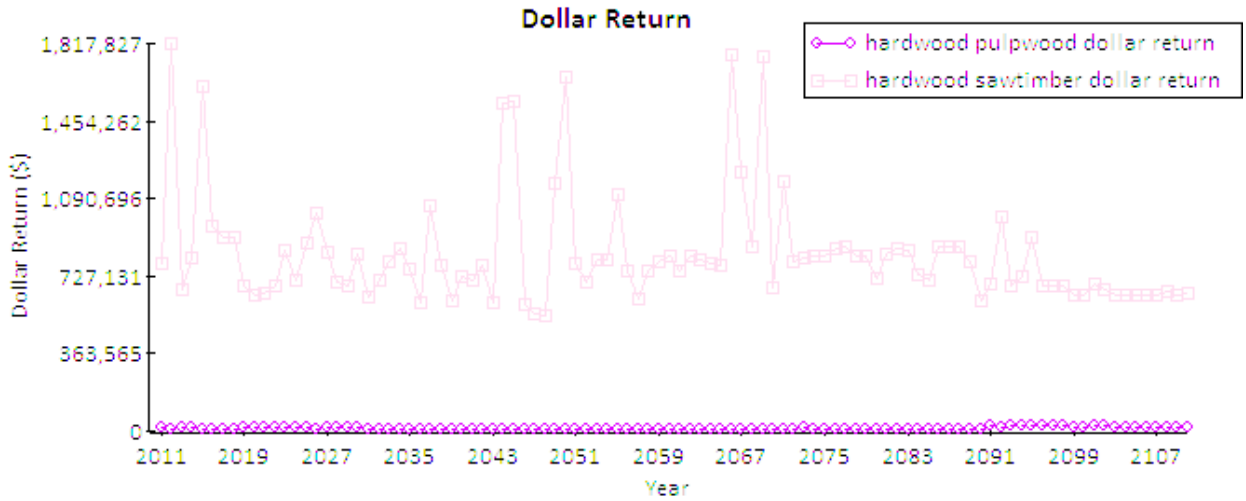


Figure H.5: Estimated Revenue projections from various Harvest Types, 100-year period.

The annual growth rate on the forest based on continuous forest inventory data from 2000 is 12,900,000 Board Feet. The breakdown by previously used forest zone identifiers are as follows:

General Zone	6,500,000 Board Feet
Special Zone	1,400,000 Board Feet
Water Influence Zone	4,100,000 Board Feet
Recreation Zone	100,000 Board Feet

Wildland Zone 800,000 Board Feet

In order to determine incremental forest growth and a sustainable harvest volume for Savage River State Forest, an accurate assessment of harvestable acreage was made in 2016. Total acreage determination for Savage River State Forest utilizing Geographical Information Systems yields total perimeter acreage of 55,452. This figure reflects all the inholdings of the state forest that are not necessarily part of the managed acreage. Within the boundaries of the forest lie two state parks; New Germany State Park and Big Run State Park. These separate entities account for 538 and 300 acres respectively, reducing the total forest acreage to 54,614. Additionally, the Savage River Reservoir acreage must be deducted from the forest total. Removing the 363 acres occupied by the reservoir to the high water mark further reduces the overall forest acreage to 54,251 acres.

After this determination of forest acreage has been calculated, the areas of the forest that are excluded from timber management must be removed from the harvestable acreage total and any growth figures from these areas cannot be included in determining the overall growth that is the basis for the annual forest harvest volume. Areas of High Conservation Value Forest including Ecologically Significant Areas, Wildlands, Wetlands of Special State Concern, Old Growth, Old Growth Ecological Management Areas, and fifty foot no-cut stream buffers comprise 18,482 acres of the state forest. Deducting the acreage occupied by these special areas from the forest total results in what was commonly assumed to be the former “General Zone” made up of 35,768 acres. This acreage and the associated forest growth within have been used as the basis for the annual harvest levels on Savage River State Forest for decades**.**

Updated analysis and scrutiny has illustrated that a large portion of the previously identified 35,768 acres of General Zone that are used as the basis for annual harvest rates are composed of inoperable lands. These inoperable lands have a variety of management issues including lack of access, known rock and water impediments, steep slopes, powerlines and previously cruised stands that have been denied as harvest sites by the Interdisciplinary Team. Collectively, these areas cover 12,093 acres, further reducing total harvestable acres from 35,768 to 23,675. Forest and county infrastructure including roads and campsites also contribute to the loss of harvestable acres of the forest, eliminating 1,339 acres resulting in a total assumed harvestable acreage of 22,336 acres.

The previous deductions from the total harvestable acreage have been mapped and impacts on harvests can readily be illustrated before any harvest delineation occurs in the field. Conversely, areas that have not been documented and are subsequently discovered during the implementation of a timber harvest contribute to the loss of harvestable acreage. A five-year review of Annual Work Plans for Savage River State Forest shows, on average, a 13 percent loss of planned harvest acreage, which equates to 2,863 acres. This loss is mainly attributed to unmapped water courses and rock outcrops, but can include other factors such as rare, threatened and endangered species discoveries that require specific buffering protocols and aesthetic buffers along roadways. The resulting 19,473 acres become the realistic harvestable acres that should be used to calculate growth and sustainable harvest values for Savage River State Forest.

It should be noted that the average loss figure of 13 percent is relatively low for typical harvests. This number was calculated using a large proportion of conifer harvests that typically have minimal acreage loss, if any. Acreage loss on a typical hardwood harvest approaches

anywhere from 15 to 20 percent loss which further reduces the realistic harvestable area.

The inventory of the harvestable area of the state forest has been completed using SILVAH protocols. Standing board foot volume was determined using the intense stand inventory data collected over the last five years and found to be 111,268,722 Board Feet. The average board foot volume on the 19,473 acres is 5,714 Board Feet/acre. An annual average growth figure of 1.1%* was applied to the 5,714 Board Feet resulting in an average annual growth figure of 63 Board Feet/Acre/Year across the harvestable acreage (Frieswyk, 2001). Applying this resulting growth figure to the harvestable acreage yields a total average annual incremental growth of 1,226,799 Board Feet /Year for Savage River State Forest.

The determination of annual incremental growth for the harvestable areas of Savage River State Forest is directly predicated on the land area that is available for harvest. However, harvest standards that have been implemented as a result of Forest Certification also contribute to a reduced annual harvest volume. In particular, the retention standard for regeneration harvests. On average, five percent of the original stand is to be retained if the harvest exceeds ten acres in size. The trees that are retained per the standard have a greater impact on the harvest volume than the acreage given that the selected trees are usually single stems or in small clusters. Typically, these trees fall in larger diameter classes and therefore a greater board foot volume remains in the stand throughout the rotation and any associated growth is omitted from growth figures. Applied to the total average annual incremental growth, the five percent retention subtracts 61,340 Board Feet leaving 1,165,459 Board Feet of growth available for harvest annually.

The average annual harvest rate in the amended “general zone” since 2009 is 957,200 Board Feet. The annual harvest rates since 2009 are as follows:

2009	1,714,735 Board Feet
2010	1,244,076 Board Feet
2011	850,561 Board Feet
2012	144,349 Board Feet
2013	863,049 Board Feet
2014	521,526 Board Feet
2015	1,286,994 Board Feet
2016	941,285 Board Feet
2017	853,347 Board Feet
2018	1,152,074 Board Feet

Yearly average harvest volumes are not to exceed growth estimations.

Appendix I - Tract Maps

Appendix I
Savage River State Forest – Tract Maps

Figure I.1 – Forest Compartments

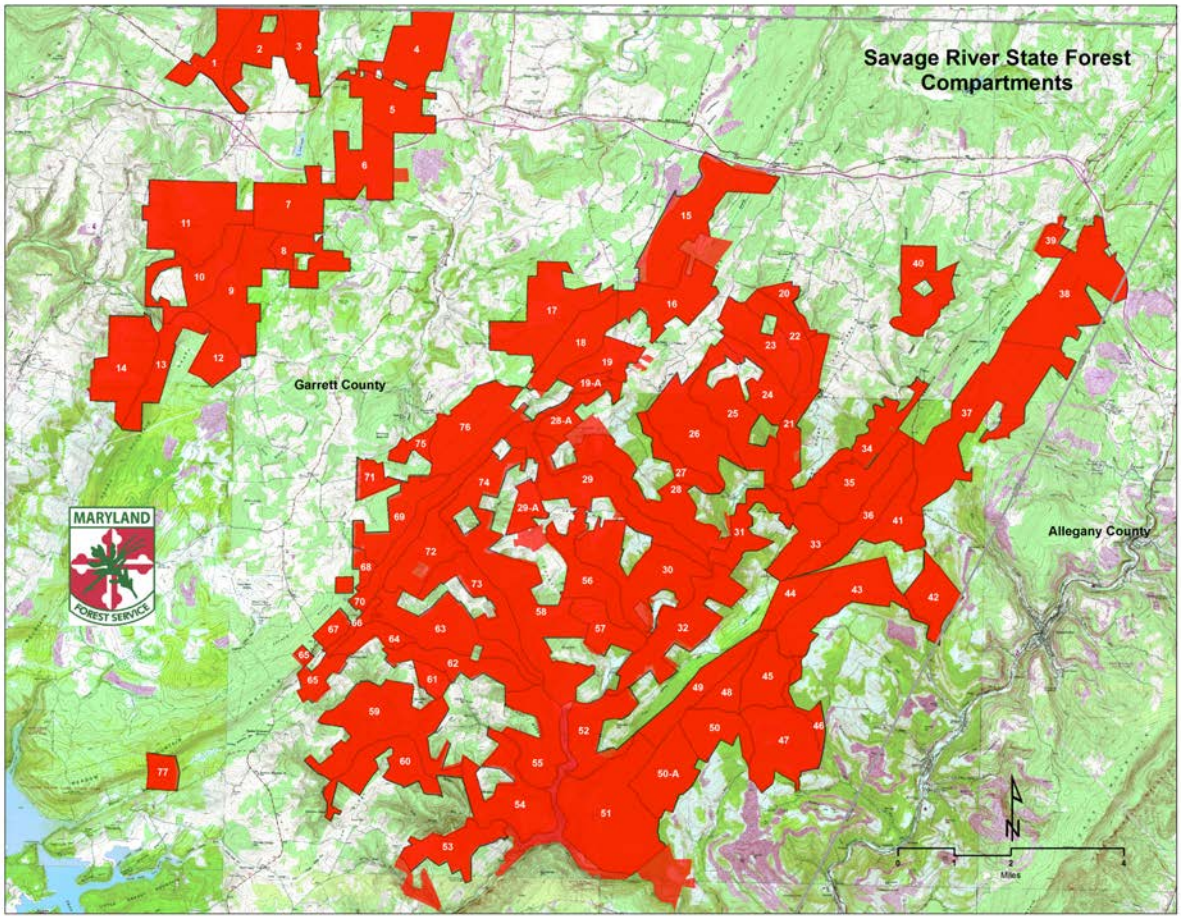


Figure I.2 High Conservation Value Forest

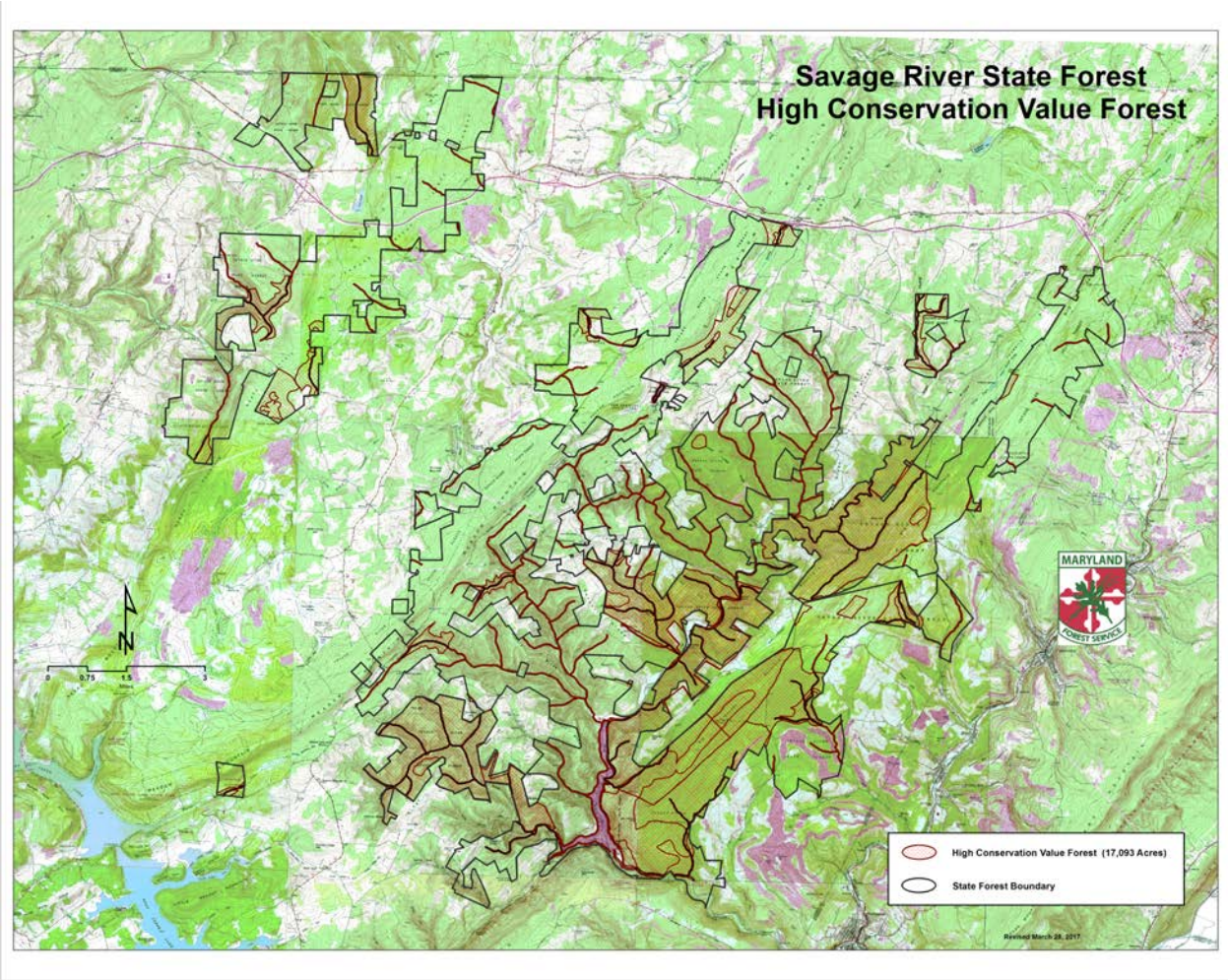


Figure I.3 – Old Growth and Old Growth Ecosystem Management Areas

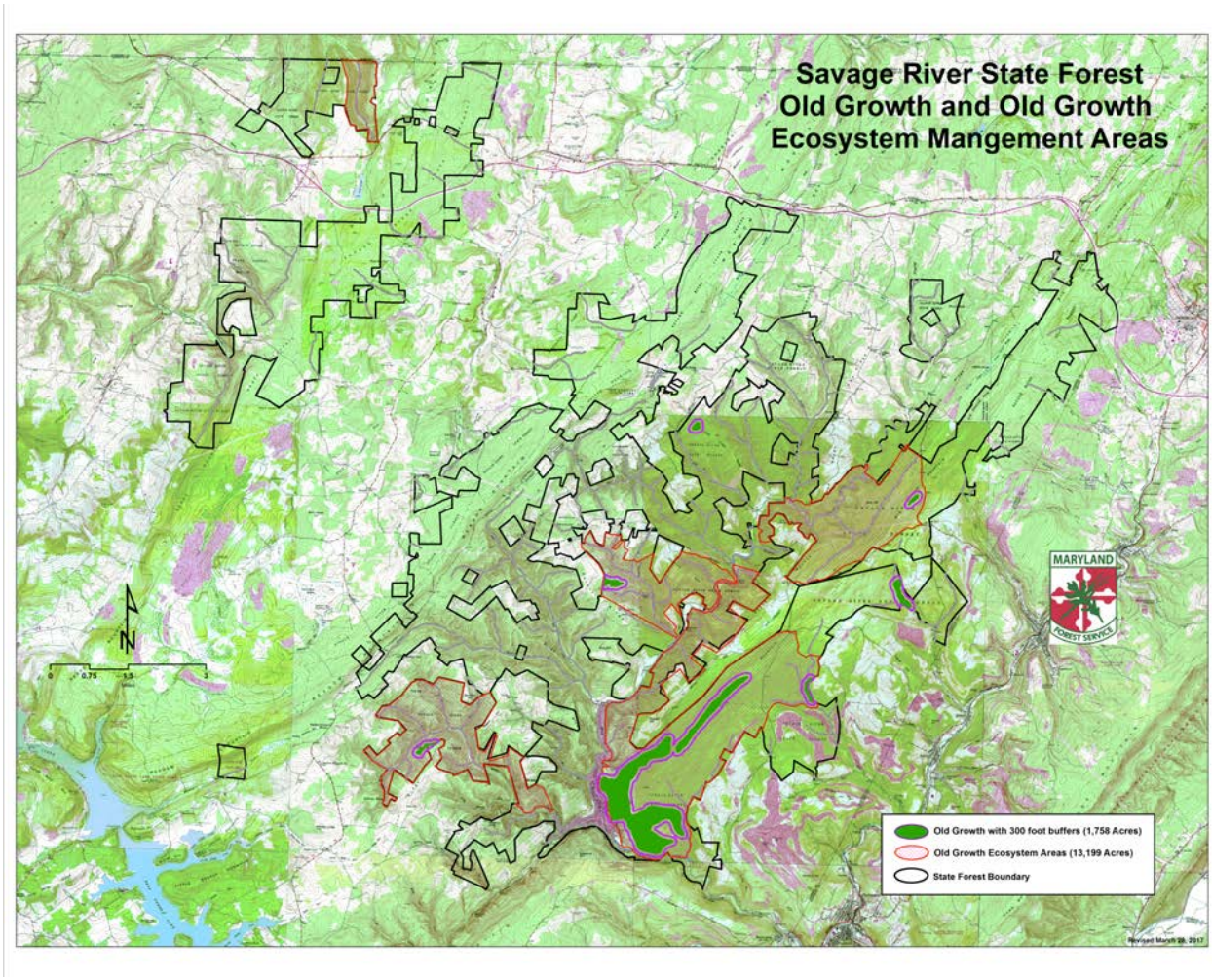


Figure I.4 – Riparian Buffers and Wetlands of Special State Concern

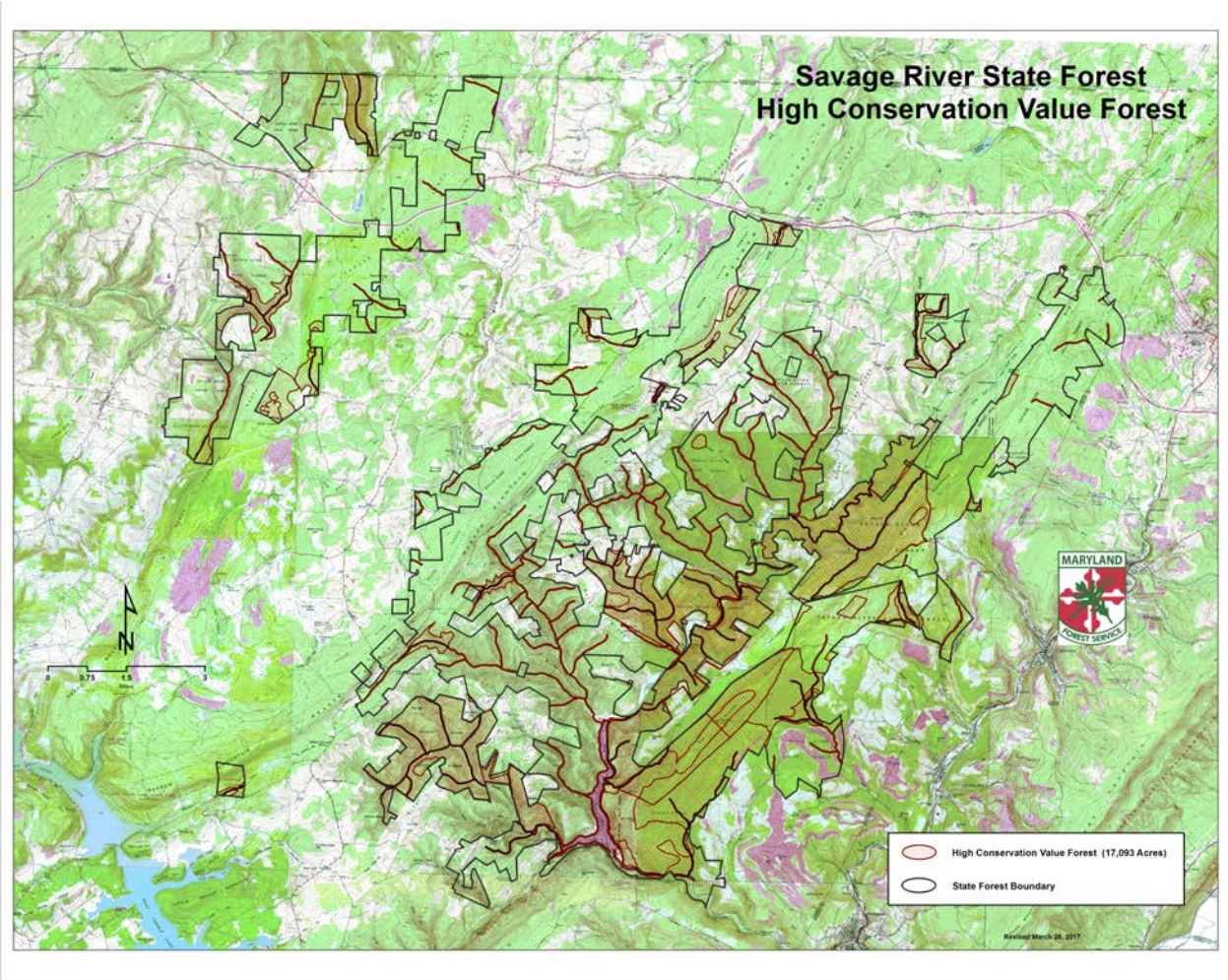


Figure I.5 – Ecologically Significant Areas

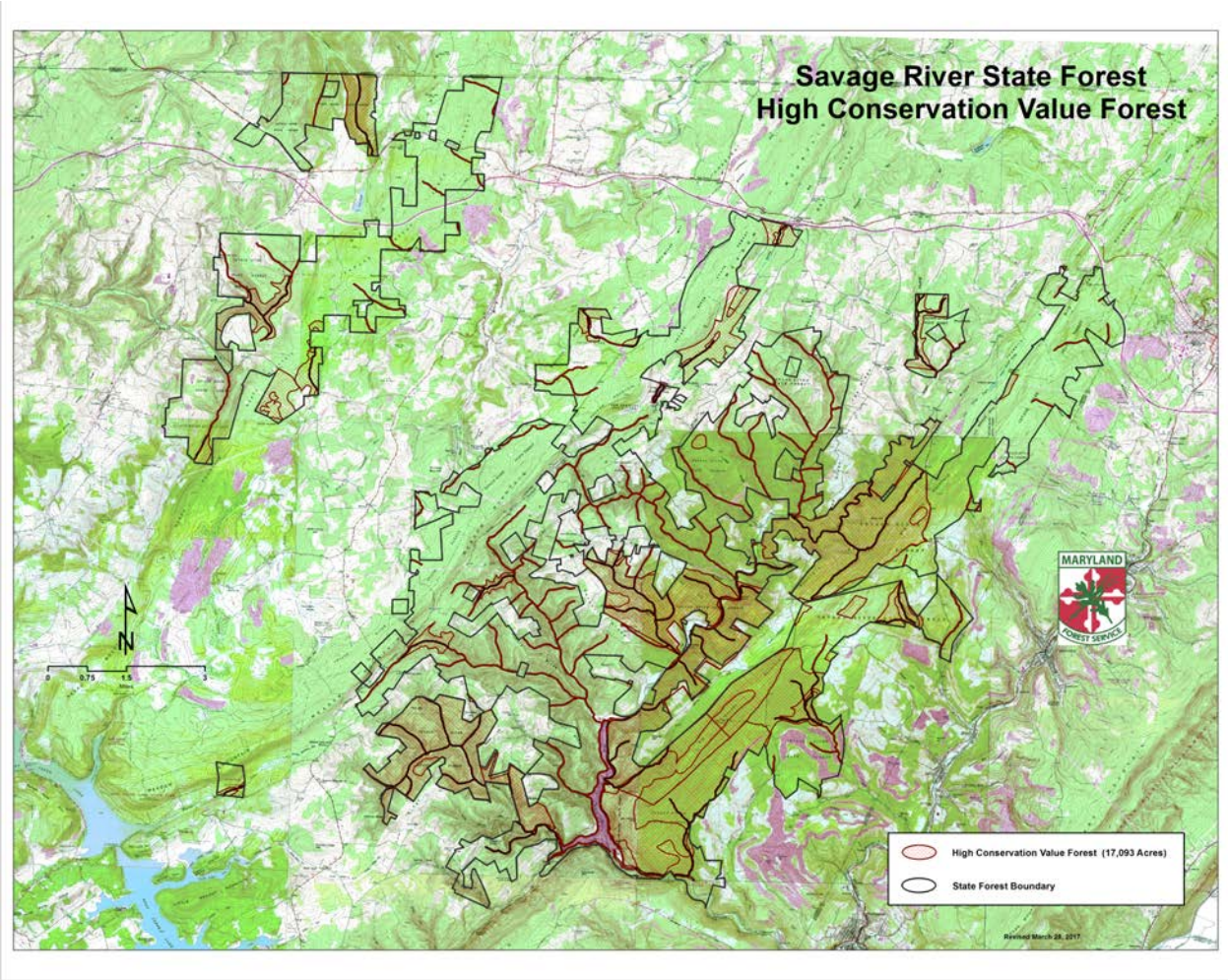
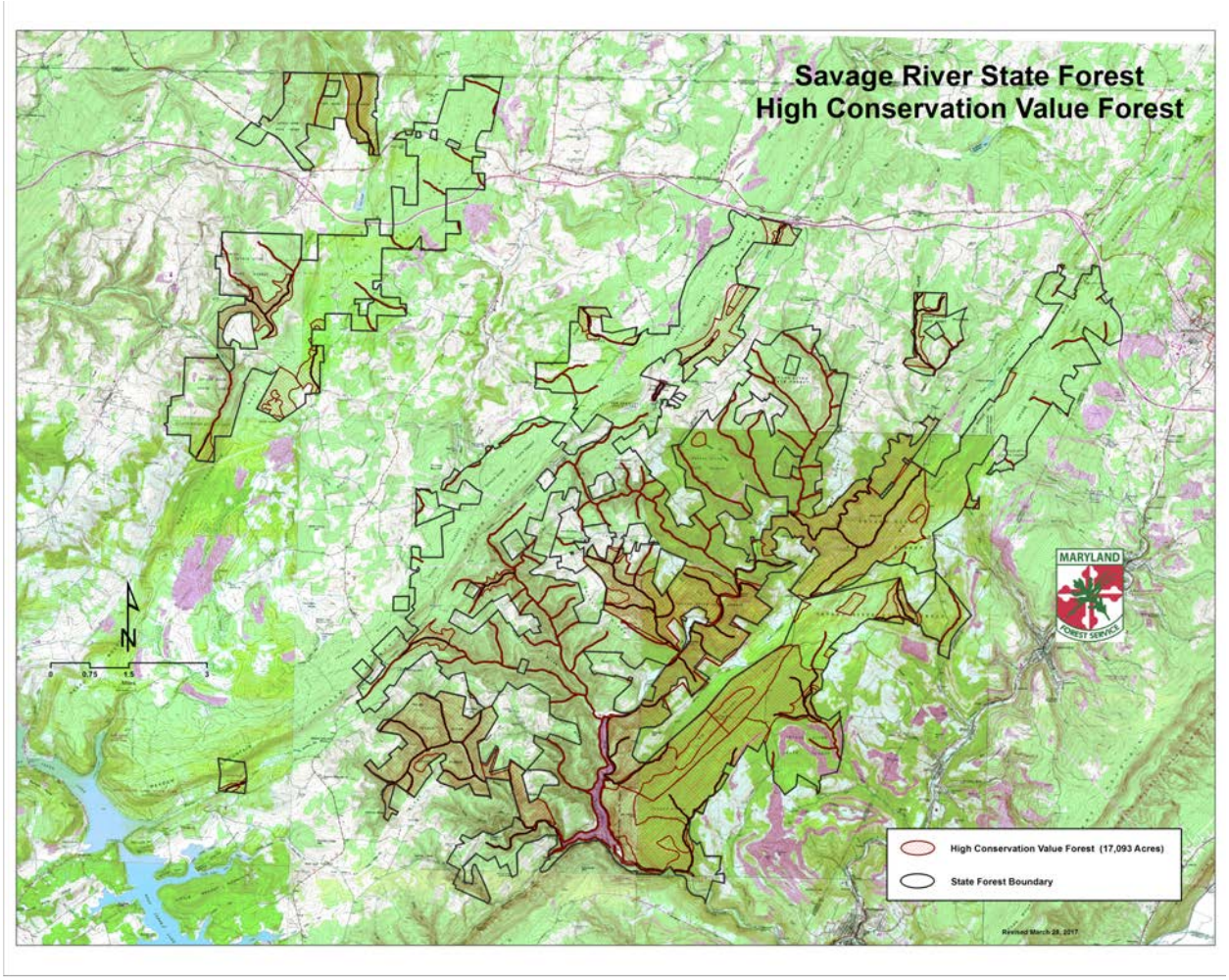


Figure I.6 – Wildlands



The Conifer Component of the Forests of Garrett County

Introduction

Below is a synopsis of the conifer forest of Garrett County based on two historical documents, Maryland Geological Survey, The Forests of Garrett County, H. M. Curran (1902), and The Forests of Garrett County, Fred W. Besley (1916). These are textual pieces that were left for us to learn what that forest looked like then, and possibly what were it components leading up to that time. According to early forest inventories sources such as Fred W. Besley (1916) report conifers have been present but a minor component to the Western Maryland forests.

Besley reported that the forest survey of 1913, one percent of the forests of Garrett County was found in pine and another one percent was in mixed hardwood and pine. Pine and hemlock stands occurred on 1,464 and 617 acres respectively. Hemlock and pine forest type on 1,277 acres. These observations of the forest at the turn of the twentieth century offer a glimpse that the conifer component of that forest was small compared to the dominating hardwood forest, but did hold an important economic place which led to it being harvested to the point of even lesser distribution and place in the subsequent forests since then.

Maryland Geological Survey
The Forests of Garrett County
H. M. Curran
1902

Conifers

The following is a complete list of coniferous trees of Garrett County in 1902:
White Pine (Pinus strobus), Pitch Pine (Pinus rigida), Tamarack (Larix larinina), Black Spruce (Picea mariana), Red Spruce (Picea rubens) and Hemlock (Tsuga canadensis).

At that time fifty-four per cent, or 235,200 acres, of Garrett County was wooded. Of this wooded area, 210,200 acres are cut-over or culled forest lands, and 25,100 acres are in virgin forests. In 1902, the largest conifer component remaining was hemlock but barely at less than 0.2 percent. White pine was not even given a percentage. For trees over 12 inches dbh, even hemlock is not given a figure.

Of the forest class entitled Swamp Timber, it states:

This is the last of the three principal types of virgin forest. The other two, Ridge Timber and Slope Timber, have each a much larger acreage than this. The Swamp Timber has fewer species than any of the types of forest, and yet contains the most valuable timber of all. The principal species are Spruce and White Pine, with a varying amount of Hemlock. The areas occupied by this type surround and extend into the swamps and sedge-covered tracts along the streams, known as Glades and mountain meadows. The wetter portions of these areas are covered with herbaceous plants and alder brush, and the drier portions are heavily wooded. The timber growth is mainly Spruce, with occasional groups of excellent White Pine. The last of this Swamp Timber is found in the depressions between Negro and Meadow mountains at the head of Cherry Creek. It is being rapidly lumbered, and will be removed within two years.

Hemlock - The last stand of practically pure Hemlock is found on the Youghiogheny river near Muddy Creek. This, with the exception of the White Pine of the Swamp Timber, is the heaviest stand in the county. The trees are large and grow on steep, rocky slopes above the river. A dense thicket of laurel covers the ground under the trees and adds to the difficulty of lumbering. However, the cost of logging on this tract has not prevented the lumbermen from attempting the removal of the timber. A railroad is being built along the foot of this slope and with its

completion logging will commence.

Hemlock and Hardwoods - The forests of this sub-type were once quite extensive, occupying the gradual slopes along the rivers and other streams. Recent lumbering operations have rapidly reduced these areas. There are three small tracts in the county, two on Casselman river and one on Bear Creek. The Casselman tracts are being lumbered, while the Bear Creek tract remains uncut. The largest operations in the county have had for their principal object the removal of Hemlock. Extensive stands on the Youghiogheny river, Bear Creek, and Cherry Creek have been recently cut. Except in the recent cuttings on Casselman river, fire has followed lumbering, killing the reproduction and small trees left by loggers. In many places the fire has been so severe as to completely destroy all vegetation on the area; the abundant humus, and even the top. Layers of the soil have also been burned. No reproduction of Hemlock can be expected on these areas. The probability of a future stand of this species in the county is practically destroyed, unless artificial planting is done.

White Pine - White Pine was once quite a common tree along the streams and rivers of Garrett county, and was one of the first timbers removed. It reached the best development and grew in almost pure stands on the moist level lands surrounding the swamps and mountain meadows. The areas occupied by this growth were never more than a few acres in extent, and the number of such areas was small. As a scattered tree along the streams and mountain slopes it was fairly common and reached large sizes. The reproduction of this pine is fairly abundant, considering the numbers of old trees and the treatment it has received. Young seedlings are found throughout the county and are making a good growth. The last group of pure White Pine in the county was cut recently.

Spruce - The winter of 1902 will probably see the last large stand of Spruce in the county removed. It is at the head of Cherry Creek, between Negro and Meadow mountains. The best of the Spruce occurs on the level or gradually sloping land surrounding the swamps. As the land rises, and becomes drier, oak and other hardwoods prevail. The stand of Spruce is good; the trees have grown rapidly, are tall, and the trunks are clean. In all respects it seems well adapted to this locality, and but for the fact that the lands upon which it grows are valuable for agriculture, it would seem wise to encourage the growth of Spruce. The reproduction here is fair, and except for the fires which follow logging, would insure a good second growth.

Spruce, like White Pine, sometimes occurs as one of the lesser components of the moist slope forests. On Backbone Mountain, near the West Virginia line, it occurs with Hemlock in considerable abundance, but is being rapidly removed.

AN EVERGREEN FOREST ANALYSIS OF GARRETT AND ALLEGANY COUNTIES IN MARYLAND

BY

THE MARYLAND DNR FOREST SERVICE
FOREST RESOURCE PLANNING SECTION

JANUARY 2018

ROBERT FELDT, FOREST PLANNER
JACK PERDUE, PUBLIC LANDS SUPERVISOR
DONALD VANHASSENT, DIRECTOR/STATE FORESTER

An Evergreen Forest Analysis of Garrett and Allegany Counties in Maryland

INTRODUCTION

THE MARYLAND FOREST SERVICE, a unit of the Maryland Department of Natural Resources (DNR) manages over 200,000 acres of state forest land for multiple uses, which include camping, hunting, fishing, timber products, non-timber forest products, animal viewing, hiking, water quality, and more. Four of these forests are found in Garrett and Allegany Counties, in western Maryland, namely Green Ridge State Forest, Savage River State Forest, and the jointly managed Potomac and Garrett State Forests.

Beginning in 2004, State Forests in Maryland became dual certified as a Sustainable Forest under the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council (FSC), two globally recognized forest sustainability non-profit organizations. The certification process involved a very detailed review of the forests by a third party auditor. In 2015, the four western forests also received dual certification by the FSC and SFI. Annual audits by third-party auditors

ensure that forest management activities are following the Sustainable Forest Management Plan for each forest, and that activities are guided by the indicators specified by the FSC and SFI. Occasionally, an audit will reveal a deficiency or "opportunity for improvement", which can eventually be elevated to a Minor Corrective Action Request (CAR), or a more serious Major Corrective Action Request. These must be addressed in various periods of time (depending on the type of CAR), or the managing unit risks revocation of certification.

Recently, an observation by an auditor was made that management was not putting sufficient effort toward management of the western forest's evergreen forest component. This resulted in the issuance of an Opportunity for Improvement, where improvements could be made, but not required. Generally, "evergreens" in western Maryland take the form of naturally occurring hemlock (Tsuga spp.), Eastern White pine (Pinus strobus), Table Mountain pine (Pinus pungens), Pitch pine (Pinus rigida) and others, but also planted stands of spruce—notably Norway spruce (Picea abies). These species comprise the majority of the evergreen component in western Maryland forests.

METHODOLOGY

Evaluation of the evergreen component was done using ESRI Corp. ArcGIS software. Recent upgrades to ESRI software has enabled image classification, feature creation, and raster analysis available in one software package; thus simplifying the project work-flow. These tools were utilized to find potential evergreen tree cover in western Maryland, and quantify it. Additionally, the "iterator" tool used in the Modelbuilder package provides a very simple and effective means of automating the classification/extraction process, and other processes.

Over the years, the state has purchased very high resolution, leaf-off color imagery for the years 2008 and 2013. The recent 2013 imagery also included the color near-infrared band (CIR), in addition to the red/green/blue bands common to regular color imagery. Near-infrared enhances the appearance of healthy, green vegetation, which appears as bright red on the CIR image. The combination of imagery collection during leaf-off, and the inclusion of the CIR band, makes this the perfect imagery for determining evergreen coverage.

The imagery is provided to the state at 6 inch resolution, where one image pixel represents a 6 x 6 inch area on the ground. The assessment of evergreen coverage did not require such high resolution, so the imagery was resampled to 3.2808 x 3.2808 feet per pixel (approximately 1 square meter)(figure 1). This made moving the numerous imagery files needed for the analysis more efficient, and made image processing/classification much faster.

The imagery was downloaded from the State's iMap Maryland data portal. This had the added benefit of completing the resample and mosaic (whereby several smaller images are combined into one) process prior to delivery for use. The delivered 1 meter resolution imagery was given a unique name and placed in a folder to await processing. A model was constructed in ArcGIS Modelbuilder to automate the processing, and followed the process outlined below:

1) Iterate Raster-- Image is loaded from the file by the iterator tool
2) Parse Path--Image name and location are defined/specified.
3) Float—Band 1 is extracted as a floating point decimal raster layer.
4) Float—Band 2 is extracted as a floating point decimal raster layer.

5) Raster Calulator—The bands are combined to produce a Normalized Difference Vegetation Index (NDVI) raster
6) Reclassify—The selected values for the Normalized Difference Vegetation Index calculation were reclassified to 1.

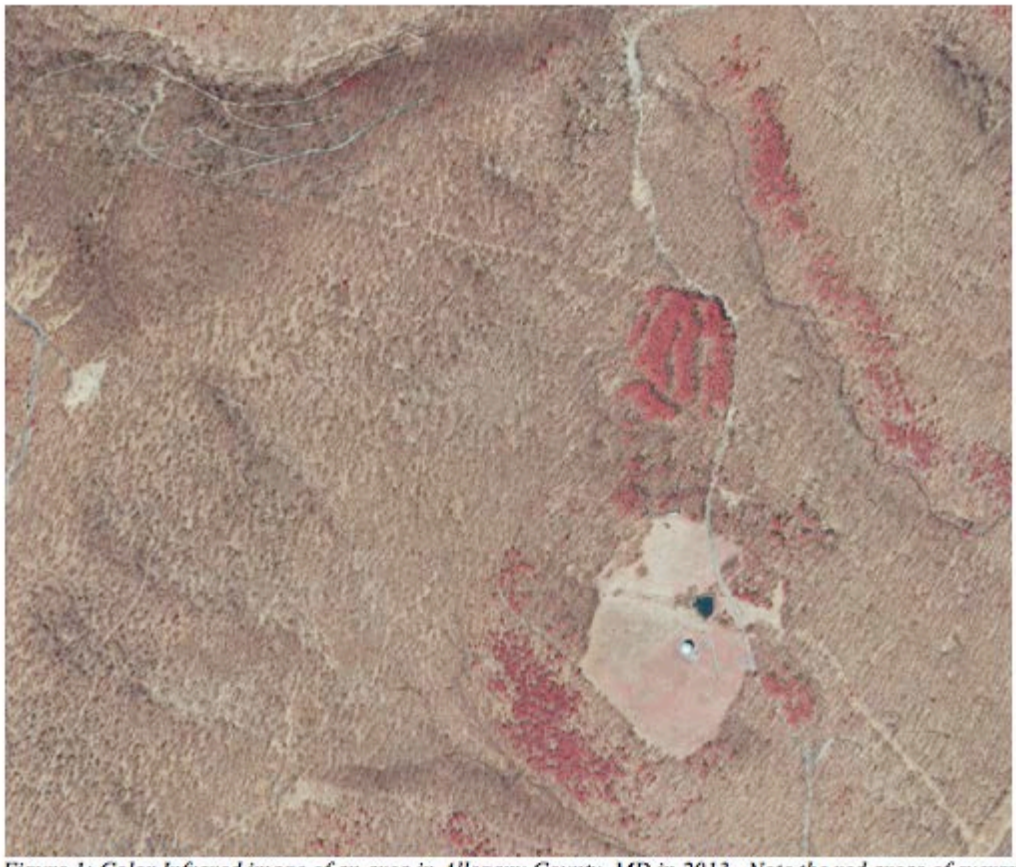


Figure 1: Color Infrared image of an area in Allegany County, MD in 2013. Note the red areas of evergreen vegetation at center and to the right.

Some additional processing extracted tree cover, and limited the returned data to those areas, so that only tree canopy was measured. This eliminated non-tree areas of evergreen shrubs, fields, and individual immature trees below the 6.5 foot threshold. There is a chance that some understory plants—namely Rhododendron and Mountain Laurel—could be classified as evergreen trees, where they occur under a hardwood overstory. This is unavoidable, but believed to be minimal for this assessment. It was possible to narrow the returns by selecting a higher threshold from the NDVI returns to eliminate these areas, and return mature evergreen trees, as these seem to have a higher NDVI value. .

The Normalized Difference Vegetation Index (NDVI) is a very commonly used method of evaluating the health of vegetation. A high index value indicates healthy, green vegetation; low index values indicate unhealthy or dead vegetation. The equation used by the ESRI NDVI tool was used to do the calculations in the Raster Calculator, and was entered as:

$$NDVI = \frac{(IR - R)}{(IR + R)} \times 100 + 100$$

Where *IR* is the pixel value from the infrared band (in this case, band 1), and *R* is the pixel value from the red band (in this case, band 2). The NDVI analysis was very effective at extracting evergreen vegetation from the leaf-off imagery, where the index values ranged from 0 to 200, and mature, healthy evergreens being classified at the higher area of the index. However, each image is slightly different for the next, and in order to have a consistent method for capturing the evergreen coverage from image-to-image, two different percentages were used to calculate the threshold for each image. Where the maximum value was greater than or equal to 180, 0.72 was used, and if the maximum was below 180, 0.78 was used. Therefore, an image with a maximum index value of 180 would have the index values between 129.6 and 180 extracted and considered mature evergreen forest. This seemed to limit the amount of understory (and thus shrub species) that was included.

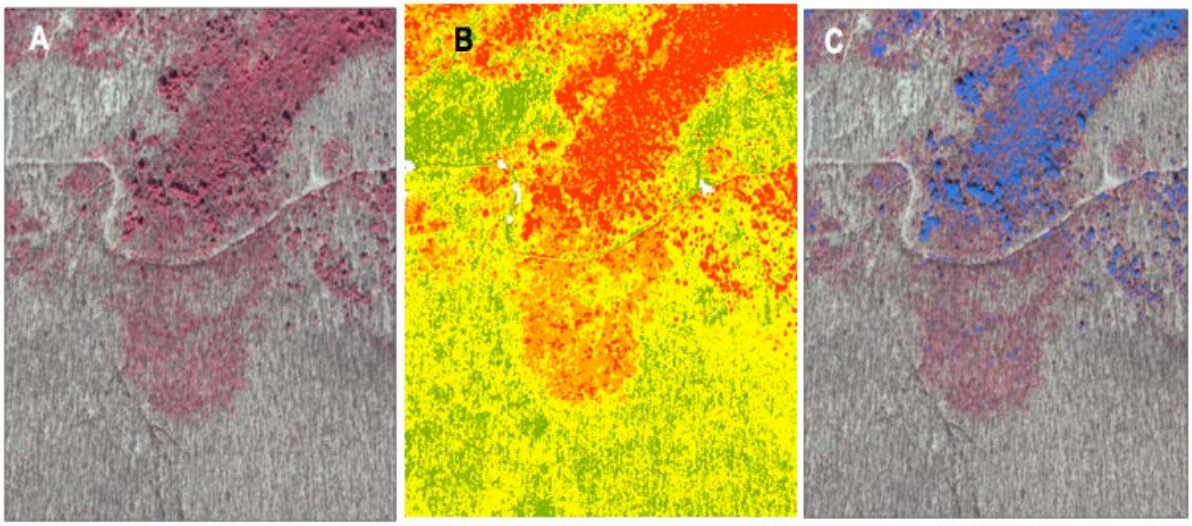


Figure 2: Sample area on the left located at 39.5311, -79.2825 in Garrett County. The left image (A) is the original CIR imagery. The Center image (B) depicts the same area after the NDVI analysis, and on the right, the same area after the evergreen trees are extracted (C). Note the amount of evergreen area in understory not extracted.

Once the evergreen vegetation was extracted as a complete dataset for each county, additional analysis could be conducted. The area was calculated using the Zonal Statistics as Table tool, and used to determine the evergreen coverage of the entire county, followed by each state forest (table 1).

Next, the Aggregate tool was used to create a raster data layer that made further processing faster. Since each 1 meter cell represents 1 meter of evergreen coverage, the tool created a new raster layer that had 3 x 3 meter cells (9 square meters), each cell representing the sum of the evergreen coverage. Thus, if the area had 3 meters of evergreen coverage, the new cell would have a value of 3.

The output of the Aggregate tool was used as the input to represent evergreen cover, and the data was assessed for intensity. This produced a raster data layer using the Focal Statistics

tool, which had a smoothing effect, and removed individual trees and smaller, disassociated clumps of evergreen trees. The result was an intensity map that could be used to identify evergreen stands.

Finally, because the original evergreen coverage data had been aggregated to a larger cell size, it made it easier to create a point density map (figure 3) for Allegany and Garrett Counties. The 3 meter raster representing evergreen coverage was converted to points—one point for each cell. Each point had the sum of the evergreen area as its value, and this value was used to give weight to the points for the density assessment.

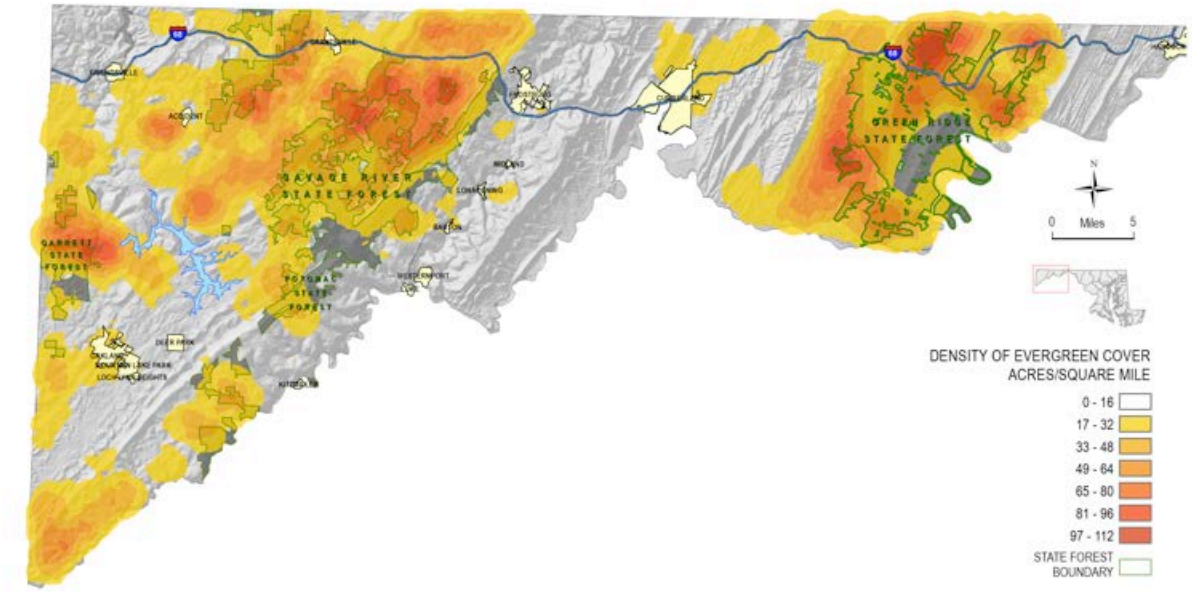


Figure 3: Density analysis of evergreen cover for Garrett and Allegany counties, MD in 2013.

EVALUATION

Evergreen tree density values range from 0 to 112 acres per square mile. Some of the highest densities of evergreen tree cover in Garrett and Allegany counties center around state forests and upland areas. Areas in and around Savage River State Forest, northern portions of Green Ridge State Forest, northern portions of the Garrett State Forest, and in and around Swallow Falls State Park have high concentrations. Larger amounts of evergreen tree cover were found in Garrett county (table 1), than in Allegany county, with Garrett having roughly 7% of it's total tree cover as evergreen, and Allegany having about the same with 6%. Historically, the earliest survey with records was completed about 1913 by Fred W. Besley—Maryland's first State Forester. His completed book "*The Forests of Maryland*" offers incredible insight into how the state's forests were growing just after the turn of the century. The tools and methods used by Besley to determine forest areas then, are crude by today's standards, but can still offer a sense of the proportions of forest areas involved at the time. Figure 4 is a compilation of two

maps created by Besley and his staff for Garrett and Allegany Counties that reflect the 1909 forest inventory they completed. Pines are depicted in green on the Besley maps, and note the large concentration of pine in northeastern Allegany County. The slopes north of Cumberland also appear to have once contained enough pine to be noted on the map, but looking at the density map on the preceding page, numbers have declined over the last century. By contrast, Garrett County had only a few significant pine and hemlock stands at the time; note the significant stand running along Savage River. 100 years later, the densities have increased around the state forest and park lands. Total forest area was estimated by Besley for Garrett to be over 274,000 acres and 163,000 acres for Allegany. They also estimated pine in Allegany to be about 2% of the total forest area, and only 1% in Garrett.

Land Unit	Total Tree Cover (Acres)	Evergreen Area	Percent of Total Area
Allegany County	216,366	10,386	4.8%
Green Ridge State Forest	46,771	3,292	7.0%
Garrett County	302,245	18,446	6.1%
Savage River State Forest	52,789	3,940	7.5%
Potomac State Forest	10,454	397	3.8%
Garrett State Forest	7,308	362	5.0%

Table 1: Evergreen statistics for Garrett and Allegany Counties, Maryland. 2013.

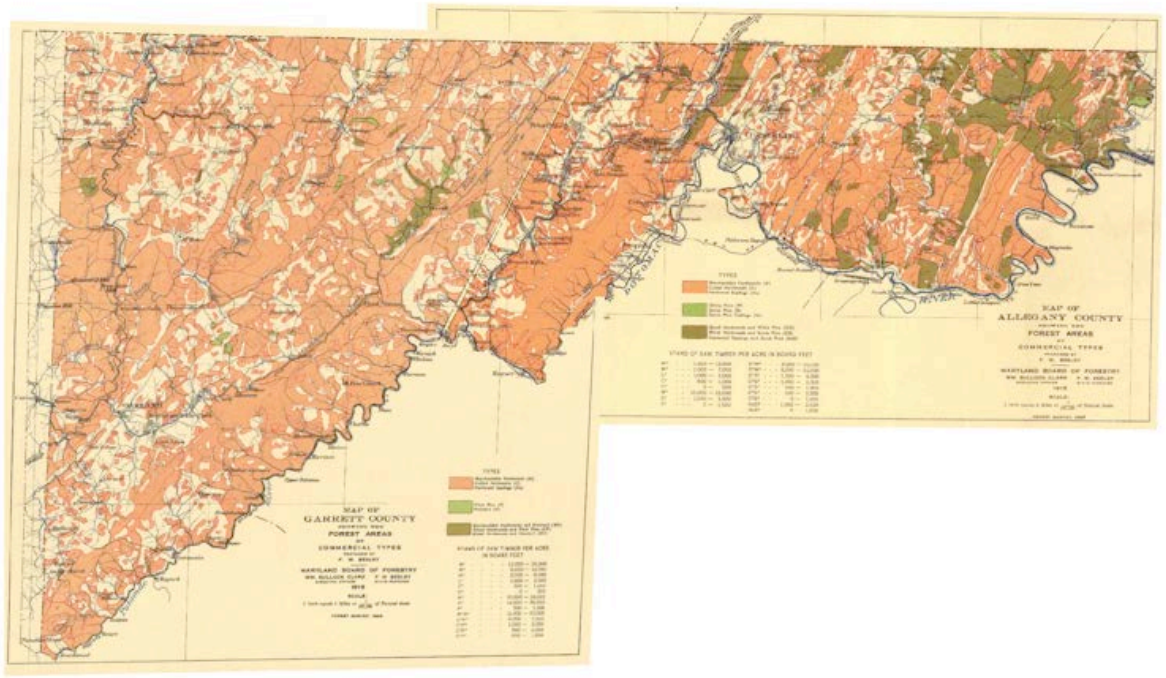


Figure 4: Earliest survey of forest in western Maryland completed in 1915 by F.W. Besley—Maryland's first State Forester. Pine areas are in green Some hemlock areas are depicted in orange.

Appendix K - Archeological Sites

Site #	Site Name	Other Name	Site Type	Cultural Affiliation	Report #	Owner	Form Completed by:
18GA142	Swamp Road		Farmstead	Late 19th, early 20th Century	GA 9B	DNR	K. LaCoste 11/6/80
18GA165	Field #237		Single Prehistoric Flake	Prehistoric Unknown	GA 9B	DNR	R.D. Williams 9/18/80
18GA166	P-1		Single Prehistoric Flake	Prehistoric Unknown	GA 9B	DNR	H.M. Dorsey 4/9/81
18GA171	Field #306	Bond Saw Mill	Saw mill and lumber camp	Early 20th Century	GA 9C	DNR	K. Youngs 6/26/80
18GA176	Field #312	Blue Lick Run Mill	Grist mill and pond, tail race possibly early 19th century	Historic Unknown	GA 9C	DNR	K. Youngs 7/29/80
18GA190	Governor Thomas Mansion		Farmstead	Mid-late 19th Century	GA 9C	DNR	K. LaCoste 8/29/80
18GA193	Field #330	Salt Block Road	Stone well, foundation	Late 19th Century	GA 9C	DNR	K. LaCoste 9/3/80
18GA195	Field #332	Maynardier Ridge I	Farmstead	Late 19th , early 20th Century	GA 9C	DNR	K. Youngs 9/23/80
			Early to				
18GA197	Field #334	Old Morgantown Road Site	mid-19th century tavern and wagon stand/ farmstead	19th, early 20th?	GA 9C	DNR	K. Youngs and K. Leeper 9/24/80
18GA204	Field #47		Mill race and dam	Historic Unknown	GA 9C	DNR	R. David Williams 9/22/80
18GA205	Field #48		Farmstead, two stone foundations	Late 19th and 20th Century	GA 9C	DNR	R. Ervim, R.D.Williams 9/22/80
18GA209	Undetermined		Lithics, artifacts scatter	Prehistoric, unknown, late 18th early 19th Century	GA 9B, 9C	DNR	P.Jehle 9/22/80

18GA221	Field #336	Crab Tree Creek Midden	Trash midden	Historic unknown	GA 9C	DNR	K. LaCoste 9/30/80
18GA238	Lower Savage River Stone Foundation		Farmstead, stone foundation	19th, 20th Century	GA 9C	DNR	K. LaCoste 10/10/80
18GA270	Wall 29	Little Bear Creek Trash Midden	Historic Artifact Scatter; Possible Trash Midden	Late 19th,20th Century?	GA 9C	DNR	H.M. Dorsey 4/9/81
18GA271	Wall 30	Little Bear Creek Stone Feature	2 parallel walls of loose stone	Historic Unknown	GA 9C	DNR	H.M. Dorsey 4/9/81
18GA274	Wall 33	Blue Lick Run Occupation Site	Farmstead, stone-lined well	Early/Late 19th	GA 9C	DNR	H.M. Dorsey 4/16/81
18GA275	Wall 34	Blue Lick Run Earthworks	Mill, earthwork and artifacts	19th, 20th?	GA 9C	DNR	H.M. Dorsey 4/16/81
18GA294	Wall 52		Prehistoric Lithic	Prehistoric Unknown	GA 9B	DNR	H.M. Dorsey 8/28/81
18GA297	Dorsey I		Stone foundation, pits, piles and walls	Historic Unknown		DNR	H.M. Dorsey 10/28/85
18GA311	Savage River		Prehistoric lithic scatter	Prehistoric Unknown		DNR	Dr. Durland Shumway 5/18/99
18GA312	Savage Mountain Brown		Stone foundation and pits	Historic Unknown		DNR	Maureen Kavanagh 3/7/00

Appendix K: Archeological Sites

Appendix L - Black Bear Bait Station Suvery Results

Appendix L

2018 BLACK BEAR BAIT STATION SURVEY RESULTS

Background

The black bear bait station survey is a technique that has been used in many states to document population trends in black bears. While it cannot be used to accurately estimate the black bear population in Maryland, it is an effective tool used to track trends in the population over time. The survey has been conducted annually in western Maryland since 1993.

Methods

Survey routes have been established throughout the occupied bear range in Maryland (Garrett, Allegany, Washington, and Frederick counties). Traditionally the survey was conducted only in Garrett and western Allegany counties (from Cumberland west). Additional survey routes have been added over the years to include areas to the east of Cumberland. In 1999 a route was added in eastern Allegany County, in 2001 a route was added to western Washington County, in 2003 a route was added to central Frederick County, and in 2009 a route was added to central Washington County. The most recent addition was added in 2014 to obtain greater survey coverage of southwest Frederick County.

The bait station survey routes are established in black bear-occupied areas. The routes consist of bait stations placed at 0.5 mile intervals. Each station consists of three partially opened sardine cans (sardines packed in soybean oil) suspended with nylon string six to eight feet from the ground and two to three feet from the main stem of a smooth-barked tree.

Bait stations are established in mid to late July and they remain in place for eight days. The stations are then checked, removed and any activity is noted for each station. The observers must distinguish between raccoon, opossum, black bear and other wildlife activity. All stations in which black bear activity was observed are considered a ‘visit’ and a visitation rate is then calculated for each survey area. The total visitation rate is then calculated for the year providing a visitation index that is used to compare results between years.

Results

In 2018, a total of 15 routes were established containing 131 bait stations across Garrett County. Of these, 70 were visited by black bears yielding a visitation rate of 53.4% (Table 1, Figure 2). In Allegany County four routes were established, consisting of 64 stations. There

were 28 visits that reflected a 43.8% visitation rate (Table 1). In Washington County, five out of 30 stations were visited on the two established routes, yielding a visitation rate of 16.7% (Table 2). The two routes in Frederick County contained 25 stations: 13 of which were visited for a rate of 52.0% (Table 2). The visitation rate for Allegany and Garrett counties combined was 50.3% (Table 1, Figure 3) and 46.4% across the entire survey area (Garrett, Allegany, Washington, and Frederick counties) (Table 2, Figure 1).

Discussion

The black bear bait station survey results continue to indicate an increasing trend in western Maryland's black bear population. It is important to note that fluctuations from one year to the next are expected, and it is the long-term trend data that is most valuable to wildlife managers. The visitation rate for the entire survey area has increased from 3.2% in 1993 to 46.4% in 2018 (Figure 1). Since this long-term survey has been implemented, routes have been added to monitor range expansion across all four western counties.

Garrett County encompasses the heart of Maryland's core bear range and the routes in this county have gone from a 3.9% visitation rate in 1993 to a 53.4% visitation rate in 2018 (Figure 2). The visitation rate for Allegany County showed a slight decrease from 44.6% in 2017 to 43.8% in 2018. Washington County showed a decrease from 38.7% in 2017 to 16.7% of the sites being visited by bears in 2018. The visitation rate in Frederick County had increased from 23.1% visitation in 2017 to 52.0% in 2018. Despite the relatively young age of the routes in Washington and Frederick Counties, visitation is occurring each year and it appears that an increasing trend is starting to materialize.

Maryland DNR implemented a bear hunting season in 2004 after 51 years with no bear harvest. Allegany and Garrett counties together comprise Maryland's traditional black bear harvest zone. The most recent expansion of the harvest zone came in 2016 and now includes the entire occupied bear range in Maryland (Garrett, Allegany, Washington, and Frederick counties). The combined visitation rate for these four counties decreased from 52.3% in 2017 to 46.4% in 2018 (Table 2). Although the overall trend continues to increase within the harvest zone, when comparing the 11 years prior to the initiation of the harvest and 14 years coinciding with the harvest, the trend line shows a much less dramatic increase (Figure 3). This indicates that the current black bear harvest is slowing the black bear population growth.

It is important to remember that a population estimate cannot be determined utilizing this survey. The visitation rate index does not calculate bear numbers, nor can it be used to extrapolate population numbers from previous estimates. Its purpose is to monitor trends in Maryland's bear population over time. This survey is proving to be especially useful in monitoring trends in the black bear population outside of Maryland's core bear range (Garrett and Allegany counties) as well as providing a practical means of monitoring the impacts of Maryland's black bear harvest.

Table 1. Summary of Maryland black bear bait station survey routes for Garrett and Allegany counties.

Year	Period	Garrett County	Allegany County	Garret & Allegany Counties Combined

# Routes	# Stations	# Visits	Visitation Rate	# Routes	# Stations	# Visits	Visitation Rate	# Routes	# Stations	# Visits	Visitation Rate

1993	mid July	10	77	3	3.9%	1	20	0	0.0%	11	97	3	3.1%
1994	mid June	12	91	10	11.0%					12	91	10	11.0%
1996	late June	11	63	6	9.5%					11	63	6	9.5%
1997	mid July	16	112	14	12.5%					16	112	14	12.5%
1998	mid July	16	131	14	10.7%	1	20	4	20.0%	17	151	18	11.9%
1999	mid July	17	136	33	24.3%	4	80	6	7.5%	21	216	39	18.1%
2000	mid July	17	136	40	29.4%	4	67	0	0.0%	21	203	40	19.7%
2001	mid July	17	129	68	52.7%	4	70	2	2.9%	21	199	70	35.2%
2002	mid July	17	136	65	47.8%	4	71	4	5.6%	21	207	69	33.3%
2003	mid July	17	138	70	50.7%	4	67	2	3.0%	21	205	72	35.1%
2004	mid July	17	134	73	54.5%	4	67	4	6.0%	21	201	77	38.3%
2005	mid July	17	136	88	64.7%	4	66	0	0.0%	21	202	88	43.6%
2006	mid July	17	133	83	62.4%	4	63	14	22.2%	21	196	97	49.5%
2007	mid July	17	129	87	67.4%	4	63	10	15.9%	21	192	97	50.5%
2008	mid July	17	134	76	56.7%	4	66	17	25.8%	21	200	93	46.5%
2009	mid July	17	134	77	57.5%	4	67	15	22.4%	21	201	92	45.8%
2010	mid July	16	126	76	60.3%	4	66	21	31.8%	20	192	97	50.5%
2011	mid July	16	126	83	65.9%	4	64	28	43.8%	20	190	111	58.4%
2012	mid July	16	125	83	66.4%	4	65	35	53.8%	20	190	118	62.1%
2013	mid July	15	121	93	76.9%	4	65	30	46.2%	19	186	123	66.1%
2014	mid July	15	122	80	65.6%	4	65	26	40.0%	19	187	106	56.7%
2015	mid July	15	129	91	70.5%	4	67	26	38.8%	19	196	117	59.7%
2016	mid July	14	122	64	52.5%	4	63	32	50.8%	18	185	96	51.9%

2017	mid July	13	115	77	67.0%	4	65	29	44.6%	17	180	106	58.9%
2018	mid July	15	131	70	53.4%	4	64	28	43.8%	19	195	98	50.3%

Table 2. Summary of Maryland black bear bait station survey routes for Washington County, Frederick County, and survey-wide.

Year	Period	Washington County				Frederick County				Garrett, Allegany, Washington, & Frederick Counties Combined			
		# Routes	# Stations	# Visits	Visitation Rate	# Routes	# Stations	# Visits	Visitation Rate	# Routes	# Stations	# Visits	Visitation Rate
1993	mid July									11	97	3	3.1%
1994	mid June									12	91	10	11.0 %
1996	late June									11	63	6	9.5%
1997	mid July									16	112	14	12.5 %
1998	mid July									17	151	18	11.9 %
1999	mid July									21	216	39	18.1 %
2000	mid July									21	203	40	19.7 %
2001	mid July	1	11	1	9.1%					22	210	71	33.8 %
2002	mid July	1	15	6	40.0 %					22	222	75	33.8 %
2003	mid July	1	16	4	25.0 %	2	31	0	0.0%	24	252	76	30.2 %
2004	mid July	1	16	4	25.0 %	2	31	0	0.0%	24	248	81	32.7 %
2005	mid July	1	16	3	18.8 %	1	19	1	5.3%	23	237	92	38.8 %
2006	mid July	1	16	2	12.5 %	1	22	0	0.0%	23	234	99	42.3 %
2007	mid July	1	16	6	37.5 %	1	22	0	0.0%	23	230	103	44.8 %
2008	mid July	1	15	4	26.7 %	1	21	3	14.3 %	23	236	100	42.4 %

2009	mid July	2	26	4	15.4 %	1	21	2	9.5%	25	248	98	39.5 %
2010	mid July	2	29	12	41.4 %	1	21	2	9.5%	24	242	111	45.9 %
2011	mid July	2	28	16	57.1 %	1	20	3	15.0 %	23	238	130	54.6 %
2012	mid July	2	29	11	37.9 %	1	21	1	4.8%	23	240	130	54.2 %
2013	mid July	2	29	9	31.0 %	1	21	2	9.5%	22	236	134	56.8 %
2014	mid July	2	30	9	30.0 %	2	26	10	38.5 %	23	243	125	51.4 %
2015	mid July	2	30	13	43.3 %	2	26	4	15.4 %	23	252	134	53.2 %
2016	mid July	2	31	11	35.5 %	2	26	7	26.9 %	22	242	114	47.1 %
2017	mid July	2	31	12	38.7 %	2	26	6	23.1 %	21	237	124	52.3 %
2018	mid July	2	30	5	16.7 %	2	25	13	52.0 %	24	250	116	46.4 %

Figure 1. Maryland black bear bait station survey results for the entire survey area (Garrett, Allegany, Washington, and Frederick counties) (1993-2018)

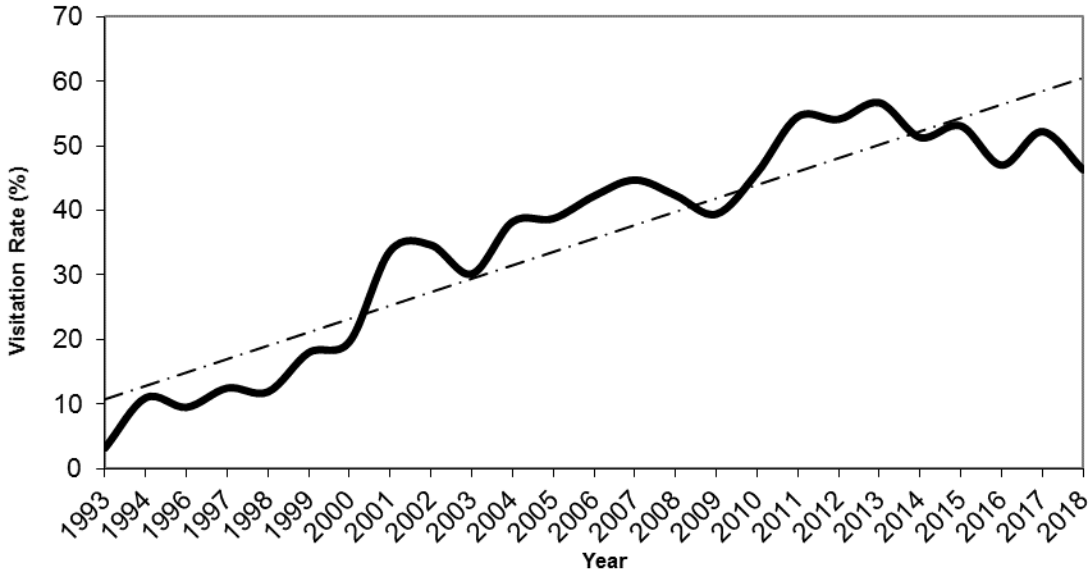


Figure 2. Maryland black bear bait station survey results for Garrett County. (1993-2018)

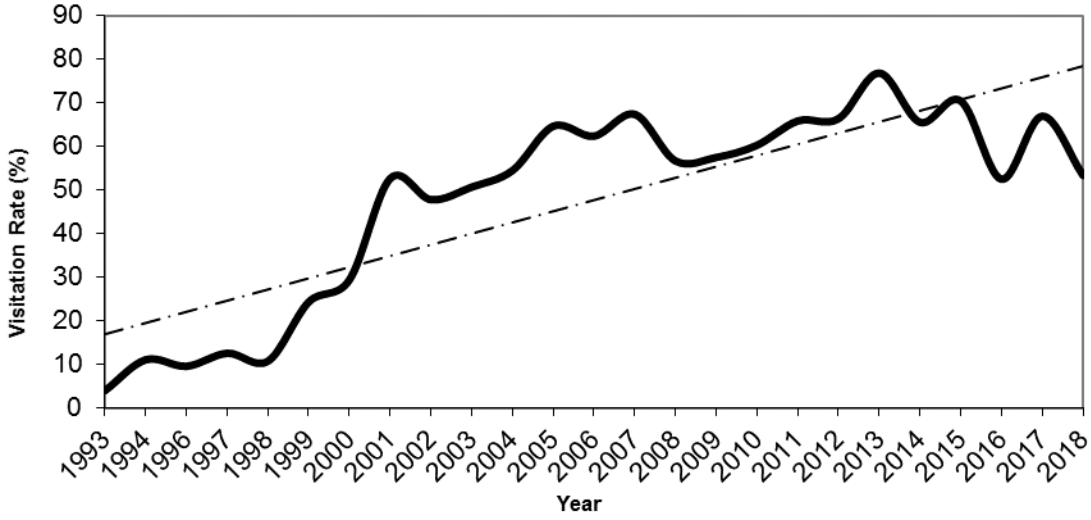
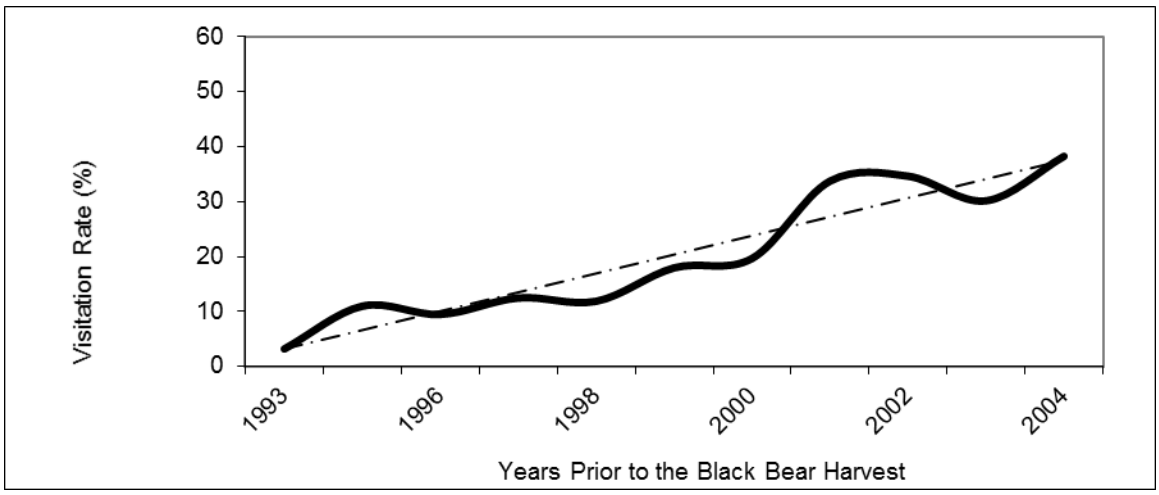
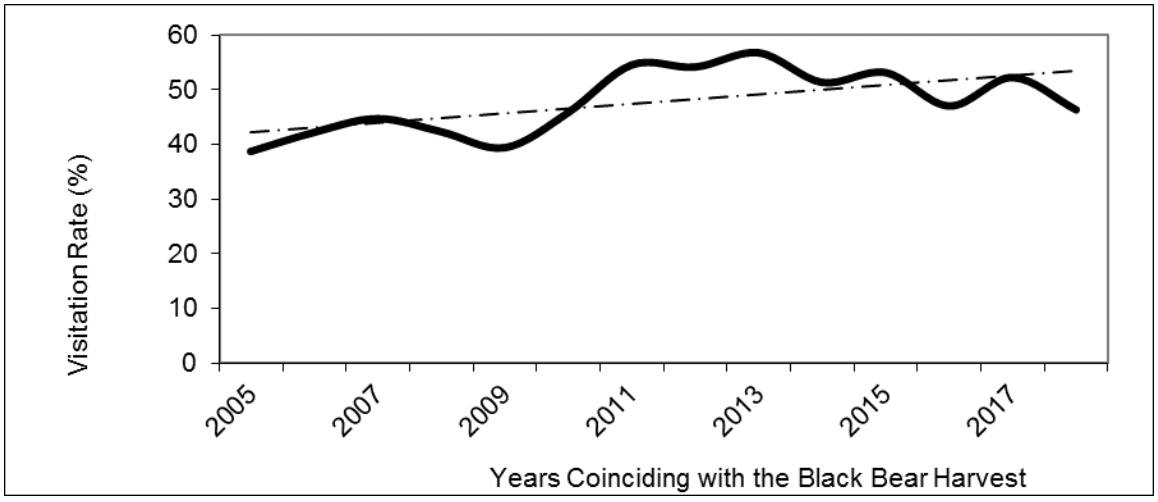


Figure 3. Maryland black bear bait station survey results within the harvest zone (Garrett, Allegany, Washington, & Frederick counties) split to show the 11 years prior to the implementation of the harvest and the 14 years coinciding with the harvest. (1993-2018)




60
50
40
30
20
10
0
Visitation Rate (%)
2005
2007
2009
2011
2013
2015
2017
Years Coinciding with the Black Bear Harvest

Appendix M - Citations

Appendix M

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