Response to Comments
Watergauge Woodland Restoration Project
July 2009

This letter is in response to your comments for the Watergauge Woodland Restoration proposal. As you are aware, the intent of scoping of projects is to engage interested publics in the process, identify issues or concerns, and develop a project that meets both Forest Plan and project objectives. All comments have been reviewed by District and Forest Supervisors Office staff, who identified several topics that can be addressed by providing additional discussion and references on the topics. The IDT responsible for the proposed Watergauge Woodland Restoration project listed these topics for discussion:

1) Appropriateness of the site for woodland restoration (includes soils, plants and animals).
2) Appropriateness of the site for prescribed burning (includes the historic role of fire in the project site and the need to continue prescribed fire to achieve desired conditions).
3) Appropriateness of Riparian Buffer Zones and Mountain Bog Creation.
4) Old Growth Delineation and Illegal ATV Trails.
5) Other Miscellaneous Questions or Comments Relative to the project.

The Following Discussion Addresses this issue: Appropriateness of the Site for Woodland Restoration (issue identified by Georgia ForestWatch).

Woodland restoration is recognized as an important component of the Land and Resource Management Plan (LRMP) for the Chattahoochee-Oconee Forests (2004). Specifically, the LRMP has an objective for restoring 10,000 acres of open woodlands, savannas and grasslands on the Chattahoochee National Forest (LRMP, page 2-6). In addition, Pine/Oak Woodlands are designated within Georgia's State Wildlife Action Plan as a "High Priority Habitat" within both the Blue Ridge and Piedmont ecoregions of Georgia. Furthermore, both vegetation management and the restoration of fire within woodland habitats (Blue Ridge and Piedmont ecoregions) are ranked as "High Priority Management Needs" within Georgia's State Wildlife Action Plan (GASWAP, 2005, Appendix C, p. 25, 27) for remnants of habitats such as those found within much of the uplands of the Watergauge Road area (Floyd and Moffett, Response for Watergauge Woodland Project, April 2009).

Bartram (1791) and Brewster (1885) described extensive open oak and pine woodlands in their travels through the southern Appalachians, which supported a unique assemblage of plant and animal species. Some of the wildlife species, such as northern bobwhite and golden-winged warbler, that have been recorded as common in these forest types (Brewster 1885, 1886) have declined significantly in the region (Georgia Department of Natural Resources 2005). In addition, study of early manuscripts and writings indicates that the native ecosystem of this region of the watershed did indeed describe a landscape including forest, meadows, and even vast savannahs. Bartram wrote that he observed

"swelling turfy ridges, varied with groves of stately forest trees" (Williams, Response for Watergauge Woodland Project, December 2008). Although it is recognized that these historical accounts were not necessarily specific to the Watergauge Road area, they do in fact, give some perspective as to how common woodlands historically were within the Southern Appalachian landscape. Woodlands have never been described as "historically rare" within the Piedmont or Blue Ridge ecoregions.

The Watergauge Road area was identified as suitable for woodland restoration for a variety of reasons. These reasons include: existing forest types (including plants), soils, geology, slope and aspect. Although pine / oak woodlands and savanna habitats occur within areas of shallow soil, low rainfall, and low Site Index (SI) values, many other factors ultimately determine the potential vegetative composition of a site, such as soil chemistry, underlying geology and fire frequency. SI values should not be used exclusively as a measure of ecological evaluation, as these values have traditionally been developed as a silvicultural tool, used as an index value to compare "tree" growing conditions. Although SI values generally reflect productivity of a given site, these values are not necessarily reflective or indicative of natural climax vegetation and may be of limited use for ecological evaluation (Floyd and Moffett, Response for Watergauge Woodland Project, April 2009). The Watergauge Project is not proposing to produce commercial timber species nor evaluating the site's ability to produce commercial timber species. All sites proposed for treatment were overlayed with soil series data in order to validate the appropriateness of mechanical woodland treatment. It was determined that all of the soil series' found within the treatment areas are appropriate to support woodland vegetation. However, as mentioned in a comment letter submitted by Georgia ForestWatch, there are several additional stands adjacent to the project area that currently have low SI values, thus potentially being suitable for woodland restoration in the future (Jenkins, Response for Watergauge Woodland Project, December 2008). These additional stands will be analyzed in the future to determine their suitability for woodland restoration, and if so, could potentially be treated in a "second phase" of this project in the future.

The NatureServe Ecological System to which the proposed restoration site most closely conforms is the Southern Appalachian Low-Elevation Pine Forest (SALEPF), although it also contains elements of Southern Piedmont Dry Oak – Pine Forest, and Southern Appalachian Montane Pine Forest and Woodland (NatureServe 2009). However, for the purposes of this demonstration site, the SALEPF descriptions will be used to model and monitor this project. This system occurs in a variety of topographic and landscape settings and is dominated by either *Pinus echinata* (shortleaf pine) or *P. virginiana* (Virginia pine) and also contains numerous dry-site oak species, such as *Quercus falcate* (southern red oak), *Q. prinus* (chestnut oak) and *Q. coccinea* (scarlet oak). In addition, but to a lesser extent, numerous pitch pine stems can also be found scattered throughout the surrounding landscape. The presence of these species alone, indicates the potential for this site to support a woodland habitat. The soil mapping units delineated in areas proposed for manual thinning are primarily of the Evard, Hayesville, Porters and Saluda series. These soils occur on ridgetop and sideslope landforms with slope gradients ranging up to 25 percent. Textures of these soil series are typically coarse, sandy loam in

the upper horizons (exception is Hayesville which is clayey) that can create dry, well drained conditions. These sites would be suitable for xeric plant communities often found on exposed slopes with southern or western aspects (Rightmyer, personal communication, 2009).

Plant species found within (as opposed to along the road shoulders) the unit along ridgetops and exposed slopes are representative of woodland/grassland systems. These include *Baptisia tinctoria* (rattleweed), *Coreopsis major* (woodland coreopsis), *Danthonia sericea* (silky poverty grass), *Desmodium paniculatum* (beggarlice), *D. rotundifolium* (roundleaf tick-trefoil), *Hylodesmumnudiflorum* (naked tick-trefoil), *Galactia regularis* (milk-pea), *Hypericum hypericoides* (St. John's-wort),*Liatris spicata* (blazing star), *Piptochaetium avenaceum* (needle grass), *Pityopsis graminifolia* (grassleavedaster), *Silphium compositum* (rosinweed), *Stylosanthes biflora* (pencil-flower), and *Tephrosia virginiana* (goat's rue). The location, extent, abundance, and apparent persistence of this suite of species do not support a simple "weedy/opportunistic" gap phase forest model as stated in the Georgia ForestWatch response letter (Floyd and Moffett, Response for Watergauge Woodland Project, April 2009).

Forest Service Bird Point data and incidental observations from several interagency biologists have indicated the presence of several woodland obligate bird species either within or near the project area. This project will further enhance the habitat for these species, many of which are showing declining population trends. Northern bobwhite, Brown-headed Nuthatch and Eastern Wood Pewee are both present in the area and would greatly benefit from this project. These species are a very high conservation priority in the Partners in Flight conservation scheme, the Appalachian Mountain Joint Venture, and the State Wildlife Action Plan (Klaus, Response for Watergauge Woodland Project, October 2008). "{Watergauge Woodland Project} is right on the mark with these conservation initiatives both in terms of the target species and the proposed methods. Past fires conducted by the USFS appear to have been very well executed, and had no discernable negative impact on ravines or 'fire intolerant' communities in the area", (Klaus, Response for Watergauge Woodland Project, October 2008). Judging from the area's history of fire as well as results of recent prescribed fire, this project could have a positive effect on a number of species of concern, such as Brown-headed Nuthatch and Northern Bobwhite (Muise, Response for Watergauge Woodland Project, November 2008). Early successional habitat types (which would be created by the Watergauge Woodland Project) are underrepresented across the entire Chattahoochee National Forest, but are critical to the majority of USFS Management Indicator Species. "Many species of Warblers, Bobwhite Quail, Wild Turkey, White-tailed Deer, and black bears will all benefit from this project" (Lowrey, Response for Watergauge Woodland Project, November 2008).

The Following Discussion Addresses this issue: Appropriateness of the Site for Prescribed Burning (issue identified by Georgia ForestWatch).

There is a growing body of scientific literature on the various aspects of fire; both wildfire and prescribed fire. The Forest Service, along with numerous cooperators, has invested significant resources in the study of fire for the past 50 years, and has increased this investment through the Joint Fire Science program in recent years. Several studies on prescribed fire in southern Appalachian ecosystems are listed in the attachment of references. Two excellent resources reviewing the effects of fire include Wildland Fire in Ecosystems – Effects of Fire on Soil and Water (Neary et. al, 2005), part of a multi-volume work led by the Rocky Mountain Experiment Station. Another synthesis document titled "The Encyclopedia of Southern Fire Science" (Outcalt, 2000) is hosted by the Southern Research Station as a hyperdocument-based encyclopedia system accessible over the Internet. Both of these sources of information provide the management community access to scientific knowledge needed for the ground application of burning.

Prescribed fire is a widely applied and accepted tool in the management of forest ecosystems, with a long history of use in the southern United States. Dr. James Vose, project leader and research scientist at Coweeta Hydrologic Laboratory, presented an excellent overview paper at a 2003 conference that provides a discussion of the role of fire in southern Appalachian ecosystems (Vose, 2003). The abstract from this paper reads as follows:

Forest ecosystems in the southern Appalachians are the consequence of a long history of natural and human disturbances. Fire regimes have progressed from a long period of low intensity native American burning, a short period of intense fires for land clearing and post-logging after European settlement, a century of fire exclusion and reforestation of abandoned agricultural land, and contemporary land management activities that include prescribed burning. The structure and function of current day forests – increases in fire intolerant species, decreases in fire tolerant species, increased susceptibility to insect outbreaks – suggest that fire exclusion may have had an important role in initiating the successional trajectory. Land managers need tools to create, enhance, and maintain desired ecosystem conditions such as healthy and sustainable forests. Studies in the southern Appalachians indicate that these ecosystems have maintained characteristics of resistance and resiliency that promote positive responses to prescribed burning. For example, low intensity and severity fires generally have had a positive effect on plant diversity and nutrient availability, and no negative effects on water quality. Impacts on overstory species composition will require a long-term perspective; however, it is likely that aggressive treatments such as repeated burns, perhaps in combination with selective thinning and planting, will be required to alter the current successional trajectory.

Dr. Vose closes his paper by stating, "Results from ecosystem studies suggest that southern Appalachian ecosystems retain many characteristics of resilience and resistance to fire." He indicates that prescribed fires in degraded stands result in very little ecosystem nutrient loss or increased erosion. The research studies related to these findings are listed in an attached reference document, most being posted also on Internet sites.

The effects of prescribed fire depend on its intensity and severity. At the extremes, fires of high intensity and severity can have a greater effect on ecosystem structure and function than clear-cutting or other intensive practices. The application of a prescribed fire is driven by the goal to obtain a desired outcome or future condition of the forest. (Vose, 2000) Dr. Vose further states the term "desired ecosystem condition" is a more appropriate term for describing the desired outcome from prescribed fire.

Reasons for the application of prescribed fire includes: improving wildlife habitat, reducing hazardous fuels, disposal of logging debris, site preparation for regeneration, managing competing vegetation, improving access, perpetuating fire-dependent species, cycling nutrients, and managing for endangered species. The Chattahoochee-Oconee National Forests have been successful in implementing prescribed burns during the past thirty plus years to meet these objectives. Prescribed fire technology, training and planning have accelerated in recent years to make prescribed fire a safe, well-planned operation on the Forest. Forest Service personnel, along with participants from cooperating agencies, must be qualified in various skill areas to be involved in the planning, design, implementation and evaluation phases. Planning for prescribed fires, such as those presented in this scoping letter, begin a year or more ahead of the actual burn period.

Prescribed fires on the Chattahoochee-Oconee NFs are generally categorized as "surface fires." Surface fires burn the upper litter layer and small branches that lie on or near the surface of the ground. Surface fires usually move rapidly through an area, and do not consume the organic layer. Moisture in the organic horizons often prohibits ignition of the humus layer, and protects the soil and soil-inhabiting organisms from the heat. Within the boundaries of a prescribed fire there will be isolated areas where fire can burn at higher intensity, resulting in consumption of the organic layers. These areas are typically small in size and unavoidable due to the extent of the burn. The heat pulse generated at the burning front of these fast-moving fires does not normally persist long enough to damage tissues underneath the thick bark of large trees. However, it will girdle the root collar of small trees and shrubs, and reduce small-diameter branches and other fine surface fuels (Nyland 1996).

Surface fires, also described as "understory fire," are generally non-lethal to the dominant vegetation and do not substantially change the structure of the dominant vegetation. Approximately 80 percent or more of the aboveground dominant vegetation survives fires. This fire regime applies to fire-resistant forest and woodland types (Forest Service 2005). Prescribed fire practitioners use the term fire or fireline intensity to describe the rate of aboveground fuel consumption, and therefore the energy release rate. Intensity is classified as low, moderate, or high, and is further categorized by defining fire behavior characteristics such as rate of spread, flame length and fireline intensity. These characteristics vary within a prescribe fire's boundary depending on the climate conditions, fuel size and loads, fuel moisture, and soil moisture. Burns of low intensity will be prescribed for this project.

The ecological effects of a specific fire are described by the term fire severity. A 2005 technical report *Wildland Fire in Ecosystems – Effects of Fire on Soil and Water* (Forest Service, 2005) states "Fire severity describes the magnitude of the disturbance and, therefore, reflects the degree of change in ecosystem components. Fire affects both the aboveground and belowground components of the ecosystem. Thus severity integrates both the heat pulse above ground and the heat pulse transferred downward into the soil. It reflects the amount of energy (heat) that is released by a fire that ultimately affects resources and their functions." Fire severity is a qualitative measure of the magnitude of change resulting from a fire and does not necessarily imply negative consequences.

The Georgia ForestWatch comment letter states "[t]he Forest Service has never fully addressed the current information about fire regimes in the forests of the Southern Appalachians, and more specifically the fire regime of Northern Georgia." Responding to this comment is the discussion below, describing the historic role of fire in the project areas:

The Following Discussion Addresses this issue: The role of fire in shaping vegetation in the southern Appalachian Mountains (issue identified by Georgia ForestWatch).

Anthropogenic fires have been a key form of disturbance in southern ecosystems for more than 10,000 years (Fowler and Konopik 2007), although, for the last 80+ years, total fire control has been the primary policy on National Forest system lands, and until recently, the complete exclusion of fire allowed unrestricted vegetation expansion. Both fire-tolerant and fire-intolerant species were free to grow, limited only by slope, moisture, elevation and the presence or lack of fire and other disturbances. Fire exclusion has allowed mesophytic hardwoods to dominate on many sites where oaks and pines once thrived. Stem densities of these species range from the hundreds, in some cases, to thousands per acre, shading the ground and reducing the abundance and richness of grasses and forbs and suppressing oak and hickory regeneration. Fire-tolerant and fire-adapted species such as oaks, shortleaf pine, table mountain pine, montane longleaf pine, and their associated communities typically dominated south- and west-facing slopes, but due to fire exclusion these are being replaced by fire-intolerant, mixed mesophytic hardwood species. Once restricted to cool, moist sites, fire-intolerant white pine now occurs on dry sites because of infrequent natural fire (Abella and Shelburne 2003). Ericaceous shrubs such as mountain laurel and rhododendron have "escaped" from riparian areas into upland forests (Elliot et al 1999). Logging and subsequent fire exclusion allowed the spread of pioneer species such as Virginia pine, and the difficulty in regenerating Appalachian oak species as a result of fire exclusion is well known. In fact, the Southern Appalachian Assessment cites "[F]ire appears to be a major factor in the development of upland oak forests, where light burning appears to increase the amount of oak regeneration beneath maturing stands of mixed hardwoods" (SAMAB 1996).

Although anthropogenic fires have been one of the primary disturbances responsible for shaping vegetation across the region, there continues to be disagreement about the "naturalness" of fire (or role of fire as a natural disturbance process) in the Southern

Appalachian mountains, particularly because the majority of fire ignitions in the mountains were historically started by Native Americans rather than lightning. Regardless of the ignition source, a growing number of scientists and natural resource managers in the Southern Appalachian mountains now understand, and have documented, the important role fire has played in shaping the oak and pine forests we know today. Some of the most recent research in the Great Smoky Mountains National Park has now documented a historic fire return interval of 4 years, beginning in the early 1700's and ending in the early 1900's (Grissino-Mayer, personal communication). Although this study focused on documenting the historic fire return interval within forest communities that occurs on south and west slopes, as well as along ridgetops, it is also important to note that the above mentioned study also documented several historic fire scarred trees that were found on north slopes as well. This information supports the management philosophy that although fires were historically more frequent within the drier, exposed forest communities, they were also present on north slopes, most likely backing down to a natural fire compartment boundary such as a stream. This natural fire intensity mosaic, based on forest types, aspect, elevation, fuel loads, weather and the time since the last burn, is the model the Forest Service attempts to replicate when prescribing a controlled burn at the landscape-scale. As acknowledged at the recent Fire Learning Network meeting in Georgia, there will most likely always be some debate regarding the appropriateness and effects of prescribed fire, however; growing numbers of scientists and land managers now feel comfortable moving forward with a landscape scale prescribed burning program given the current amount of supportive research that is available on such topics. Prescribed burning in the mountains is not considered experimental at this point.

As mentioned in the scoping notice for this proposal, we are proposing to use low intensity surface fires to reduce hazardous fuels and to create a diversity of wildlife and plant habitats within the prescribed burn units. Mostly, only the forest communities that occur on south and west slopes and ridgetops will be affected (improved) by this proposal. Mesic slopes and riparian areas are usually unaffected because they either do not burn, or they burn at such a low intensity that there is little structural (habitat) change within those habitats. The goal of a prescribed burn is not to achieve 100% black, but rather to mimic the natural mosaic of fire spread and fire intensities. Our goal is to improve plant and animal habitat within those forest communities that are most appropriate and most likely to benefit from the prescribed fire treatment. Many plant and animal benefits have been realized and documented from the use of prescribed burning in the Southern Appalachian Mountains. On xeric mixed pine-hardwood ridges in the southern Appalachians, fire is considered an integral part of restoring diversity and productivity within these sites (Swift et al 1993, Vose et el 1994). Other potential benefits include: (1) reduction of fuel loads to minimize the risk and impacts of wildfire; (2) reduction of the evergreen (white pine) understory to promote regeneration of desirable species such as oaks; (3) increased diversity of plants, small mammals, birds, amphibians, and insects; (4) stimulation of fast-growing new shoots to increase productivity and forage for herbivores; and (5) stimulation of nutrient cycling rates to increase site productivity (Southern Research Station). Some documented plant and animal benefits associated with prescribed burning in the Southern Appalachian

Mountains include: increased abundance and diversity of floral visiting insects (Campbell et al. 2007); increased plant herbaceous cover for the rare Diana fritillary butterfly (Campbell et al. 2007); increased suitability for bats' foraging and commuting activity (Loeb and Waldrop 2007); increased population responses of small mammals (Greenberg et al. 2006) and increased oak regeneration (SAMAB 1996), to name a few.

In addition, several additional research studies were recently presented at the June 2008 and May 2009 meetings of the Southern Blue Ridge Fire Learning Network which also suggest that fire is critical to the establishment of both pine and oak forests, as well as critical to the establishment and maintenance of a well developed herbaceous understory in many of the forest communities of the Southern Appalachians, including mesic oak-hickory forests and high elevation (above 4,500 ft.) northern red oak forests. Currently, our most recent prescribed fire monitoring results collected from Stephens County, GA (Upper Piedmont Physiographic Province) has indicated a 25% increase in post burn herbaceous diversity.

Fire types on the Chattahoochee National Forest (issue identified by Georgia ForestWatch) :

Three types of fires occur in forests when conditions are favorable: surface, ground, and crown fire. Surface fires burn the upper litter layer and small woody debris on or near the ground. They move quickly through an area, and consume little of the organic layer. Moisture in the organic layer protects soil and soil-dwelling organisms. Large thick-barked trees are usually not affected by this fast-moving fire, but small trees and shrubs are girdled.

Ground fires smolder and creep slowly through the litter and organic layers, consuming all or most of the organic layer, and exposing mineral soil or rock. Ground fires may burn for weeks or months during periods of extended drought and are usually not extinguished until precipitation is significant or fuel is exhausted.

Crown fires occur when conditions are conducive to the rapid spread of fire from fuels on the ground, into the midstory, then the canopy layer (ladder fuels). These types of fire occur during periods of drought, low humidity, or strong winds, in areas with an accumulation of volatile fuels. Crown fires generally kill a higher percentage of trees and shrubs and can consume most of the organic layer of soil.

The shorter the interval between fires, the higher the likelihood that fires will kill only small trees or susceptible species such as thin-barked hardwoods or white pine encroachment. Frequent fire prevents the accumulation of sufficient fuel to support severe fires. This fire regime perpetuates fire-adapted species (Mutch 1970).

The vast majority of the prescribed burning conducted on the Chattahoochee National Forest is low intensity, dormant or transition season burning. This type of burning usually results in surface fire, with patchy areas of higher intensity fire (which affects more vegetation and creates more diversity by opening the canopy) and areas that do not

burn at all due to moisture or breaks in fuel such as rock outcrops. Prescribed fire is not applied "corner to corner, top to bottom" in a burning block, with the intention of burning the entire area uniformly. There is generally no intent or purpose in burning moist coves or riparian areas, although fire does occasionally occur naturally in those habitats. Those areas serve as boundaries for burning blocks because they serve as natural fire breaks, requiring much less ground disturbance than bladed fire-lines.

The Georgia ForestWatch comment letter also questioned the effects of prescribed fire on soils. The letter specifically stated "[w]e believe that such an assessment will likely reach the suggested conclusion (the burns would result in reduction of site fertility) due to the fact that the site will require frequent and relentless burning to destroy the "O" (organic horizon), not the "duff" layer, which is independent and not considered as a true "soil" horizon layer, as well as the "A" horizon of the soils within the project area." The following discussion addresses this issue:

The Following Discussion Addresses this issue: Effects of Prescribed Fire on Soils, Nutrients and Repeated Use of Fire (issue identified by Georgia ForestWatch).

Soils are fundamental to a healthy and functioning ecosystem. How soils are affected by fire and how much impact a fire has on an ecosystem are largely determined by how severely a fire burns. (Erickson, 2008) Fire severity reflects the duration and amount of energy that is released and available to alter various components of an ecosystem, whereas soil burn severity reflects the impact of fire on soils due to heat at the soil surface.

Phosphorus is an important element to plant growth, and is known to be deficient in some soils, particularly the deep sands found in the southeastern coastal plains. Knoepp et al (2004) identified phosphorus as probably the second most limited nutrient found in natural ecosystems, with nitrogen being the most limiting. Soils of the Chattahoochee are not identified as "phosphorus deficient." Phosphorus is volatilized at higher temperatures (774^{o}C +) during soil heating than nitrogen (300-500^{o}). The combustion of organic matter leaves a relatively large amount of highly available P in the surface ash found on the soil surface immediately following fire, remaining available for plant growth.

Phosphorus volatilizes at temperatures of about 1,418 ^{o}F. Heat sensitive paint and chalk on tiles (suspended 30cm above forest floor) have been used in several southern Appalachian studies to characterize the temperature of prescribed burns. Mean temperatures ranged from 529 – 1470^{o}F for summer burns, and 126 – 1292^{o}F for late winter burns. Higher temperatures would be expected in situations where large fuels (log piles) smoldered for extended periods of time creating thick piles of ash. Fire severity affects changes in extractable P, losing 50 to 60 percent of the total fuel P to volatilization. Part of this volatilized P ends up as increased available P in both the soil and ash following burning (Knoepp et al 2004.)

Many chemical properties and processes occurring in soils depend upon the presence of organic matter. Soil organic matter is particularly important for nutrient supply, cation

exchange capacity, and water retention. Burning, however, consumes aboveground organic material (future organic matter, including large logs), and soil heating can consume soil organic matter. The importance of retaining organic matter in soils is included in the objectives for prescribed fire prescriptions by identifying desired burning conditions that consume above ground fuels in low intensity burning, with low severity. The desired result is to burn the L-layer or Oi layer which is made up of readily identifiable plant materials. In layperson terms this is the "litter" layer. Beneath this layer is the F-layer or the Oe which contains partially decomposed organic matter, but can still be identified as different plant parts, a "duff layer." The H-layer (Oa) is the humus layer of completely decayed and disintegrated organic materials, some of which are usually mixed with the upper mineral soil layers. (Knoepp et al, 2004) Mineral soil begins beneath these layers of fresh and/or decomposing plant materials.

Elliott (2004) described the effects of a prescribed burn treatment in western North Carolina, conducted to restore a pine-hardwood ecosystem. The study assessed fire severity by measuring heat penetration of the burn into the forest floor and mineral soil. Results revealed that little consumption of the Oe+Oa layer occurred during burning, while the litter layer (Oi) was consumed by as high as 94%. This maintenance of the Oe+Oa layers is critical for site nutrient retention (nitrogen and carbon) and soil stabilization. Burning that keeps Oe+Oa layers intact provides protection to the soil surface from erosion loss. This desired condition meets the direction of Forest Plan standard FW-202 (page 2-55 Forest Plan).

Fire managers cannot control fire weather but they can control ignition timing and type, and consequently fire intensity (Clinton 2007). Under all site conditions, the longer a prescribed fire persists in one place the more intense the fire and the more likely there will be significant consumption of the humus layer. Minimizing consumption of the humus layer has important implications for long-term site productivity, as this layer is typically the largest reservoir of available site nutrients in these ecosystems. This retention of humus is particularly important during the post-burn recovery period when young woody and herbaceous seedlings are becoming established (Clinton and Vose, 2000). Prescribed burning can enhance overall site quality and productivity over the long-term by stimulating nitrogen cycling processes (Rightmyer, personal communication, 2008).

Knoepp (2004) provides a summary of the effects of prescribed burning on organic matter: "The most basic soil chemical property affected by soil heating during fires is organic matter. Soil organic matter plays a key role in nutrient cycling, cation exchange, and water retention in soils. When organic matter is combusted, the stored nutrients are either volatilized or are changed into highly available forms that can be taken up readily by microbial organisms and vegetation. The amount of change in organic matter and nitrogen is directly related to the magnitude of soil heating and the severity of the fire. High- and moderate-severity fires cause the greatest losses."

The Following Discussion Addresses This Issue: Appropriateness of Riparian Buffer Zones and Mountain Bog Creation (issue identified by Georgia ForestWatch).

The primary purpose for this project is to create woodland habitat conditions on appropriate sites. Appropriate sites identified within the project area include ridgetops and slopes with a southerly or westerly aspect. Woodlands will not be created in "fire protected" sites such as riparian corridors. Therefore, there will be a 100 foot riparian buffer created around all intermittent and perennial streams, where there will be no logging, i.e., woodland creation within these areas. In addition to the exclusion of logging within these buffer zones, these areas will also be marked as "no-ignition" zones, meaning there will be no ignition of prescribed fires within these areas, but fire will be allowed to creep through naturally or go out.

Mountain Bogs are one of the rarest habitats found in the all of the Southern Appalachians. This is especially true of Georgia's Blue Ridge where only 15-20 true mountain bogs are known to either be reasonably intact or to contain significant and recognizable mountain bog features. Mountain bogs are typically quite small (0.5 –5 acres), and are usually found near seep/spring/creek complexes associated with small alluvial basins or historical beaver swamps. The vegetation is a mosaic of trees, shrub thickets, and herbaceous openings that may be dominated by either graminoids and/or sphagnum moss. The substrate varies along a peat-to-loamy muck continuum, with occasional exposed areas of mineral soil and gravelly seeps. These open habitats naturally succeed to forested communities; however, historically a greater equilibrium existed between bog succession and bog creation. Today, the rate of bog loss far exceeds the rate of bog creation, primarily as a result of stream impoundment, stream channelization, conversion to agriculture and pasture, and human intolerance for allowing natural beaver (*Castor canadensis*) disturbance. Thus, mountain bog habitats with restoration potential within government ownership are of significant conservation importance, including sites that have been subject to extensive hydrologic alteration and those that have matured to forested wetlands in the absence of adequate vegetative disturbance (Floyd and Moffett, Response for Watergauge Woodland Project, April 2009).

The Forest Service has cooperated with the Georgia Plant Conservation Alliance (GPCA) in order to restore and maintain several bogs on the Chattooga River Ranger District. Restoration and maintenance of the bogs is typically accomplished by cutting and removing encroaching woody vegetation from the wetted bog area. A general rule of thumb is to remove enough woody vegetation from the bog to allow for 80% or more of the days sunlight to reach the grass and forbs at the bogs surface. The Watergauge bog will be managed with this same intent. Potential tools used to manage the Watergauge bog include clippers, lopping shears, handsaws and chainsaws. Backhoes or any other kind of wheeled or tracked vehicle will not be used for bog management.

Both the vegetative and hydrologic restoration of mountain bog habitats such as the wetland complex found within the Watergauge Road area are activities identified within Georgia's State Wildlife Action Plan as "Priority Conservation Actions (GASWAP, 2005, Appendix L, p. 13-14; p. 25-26).

The presence of long abandoned beaver impoundments (*Castor canadensis*) are evidenced by the presence of linear earthen mounds, positioned perpendicular to the drainage course; deteriorated logs found within the interior of these ca. 0.3 – 0.75 m high mounds serve as confirmation that these are, in fact, historic beaver dams.

Historically, it is believed that beaver activity was perhaps the dominant force in creating and maintaining mountain bogs. While it is possible to restore bog habitat through this form of biological manipulation, this method is perhaps the most impractical means of restoring and maintaining bog habitat to the appropriate seral state for the purpose of creating habitat for imperiled bog plants and animals for the following reasons:

1) The cycle of beaver colonization, inundation, and abandonment varies greatly both temporally and spatially; the pond formation to eventual decay and return to an unaltered stream channel may range from a year to many centuries.

2) There is a fundamental difference between bog habitats possessing suitable habitat characteristics necessary for the existence of rare bog plants and animals, and simply a recently abandoned beaver pond. Beaver ponds are a shifting mosaic of environmental conditions over time, with habitat suitability for a given species dependent upon age and size of the impoundment, successional status, substrate, and hydrologic characteristics (Naiman, et al. 1988). An example of these dynamics at play on the landscape can be found within the various habitat types of Hedden Creek Bog. While numerous habitat types exist within this beaver pond complex, including areas of shallow water and large standing snags, seeps and springs, sedge meadows, open stream channels, active beaver impoundments, and bog habitat with deep muck substrate and *Sphagnum*, only a small portion of this entire complex is suitable for rare plant and animal species that depend upon the presence of early seral mountain bog habitat.

3) The suitability of a wetland site for recolonization or reintroduction of beaver may be affected by vegetative changes, including the absence of preferred woody species utilized for food.

Although the value and importance of the various types of wetland habitat types created by beaver on the landscape are recognized, we do not believe the introduction of beaver is the appropriate technique to achieve mountain bog habitat restoration goals. In order to produce and maintain the desired early successional mountain bog habitat across the Southern Appalachian landscape in Georgia within a time frame necessary for the conservation of rare species, we advocate mimicking the beneficial effects of natural disturbance artificially through woody vegetation removal (i.e., with hand tools and chainsaws, including the girdling of large trees that block infiltration of sunlight to the bog substrate), prescribed fire, and judicious use of the appropriately labeled herbicide in cut-stem treatments(Floyd and Moffett, Response for Watergauge Woodland Project, April 2009).

The Following Discussion Addresses this issue: Old Growth Delineation and Illegal ATV trails (issue identified by the Chattooga Conservancy).

Forest-wide standard 044 (FW-044, page 2-17 in LRMP) requires that a total of 5 percent of each 6th level HUC which contains 1,000 acres or more of National Forest be allocated to old growth or old growth compatible management. At this time, it appears that 15 percent of the HUC comprising the Watergauge project area has already been allocated to an old growth compatible management prescription, i.e., Wild and Scenic River Corridor, 2.A.1; however, further analysis and interpretation will be needed to determine the current amount of old growth which is present within the HUC, and if any additional acreage is needed to meet LRMP requirements. The decision to delineate old growth will be made in the future and separately from this decision. However, the Watergauge Decision will include taking steps to eliminate the ATV problem which is totally out of hand in this area. Likely techniques will include barricading routes with large debris such as rocks or logs, or erecting gates or decommissioning the entire route.

Other Miscellaneous Questions or Comments Relative to the project (issue identified by Georgia ForestWatch):

Invasives and the use of herbicides within the project area – Non-native, invasive plants and animals (NNIS) will be continually monitored within the project area. Currently, only a few of the more common NNIS have been documented along road shoulders within the project area. In order to mitigate against the potential spread of NNIS, all logging equipment will be washed prior to operation within the project area. If NNIS were found to be encroaching within the project area, immediate measures would be taken to remove the pests. If chemicals were determined to be the most effective means in treating new invasives, then chemicals would be applied under the programmatic NNIS Treatment Decision Notice signed by Ranger David W. Jensen on May 6, 2008. The Watergauge Woodland project does not itself include the use of chemicals to maintain or restore woodland conditions, nor does it include the construction of new system roads.

KV Funding for NNIS Treatments, Adelgid Treatments and Barricading illegal ATV trails – Although the amount of KV receipts generated from this project are unknown at this time, it is anticipated these receipts will be used to treat the existing NNIS infestations along FSR 511 and FSR 511B, as well as any other newly infested areas that might be identified. In addition, KV receipts will be used to barricade illegal ATV routes within the project area, as well as also being used to do some supplemental seeding of the project area in a desired mix of grass and forbs. KV receipts will not be used to treat Hemlock Wooly Adelgid at this time, as funding sources are already in place to accomplish this task. It is important to note that KV receipts can only be used within the sale area boundary of the project.

Supplemental Funding for Fire Management and Bog Creation – The district does not anticipate any "special" fire management proceeds under this proposal. In addition, the Georgia Department of Transportation will not be financing any of the bog restoration work in this area.

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