Forest Management Plan for the ~~XXX~~ Property, Wilkes and Watauga Counties, North Carolina

Prepared by:

Wade Johnston
EcoForesters, Inc.

wjohnston@ecoforesters.org
828.484.6842

Prepared for:

~~XXX~~
~~123 Main Street~~
~~Townsville~~, NC ~~23456~~

Wilkes Tax IDs: ~~xxxxxxx~~, ~~yyyyyyy~~
Watauga Tax ID: ~~zzzzzzzzzzzzz~~

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Summary

Background and Landowner Objectives

During June of 2015 EcoForesters conducted a forest inventory of the approximately 1,725 acre ~~XXX~~ Property (hereafter referred to as "the Property") located in Wilkes and Watauga Counties, North Carolina (see Location Map, *Appendix* G) for the purpose of creating a forest management plan. 1,125 acres of this property are located in Wilkes County (two parcels, 1,024 acres and 101 acres) and 600 acres in Watauga County (see Parcel ID map, Appendix G)

The Property is currently utilized for forestry and for recreation and enjoyment. The purpose of this management plan is to map and describe the general forest condition and set forth management actions based on the landowner's objectives. The forest management objectives of the landowner are listed below:

Financial Return through Timber Production
Forest Ecological Health
Wildlife Habitat
Aesthetic Beauty
Recreation
Biodiversity
High Water Quality

The Property is mostly forested and contains eight different forest cover types (see Table 1 and Appendix G). The diversity of forest types is due to variation in management history, topography, soils, elevation, and aspect. The soils are relatively nutrient rich in rich cove forests to more nutrient poor in the oak dominated stands (Appendix A). To classify forest types, Forest Stewards uses an ecological community classification system developed by Michael P Schafale of the North Carolina Natural Heritage Program (http://cvs.bio.unc.edu/pubs/4thApproximationGuideFinalMarch2012.pdf).

Location and Water Resources

The Property is located along ~~Mountain Range~~, roughly bordered by ~~Big Stream~~ to the west and the ~~Large Creek~~ to the east (see Location Map, Appendix G). To the south the Property borders ~~two well-known housing developments~~. While no major water features occur on the Property itself, it contains over 10 miles of perennial streams that are tributaries of both ~~Big Stream and Large Creek~~, which both empty into the ~~Small River~~ just above and below, respectively, the ~~Artificial Water Body~~ near the town of ~~Townsville~~. Most of these tributaries begin at springheads on the Property. These headwater areas contain numerous seeps and springs that provide important habitat for small amphibians. There are many more intermittent and ephemeral streams on the Property as well.

Topography and Soils

The Property occurs at elevations ranging from 1,350 feet along ~~Big Stream~~ in the southwest corner to 2,275 feet at a pinnacle along ~~Mountain Range~~ on the northern boundary. The terrain contains predominantly deep, well-drained soils that formed in felsic to mafic, high-grade metamorphic and igneous rocks that occur on gently sloping to very steep topography. Forest productivity potential for soils varies greatly, with the most productive soils occurring on gentle, north facing slopes and in coves. The least productive soils occur on ridges and south and west-facing slopes. (See Soils Map, Appendix G, and reports describing the characteristics, parent materials, and productivity values are presented in Appendix A.)

The majority of soils are considered to have moderate to severe limitations for erosion hazard and equipment operability due to the steepness of the slopes and/or to soil wetness. The act of removing trees is not the main cause of erosion in forest management. Erosion primarily occurs in areas of access roads and skid trails, in loading areas, and in other areas where the soil surface has been disturbed. Soils with moderate to severe erosion hazard indicate the need for additional care in the construction and maintenance of roads, or the use of special equipment, and to carefully plan the timing of harvesting and other management activities.

Wildlife and Rare, Threatened or Endangered Species

The Property provides great wildlife habitat. Acorns, hickory, and beech nuts provide an important hard mast food source for wildlife. There are scattered denning sites in occasional rock outcrops and boulder fields and in large hollow trees throughout the forest. Occasional snags, hollow logs, and coarse woody debris are found—primarily in the oak dominated forest types. However, most of the forest on the Property is of a successional stage that does not yet have an abundant amount of over-mature trees, snags, and coarse woody debris, characteristics commonly found in old growth forests which can provide important habitat for some species of birds, small mammals, and amphibians.

Springs and seeps are common at the headwaters of streams and provide important habitat for amphibians. The unnamed springs and streams, along with bordering ~~Big Stream~~ and ~~Large Creek~~, provide abundant aquatic habitat for amphibians and aquatic species on the Property.

A search of the NC Natural Heritage Program database turned up no recorded evidence of rare, threatened, or endangered species located on the Property. While this indicates a low prospect of their presence, it does not preclude the potentiality.

Below are some general management approaches to maintain or improve important wildlife habitats on the Property:

- In mesic deciduous forest, including cove hardwood types, management that enhances structural diversity and mimics mature forest conditions through creation of gaps is beneficial for numerous wildlife species.
- In oak dominated forests, management should perpetuate oak dominance in addition to enhancing structural diversity. This can be done with gaps that allow sufficient sunlight to reach the forest floor (0.5 acre gaps or larger) or by prescribed fire. Fire also is beneficial in reducing dense shrub layers of mountain laurel or other species which in turn enhances overall forest regeneration and stability, providing mast and herbaceous forage for wildlife.
- If funds are available, wildlife that depends on evergreen cover would benefit from the continued selecting and protecting of specimen hemlock trees from the exotic pest hemlock wooly adelgid. Such protection can continue to save some of these trees such that a seed source is available when a biological control mechanism becomes available.
- Any sources of sediment from the Property that may be flowing into creeks during large rain events should be stabilized to maintain high water quality and subsequently benefit aquatic species and amphibians.

Management History

~~Detailed history of the Property removed.~~

The entire property was timbered approximately 60 years ago. These harvests were likely initiated in part to salvage the remains of the American chestnut trees that died during the chestnut blight, as well as to liquidate other mature timber. Since then, ~~ACME, Inc.~~ used the forest as a source of timber ~~to make wood products~~, primarily using selective cut harvest methods, or high-grading, to minimize the cost of operations and maximize profit. ~~The next owners~~ continued this management strategy and also performed some large patch clearcuts in the late 1990s.

Roughly 55 acres in the northeast portion of the Property was purchased ~~from the seller to the buyer in the early 2000s.~~ These parcels were essentially clearcut ~~by the seller~~ just before the sale.

The current landowner has let the trees grow according to the existing forest management prescription and maintained the existing road/trail infrastructure.

Current Forest Conditions and Concerns

The overall forest conditions reflect this complex patchwork of past forest management, and the forest has not yet fully recovered. Years of selective, opportunistic harvesting have left the forest with relatively low quality and young timber at present. Stewardship activities should facilitate patterns of natural succession while promoting diversity and vigorously growing trees, thereby promoting forest diversity.

The forest is generally healthy, though we believe it contains less overall diversity than was present in historic times. We define diversity to include a property wide scale consideration of species composition (both overstory and understory), age class distribution, and successional stage. We attribute the loss of diversity to (1) the widespread use of clearcutting throughout much of the forest during the past century, (2) the introduction of non-native pests (most notably the chestnut blight and the hemlock wooly adelgid), and (3) a reduction of fire frequency on some of the drier sites. These factors, alone or in combination, have led to the following:

- Much of the forest has been converted from multiple-aged stands to even-aged stands that develop following clearcutting and selective harvesting practices, and many of these stands are between 60 and 80 years old.
- The overstory contains a greater percentage of early successional species than were previously present due to the ability of these species to aggressively regenerate sites following clearcutting.
- American chestnut has essentially been lost from the overstory due to disease attacks, though it still persists in the understory.
- A large percentage of the forest is entering into the understory reinitiation stage of stand development (see Glossary), and in many cases, the next cohort of trees that will occupy the overstory represent more shade tolerant species than those currently there.
- Overstory trees in the many stands that are entering the understory reinitiation phase of stand development are competing heavily for limited resources, which slows their growth rates. This reduced vigor may increase their vulnerability to environmental stresses. The even-aged nature of the forest compounds this problem by making it difficult for trees to differentiate into dominant, co-dominant, intermediate and suppressed crown classes.
- For the most part, the forest is not structured to achieve historical levels of gap phase stand disturbances. This is due both to the loss of large American chestnut from the overstory, and the lack of very old (and very large) trees. The lack of large gaps favors the succession of shade tolerant species.
- There is evidence that the production of high quality hard mast will fall well below historical levels due first to the loss of American chestnut, and then to the loss of oaks that will be replaced in many areas by shade tolerant species, such as birch and maple.
- Mountain laurel is becoming increasingly dense on drier sites (perhaps due to a reduction in fire frequency), and is limiting the growth of other species.
- Rhododendron may be expanding its range, and is limiting the growth of other species where that occurs.

In addition to the above concerns related to past management we add the following present and future concerns:

- Oak decline: Oak decline is attributed to a complex of environmental, insect, and disease factors that lead to the dieback or death of oak. It is often associated with dry soil conditions which can leave trees stressed and susceptible to other pests. Isolated evidence of oak decline was observed in some areas, but it was not widespread.
- Hemlock Wooly Adelgid: The hemlock wooly adelgid is common throughout the forest, and is starting to cause significant mortality of eastern Hemlock. Based on patterns of mortality that have occurred in other regions, it is likely that more than 90% of the hemlock will die within the next several years. At this point there is no cost-effective means to save large stands of hemlock trees.
- Insect and disease issues: We did not observe outbreaks of other insects or diseases; however, there is a continual threat that various insects and diseases may become established. Maintaining a diversity of forest conditions is the best strategy to maximize the resistance and resilience of the forest to unknown future insect and disease problems.
- Exotic invasive plants: Japanese stiltgrass and Chinese privet were found in small numbers. The vast majority of these species are located along the edges of the roads running throughout the Property. Though infestation levels are low presently, these species possess the potential to spread and inhibit forest regeneration, especially in future active forest management areas. These infested areas should be treated (see Appendices C, D, E and F) to prevent their spread into disturbed areas. It is also likely that in the next several decades new invasive exotic plant species will be found on the Property.
- Air pollution and global climate change: it is possible that both of these factors could drastically stress forest vegetation in the future. Maintaining a diversity of forest conditions across the Property is the best approach to maximize the resistance and resilience of the forest to unknown future forest stresses.

In summary, while there are no known, imminent threats to the forest, we believe that the overall condition of the forest can be improved by increasing, and in some cases restoring forest diversity.

Forest Infrastructure and Harvest Operation Considerations

There is access to much of the forest on the Property on maintained and abandoned forest roads and trails, though some of these trails are on sensitive soils and should only be used only in dry conditions. Upon time to harvest timber, careful consideration must be given to the placement of additional temporary trails and harvesting systems as to minimize impact to the residual forest and prevent erosion. The Infrastructure Map (see Appendix G) shows property access, four-wheel drive accessible roads, and a trail system. The trails are largely composed of old logging roads that have been maintained for recreational purposes, and there are dozens of abandoned logging roads throughout the Property that were not mapped.

Any future logging operations must rigorously abide by Best Management Practices such that soil resources and water quality are maintained. Following BMPs specifically means establishing 50 foot Streamside Management Zones (SMZs) in which harvest equipment will be precluded and timber harvesting minimized to maintain at least 50% forest cover throughout the SMZs. In order to maximize revenues, benefit the future forest, and protect water quality, the landowner should hire a registered forester to plan and administer the sale of timber.

Roads that will be utilized during forest management require special attention to improve, maintain, and monitor road conditions during and after management. Additional improvements to roads and water crossings may be necessary in areas where heavy use of large trucks or equipment will occur. As a general principle existing roads should be used whenever possible and additional road construction minimized. Careful consideration must be given to the placement of temporary roads and harvesting systems as to minimize impact to the residual forest and prevent erosion. Logging operations must rigorously abide by Best Management Practices such that soil resources and water quality are maintained. Best Management Practices can be read at http://www.dfr.state.nc.us/water_quality/bmp_manual.htm

Aesthetics and Recreation

The Property has high aesthetic value and this can be maintained by utilizing management practices that minimize the size of canopy openings and retain a high number of residual trees. Existing roads and trails provide ample access to recreational activities including hiking, horseback riding, hunting, and camping.

In consideration of the forest management history, current conditions for each stand, and the landowner's objectives, EcoForesters in consultation with the landowner has set forth management actions that are detailed in Table 2. The remainder of this report contains more detail on stand descriptions and management recommendations.

Summary Tables

Table 1. Area of Each Cover Type	
Type	**Acres**
Management Zone 1 – Oak/Hickory	1234
Management Zone 2 – Cove	250
Management Zone 3 – Early Successional	72
Management Zone 4 – Two-Aged	43
Management Zone 5 – Mature	126
Grand Total	**1722**

Table 2. Management Actions by Zone				
Mgt. Zone	**Suggested Management Action**	**Target Date**	**Revenue**	**Requirement**
1, 4, 5	Conduct controlled burning to maintain shade intermediate species and promote understory diversity.	2016-2026	Cost*	Optional*
1, 2, 5	Conduct crop tree release to promote both diversity and growth rates.	2016-2026	Cost**	Optional**
1, 3	Control invasive species Japanese stiltgrass and Chinese privet	Continuous	Cost*	Optional*
1, 5	Conduct regeneration harvest through 2-5 acre patch cuts at various locations in stands to promote oak regeneration. Repeat every 25 years.	2031-2041	Moderate	Required for PUV program
2	Conduct crown thinning or group selection harvest to maintain vigor of canopy trees and promote structural diversity.	2031-2041	Moderate	Required for PUV program
3	Conduct crop tree release to help maintain health and vigor of desirable species	2026-2036	Cost**	Optional**
3	Conduct crown thinning or group selection harvest to maintain vigor of canopy trees and promote structural diversity.	2076-2096	Potential	Required for PUV Program^
4	Conduct group selection harvest given favorable markets for low grade hardwoods.	2031-2041	Potential	Required for PUV Program^
5	Conduct group selection paired with thinning harvest to maintain vigor of canopy trees and promote structural diversity, only if landowner requires immediate revenues prior to the patch cut prescription detailed above.	2026-2031	Moderate	Optional
Entire Property	Reassess forest in updated management plan	2026	Cost	Required for PUV program

*Cost share assistance is available from NC Forest Service or NRCS for this pre-commercial treatment.
**These optional treatments may benefit forest health and diversity, but likely will not increase the net return of future harvests and are therefore not required to be conducted to satisfy the requirements of the PUV Taxation Program.
^These harvests are required by the PUV program if they are commercially viable. This will depend on markets for low grade hardwoods. If markets are not sufficient for a commercial timber sale then harvesting should be delayed.

All stands will be allowed to regenerate naturally after regeneration harvests using the existing seed bank. Planting is not a cost-effective method for regeneration of natural forest community types in this region.

Table 3. Basal Area (square feet per Acre) by Cover Type and Diameter Class

Habitat Type	<4	4-8	8-12	12-16	16-20	20-24	>24	Total
Chestnut Oak Forest – Herb	0	10	21	35	25	9	9	**109**
Chestnut Oak Forest – White Pine	0	13	23	36	32	14	8	**127**
Rich Cove Forest – Foothills Intermediate	0	8	16	29	29	4	7	**94**
Montane Oak Hickory Forest – Typic	0	9	15	20	18	17	6	**85**
Early Successional Hardwood Forest	15	25	5	5	0	0	0	**45**
Two-Aged Montane Oak Hickory Forest	0	40	27	10	10	0	0	**87**
Montane Alluvial Forest	0	10	30	60	30	5	0	**135**
Chestnut Oak Forest – Heath	0	20	37	10	23	0	0	**90**
Management Zone 5*	***0***	***8***	***23***	***38***	***39***	***22***	***13***	**143**

*Not a forest community type, see Management section for details.

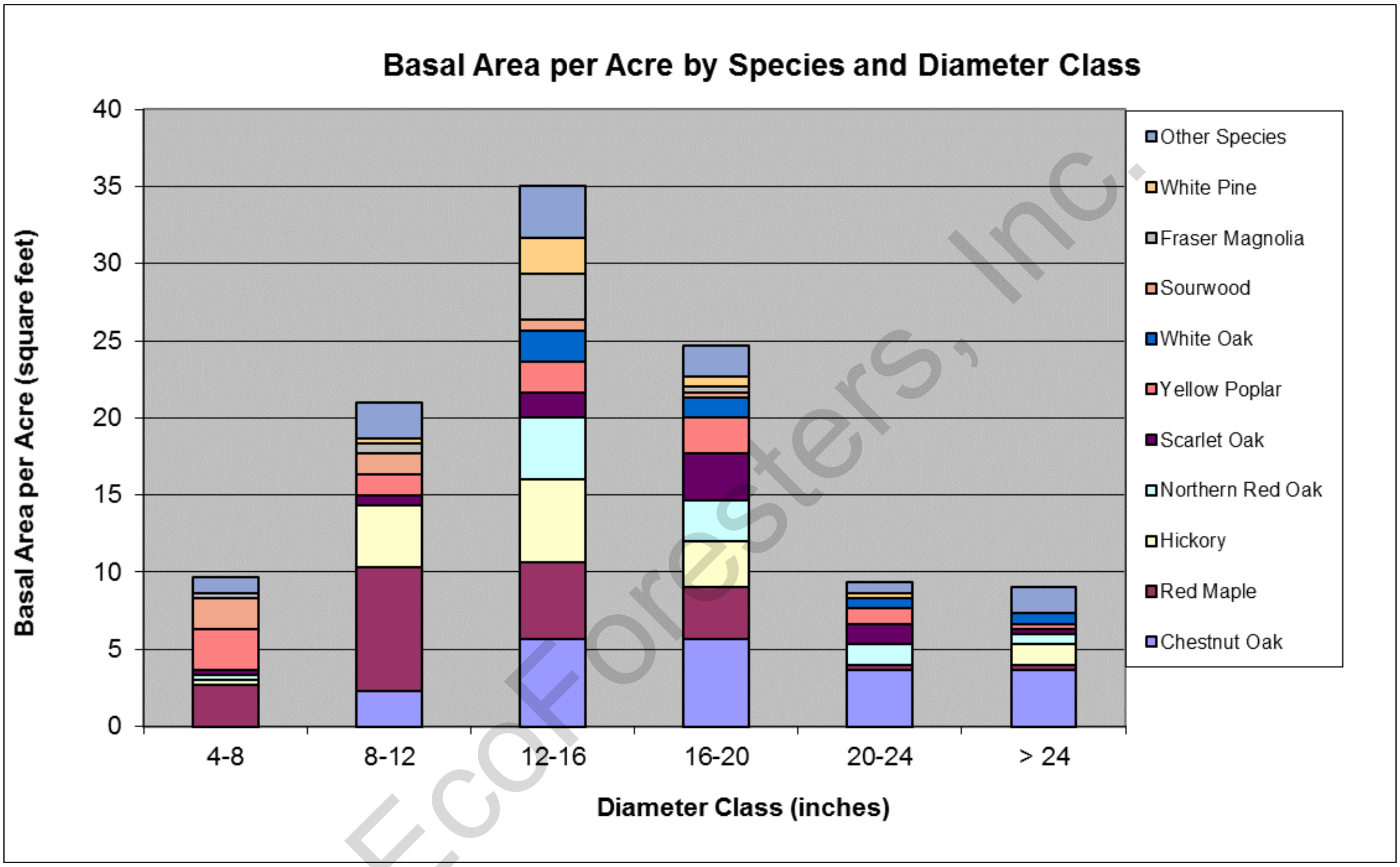
Forest Community Type Descriptions

1. Chestnut Oak Forest – Herb Subtype (618 ac.)

The most abundant forest community type on the Property and also one of the most common forest types in the region, these forests generally occur on slopes and ridges on all aspects. These stands are dominated by chestnut oak and a lesser amount of other oaks. Red maple is co-dominant in the canopy, but is most common in the sub-canopy where it mixes with other shade tolerant species such as sourwood and blackgum. As the chart below shows, oaks are dominant between in diameter classes above 12 inches, representing trees approximately 80 years old that regenerated following chestnut blight era timber harvesting. Much of this stand has since been selectively cut over multiple times since the last large-scale harvest, and most of the trees of merchantable diameters are very poorly formed.

These stands provide important wildlife habitat. The dominance of oaks provides an abundant acorn crop, an important food source for numerous wildlife species. This food source will likely decline in upcoming decades as oaks fall out of the canopy and are replaced by red maple and other shade tolerant species.

These stands are currently succeeding from the Stem Exclusion to the Understory Reinitiation phase (see glossary). This transition is evidenced by occasional canopy gaps and a relatively dense understory of trees and shrubs. Over the next several decades, more trees will fall out of canopy dominance due to increased competition and limited resources for growth, and more light will reach the understory allowing the growth of a younger age class of trees. However, it is likely that without management, the next cohort of trees will be dominated by shade tolerant species, at the expense of shade intermediate species such as oaks and hickories.



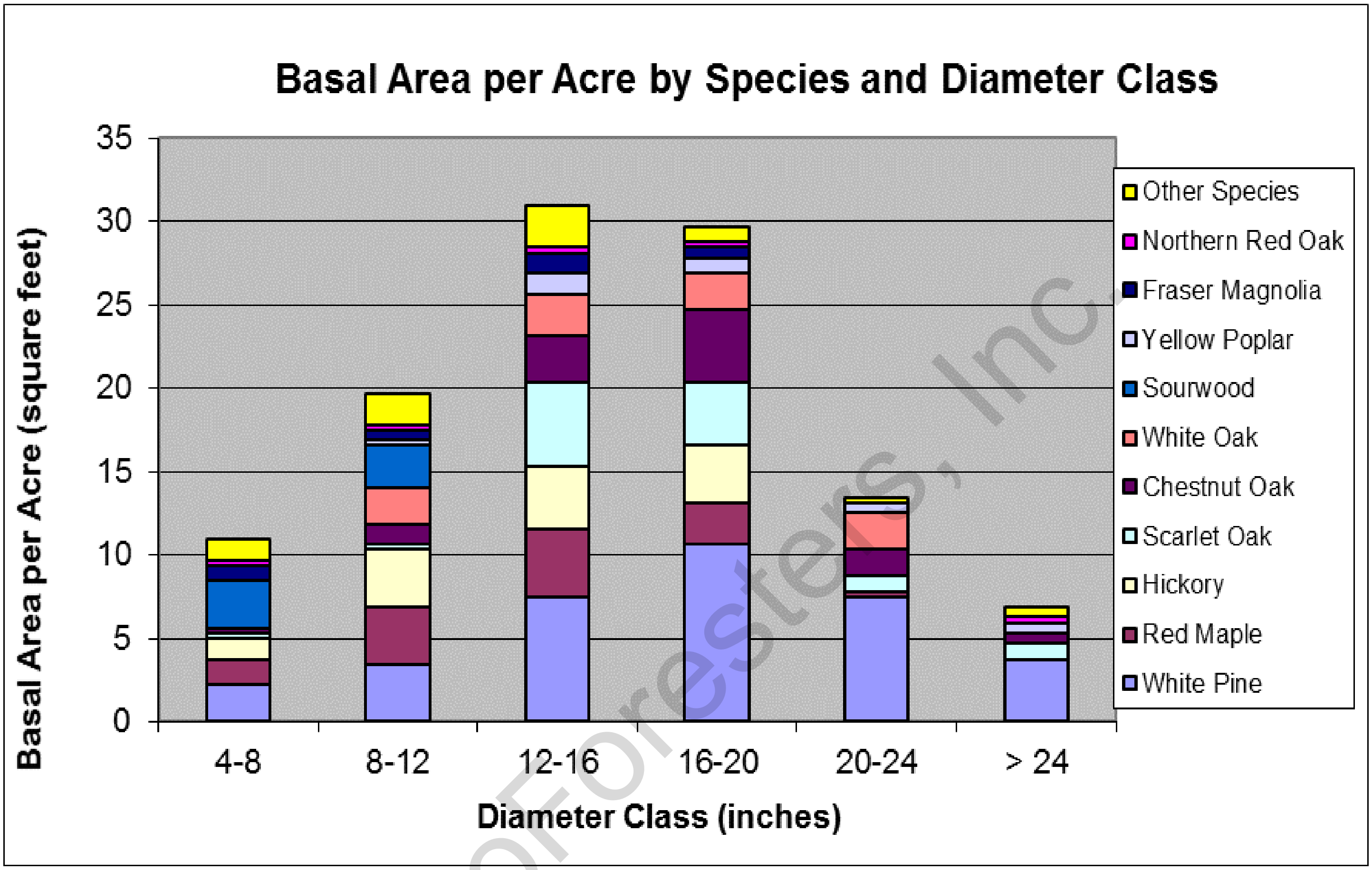
2. Chestnut Oak Forest – White Pine Subtype (607 ac.)

This forest community type is also abundant on the Property, but is not as common in the region as the Herb Subtype. They are quite similar in many ways, except the White Pine Subtype has a significant component of white pine and mountain laurel is more common in the shrub layer, though not as common as in the Dry Heath Subtype. These stands naturally occur in all the same site conditions as the Herb Subtype.

White pine and mixed oaks dominate the canopy, with more shade tolerant species such as red maple, sourwood, and sweet birch composing the understory. This stand is also approximately 60-80 years old and would have been harvested at the same time as the Herb Subtype. The basal area of this stand is significantly higher than the Herb Subtype, and this difference is almost exclusively found in the 16-20” stems and is due to the white pine component.

Dense white pine saplings and occasional mountain laurel thickets create cover for birds and small animals, but otherwise the wildlife habitat suitability is similar to the Herb Subtype: hard mast-producing trees along with occasional snags and rock outcrops for denning sites.

These stands are currently succeeding from the Stem Exclusion to the Understory Reinitiation phase (see glossary). This transition is evidenced by occasional canopy gaps and a relatively dense understory of trees and shrubs. Over the next several decades, more trees will fall out of canopy dominance due to increased competition and limited resources for growth, and more light will reach the understory allowing the growth of a younger age class of trees. However, it is likely that without management, the next cohort of trees will be dominated by shade tolerant species, at the expense of shade intermediate species such as oaks, hickories, and white pine.



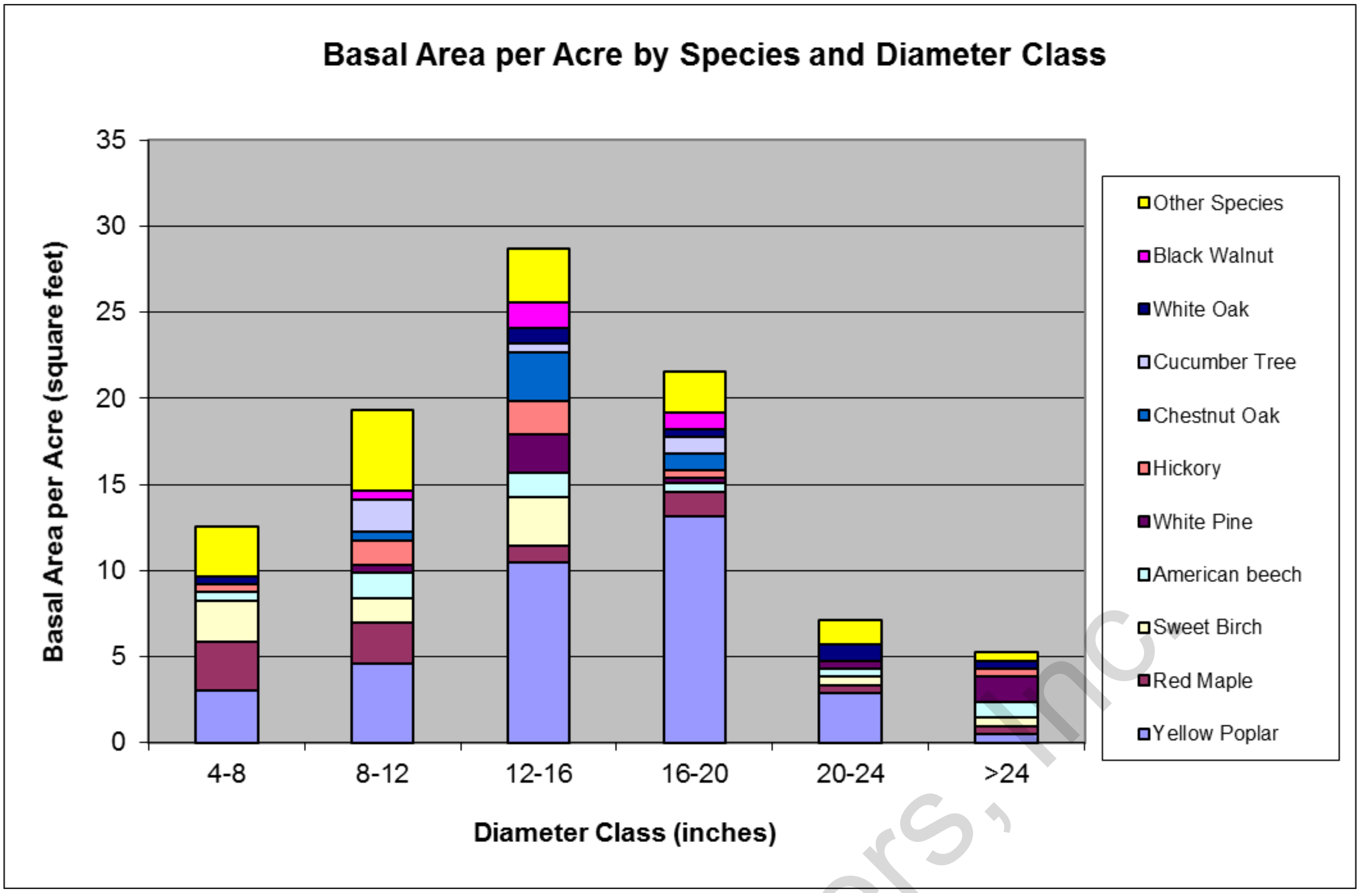
3. Rich Cove Forest – Foothills Intermediate Subtype (256 ac.)

This type occurs at lower elevations (< 2000'), generally in coves, gorges, or sheltered slopes. The sites are mesic, with soils that are generally rich and loamy. These stands vary in age from 40 to 80+ years old. Age variability between these stands is related to access difficulty. Because these are the most productive sites on the Property, they have been the most targeted for harvesting. Easily accessible Rich Cove stands on gentler slopes and closer to existing forest roads have been harvested more heavily and more recently. Older stands are very difficult to reach, often at the bottom of extremely steep slopes and far from the network of forest roads. Because these sites are mesic, fire likely has not played as significant a role in this forest type's past than in oak dominated stands.

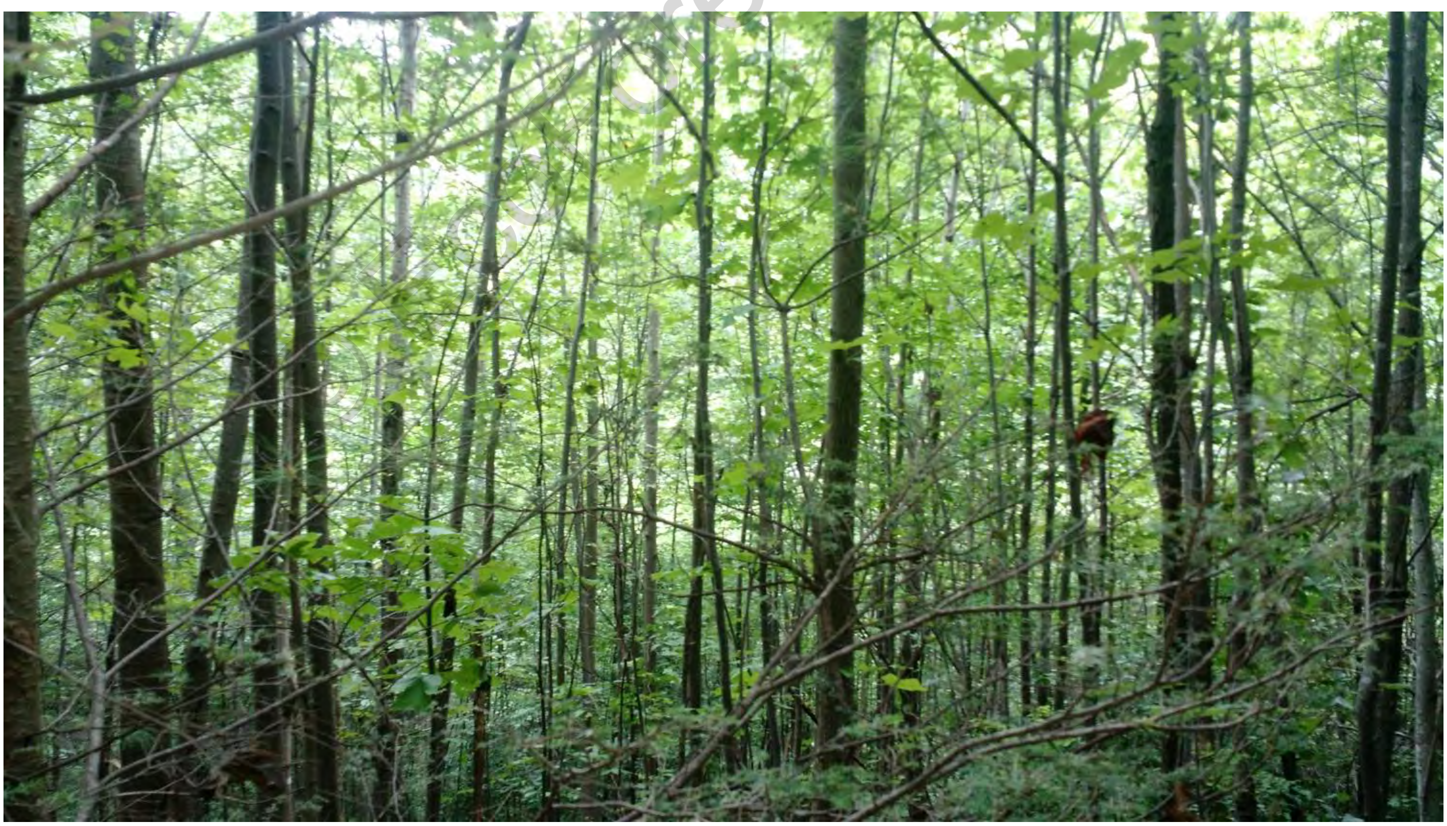
Yellow poplar dominates the canopy of this stand, comprising over two thirds of the basal area of stems 12-24" dbh. This community type has the greatest number of different species of all the other community types occurring on the Property. While it is the most biodiverse, the number of individuals representing each species is relatively low. Oaks and hickories are infringing on this type from the slopes above. Sweet birch, cucumber tree, black walnut, white pine, white ash, and silverbell are all found in the understory. These stands' close proximity to streams flowing through the Property provides important habitat for amphibians and serves as a water source for other wildlife.

Eastern hemlock was historically a major component of this forest type, but since the introduction of the invasive exotic Hemlock Wooly Adelgid, almost all eastern hemlocks on the Property are either dead or infested and will be dead within the next few years.

These stands are in the Stem Exclusion stage of forest succession. This stage occurs when canopy closure is reached and trees compete with each other for limited resources. The more vigorous trees usurp the growing space and weaker ones die. This competition also limits regeneration of a younger cohort of tree species and the development of understory trees and shrubs. As a result, there is limited structural and biological diversity. Over the next several decades this stand will transition into the Understory Reinitiation stage of stand development in which a new cohort of trees will fill in growing space created by the death of some overstory trees.



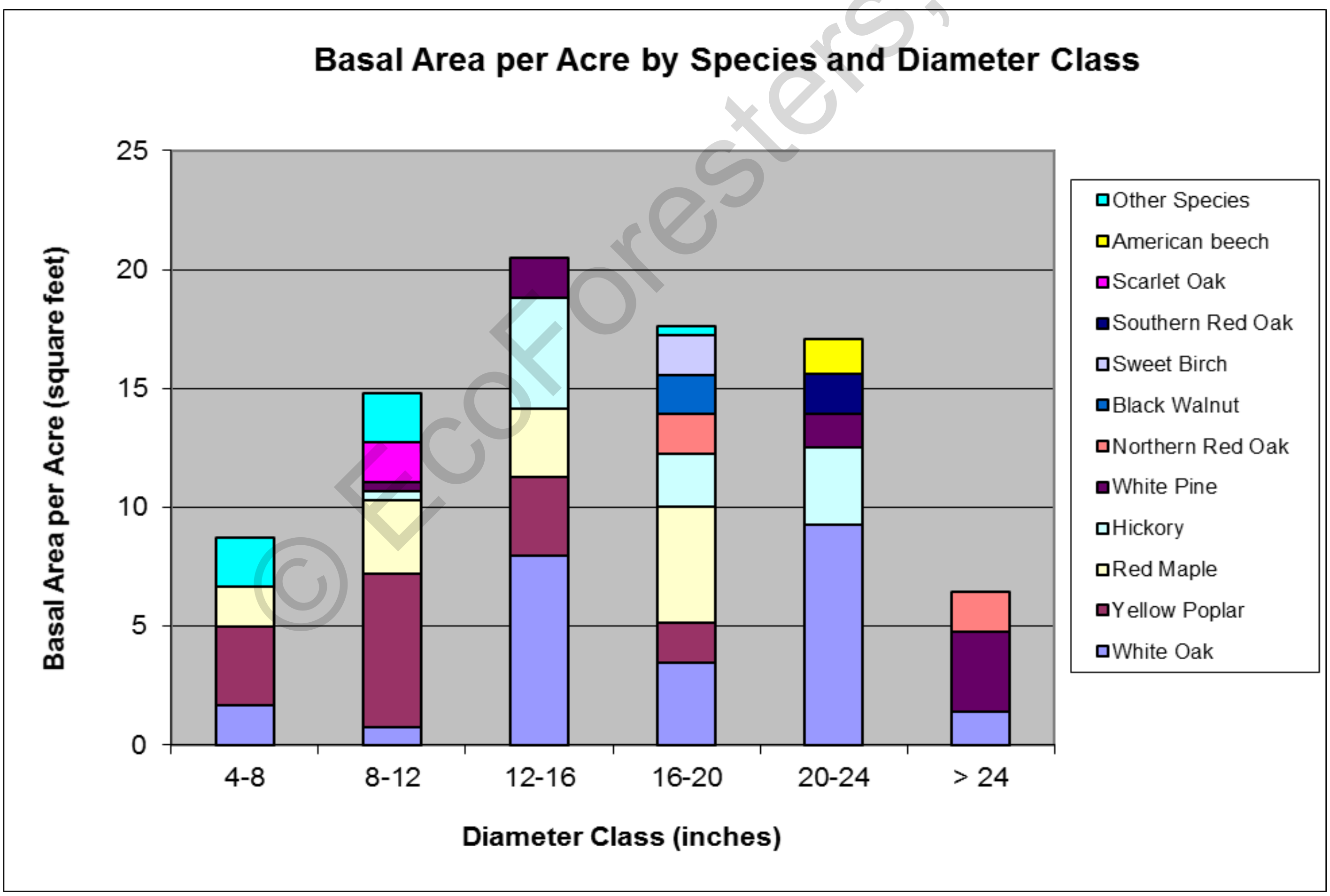
4. Montane Oak-Hickory Forest – Typic Subtype (107 ac.)



This cover type occurs primarily on middle slopes and coves below 4000 feet elevation, most frequently on north and east facing slopes. The sites are mesic and with soils that are generally rich and loamy. This cover type is defined by the dominance of yellow poplar. Portions of these stands have regenerated after a timber harvest approximately 50 years ago.

Due to its superior ability to spread its seed and grow rapidly in full sunlight on rich sites following a clear-cut or on abandoned fields, yellow poplar occupies over 90% of the basal area in this stand. Most of the dominant trees in this stand are between 10 and 20 inches dbh. Among the poplars is a mixture of other hardwood species commonly found in rich cove forests. The most common canopy species other than yellow poplar is northern red oak and black locust, while shade tolerant silverbell, American beech, red maple, and sweet birch are the most common tree species in the sub-canopy. The shrub layer is mostly open. There is likely a dense herbaceous layer that emerges in the spring.

This stand is primarily in the Stem Exclusion phase of forest succession (see glossary). Over the next several decades, assuming a lack of natural or human disturbance, more trees will fall out of canopy dominance due to increased competition and limited resources for growth, and more light will reach the understory allowing the growth of a younger age class of trees. This phase of Understory Reinitiation can last many decades. The ingrowth of younger trees creates multiple age-classes which increases structural diversity and subsequently increases biological diversity. The next generation of trees usurping this growing space is likely to consist of primarily shade tolerant species such as red maple. Larger disturbances would need to take place in order to allow more light to reach the forest floor that would cause shade intolerant yellow poplar and shade intermediate northern red oak to regenerate and successfully grow into the overstory.



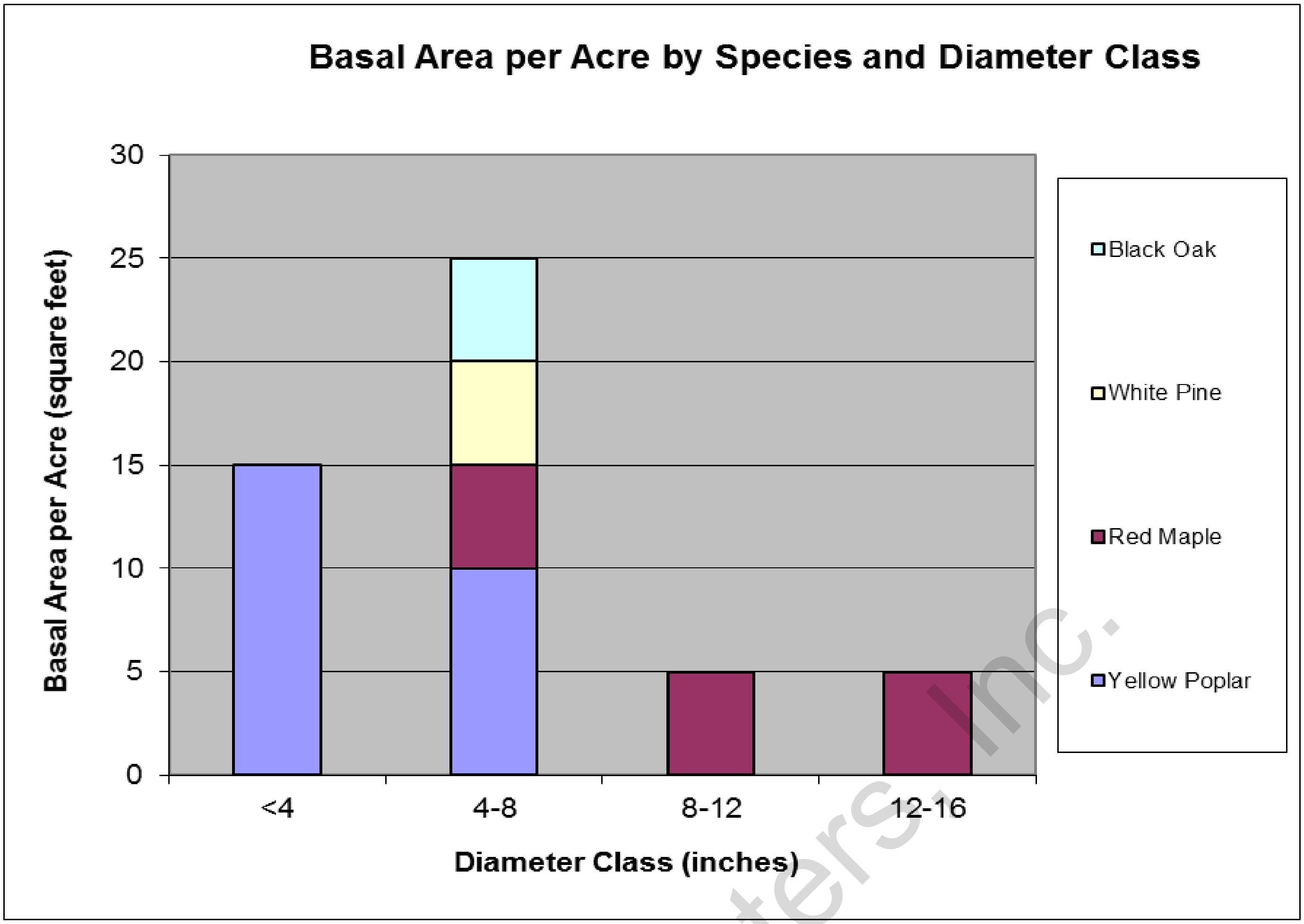
5. Early Successional Hardwood Forest (73 ac.)

The youngest forest community type found on the Property, Early Successional Hardwood Forest stands are in the process of regenerating from a major stand disturbance in the form of heavy harvesting. These stands were clearcut within the past 20 years, one in the late 1990s and the other in 2002.

Yellow poplar dominates the canopy and the majority of stems are less than 6" dbh. Red maple coppice (see glossary) is prevalent in the understory, along with the occasional oak coppice or pine. The red maples seen in the larger diameter classes in the chart below are residuals from before the harvest. These stems had such little value they were not even worth cutting down.

Because this community type has only developed for about 20 years following the harvest, there is very little structural diversity. The forest is in a successional stage known as Stem Exclusion (see glossary). The result is a very dense and even overstory with little to no understory trees. While there are exceptions, this successional stage has the least amount of biological diversity when compared to earlier and subsequent stages.

Management considerations for this forest type may include efforts to increase structural and biological diversity through crop tree release (see glossary). Lastly, while fire has played a historical role in oak dominated forest, it may not be advisable in this type until trees have grown enough that fire would not cause significant mortality.

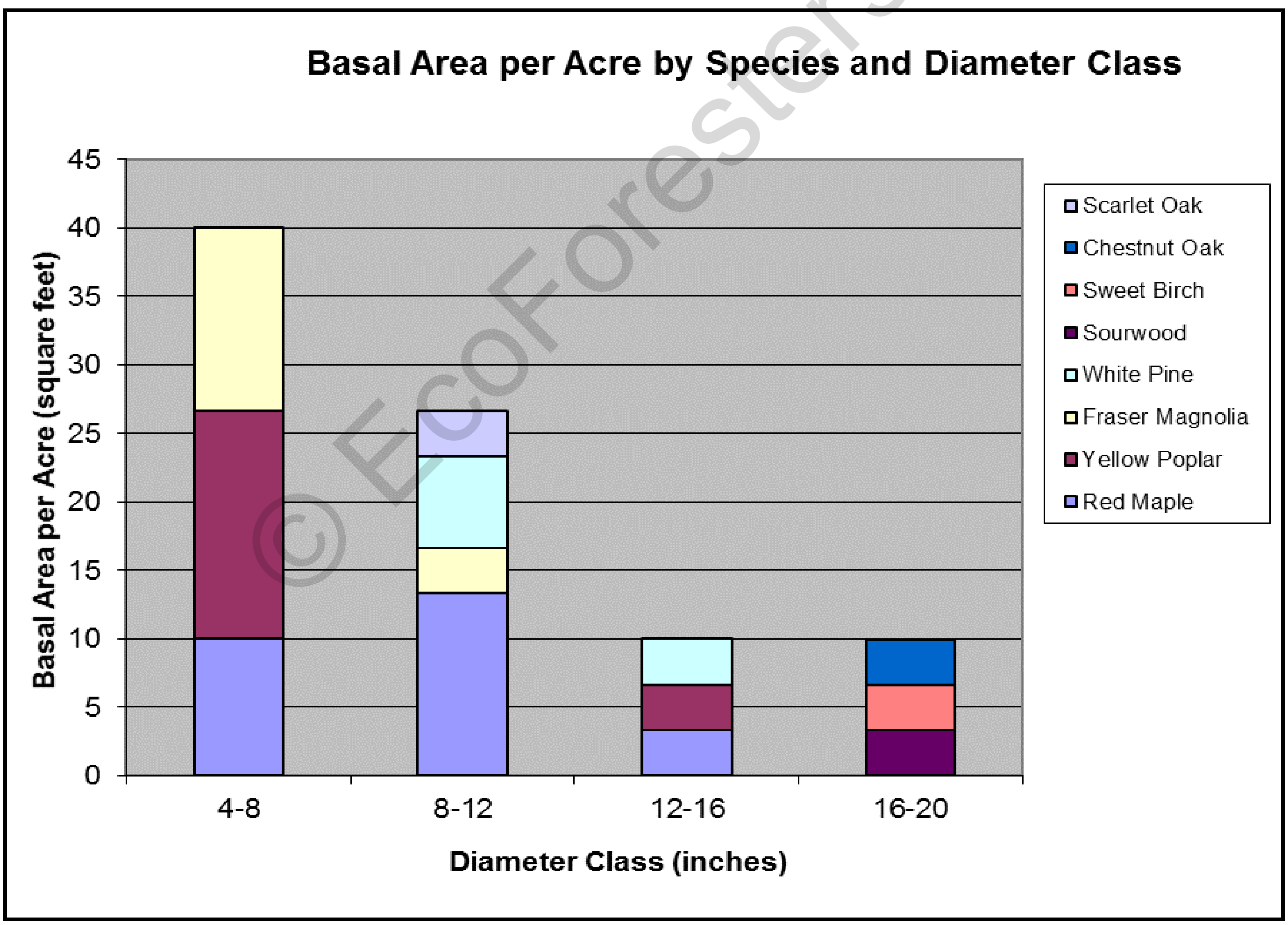


6. Two-Aged Montane Oak-Hickory Forest (22 ac.)

This type is very similar to the Montane Oak-Hickory Forest – Typic Subtype, except it has two distinct age classes. Typically a result of previous timber harvests, this type has an older cohort dominating the canopy and a younger generation advancing into the midstory. This stand is significantly older than the Early Succsessional Hardwood Forest type, having most of its basal area per acre between 6 and 10” dbh.

The canopy is dominated by undesired residuals from the past management, all of very poor form and little value. Chestnut oak, red maple, sourwood, and sweet birch are the most prevalent. The understory is composed of yellow poplar, red maple, white pine, and Fraser magnolia.

These stands are very slowly succeeding from the Stem Exclusion to the Understory Reinitiation phase (see glossary). This transition is evidenced by occasional canopy gaps and a relatively dense understory of trees and shrubs. Previous management practices have artificially advanced this process by removing enough of the original cohort to allow a second cohort to become established, but left unhealthy and poorly formed trees to provide seed source. Over the next several decades, more trees will fall out of canopy dominance due to increased competition and limited resources for growth, and more light will reach the understory allowing the younger cohort to become codominant in the canopy. However, it is likely that without management, the next cohort of trees will be dominated by shade tolerant species, at the expense of shade intermediate species such as oaks and hickories.



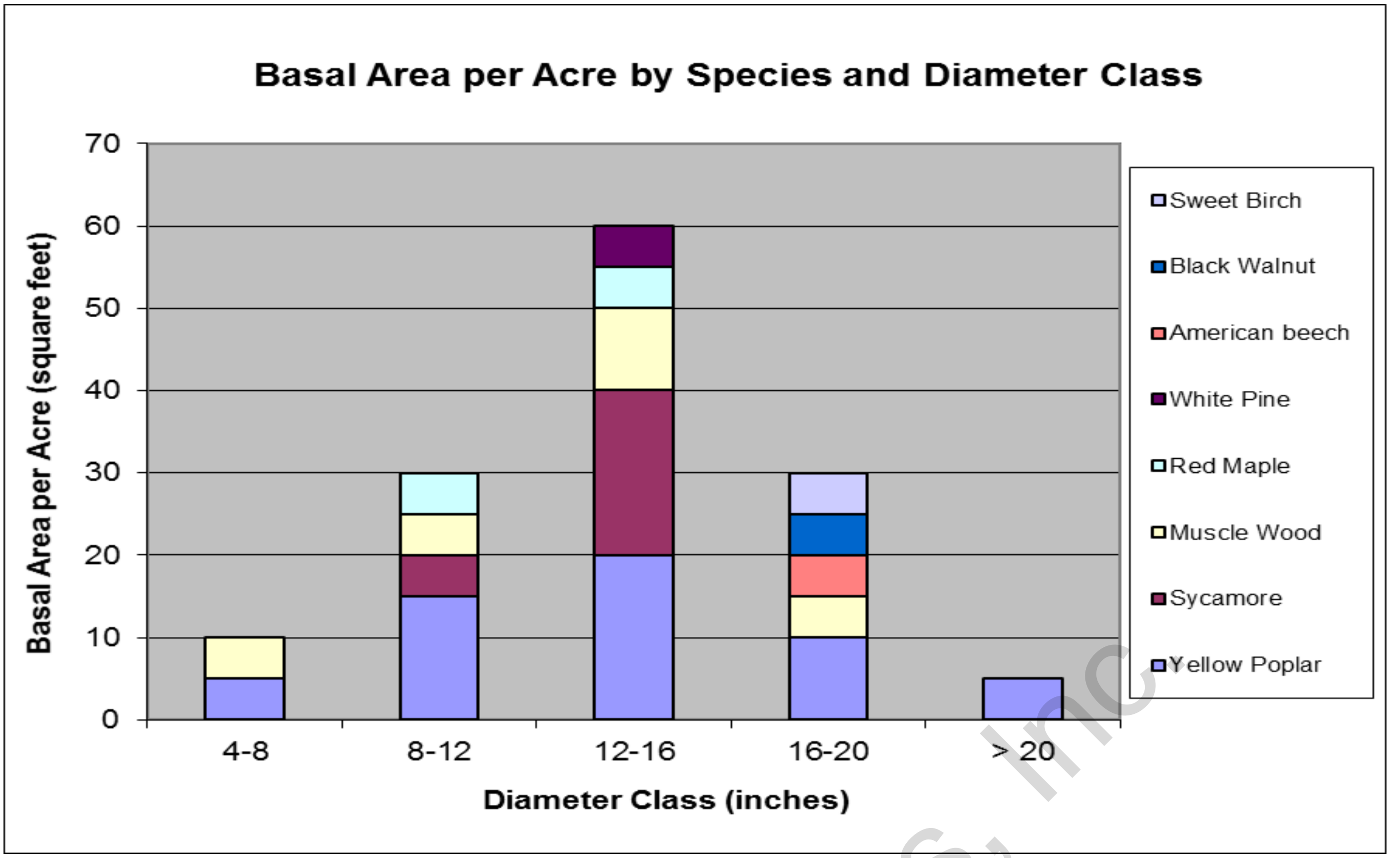
7. Montane Alluvial Forest (21 ac.)

This is a unique forest community type on the Property. Similar to the other cove forests there is a strong presence of mesophilic species such as yellow poplar, black walnut, and sweet birch. However, these Montane Alluvial stands also consist of several species which do not appear anywhere else on the Property such as sycamore, musclewood, and even a river birch. These species are normally found in lowlands, near large creeks or rivers and on floodplains. The understory is open and the trees are spaced very well, meaning that neighboring trees competing less with one another for resources.

Site conditions in these stands are very mesic, the topography is a flat floodplain terrace, and there is always flowing surface water. These stands do not provide as much hard mast for wildlife, but they have rich herb layers and grasses for grazers as well as quality riparian habitat for amphibians.

While this type contains the highest basal area per acre, the acreage is quite low, and also most of the basal area is located in the 12-16” diameter class, which is not yet merchantable.

These stands are currently succeeding from the Stem Exclusion to the Understory Reinitiation phase (see glossary). This transition is evidenced by occasional canopy gaps and a relatively dense understory of trees and shrubs. Over the next several decades, more shade intolerant trees will fall out of canopy dominance due to increased competition and limited resources for growth, and more light will reach the understory allowing the growth of a younger age class shade tolerant of trees.



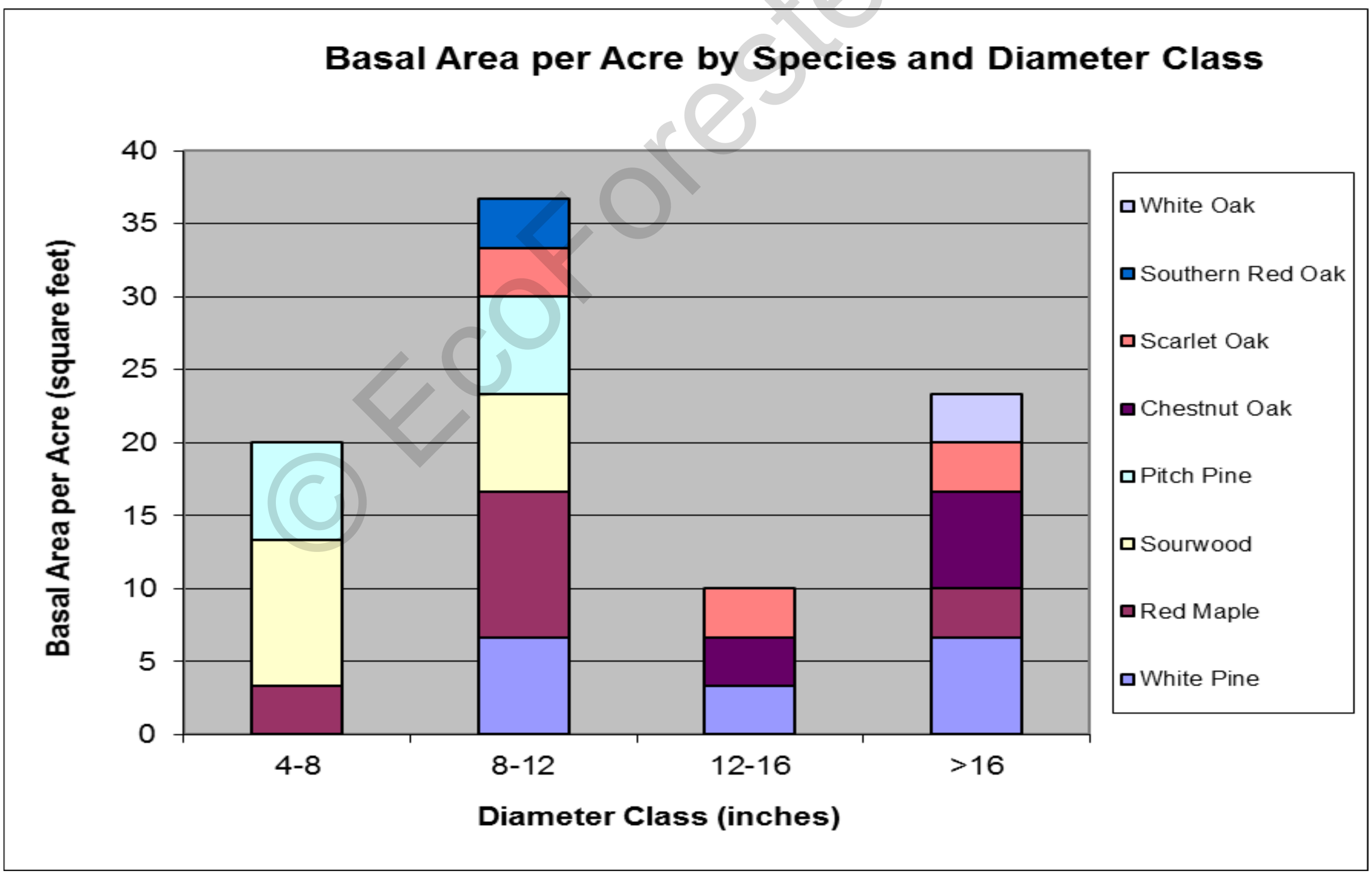
8. Two-Aged Chestnut Oak-Hickory Forest – Dry Heath Subtype (21 ac.)

Found on extremely xeric sites, predominantly ridgelines and exposed south and west facing slopes, this is the least productive forest community type on the Property. Soils are low in nutrients and subsequently cause slow tree growth. Major differentiating characteristics of the Dry Heath Subtype are a prevalent evergreen shrub layer, primarily mountain laurel, and dry soils.

Stands in this community type on the Property are two-aged stands, meaning there are two distinct cohorts that regenerated at different times. Heavy selective cutting removed enough of the canopy for regeneration to begin, but a combination of the poor site conditions and often dense evergreen shrubs has suppressed the younger cohort's ability to become codominant in the canopy. The residual stems in the older cohort are in extremely poor form and have little market value.

The canopy is dominated by white pine, chestnut oak, and scarlet oak. Red maple, sourwood, and pitch pine make up the understory, amidst a dense evergreen shrub layer. There is no new regeneration to speak of in these stands. Most of the basal area in these stands are less than 12" in diameter, too immature to be merchantable. The residual stems in the older cohort, generally greater than 16" in diameter, are in extremely poor form and have little market value. However, the presence of mature oaks provides an important hard mast food source for many wildlife species and the dense evergreen shrubs provide cover.

These stands are very slowly succeeding from the Stem Exclusion to the Understory Reinitiation phase (see glossary). This transition is evidenced by occasional canopy gaps and a relatively dense understory of trees and shrubs. Previous management practices have artificially advanced this process by removing enough of the original cohort to allow a second cohort to become established, but left unhealthy and poorly formed trees to provide seed source. Over the next several decades, more trees will fall out of canopy dominance due to increased competition and limited resources for growth, and more light will reach the understory allowing the younger cohort to become codominant in the canopy. However, it is likely that without management, the next cohort of trees will be dominated by shade tolerant species, at the expense of shade intermediate species such as oaks and hickories.



Management Zone 1 (1,234 ac.)

This management zone consists of the stands belonging to the Chestnut Oak Hickory – Herb Subtype and White Pine Subtype, as well as the Montane Oak-Hickory – Typic Subtype.

There is increasing evidence that much of the eastern forests, particularly the drier forests upon which oak and hickory are prevalent, were regularly burned for centuries by Native Americans and early settlers. As a result this cover type was historically dominated by fire adapted species such as oaks, hickories, and American chestnut. Without fire or other disturbances that would allow more light to reach the forest floor, it is likely that forests on these sites will in the future become dominated by shade tolerant species such as red maple and sourwood.

The absence of regenerating oak species causes concern as to what the future conditions of the stand may be. There is evidence throughout the Property that deer browsing has contributed to the sparse regeneration of various tree species. Implementing some management actions could work to increase tree regeneration and to control the deer population. These could include continuing to use the Property for hunting, and working to cull the deer herd through a Quality Deer Management Program. The creation of early successional habitat through timber harvesting could provide a quality habitat and food source for deer.

Trees in these community types are relatively small and have not reached financial or biological maturity. A number of them currently in the 12 -16 inch diameter class would provide a greater return if harvested more than 10 years from now. As a result, aside from the optional noncommercial treatment mentioned below, this stand should be allowed to grow undisturbed at least until the next management planning cycle in 2026. Once the timber matures and becomes dominated by mature even-aged trees of an adequate saw-timber size, a regeneration harvest is recommended in order to increase structural diversity and promote oak regeneration. Group selection harvests, creating natural regeneration patches of 2 to 5 acres, should be implemented at various areas throughout the stand and are recommended to be harvested at 25 year intervals. These regeneration harvests will create different successional stages of habitat for many species of wildlife including white-tailed deer and ruffed grouse as well as promote the regeneration of various hardwood species. Zone 5 is also included in this prescription. In the meantime, crop tree release can be implemented to promote both diversity and growth rates of desirable species.

In areas inaccessible to logging equipment, an optional noncommercial treatment is prescribed fire. If adequate firelines could be established, a series of well supervised controlled burns over the next few decades could help oaks regenerate and maintain their current prominent by position in the stand by top killing competing shade tolerant species. These burns would also help increase the diversity of the understory of the stand. Any burns should be coordinated with burns on the adjacent zones. The stand should be reassessed for management action in an updated forest management plan to be developed in ten years.

Management Zone 2 (250 ac.)

This management zone consists of the Rich Cove and Montane Alluvial communities.

The majority of the basal area occurs within the 12-20 inch diameter class and could potentially be harvested. However, a number of the species that make up the majority of the basal area are of lesser timber value and should be allowed to mature for 15-25 years or until the markets for low grade timber improves. Management actions at that time should include efforts to increase structural diversity as well as improving the vigor of the residual trees. This could be done by performing crown thinning or group selection harvests. Much of this stand occurs along streams and therefore should serve as a riparian buffer in an SMZ to protect the water quality on the Property. These activities should be performed in conjunction with other management on the Property to reduce costs, as revenue generated from these treatments is marginal.

Given the steep terrain in portions of the management zone, careful consideration must be given to the placement of temporary roads and harvesting systems to minimize impact to the residual forest and prevent erosion. Logging operations must rigorously abide by Best Management Practices such that soil resources and water quality are maintained. A riparian buffer of at least 50 feet around the stream should be included in a Streamside Management Zone (SMZ). Here vegetation should be maintained and management activity limited in order to prevent erosion and maintain the high water quality on the Property. It is suggested that the landowner hire a registered forester to plan and administer this operation in order to maximize revenues, benefit the future forest, and protect water quality.

Management Zone 3 (72 ac.)

This management zone consists of the Early Successional Hardwood Forest stands on the Property. Due to the age and stage of forest succession this stand is in, it will be at least 60 years before the timber becomes commercially viable, at which time group selection harvests should be employed to mimic the regime of gap-phase dynamics and promote regeneration of shade-intermediate species as well as enhance the structural diversity of the forest.

Optional crop tree release treatments in the meantime may enhance the stand's growth vigor by allowing desirable species more resources. Additionally, early successional forests are at the greatest risk of being overtaken by invasive species. This zone should be monitored and any invasives found should be controlled immediately to prevent long-term stand damage.

Management Zone 4 (43 ac.)

This management zone consists of the Two-Aged Chestnut Oak Forest – Heath Subtype and the Two-Aged Montane Oak-Hickory communities.

Similarly to the types comprising Management Zone 1, this cover type was regularly burned for centuries. This stand likely experienced frequent low intensity fires in the past. Without fire or other disturbances that would allow more light to reach the forest floor, it is likely that forests on these sites will slowly become dominated by shade tolerant species and an increasingly dense shrub layer.

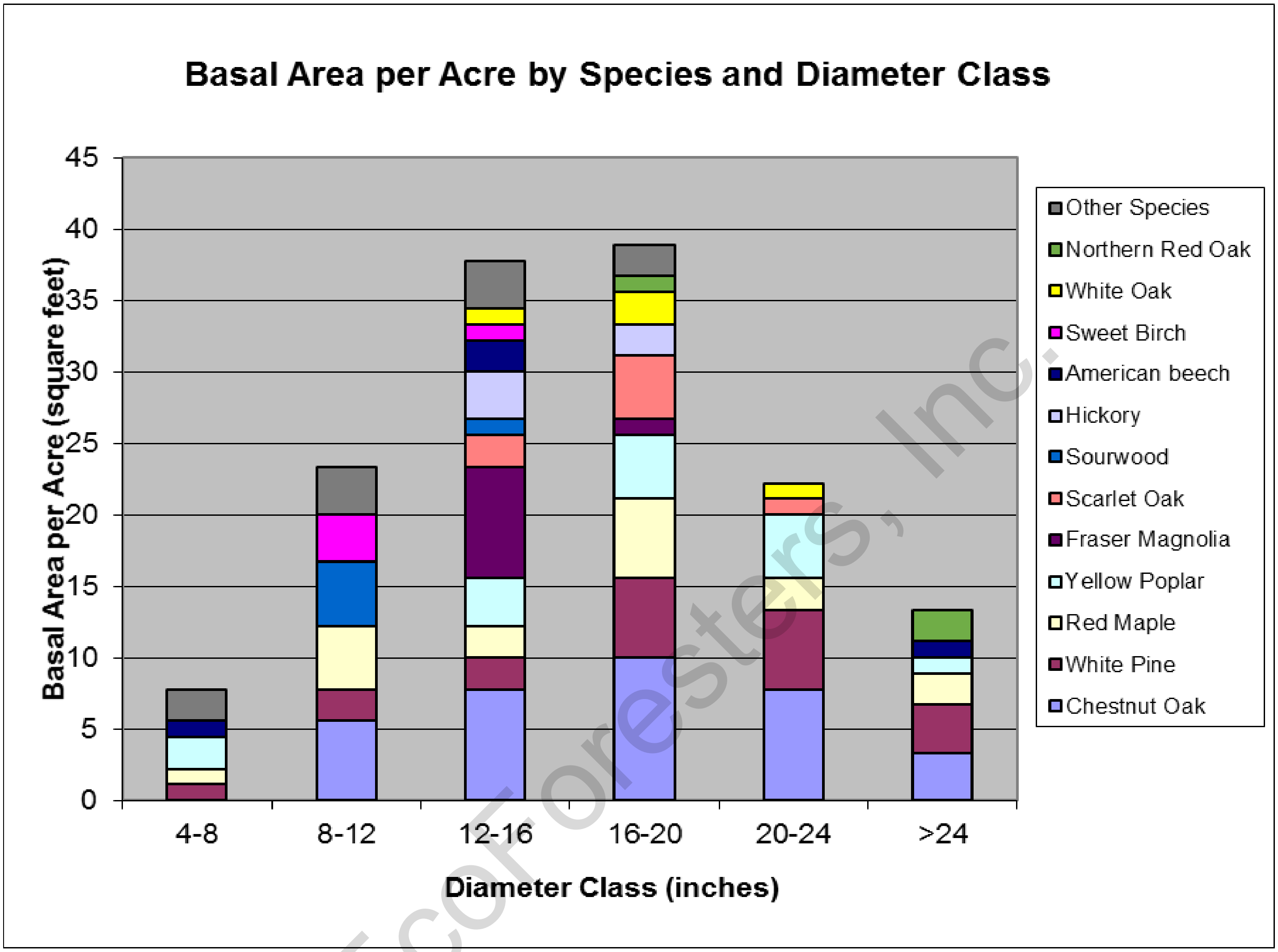
Due to the poor site quality of this stand, many of the trees are relatively small, have poor form, and are not very valuable for timber in the current market. As a result, aside from the optional noncommercial treatment mentioned below, this stand should be allowed to grow undisturbed at least until the next management planning cycle in 2026. Future commercial treatments should only be initiated when markets for low grade hardwoods are favorable and should only be conducted while active management is occurring nearby to minimize operational costs because any revenue generated from this zone will be marginal. Management actions at that time should include efforts to increase structural diversity as well as improving the vigor of the residual trees. This can be accomplished by implementing a group selection harvest to increase diversity and allow shade-intermediate regeneration to advance.

If adequate firelines could be established, a series of well supervised controlled burns over the next few decades could help oaks regenerate and maintain their current prominent by position in the stand by top killing competing shade tolerant species. These burns would also help increase the diversity of the understory of the stand. Any burns should be coordinated with burns on the adjacent zones. The stand should be reassessed for management action in an updated forest management plan to be developed in ten years.

Management Zone 5 (126 ac.)

This zone was delineated because it has the most mature timber on the Property, and contains several community types.

It is dominated by chestnut oak, white pine, red maple, yellow poplar, and other oaks. The midstory is comprised of primarily shade tolerant species such as red maple, sourwood, and sweet birch.



Though well stocked, these stands will not be biologically or economically mature for 10-15 years. At that time this zone should be managed using group selection harvests, creating natural regeneration patches of 2 to 5 acres, in various areas throughout the stand and are recommended to be harvested at 25 year intervals. These regeneration harvests will create different successional stages of habitat for many species of wildlife including white-tailed deer and ruffed grouse as well as promote the regeneration of various hardwood species. Zone 1 is also included in this prescription. In the meantime, crop tree release can be implemented to promote both diversity and growth rates of desirable species.

If the landowner should fall into economic hardship before the other zones have become fully economically viable, regeneration harvests on this zone would yield the highest revenues of any other timber on the Property. The group selection/patch cut strategy detailed above can be implemented early only in this zone, while other zones would produce only marginal revenues.

Glossary of Forestry Terms

Advanced Regeneration: regeneration that is already in place in the understory before the canopy is removed. For our studies we classify a tree as advanced regeneration if it is taller than 4.5 feet and has a dbh less than 2 inches.

Age Class: a group of trees which are all roughly the same age and usually belong to a single cohort.

Basal Area: the area of the cross section of a tree bole at 4.5 feet from groundline (DBH). A 12 inch diameter tree for example, has a basal area of 113 square inches or 0.79 square foot. Unless otherwise indicated, basal area units are in square feet.

Basal Area per Acre: the total area of the cross sections of all trees occupying a given acre of land. This measurement is used because it offers the forester the best estimate of how well any given forest site is stocked, and whether or not the site is achieving its optimum growth potential compared to its site quality. Unless otherwise indicated, basal area units are in square feet.

Best Management Practice: forest management practices that reduce erosion and prevent or control water pollution.

Biodiversity: the variety of life forms in a given area; can be categorized in terms of number of species, variety of plant and animal communities, genetic variability or some combination of these categories.

Board Foot: a unit of measure equal to a board that is 1 inch thick, 12 inches long and 12 inches wide, or 144 cubic inches.

Canopy: the general level of the tree crowns in any given forest stand. This zone may be well-defined and unbroken, such as with plantations and classic even-aged forest, or it may be multileveled and weakly defined, such as with multi-stage and uneven aged forests.

Canopy Closure: the canopy is considered to be “closed” if the crowns are touching and the forest floor is fully shaded.

Chestnut Blight: a fungal disease introduced from Asia in the early 1900’s that attacks American chestnut trees. The disease eventually killed nearly all mature chestnut trees by 1940. Most of the chestnut trees were harvested before or shortly after the blight killed them. Fortunately, the root system is fairly resistant to the blight and the chestnut persists as shoots from the old root systems. Unfortunately they are only able to grow for several years before the blight attacks them.

Clear-cut: a harvesting and regeneration method that removes all trees within a given area.

Cohort: an aggregation of trees that begins growth as the result of a single disturbance.

Competition: The struggle between trees to obtain sunlight, nutrients, water and growing space. Every part of the tree, from the roots to the crown, competes for space and food.

Coppice: Trees which have regenerated from shoots formed at the stumps of the previously cut trees.

Cover Type: a stand or group of stands which has been designated to one category (i.e. Montane Oak-Hickory) because of similarities such as species composition, age, structure, or site characteristics.

Crop Tree Release: competing trees are removed whose crowns are impeding growth of a crop tree. The crop tree is selected usually based on species, form, superior health, and/or larger size. It is similar to a crown thinning, but usually applied to younger stands of trees still in the Stem Exclusion phase.

Crown: the branches and foliage at the top of a tree.

Crown Class a definition of tree position within the forest canopy. The basic four tree positions are defined as follows:

> **Dominant Tree**- tree is above the general level of the canopy, and receives full sun from above and from one or more sides of the crown.
>
> **Co-dominant Tree-** tree is level with the general level of the canopy, receiving full sun from above but only partial sun from the sides of the crown.
>
> **Intermediate Tree-** tree is generally below the general level of the canopy, but occupies the lower canopy levels. Crown receives partial sun from above, but no sun from the sides.
>
> **Suppressed Tree-** tree is generally below the level of the canopy, does not occupy the canopy layer and is fully shaded from the top and sides.

Crown Thinning: trees are removed from the upper crown classes in order to open up the canopy and favor the development of the most promising trees of the same canopy position.

DBH (diameter at breast height): measured diameter of a tree at 4.5 feet from groundline. In hilly or mountainous terrain 4.5 feet is measured from the highest side of the stump (uphill side on a slope). Certain rules for exceptions are used for trees with forks butt swell or cankers at normal 4.5 feet bole height.

Edge: the transition between two different types or ages of vegetation.

Even-Aged: trees are of that are of the same age or at least the same cohort.

Even-Aged Management: a forest management method used to produce stands that are all the same age or nearly the same age by harvesting all trees in an area at one time or in several cuttings over a short time.

Grade: a system for judging the quality of timber in a tree. In forest service grading rules, grade 1 is greater than 16 inches dbh and with only minor sweep or defects. Grade 2 is greater than 14 inches dbh or greater than 16 inches and with moderate sweep or defects. Grade 3 is greater than 12 inches or greater than 14 inches and with significant sweep or defects. A tree designated as a cull has no timber value due to defects, size, or species.

Group Selection: the removal of small groups of trees to regenerate shade-intolerant trees in the opening (usually at least 1/3 acre).

Growing Space: a reference to the amount of resources (water, sunlight, soil nutrients) available to allow for tree growth. Growing space decreases and becomes very limited as competition between trees increases.

Hemlock Wooly Adelgid: Native to southern Japan, this bug was introduced to the U.S. in the 1920's and has now been established in eleven eastern states, from Georgia to Massachusetts. Appearing as a small cottony pinhead, the insect feeds on the sap of hemlocks, attaching themselves at the base of the needles. After infestation, in the southern Appalachians 90% mortality of all hemlocks can be expected within several years.

High-Grading: a harvesting technique that removes only the biggest and most valuable trees from a stand and provides high returns at the expense of future growth potential. Poor quality, shade-loving trees tend to dominate in continually high-graded sites.

Hydric: a site having or characterized by excessive soil moisture.

Low Thinning: trees are removed from only the lower crown classes.

Mast: fruits or nuts used as a food source by wildlife. Soft mast includes most fruits with fleshy coverings, such as persimmon, dogwood seed or black gum seed. Hard mast refers to nuts such as acorns and beech, pecan and hickory nuts.

Mesic: a site that generally has moderate or generally well balanced soil moisture levels.

Natural Regeneration: the growth of new trees in one of the following ways without human assistance: (a) from seeds carried by wind or animals, (b) from seeds stored on the forest floor, or (c) from stumps that sprout.

Prescribed Burning: the practice of using regulated fires to reduce or eliminate material on the forest floor, for seedbed preparation or to control competing vegetation. Prescribed burning simulates one of the most common natural disturbances. Also called controlled burning.

Salvage Cut: the harvesting of dead or damaged trees, or the harvesting of trees in danger of being killed by insects, disease, flooding or other factors in order to save their economic value.

Selective Thinning: dominant trees are removed in order to stimulate the growth of the trees in lower crown classes. This method of timber harvesting is useful in order to favor shade tolerant species. However, in forests, such as most of the southern Appalachian forests, that are dominated by shade intolerant or intermediate species, selective thinning degenerates into the practice of harvesting the best trees and leaving the poorest, also known as high-grading.

Shade Intermediate: trees that can survive in partial shade, but generally do best in full sun.

Shade Intolerant: trees that require full sunlight to thrive and cannot grow in the shade of larger trees.

Shade Tolerant: trees that have the ability to grow in the shade of other trees and in competition with them.

Shelterwood Cut: removing trees in the harvest area in a series of two or more cuttings so that new seedlings can grow from the seeds of older trees. This method produces an even-aged forest.

Site, Site Quality: the inherent productivity of a given piece of forest land. Soil type, soil depth, slope aspect, general terrain, elevation, position on slope, local climate and local precipitation patterns all affect the site quality of a forest stand. Site quality determines the limits of any given piece of land to produce volume and tree growth, and it normally influences the tree species occupying this piece of land.

Site Index: a measurement used to quantify site quality for any given piece of forest land. Site Index is normally expressed, in the southern Appalachian forest types, by the total height of the dominant trees in the stand at 50 years of age. Site Index is always expressed for specific species or species type, as the Site Index value varies between tree species (i.e. White Pine versus Upland Oak).

Silviculture: the art, science and practice of establishing, tending and reproducing forest stands of desired characteristics. It is based on knowledge of species' characteristics and environmental requirements.

Snag: a standing dead or dying tree.

Stand: a delineated portion of forest land that shares similar characteristics in such a way that this portion of the forest can be separated from adjoining forest lands. These shared characteristics can include tree species (conifer, hardwood, mixed oaks, cove hardwoods, etc.), age of the trees, stand structure (even-aged or uneven-aged), site index or site quality, elevation, slope aspect, or special site conditions (swamp, wetlands, rocky, heavy clay soils, special wildlife habitats, etc.). This concept always needs to be used with some care, because natural diversity is such that forest land cannot be completely pigeonholed or defined fully by what is essentially a broad brush approach.

Stem Injection: a method of injecting herbicide directly into the cambium layer of a tree to induce mortality. This method insures the herbicide only impacts the desired tree and does not spread unintentionally. It is commonly used in crop tree release.

Stocking: a measurement or calculated number that expresses the number of trees found on a tract or on a given unit of area (acre, hectare). This is most often expressed by actual number counts of trees (i.e. trees per acre, stems per hectare) or in Basal Area per unit area (i.e. square feet per acre, square meters per hectare).

Total number of trees on a tract is meaningful and normally calculated for a timber sale bid offering, but Total Basal Area on a tract is meaningless and is never calculated.

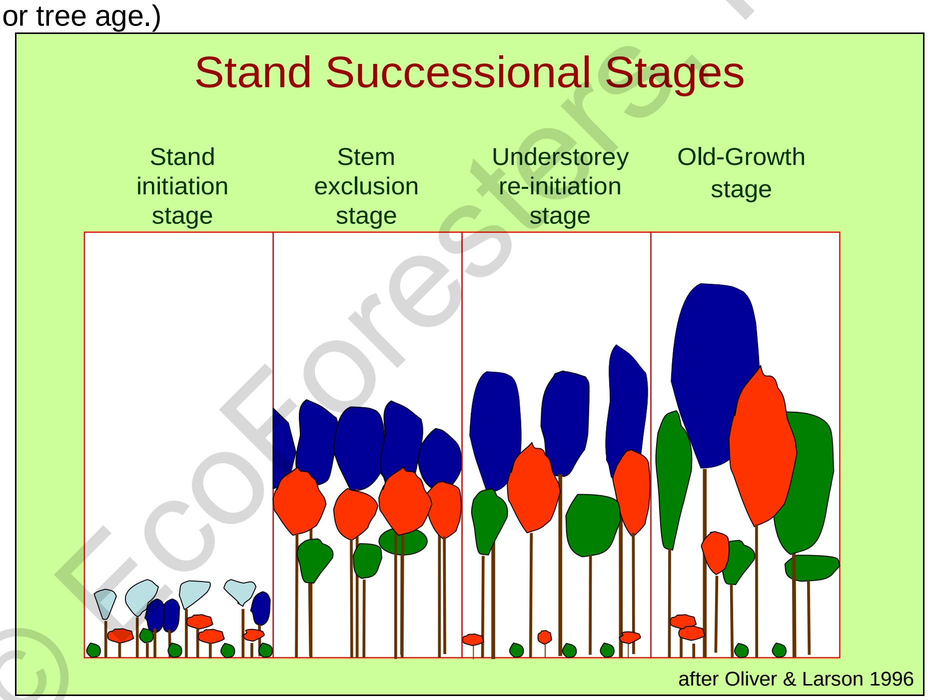
Succession or Stand Development: a given aggregation of trees of a single age class or cohort proceeds from birth to death in a sequence of developmental steps. The steps in the following model were developed by Oliver and Larson, 1996:

Stand Initiation: after a lethal disturbance has created a unit of vacant growing space, the trees that become established in it do not fully occupy the space. Until they do there is opportunity for additional plants to fill the empty spaces such as herbaceous annuals.

Stem Exclusion: when canopy closure is reached and trees begin to compete with each other for limited resources. The more vigorous trees usurp the growing space and weaker ones die. This competition also limits regeneration of a younger cohort of tree species.

Understory Reinitiation: scattered trees that have previously been successful in competition with other trees begin to be lost to pests or other damaging agents. The surrounding tree crowns do not fully close again and the vacancies of growing space thus allow for the growth of new trees. These trees are often advanced regeneration of shade tolerant species.

Old Growth: this occurs when the process of Understory Reinitiation is complete and the initial older cohort has been completely replaced by younger cohorts. Forests in this stage are usually dominated by shade tolerant species. Because there are many age classes of trees, structural and biological diversity is increased. The forest is heavily stratified with foliage extending from tree tops to the forest floor in some places. Biodiversity is also enhanced by a large number of standing and fallen dead trees. Production of wood and organic matter tend to be balanced by loss and decay. (Note this is a unique definition of old growth and there are many others which are based on other factors such as forest structure or tree age.)



Two-aged: a stand that contains only two cohorts.

Understory: the area below the forest canopy that comprises shrubs, snags and small tree. Because the understory receives little light, many of the plants at this level tolerate shade and will remain part of the understory. Others will grow and replace older trees that fall.

Uneven-aged: a stand that contains three age-classes intermingled intimately on the same area.

Xeric: a site that is regularly deficient in moisture.

Appendix A: Soil Descriptions

<u>Soil Report Document Order:</u>

- Map Unit Description – Wilkes County
- Forestland Productivity – Wilkes County
- Map Unit Description – Watauga County
- Forestland Productivity – Watauga County

Map Unit Description (Brief, Generated)

Wilkes County, North Carolina

[Minor map unit components are excluded from this report]

Map unit: CeF - Chestnut-Ashe complex, 25 to 90 percent slopes, very stony

Component: Chestnut, very stony (45%)

The Chestnut, very stony component makes up 45 percent of the map unit. Slopes are 25 to 90 percent. This component is on mountains, mountain slopes. The parent material consists of residuum weathered from gneiss and/or creep deposits derived from gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Ashe, very stony (35%)

The Ashe, very stony component makes up 35 percent of the map unit. Slopes are 25 to 90 percent. This component is on mountains, mountain slopes. The parent material consists of residuum weathered from granite and gneiss. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: ChD - Chestnut-Edneyville complex, 8 to 25 percent slopes, stony

Component: Chestnut, stony (55%)

The Chestnut, stony component makes up 55 percent of the map unit. Slopes are 8 to 25 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from gneiss and/or creep deposits derived from gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Edneyville, stony (30%)

The Edneyville, stony component makes up 30 percent of the map unit. Slopes are 8 to 25 percent. This component is on mountain slopes, mountains. The parent material consists of creep deposits over residuum weathered from igneous and metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Wilkes County, North Carolina

Map unit: ChE - Chestnut-Edneyville complex, 25 to 60 percent slopes, stony

Component: Chestnut, stony (60%)

The Chestnut, stony component makes up 60 percent of the map unit. Slopes are 25 to 60 percent. This component is on mountains, mountain slopes. The parent material consists of residuum weathered from gneiss and/or creep deposits derived from gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Component: Edneyville, stony (25%)

The Edneyville, stony component makes up 25 percent of the map unit. Slopes are 25 to 60 percent. This component is on mountain slopes, mountains. The parent material consists of creep deposits over residuum weathered from igneous and metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map unit: CsD - Cowee-Saluda complex, 8 to 25 percent slopes, stony

Component: Cowee, stony (70%)

The Cowee, stony component makes up 70 percent of the map unit. Slopes are 8 to 25 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from gneiss and/or creep deposits derived from gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Saluda, stony (15%)

The Saluda, stony component makes up 15 percent of the map unit. Slopes are 8 to 25 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from granite and gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Wilkes County, North Carolina

Map unit: CsE - Cowee-Saluda complex, 25 to 60 percent slopes, stony

Component: Cowee, stony (70%)

The Cowee, stony component makes up 70 percent of the map unit. Slopes are 25 to 60 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from gneiss and/or creep deposits derived from gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Component: Saluda, stony (15%)

The Saluda, stony component makes up 15 percent of the map unit. Slopes are 25 to 60 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from granite and gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map unit: EsD - Evard-Cowee complex, 8 to 25 percent slopes, stony

Component: Evard, stony (53%)

The Evard, stony component makes up 53 percent of the map unit. Slopes are 8 to 25 percent. This component is on mountain slopes, mountains. The parent material consists of creep deposits over residuum weathered from schist and/or gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Cowee, stony (31%)

The Cowee, stony component makes up 31 percent of the map unit. Slopes are 8 to 25 percent. This component is on mountain slopes, mountains. The parent material consists of creep deposits over residuum weathered from schist and/or gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Wilkes County, North Carolina

Map unit: EsE - Evard-Cowee complex, 25 to 60 percent slopes, stony

Component: Evard, stony (60%)

The Evard, stony component makes up 60 percent of the map unit. Slopes are 25 to 60 percent. This component is on mountain slopes, mountains. The parent material consists of creep deposits over residuum weathered from schist and/or gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Component: Cowee, stony (24%)

The Cowee, stony component makes up 24 percent of the map unit. Slopes are 25 to 60 percent. This component is on mountain slopes, mountains. The parent material consists of creep deposits over residuum weathered from schist and/or gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map unit: OsB - Ostin very cobbly loamy sand, 1 to 5 percent slopes, occasionally flooded

Component: Ostin (97%)

The Ostin component makes up 97 percent of the map unit. Slopes are 1 to 5 percent. This component is on valleys, flood plains. The parent material consists of sandy alluvium over cobbly and gravelly alluvium derived from igneous and metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 33 inches during January, February, March, April. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: TcC - Tate-Cullowhee, frequently flooded complex, 0 to 25 percent slopes

Component: Tate (55%)

The Tate component makes up 55 percent of the map unit. Slopes are 6 to 25 percent. This component is on fans, valleys. The parent material consists of colluvium derived from igneous and metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Wilkes County, North Carolina

Map unit: TcC - Tate-Cullowhee, frequently flooded complex, 0 to 25 percent slopes

Component: Cullowhee, drained (25%)

The Cullowhee, drained component makes up 25 percent of the map unit. Slopes are 0 to 2 percent. This component is on valleys, flood plains. The parent material consists of loamy alluvium over sandy and gravelly alluvium. Depth to a root restrictive layer, strongly contrasting textural stratification, is 20 to 40 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 9 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Forestland Productivity

Wilkes County, North Carolina

[This report shows only the major soils in each map unit]

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
CeF:				
Chestnut, very stony	Black oak	71	53	Eastern white pine, Shortleaf pine, Yellow-poplar
	Chestnut oak	69	51	
	Eastern white pine	78	139	
	Scarlet oak	---	---	
	Shortleaf pine	---	---	
	White oak	70	52	
	Yellow-poplar	97	102	
Ashe, very stony	Chestnut oak	57	40	Eastern white pine, Shortleaf pine
	Eastern white pine	80	144	
	Northern red oak	---	---	
	Pitch pine	---	---	
	Scarlet oak	---	---	
	Shortleaf pine	57	82	
	Virginia pine	62	95	
ChD:				
Chestnut, stony	Black oak	71	53	Eastern white pine, Shortleaf pine, Yellow-poplar
	Chestnut oak	69	51	
	Eastern white pine	78	139	
	Scarlet oak	---	---	
	Shortleaf pine	---	---	
	White oak	70	52	
	Yellow-poplar	97	102	
Edneyville, stony	Black oak	---	---	Eastern white pine, Northern red oak, Yellow-poplar
	Chestnut oak	---	---	
	Eastern white pine	90	166	
	Northern red oak	92	74	
	Scarlet oak	73	55	
	Virginia pine	---	---	
	Yellow-poplar	97	102	
ChE:				
Chestnut, stony	Black oak	71	53	Eastern white pine, Shortleaf pine, Yellow-poplar
	Chestnut oak	69	51	
	Eastern white pine	78	139	
	Scarlet oak	---	---	
	Shortleaf pine	---	---	
	White oak	70	52	
	Yellow-poplar	97	102	

Forestland Productivity

Wilkes County, North Carolina

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
ChE:				
Edneyville, stony	Black oak	---	---	Eastern white pine, Northern red oak, Yellow-poplar
	Chestnut oak	---	---	
	Eastern white pine	90	166	
	Northern red oak	92	74	
	Scarlet oak	73	55	
	Virginia pine	---	---	
	Yellow-poplar	97	102	
CsD:				
Cowee, stony	Black oak	---	---	Eastern white pine, Shortleaf pine
	Chestnut oak	55	38	
	Eastern white pine	78	139	
	Northern red oak	---	---	
	Pitch pine	52	72	
	Scarlet oak	54	38	
	Shortleaf pine	---	---	
	Virginia pine	63	96	
	White oak	---	---	
	Yellow-poplar	80	71	
Saluda, stony	Chestnut oak	---	---	Eastern white pine, Shortleaf pine
	Eastern white pine	---	---	
	Pitch pine	---	---	
	Shortleaf pine	---	---	
	Virginia pine	---	---	
	Yellow-poplar	---	---	
CsE:				
Cowee, stony	Black oak	---	---	Eastern white pine, Shortleaf pine
	Chestnut oak	55	38	
	Eastern white pine	78	139	
	Northern red oak	---	---	
	Pitch pine	52	72	
	Scarlet oak	54	38	
	Shortleaf pine	---	---	
	Virginia pine	63	96	
	White oak	---	---	
	Yellow-poplar	80	71	

Forestland Productivity

Wilkes County, North Carolina

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
CsE:				
Saluda, stony	Chestnut oak	---	---	Eastern white pine, Shortleaf pine
	Eastern white pine	---	---	
	Pitch pine	---	---	
	Shortleaf pine	---	---	
	Virginia pine	---	---	
	Yellow-poplar	---	---	
EsD:				
Evard, stony	Eastern white pine	91	168	Chestnut oak, Eastern white pine, Shortleaf pine, White oak
	Hickory	---	---	
	Northern red oak	---	---	
	Pitch pine	---	---	
	Shortleaf pine	73	116	
	Southern red oak	75	57	
	Virginia pine	70	109	
	White oak	75	57	
	Yellow-poplar	95	98	
Cowee, stony	Black oak	---	---	Eastern white pine, Shortleaf pine
	Chestnut oak	55	38	
	Eastern white pine	78	139	
	Northern red oak	---	---	
	Pitch pine	52	72	
	Scarlet oak	54	38	
	Shortleaf pine	---	---	
	Virginia pine	63	96	
	White oak	---	---	
	Yellow-poplar	80	71	
EsE:				
Evard, stony	Eastern white pine	91	168	Chestnut oak, Eastern white pine, Shortleaf pine, White oak
	Hickory	---	---	
	Northern red oak	---	---	
	Pitch pine	---	---	
	Shortleaf pine	73	116	
	Southern red oak	75	57	
	Virginia pine	70	109	
	White oak	75	57	
	Yellow-poplar	95	98	

Forestland Productivity

Wilkes County, North Carolina

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
EsE:				
Cowee, stony	Black oak	---	---	Eastern white pine, Shortleaf pine
	Chestnut oak	55	38	
	Eastern white pine	78	139	
	Northern red oak	---	---	
	Pitch pine	52	72	
	Scarlet oak	54	38	
	Shortleaf pine	---	---	
	Virginia pine	63	96	
	White oak	---	---	
	Yellow-poplar	80	71	
OsB:				
Ostin	American sycamore	---	---	American sycamore, Black walnut, Eastern white pine, Yellow-poplar
	Black cherry	---	---	
	Black locust	---	---	
	Eastern hemlock	---	---	
	Eastern white pine	---	---	
	Red maple	---	---	
	River birch	---	---	
	Virginia pine	---	---	
	Yellow-poplar	100	107	
TcC:				
Tate	Black locust	---	---	Eastern white pine, Yellow-poplar
	Eastern hemlock	---	---	
	Eastern white pine	89	164	
	Northern red oak	---	---	
	White oak	---	---	
	Yellow-poplar	92	83	
Cullowhee, drained	American sycamore	---	---	Eastern white pine, Yellow-poplar
	Eastern hemlock	---	---	
	Eastern white pine	100	139	
	Red maple	---	---	
	Shortleaf pine	82	132	
	Yellow birch	---	---	
	Yellow-poplar	103	112	

Map Unit Description (Brief, Generated)

Watauga County, North Carolina

[Minor map unit components are excluded from this report]

Map unit: AcF - Ashe-Chestnut complex, 50 to 95 percent slopes, very rocky

Component: Ashe, very rocky (55%)

The Ashe, very rocky component makes up 55 percent of the map unit. Slopes are 50 to 95 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from granite and gneiss that is affected by soil creep in the upper solum. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Chestnut, very rocky (30%)

The Chestnut, very rocky component makes up 30 percent of the map unit. Slopes are 50 to 95 percent. This component is on mountain slopes on mountains. The parent material consists of residuum weathered from biotite gneiss and/or gneiss that is affected by soil creep in the upper solum. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: ArF - Ashe-Cleveland-Rock outcrop complex, 50 to 95 percent slopes, extremely bouldery

Component: Ashe, extremely bouldery (45%)

The Ashe, extremely bouldery component makes up 45 percent of the map unit. Slopes are 30 to 95 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from granite and gneiss that is affected by soil creep in the upper solum. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Cleveland, extremely bouldery (20%)

The Cleveland, extremely bouldery component makes up 20 percent of the map unit. Slopes are 30 to 95 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from granite and gneiss that is affected by soil creep. Depth to a root restrictive layer, bedrock, lithic, is 10 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Watauga County, North Carolina

Map unit: ArF - Ashe-Cleveland-Rock outcrop complex, 50 to 95 percent slopes, extremely bouldery

Component: Rock outcrop (20%)

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map unit: BoD - Brownwood fine sandy loam, 15 to 30 percent slopes, stony

Component: Brownwood, stony (90%)

The Brownwood, stony component makes up 90 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountains, mountain slopes. The parent material consists of residuum weathered from mica schist and/or micaceous gneiss and/or other micaceous metamorphic rock. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: BoE - Brownwood fine sandy loam, 30 to 50 percent slopes, stony

Component: Brownwood, stony (90%)

The Brownwood, stony component makes up 85 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes, mountains. The parent material consists of affected by soil creep in the upper solum over residuum weathered from mica schist and/or gneiss and/or other micaceous metamorphic rock. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: BoF - Brownwood fine sandy loam, 50 to 80 percent slopes, stony

Component: Brownwood, stony (85%)

The Brownwood, stony component makes up 85 percent of the map unit. Slopes are 50 to 95 percent. This component is on mountains, mountain slopes. The parent material consists of affected by soil creep in the upper solum over residuum weathered from mica schist and/or gneiss and/or other micaceous metamorphic rock. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Watauga County, North Carolina

Map unit: BrF - Brownwood fine sandy loam, 50 to 95 percent slopes, very rocky

Component: Brownwood, very rocky (85%)

The Brownwood, very rocky component makes up 85 percent of the map unit. Slopes are 50 to 95 percent. This component is on mountains, mountain slopes. The parent material consists of affected by soil creep in the upper solum over residuum weathered from mica schist and/or gneiss and/or other micaceous metamorphic rock. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map unit: ChF - Chestnut-Ashe complex, 50 to 95 percent slopes, very stony

Component: Chestnut, very stony (50%)

The Chestnut, very stony component makes up 50 percent of the map unit. Slopes are 50 to 95 percent. This component is on mountain slopes on mountains. The parent material consists of residuum weathered from biotite gneiss and/or gneiss that is affected by soil creep in the upper solum. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Ashe, very stony (35%)

The Ashe, very stony component makes up 35 percent of the map unit. Slopes are 50 to 95 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from granite and gneiss that is affected by soil creep in the upper solum. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: CkD - Chestnut-Edneyville complex, 15 to 30 percent slopes, stony

Component: Chestnut, stony (50%)

The Chestnut, stony component makes up 50 percent of the map unit. Slopes are 15 to 30 percent. This component is on ridges on mountains. The parent material consists of residuum weathered from biotite gneiss and/or gneiss. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Watauga County, North Carolina

Map unit: CkD - Chestnut-Edneyville complex, 15 to 30 percent slopes, stony

Component: Edneyville, stony (40%)

The Edneyville, stony component makes up 40 percent of the map unit. Slopes are 15 to 30 percent. This component is on ridges on mountains. The parent material consists of residuum weathered from biotite gneiss and/or gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: CkE - Chestnut-Edneyville complex, 30 to 50 percent slopes, stony

Component: Chestnut, stony (70%)

The Chestnut, stony component makes up 70 percent of the map unit. Slopes are 30 to 50 percent. This component is on ridges on mountains, mountain slopes on mountains. The parent material consists of residuum weathered from biotite gneiss and/or gneiss that is affected by soil creep in the upper solum. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Component: Edneyville, stony (20%)

The Edneyville, stony component makes up 20 percent of the map unit. Slopes are 30 to 50 percent. This component is on ridges on mountains, mountain slopes on mountains. The parent material consists of residuum weathered from biotite gneiss and/or gneiss affected by soil creep in the upper solum. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: CsC - Cullasaja very cobbly loam, 8 to 15 percent slopes, very stony

Component: Cullasaja, very stony (85%)

The Cullasaja, very stony component makes up 85 percent of the map unit. Slopes are 8 to 15 percent. This component is on fans on mountain slopes, mountains. The parent material consists of cobbly and stony colluvium derived from igneous and metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 10 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Watauga County, North Carolina

Map unit: CsD - Cullasaja very cobbly loam, 15 to 30 percent slopes, very stony

Component: Cullasaja, very stony (95%)

The Cullasaja, very stony component makes up 95 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountains, fans on mountain slopes. The parent material consists of cobbly and stony colluvium derived from igneous and metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 10 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: CsE - Cullasaja very cobbly loam, 30 to 50 percent slopes, very stony

Component: Cullasaja, very stony (95%)

The Cullasaja, very stony component makes up 95 percent of the map unit. Slopes are 30 to 50 percent. This component is on coves on mountain slopes, mountains. The parent material consists of cobbly and stony colluvium derived from igneous and metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 10 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: DeB - Dellwood cobbly sandy loam, 1 to 5 percent slopes, occasionally flooded

Component: Dellwood, occasionally flooded (90%)

The Dellwood, occasionally flooded component makes up 90 percent of the map unit. Slopes are 1 to 5 percent. This component is on valleys, flood plains. The parent material consists of cobbly and gravelly alluvium. Depth to a root restrictive layer, strongly contrasting textural stratification, is 8 to 20 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 36 inches during January, February, March, April. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 3s. This soil does not meet hydric criteria.

Map unit: EvD - Evard-Cowee complex, 15 to 30 percent slopes, stony

Component: Evard, stony (55%)

The Evard, stony component makes up 55 percent of the map unit. Slopes are 15 to 30 percent. This component is on ridges, hills, mountains. The parent material consists of residuum weathered from biotite gneiss and/or amphibolite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Watauga County, North Carolina

Map unit: EvD - Evard-Cowee complex, 15 to 30 percent slopes, stony

Component: Cowee, stony (35%)

The Cowee, stony component makes up 35 percent of the map unit. Slopes are 15 to 30 percent. This component is on ridges, hills, mountains. The parent material consists of residuum weathered from biotite gneiss and/or amphibolite. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Map unit: EvE - Evard-Cowee complex, 30 to 50 percent slopes, stony

Component: Evard, stony (55%)

The Evard, stony component makes up 55 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes on mountains, hillslopes on hills. The parent material consists of residuum weathered from biotite gneiss and/or amphibolite affected by soil creep in the upper solum. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Cowee, stony (35%)

The Cowee, stony component makes up 35 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes on mountains, hillslopes on hills. The parent material consists of residuum weathered from biotite gneiss and/or amphibolite affected by soil creep in the upper solum. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: FaD - Fannin loam, 15 to 30 percent slopes, stony

Component: Fannin, stony (90%)

The Fannin, stony component makes up 90 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountains, mountain slopes. The parent material consists of residuum weathered from mica schist and/or micaceous gneiss and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Forestland Productivity

Watauga County, North Carolina

[This report shows only the major soils in each map unit]

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
AcF:				
Ashe, very rocky	Chestnut oak	70	52	---
	Eastern white pine	81	146	
	Hickory	---	---	
	Pitch pine	---	---	
	Scarlet oak	---	---	
	Virginia pine	62	95	
Chestnut, very rocky	Black oak	71	53	Chestnut oak, Eastern white pine, Scarlet oak
	Chestnut oak	69	51	
	Eastern white pine	78	139	
	Scarlet oak	68	50	
	White oak	70	52	
ArF:				
Ashe, extremely bouldery	Chestnut oak	70	52	---
	Eastern white pine	81	146	
	Hickory	---	---	
	Pitch pine	---	---	
	Scarlet oak	---	---	
	Virginia pine	---	---	
Cleveland, extremely bouldery	Black oak	---	---	---
	Chestnut oak	45	30	
	Eastern white pine	70	121	
	Pitch pine	---	---	
	Scarlet oak	---	---	
	Shortleaf pine	---	---	
	Virginia pine	57	84	
Rock outcrop	---	---	---	---
BoD:				
Brownwood, stony	Black oak	69	51	Eastern white pine, Scarlet oak, Yellow-poplar
	Chestnut oak	71	50	
	Eastern white pine	78	139	
	Northern red oak	80	62	
	Scarlet oak	68	50	
	White oak	70	52	
	Yellow-poplar	97	102	

Forestland Productivity

Watauga County, North Carolina

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
BoE:				
Brownwood, stony	Black oak	69	51	Eastern white pine, Scarlet oak, Yellow-poplar
	Chestnut oak	71	50	
	Eastern white pine	78	139	
	Northern red oak	80	62	
	Scarlet oak	68	50	
	White oak	70	52	
	Yellow-poplar	97	102	
BoF:				
Brownwood, stony	Black oak	69	51	Eastern white pine, Scarlet oak, Yellow-poplar
	Chestnut oak	71	50	
	Eastern white pine	78	139	
	Northern red oak	80	62	
	Scarlet oak	68	50	
	White oak	70	52	
	Yellow-poplar	97	102	
BrF:				
Brownwood, very rocky	Black oak	69	51	Eastern white pine, Scarlet oak, Yellow-poplar
	Chestnut oak	71	50	
	Eastern white pine	78	139	
	Northern red oak	80	62	
	Scarlet oak	68	50	
	White oak	70	52	
	Yellow-poplar	97	102	
ChF:				
Chestnut, very stony	Black oak	71	53	Eastern white pine, Shortleaf pine
	Chestnut oak	69	51	
	Eastern white pine	78	139	
	Scarlet oak	68	50	
	Shortleaf pine	---	---	
	White oak	70	52	
Ashe, very stony	Chestnut oak	70	52	---
	Eastern white pine	81	146	
	Hickory	---	---	
	Pitch pine	---	---	
	Scarlet oak	---	---	
	Virginia pine	---	---	

Forestland Productivity

Watauga County, North Carolina

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
CkD:				
Chestnut, stony	Black oak	71	53	Eastern white pine
	Chestnut oak	69	51	
	Eastern white pine	78	139	
	Scarlet oak	68	50	
	White oak	70	52	
Edneyville, stony	Black oak	---	---	Chestnut oak, Eastern white pine, Shortleaf pine, White oak
	Chestnut oak	---	---	
	Eastern white pine	90	166	
	Scarlet oak	73	55	
CkE:				
Chestnut, stony	Black oak	71	53	Eastern white pine
	Chestnut oak	69	51	
	Eastern white pine	78	139	
	Scarlet oak	68	50	
	White oak	70	52	
Edneyville, stony	Black oak	---	---	Chestnut oak, Eastern white pine, Shortleaf pine, White oak
	Chestnut oak	---	---	
	Eastern white pine	90	166	
	Scarlet oak	73	55	
CsC:				
Cullasaja, very stony	Black cherry	---	---	Black cherry, Eastern white pine, Northern red oak, Yellow-poplar
	Northern red oak	92	74	
	Yellow birch	---	---	
	Yellow-poplar	109	122	
CsD:				
Cullasaja, very stony	Black cherry	---	---	Black cherry, Eastern white pine, Northern red oak, Yellow-poplar
	Northern red oak	92	74	
	Yellow birch	---	---	
	Yellow-poplar	109	122	
CsE:				
Cullasaja, very stony	Black cherry	---	---	Black cherry, Eastern white pine, Northern red oak, Yellow-poplar
	Northern red oak	92	74	
	Yellow birch	---	---	
	Yellow-poplar	109	122	

Forestland Productivity

Watauga County, North Carolina

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
DeB:				
Dellwood, occasionally flooded	American sycamore	---	---	Eastern white pine, Yellow-poplar
	Eastern hemlock	---	---	
	Eastern white pine	91	168	
	Red maple	---	---	
	River birch	---	---	
	Yellow-poplar	100	107	
EvD:				
Evard, stony	Chestnut oak	77	59	Chestnut oak, Eastern white pine, Shortleaf pine, White oak
	Eastern white pine	93	172	
	Hickory	---	---	
	Pitch pine	---	---	
	Shortleaf pine	73	116	
	Virginia pine	69	107	
	White oak	---	---	
Cowee, stony	Black oak	---	---	Eastern white pine, Shortleaf pine
	Chestnut oak	55	38	
	Eastern white pine	78	139	
	Pitch pine	52	72	
	Scarlet oak	54	38	
	Virginia pine	63	96	
EvE:				
Evard, stony	Chestnut oak	77	59	Chestnut oak, Eastern white pine, Shortleaf pine, White oak
	Eastern white pine	93	172	
	Hickory	---	---	
	Pitch pine	---	---	
	Shortleaf pine	73	116	
	Virginia pine	69	107	
	White oak	---	---	
Cowee, stony	Black oak	---	---	Eastern white pine, Shortleaf pine
	Chestnut oak	55	38	
	Eastern white pine	78	139	
	Pitch pine	52	72	
	Scarlet oak	54	38	
	Virginia pine	63	96	
	White oak	---	---	

Forestland Productivity

Watauga County, North Carolina

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
FaD:				
Fannin, stony	Chestnut oak	---	---	Eastern white pine, White oak, Yellow-poplar
	Eastern white pine	94	174	
	Northern red oak	---	---	
	Scarlet oak	---	---	
	Virginia pine	---	---	
	White oak	---	---	
	Yellow-poplar	96	100	

Appendix B: Habitat Descriptions

CHESTNUT OAK FOREST (HERB SUBTYPE) G4G5
Synonyms: *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267).
Ecological Systems: Southern Appalachian Oak Forest (CES202.886).

Concept: Subtype covers the common examples of the Blue Ridge and foothills that have well-developed herb layers and sparse to moderate shrub layers.

Distinguishing Features: The Herb Subtype is distinguished from the Dry Heath Subtype and the Mesic Subtype by the presence of a well-developed herb layer and absence of a dense shrub layer. Much confusion remains over the best way to classify our low elevation *Quercus prinus-Quercus rubra* forests. Multiple associations that are similar to this are used in adjacent states and ecoregions. Until there is further analysis, all *Quercus prinus-Quercus rubra* forests that do not fit the Mesic Subtype should be classified as this subtype.

Comments: *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522) is a drier acidic but non-heath chestnut oak community known from western Virginia. *Quercus prinus - Quercus rubra / Hamamelis virginiana* Forest (CEGL006057) is another related association defined in Virginia. *Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524) is a wide-ranging association of the Ridge and Valley, with some plots located in the Blue Ridge of Virginia near the state line. All could potentially be recognized as this subtype if they were found in North Carolina. Distinctions among them hold up in analysis of large plot datasets, but their field interpretation and ecological significance remain unclear.

CHESTNUT OAK FOREST (WHITE PINE SUBTYPE) G3
Synonyms: *Pinus strobus - Quercus (coccinea, prinus) / (Gaylussacia ursina, Vaccinium stamineum)* Forest (CEGL007519).
Ecological Systems: Southern Appalachian Oak Forest (CES202.886).

Concept: Subtype covers examples with a significant component of *Pinus strobus*, which may range from a substantial minority to codominant. Most examples resemble the Dry Heath Subtype except for the pine component.

Distinguishing Features: This subtype is distinguished from all other subtypes by having *Pinus strobus* present as a significant natural component along with *Quercus montana*. Undergrowth usually resembles that of the Dry Heath Subtype. The White Pine Subtype subtype should only be used where white pine is believed to be naturally present, not for forests where it has been planted or where it likely spread from nearby plantings. Forests with a more mesophytic composition, such as the forests of *Quercus rubra* and *Pinus strobus* with *Rhododendron maximum* that occur around Linville Falls, are treated as the Mesic Subtype.

Comments: This subtype is somewhat uncertain. Some literature suggests white pine increases as a result of fire exclusion, while other sources suggest that fire and logging promote it. However, there is also a geographic component. *Pinus strobus* is completely absent from many Chestnut Oak Forests in the northern Blue Ridge escarpment and in the higher parts of the mountains, regardless of stand history of logging or fire suppression. It is common in the northern foothills and in the southern escarpment, as well as in some large mountain gorges. It thus appears that the presence of *Pinus strobus* in Chestnut Oak Forests may represent natural ecological variation, while the abundance of it may be related to forest history and degree of alteration.

RICH COVE FOREST (FOOTHILLS INTERMEDIATE SUBTYPE) G4?
Synonyms: *Liriodendron tulipifera - Tilia americana var. heterophylla - (Aesculus flava) / Actaea racemosa* Forest (CEGL007291).
Ecological Systems: Southern and Central Appalachian Cove Forest (CES202.373).

Concept: Subtype covers examples at low elevations, generally below 2000 feet, lacking a significant component of high pH, rich-site flora. The herbaceous layer of this subtype is fairly diverse, much more diverse than that of Acidic Cove Forest, but is often not as dense as it is in the other subtypes.

Distinguishing Features: The Foothills Intermediate Subtype is distinguished from the Foothills Rich Subtype by the absence of strongly calciphilic species, such as *Aquilegia canadensis, Trillium simile, Asplenium rhizophyllum*, and *Cystopteris protrusa*. Some species shared by the Montane Intermediate and Foothills Rich subtypes, such as *Laportea canadensis*, are also absent or scarce. The Foothills Intermediate Subtype is distinguished from the Montane subtypes by the presence of lower elevation species.

Comments: There are a few occurrences of communities that fall between this subtype and Acidic Cove Forest. They generally have canopies of primarily *Liriodendron*, with a few of the other Rich Cove Forest canopy species. They have few or no heaths, but have herb layers with only a few species not found in Acidic Cove Forests, generally *Brachyelytrum erectum, Phegopteris hexagonoptera, Amphicarpaea bracteata, Ageratina altissima var. altissima*, and *Dichanthelium boscii*. These will be treated as a Transitional Variant, but probably represent too fine a level of variation to recognizes as an additional subtype.

MONTANE OAK–HICKORY FOREST (ACIDIC SUBTYPE) G5
Synonyms: *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230).
Ecological Systems: Southern Appalachian Oak Forest (CES202.886).

Concept: Type covers mountain upland forests dominated by mixtures of oaks with *Quercus alba* as a significant component. Subtype covers the common examples with typical acid-loving herbs and heath shrubs. This subtype lacks indicators of circumneutral soils and also lacks low elevation dry-site species.

Distinguishing Features: The Montane Oak–Hickory Forest type is distinguished from other mountain oak forest types by having a canopy containing significant *Quercus alba* mixed with other oaks, hickories, or pines. Both Chestnut Oak Forest and High Elevation Red Oak Forest have very little *Quercus alba*. High Elevation White Oak Forest has a canopy strongly dominated by *Quercus alba* and a dense heath layer occurring at elevations above 4000 feet. Montane Oak–Hickory Forests are distinguished from Oak–Hickory Forests of the Piedmont by having a significant component of montane flora, such as *Castanea dentata, Rhododendron calendulaceum, Kalmia latifolia, Magnolia fraseri*, and *Gaylussacia ursina*.

The Acidic Subtype is distinguished from the Basic Subtype by the absence or scarcity of plants that prefer circumneutral or higher soil pH and species typical of Rich Cove Forests. It is distinguished from the Low Dry Subtype by the absence of more typically Piedmont xerophytic species such as *Pinus echinata, Quercus falcata, Quercus stellata*, and *Quercus marilandica*. It is distinguished from the closely related White Pine Subtype by the absence or scarcity of *Pinus strobus* in the canopy.

MONTANE ALLUVIAL FOREST (SMALL RIVER SUBTYPE) **G3**

Synonyms: *Tsuga canadensis - Liriodendron tulipifera - Platanus occidentalis / Rhododendron maximum - Xanthorhiza simplicissima* Temporarily Flooded Forest (CEGL007143).
Ecological Systems: South-Central Interior Small Stream and Riparian (CES202.706).

Concept: Type covers forests of mountain river floodplains, consisting of a mixture of plants typically of cove forests and of floodplains. Subtype covers examples on the smaller or higher elevation rivers, where *Tsuga canadensis* or *Pinus strobus* are generally important components.

Distinguishing Features: Montane Alluvial Forests are distinguished from Rich Cove Forests and Acidic Cove Forests, with which they may share many species, by more than trace presence of some of a characteristic suite of wetland or alluvial indicator species, such as *Platanus occidentalis, Betula nigra*, and *Alnus serrulata*, coupled with evidence of flooding. The alluvial indicator species may dominate, codominate, or may be less abundant, but sites that lack them should be classified as cove forests or other upland communities. Flood-dispersed exotic plant species also are often abundant in Montane Alluvial Forests and are usually scarce in upland forests. *Microstegium vimineum, Lonicera japonica*, and *Murdannia keisak* may appear in uplands or non-riverine wetlands where they are severely disturbed, but are common even in relatively undisturbed floodplains. Montane Alluvial Forests are distinguished from Piedmont or other lowland floodplain forests by containing a substantial component of montane species, generally shared with Rich Cove Forests or Acidic Cove Forests. These may include *Tilia americana var. heterophylla, Aesculus flava, Betula lenta, Betula alleghaniensis, Tsuga canadensis, Halesia tetraptera*, and *Rhododendron maximum*.

The Small River Subtype, besides occurring in smaller, less well-developed floodplains, is distinguished from the Large River Subtype by being more like cove forests, having lesser abundance and richness of the suite of alluvial indicator plant species. *Platanus occidentalis* and *Xanthorhiza simplicissima* are the most frequent, *Betula nigra, Alnus serrulata, Arundinaria gigantea, Boehmeria cylindrica*, and a few others occasional. Also characteristic is a combination of acid-tolerant canopy species such as *Liriodendron tulipifera, Betula lenta, Acer rubrum, Betula alleghaniensis*, and *Halesia tetraptera* with lower strata of richer sites, such as *Asimina triloba, Lindera benzoin, Carpinus caroliniana, Amphicarpaea bracteata*, or any of a number of species shared with Rich Cove Forests. This is not always present, however, and lower strata are sometimes dominated by *Rhododendron maximum, Leucothoe fontanesiana*, or *Thelypteris noveboracensis*. The Large River Subtype generally has more abundance and diversity of alluvial indicator plant species present. This includes some species rarely or never found on smaller rivers, such as *Fraxinus pennsylvanica, Juglans cinerea, Acer negundo, Celtis laevigata, Liquidambar styraciflua, Quercus imbricaria, Quercus pagoda, Cornus amomum, Chasmanthium latifolium*, and *Elymus riparius*. The Large River Subtype also often has upland species of drier communities, such as oaks, *Oxydendrum arboreum, Nyssa sylvatica, Danthonia spicata*, and *Piptochaetium avenaceum*, while the Small River Subtype consists largely of mesophytic plants.

Comments: *Liriodendron tulipifera - Pinus strobus - (Tsuga canadensis) / Carpinus caroliniana / Amphicarpaea bracteata* Forest (CEGL008405) is an equivalent and fairly similar association in the Central Appalachians.

CHESTNUT OAK FOREST (DRY HEATH SUBTYPE) G5

Synonyms: *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271).
Ecological Systems: Southern Appalachian Oak Forest (CES202.886).

Concept: Type includes dry slope and ridge forests of low to moderate elevation dominated by *Quercus montana*, sometimes in combination with *Quercus coccinea* or *Quercus rubra*. *Quercus alba* is not a significant component. Subtype covers the common examples of the Blue Ridge and foothills with well-developed shrub layers dominated by deciduous or evergreen heaths other than *Rhododendron* spp., generally occurring on dry open slopes or ridges.

Distinguishing Features: Chestnut Oak Forest is distinguished from all other community types by the dominance of *Quercus montana* or the codominance of *Quercus montana* with *Quercus coccinea, Quercus rubra*, or *Acer rubrum*. *Quercus alba* is a minor component only. The Dry Heath Subtype is distinguished from the Herb Subtype and the Mesic Subtype by having a well-developed shrub layer dominated by *Kalmia latifolia, Gaylussacia* spp., or *Vaccinium* spp. It is distinguished from the White Pine Subtype by lacking *Pinus strobus*. It is distinguished from Piedmont Monadnock Forest by the presence of plants generally absent in the Piedmont, such as *Castanea dentata, Rhododendron calendulaceum, Pyrularia pubera, Gaylussacia baccata, Gaylussacia ursina, Kalmia latifolia*, and *Carex pensylvanica*.

Comments: *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522) is a dry chestnut oak forest without heath, described in western Virginia. It might occur in North Carolina. Its relationship with this subtype would need to be clarified. The shrub layer is usually dominated by tree regeneration, with only patchy *Vaccinium pallidum*. The herb layer and understory sound similar.

Vegetation analysis done for the Appalachian Trail corridor found examples with *Gaylussacia ursina* dominating the shrub layer to be distinct from other examples in this subtype. These should be recognized as a variant, and may warrant a distinct subtype. This variant is confined to areas south of the Asheville Basin.

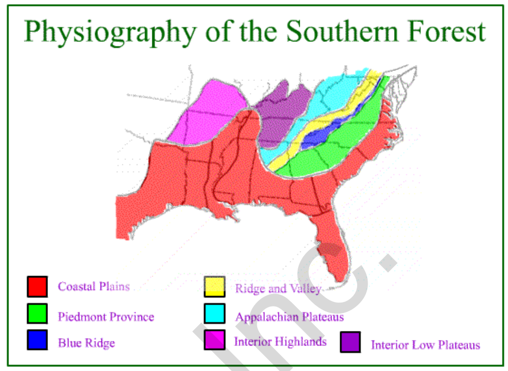
Quercus coccinea is sometimes abundant, even codominant, in these communities. This species increases with logging and is not fire tolerant, so its abundance probably is related to past human alterations.

Appendix C: Landscape Context

Southern Blue Ridge Region Landscape, Culture, and Economies

Landscape Description

Excerpted from *The Encyclopedia of Southern Appalachian Forest Ecosystems*



The Southern Blue Ridge Province extends from the Roanoke River southwestward into northern Georgia. It is of similar length to the Northern Blue Ridge, but is much broader (as wide as 112 km) and higher. The largest part of the Southern Blue Ridge Province consists of ranges of high mountains, many of which exceed 1,500 m in elevation. Mount Mitchell, the highest mountain in the Eastern United States, is 2,040 m in elevation. Local relief is generally high, exceeding 900 m. Along the northwest and southeast borders of the Mountain Highlands the ranges tend to be roughly parallel to the northeast regional strike of the rocks. In the center, however, the ranges have various trends that seem to be determined by the complex pattern of deep basins and valleys that cut through the mountains in various directions.

The Southern Appalachian Mountains are among the most biologically diverse areas in the world outside of the tropics (Braun 1950). By some estimates, there are more than 100 tree species, 500 vertebrate species, and 2,000 higher plant species native to the Blue Ridge Mountains alone. The Great Smoky Mountains contain more tree species than the entire continent of Europe. Explanations for this diversity include the great age of these mountains and the fact that they were not covered by glaciers during the Pleistocene ice ages. One of the most important factors influencing this diversity is the topography of the area. Variations in elevation and topographic position (i.e., ridge, slope, or cove) creates a variety of climatic conditions, providing suitable habitat for a wide range of species.

Climates in the Southern Appalachian Mountains create environmental conditions associated with the temperate deciduous forest biomes and the northern coniferous forest biome. The temperate deciduous forests cover most of the Southern Appalachian range. Its natural communities are dominated by deciduous tree species, although pines are commonly mixed with hardwood species.

The Cultural Landscape

In the Southern Appalachians, ecological and cultural history have been closely intertwined. Therefore, in order to more effectively document environmental change in the southern mountains, environmental historians must also investigate the two centuries of human history that preceded the eighteenth century frontier. Often celebrated for its unique natural history, the region is also home to an equally unique cultural history. For more than 800 years humans have lived in permanent settlements among the mountains of Southern Appalachia. Of course, habitation of the mountain region began as early as 10,000 years ago when

Woodland Indians first began roaming the upland forest. Largely nomadic, Woodland Indian tribes were relatively small in numbers, so their impact on the overall forest landscape was minimal. Evidence of their former settlements abounds, however. Freshly plowed fields continue to yield ancient spear and arrow points, signifying that small clans of hunters and gatherers had once called the mountain region home. The later Mississippians, Cherokees, and even Spanish, all made important contributions to the environmental history of the Southern Appalachians. The Europeans settlers did not inhabit an empty and unspoiled wilderness; rather, they reoccupied lands made vacant by two centuries of disease, famine, warfare, and natural resource extraction.

Resource Management

Although the focus of forest management has traditionally been timber production, today there are a variety of important forest resources that require attention. In addition to high quality timber, the southern Appalachian region also provides plentiful, diverse wildlife and aquatic resources, watershed protection, recreational opportunities, nontimber forest products (such as medicinals, ornamentals, etc.), and intrinsic ecosystem values.

Because of its proximity to human population centers and the strong social/cultural heritage of rural and indigenous populations, the southern Appalachian region experiences significant pressure to provide this wide diversity of resource values. Forest managers are not only challenged to address these multiple clientele needs, but address them in the context of management tools that integrate biological, ecological, social, and economic factors.

Forest Health

The capacity of the southern Appalachian region to provide extensive and diverse resource values is seriously compromised by unhealthy forest conditions. Poor health jeopardizes the underlying ecosystems that support timber, wildlife, fisheries, water, and scenic resources. A variety of insects, diseases, and other stressors have had pervasive impacts on the structure and composition of Southern Appalachian forests and threaten forest health in this region. Introduced, invasive species have changed the character of these ecosystems in unintended (and often disastrous) ways. Increased human populations, both within and near these upland ecosystems, threaten their health from overuse, water and air pollution, and urban development.

The South produces more timber than any other region of the U.S. or any other single country in the world (Wear & Greis 2002). The majority of this timber comes from private forestlands (USFS 2005), and over seventy percent of the South’s forestland is owned and managed by non-industrial private landowners (USFS 1994-2005).

Social and Economic Conditions

From the Southern Forests Network

The globalization of the timber industry, loss of wood products manufacturing facilities in our region, and increasing rural property values have significantly diminished the economic feasibility of forestland ownership for landowners (Wear 1996). Past forestry practices and various environmental threats have changed southern forests (Wear & Greis 2002), adversely affecting forest health and economic opportunities forest-based communities. Additionally, declines in forest health due to forest pests have caused deterioration in biodiversity, water quality, aesthetic values, and productive capacity with negative effects (Ward & Mistretta 2002).

The south also faces the greatest development pressures on forestlands anywhere in America. The U.S. Forest Service predicts that approximately 12 million acres of southern forests will be urbanized between 1992 and 2020 (Wear & Greis 2002).

The primary reasons for private land ownership in the south are: rural area residence, land investment growth, farm or domestic use, enjoyment of natural resources, estate purposes, and outdoor recreation (Wicker 2002). Many landowners will harvest timber during their lifetime, but many do not manage their forestlands strategically- only 2.6% of landowners in the South have written forest management plans (Butler and Leatherberry 2004). Due to lack of education, information, and services, many landowners are not realizing the maximum potential benefits of their forestland. Forest management decisions are frequently made in an information vacuum (Jones et al. 1995). The greatest obstacle to increasing landowner awareness and utilization of available support services is engagement. In many cases, the information and services landowners need are readily available, but landowners are simply unaware of their options (Measells et al. 2005).

The South is also beginning to experience the largest intergenerational transfer of land in decades. Heirs face difficult choices about whether, and how, to manage land they inherit, with many admitting they lack sufficient knowledge about their forest to manage it (Kendra and Hull 2005). There is significant concern that heirs will have little motivation to own and manage farm and forest land (Mater 2002). These landowners seem primed to receive information and assistance promoting forest sustainability and assistance.

While the region still maintains some infrastructure of primary and secondary mills, a great deal of the region’s manufacturing industry has moved overseas or become concentrated within a smaller number of businesses. As a result, growth in local employment in wood products has become somewhat stagnated even as timber harvests have increased. For instance, from the early 1980’s to early 2000’s, timber harvesting in North Carolina increased 60% by volume, but employment in the mill sector increased by only 5%, and the state lost 49% of its primary sawmills, veneer mills, pulp mills, and composite panel mills. There were 168 U.S. furniture plant closures between 2000 and 2003 with closures focused in NC (43%).

Southern Forests Network
Group Certification Program

Forest Monitoring Plan

Goals of Monitoring

Periodic monitoring of forest conditions will be conducted to assess:

- General forest condition and health
- Presence of specific exotic/invasive species
- Occurrence of insect or disease outbreaks or natural disasters
- Boundary maintenance and occurrence of trespass
- Occurrence and condition of any important wildlife habitat components; rare, threatened, or endangered species, and sensitive or unique natural communities
- Impacts of management activities
- Yields of forest products and services
- Condition of forest resources that are harvested/utilized

One to Five Year Monitoring

Forest owner(s) and manager(s) will conduct ongoing monitoring while on the property. At a minimum, a "walk-through" of the property will be completed every 1-5 years. This report will be completed to provide details on the following as applicable:

1. **Major Changes in Forest Health or Composition**
    a. Known forest disease or insect outbreak
    b. Significant patch of dead or dying trees
    c. Significant wind or wildfire impact
    d. Presence of exotic/invasive species

2. **Wildlife Activity**
    a. Presence of new wildlife on property
    b. Presence of animal remains (bones, fur, feathers)
    c. Presence/condition of animal dens/nests
    d. Populations of songbirds
    e. Mast Production
    f. Rare, threatened, and Endangered Species

3. **Hydrology**
    a. Significant change in water level or flow rate
    b. Observed change in water clarity or temperature
    c. Erosion of stream bank
    d. Runoff directly entering water feature

4. **Management Activity**
    a. Implementation projects completed or ongoing
    b. Deviations from/changes to management plan

5. **Products Harvested**
    a. Volume harvested
    b. Sales volume & value
    c. Local contracting and sales

6. **Social Concerns**
    a. Disputes regarding ownership or management
    b. Condition of Cultural, Historical or Archaeological Resources

7. **Landowner Satisfaction**
    a. General satisfaction with forest management
    b. General satisfaction with certification

Long-Term Monitoring

Every 5-15 years, depending on the intensity of management and changes to forest conditions, long-term monitoring will be completed to assess:

1. Inventories/populations of major species and any harvested species
2. Growth rates and regeneration of major species and any harvested species
3. Forest composition and condition of the forest in relation to desired conditions
4. Needed changes to management or monitoring plans
5. Value of forest products and services sold
6. Impacts of forest management on local community and landscape

Monitoring Plans

It is important to monitor a broad set of forest conditions over the long-term in order to assess the impacts of management on the landscape. Exactly what forest attributes are evaluated, and how frequently they are monitored, varies on property-by-property basis. Most forest attributes can be measured by making general observations, rather than detailed measurements. Every monitoring program, however, must collect sufficient information to be able to track changes in forest health and composition over time, assess the relative success of management activities in relation to landowner goals, track the flow of products from the land, and evaluate the impacts of management on the surrounding landscape.

An “Annual Forest Health Report” will be submitted to the Southern Forests Network to document monitoring results.

Components of a Monitoring plan

- Goals and objectives for monitoring—rationale for monitoring, intensity of monitoring
- Indicators to be monitored
- Incorporating monitoring results into the management plan
- Monitoring summary for public review

Property Level Monitoring

The purpose of property level monitoring is to maintain an up-to-date evaluation of overall forest health and development. The plan should identify critical forest attributes that should be monitored, and provide information on the methods and timing for evaluating each attribute. The forest inventory that is completed when the plan is written is the best time to identify critical attributes and decide how often they should be re-evaluated. Property-wide critical attributes that might be identified in the management plan could include the following:

- Presence of specific exotic/invasive species known to occur in the area.
- Occurrence of insect or disease outbreaks or natural disasters.
- Boundary maintenance and occurrence of trespass.
- Occurrence and condition of any important wildlife habitat components; rare, threatened, or endangered species, and sensitive or unique natural communities.
- Implementation of, or deviation from, the management plan.

Stand Level Monitoring

The purpose of stand level monitoring is to track an individual forest stand’s progress towards the desired future condition described in the management plan. When designing a project such as a commercial timber harvest, timber stand improvement, tree planting, or exotic species control operation, it is important to identify the critical attributes that will be used to evaluate the positive and negative impacts of the project. These attributes are also used to track progress towards the desired future condition, and can trigger a consulting forester to re-evaluate the management strategy.

Critical attributes for a specific stand or project area might include the following:

- Volume of forest products harvested
- Growth rates, regeneration, forest composition, and condition of the forest
- Seedlings or saplings per acre of specific species.

- Environmental impacts of any management activities to the property, nearby properties, or the larger landscape.
- Social and economic impacts of management activities on the larger community.
- Costs and return on investment associated with forest management activities.
- Incidence of a forest pest and impacts of IPM programs.

A "Long Term Forest Monitoring Report" will be completed a minimum of one year, and no more than four years, following major forest management activities according to a monitoring plan provided by SFN upon approval of each major forestry activity.

Landscape Level Monitoring

Landscape level monitoring is used to assess the impacts of management on the surrounding landscape. This might include tracking the extent of regionally significant species, the economic impact of wood or non-timber forest products sold, or the extent of different land cover types. If significant landscape-level management concerns are identified, SFN may require that a landowner address these concerns in their management plan.

Appendix E: Pest Management and Pesticide Use Plan

Southern Forests Network

Group Certification Program

Forest Management Plan Template: Pest Management & Pesticide Use

Pests will be managed using Integrated Pest Management (IPM) techniques following the general guidelines provided in the *FSC Guide To integrated pest, disease and weed management in FSC certified forests and plantations.* IPM programs manage pests though an understanding of their interactions with other organisms and the environment. IPM programs consist of four basic elements:

1. Acquisition of knowledge about the target organism's biology and population dynamics,
2. Monitoring of the target organism's population levels,
3. Determining the acceptable injury and action threshold levels of the disease, insect, animal, or weed, and
4. Employment of the lowest-impact population control method for the organism.

These components of IPM will be followed to assess any potential disease, pest or weed problem, and to determine the appropriateness and effectiveness of control methods. The Southern Forests Network Group Certification Program Operations Manual, Appendix 7: Major Pests of Southern Forests & Pest Control Strategies, provides resources and credible pest management practices for common forest pests in the South.

When chemicals are being used, a written prescription is prepared that describes application objectives, rates and methods of their application, risks and benefits of their use, methods to reduce dependence on chemicals, and the precautions that workers must employ.

To ensure that all requirements for FSC certification are met, the forest owner or manager will:

1. Include information about any planned pesticide uses in the Forest Management Plan.
2. Provide SFN with accurate information about planned chemical uses so that SFN can seek 'derogations' for any valid uses of 'highly hazardous' pesticides.
3. Immediately notify SFN when adding a new chemical treatment to the Forest Management Plan. All changes to the Forest Management Plan must be pre-approved by SFN.
4. When pesticides are used, proper precautions and techniques are used in order to minimize human health and environmental risks.

Appendix F: Wildfire Protection Plan

Southern Forests Network
Group Certification Program

Wildfire Protection Plan

Wildfire risk

Risk of catastrophic wildfire on the property is low. In general, fires in the southern Appalachians are not catastrophic as they tend to burn on the ground and shrub layer underneath the forest overstory. These fires are most common on extremely xeric sites, such as the oak dominated forest types on the Cupido/Rahman property. Wildfires are most common during dry periods before leaf-out in early spring and soon after leaf fall in late fall.

Risk to Property

The landowner has no knowledge of past wildfires on the property, though it is likely that there were regular wildfires that burned in the oak dominated forest types, formerly dominated by American chestnut, set by early settlers and native Americans. These occasional wildfires most likely continued until after the forest was last harvested ~80 years ago, after which the Forest Service implemented a fire exclusion policy.

There is very little risk to the property or forest from wildfire. Fire on the property would carry uphill, as it does in the mountains, and onto Pisgah National Forest. There is no risk to structures as there are none in the path of a wildfire that would begin on the property. The greatest risk is to timber. However, wildfire is most likely to carry and to cause damage only on the most xeric sites where timber value is close to zero. The more mesic sites with more valuable timber are generally not prone to wildfire, and wildfire does burn on these sites it burns cooler and usually causes little damage to the timber.

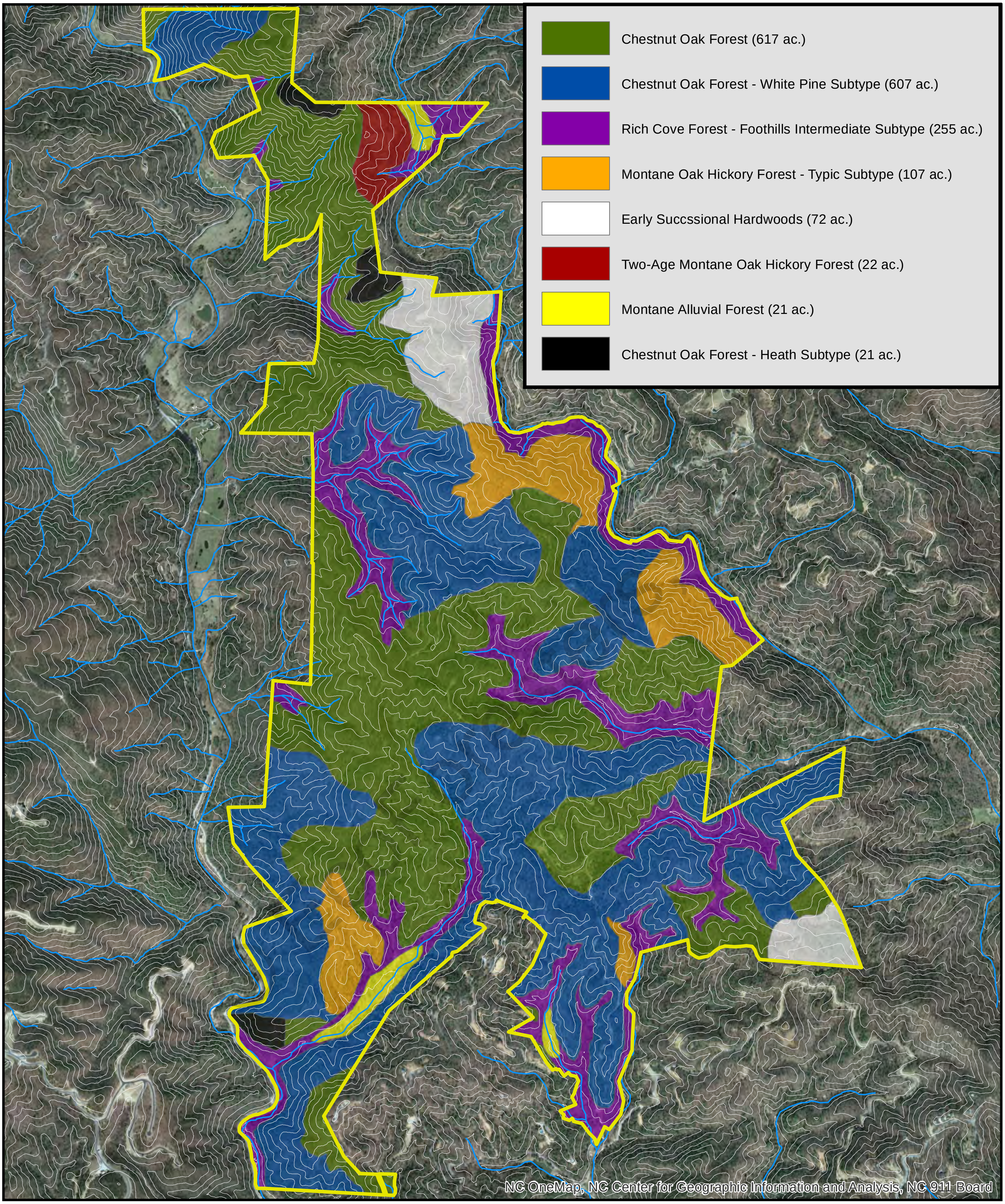
Risk Management

After the upcoming timber harvest the landowner will pursue partnering with NCDFR to conduct controlled burns in the oak dominated forests on the property. The purpose of these burns will be to promote oak regeneration and to reduce the fuel layer in the understory and further reduce the risk of wildfire.

Appendix G: Maps

Map Titles in Sequence:

1. ~~Location Map~~
2. Community Types Map
3. Management Zones Map
4. Infrastructure Map
5. Soils Map
6. Parcel Map
7. Canopy Height Map



[redacted] Forest Community Type Map

2010 True Color Aerial Orthoimagery

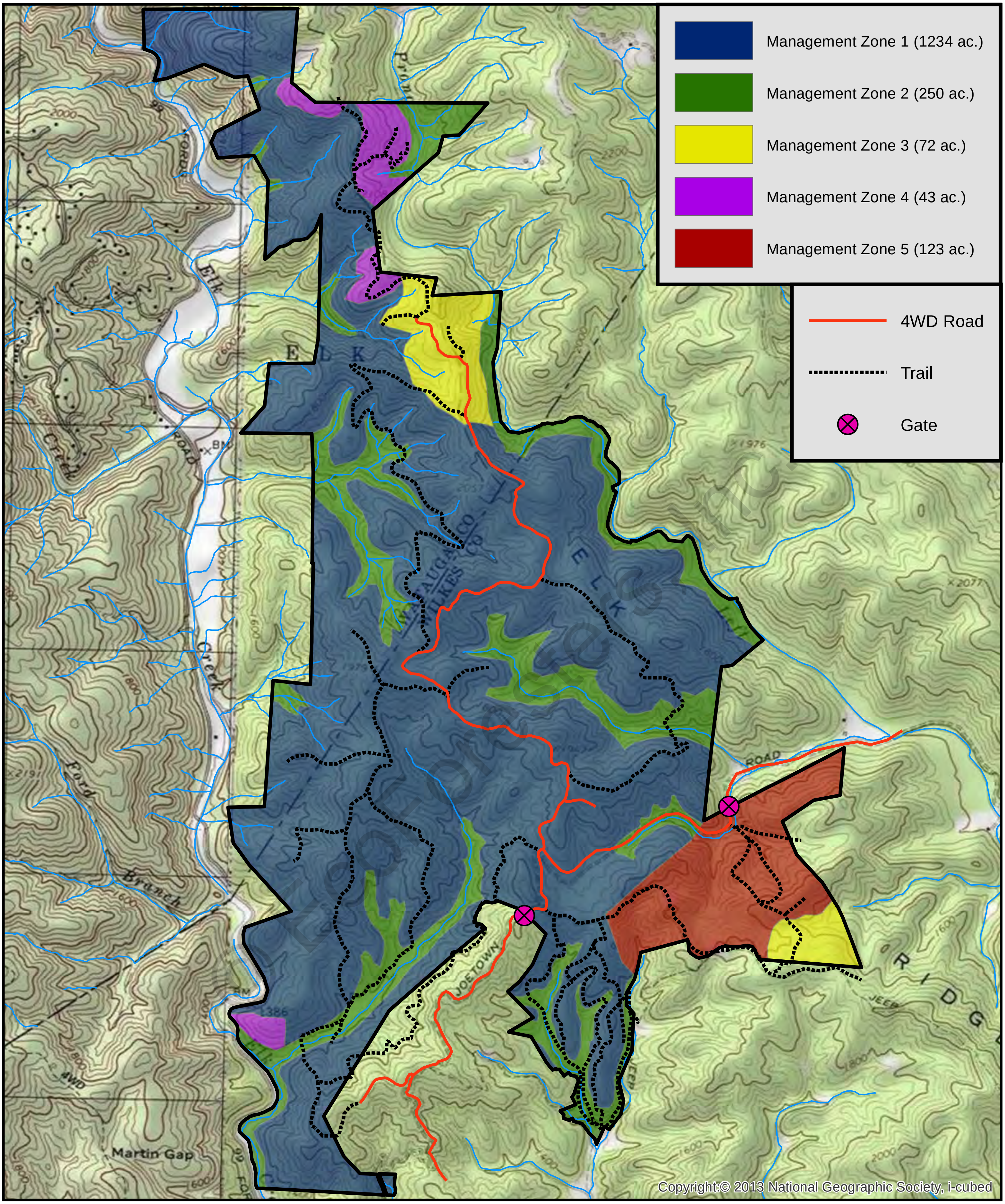
EcoForesters

Elevation Range: 1,350' - 2,275'
Contour Interval: 50'

0 0.25 0.5 1 Miles

Map Created
12/15/2015

N W E S



EcoForesters

[redacted] Management Zone Map

0 0.25 0.5 1 Miles

Map Created
12/15/2015

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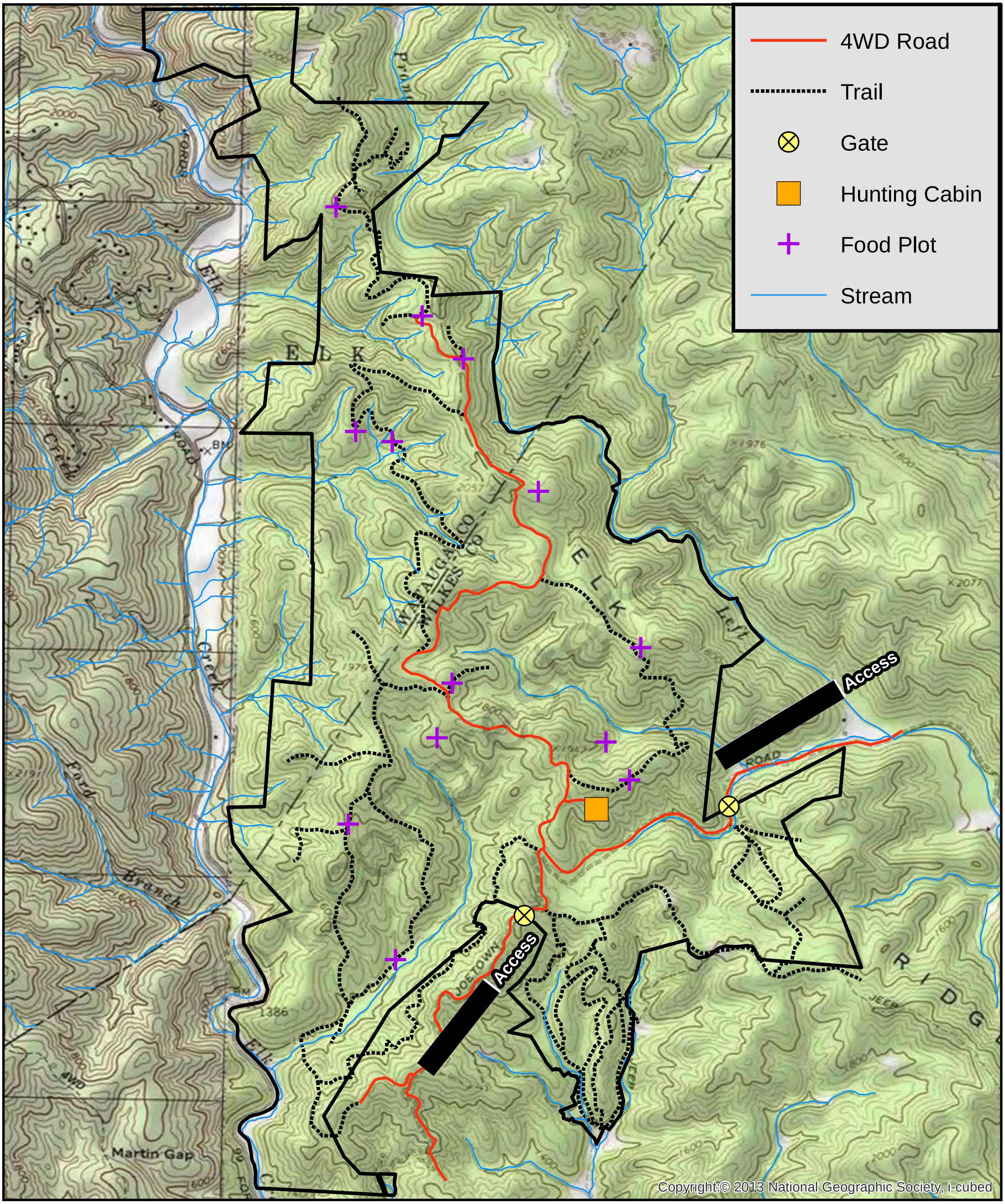

[redacted] Infrastructure Map

EcoForesters

0 0.25 0.5 1 Miles

Map Created 12/15/2015

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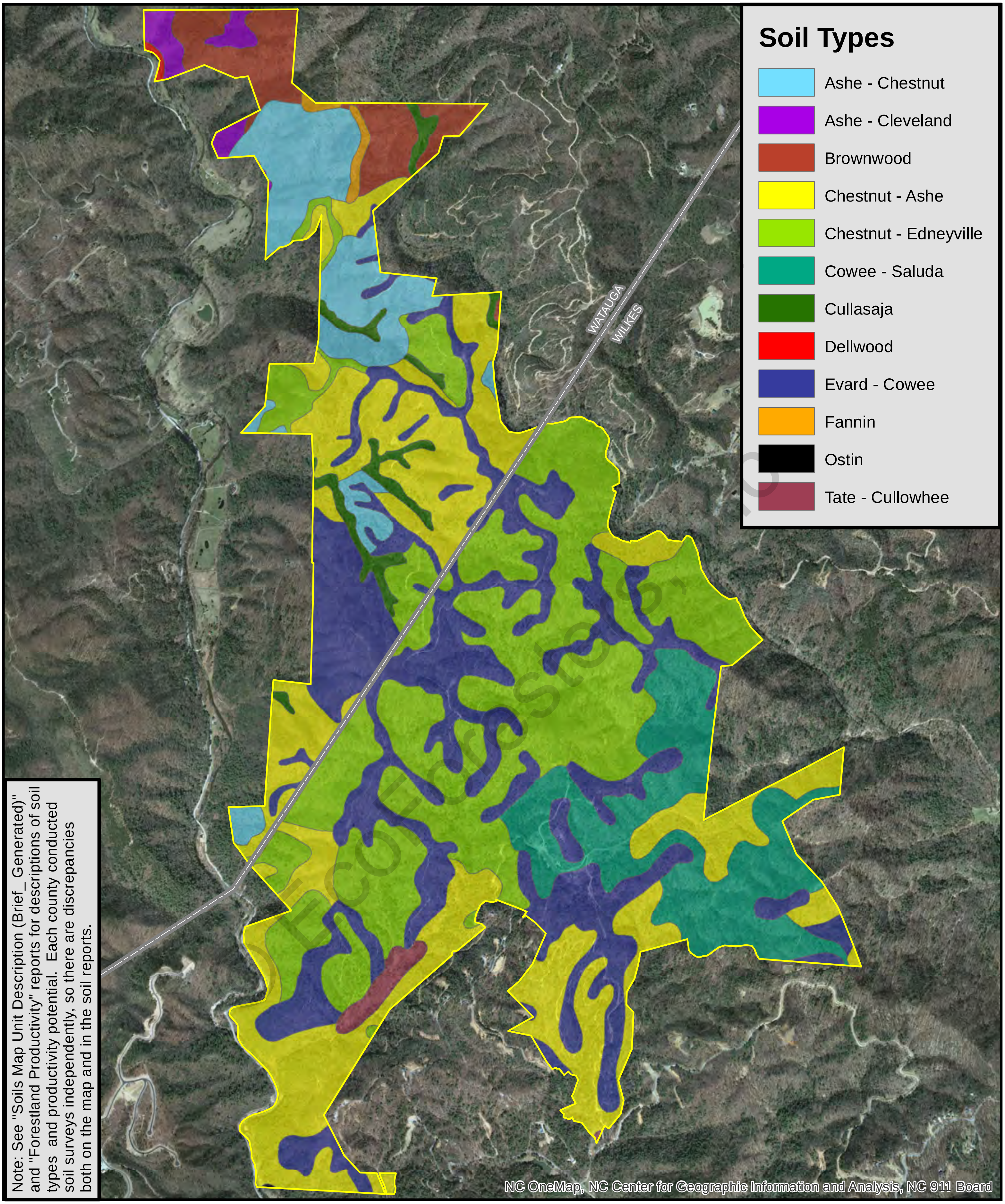

EcoForesters

[redacted] Soil Types Map

2010 True Color Aerial Orthoimagery

0 0.25 0.5 1 Miles

Map Created
12/15/2015

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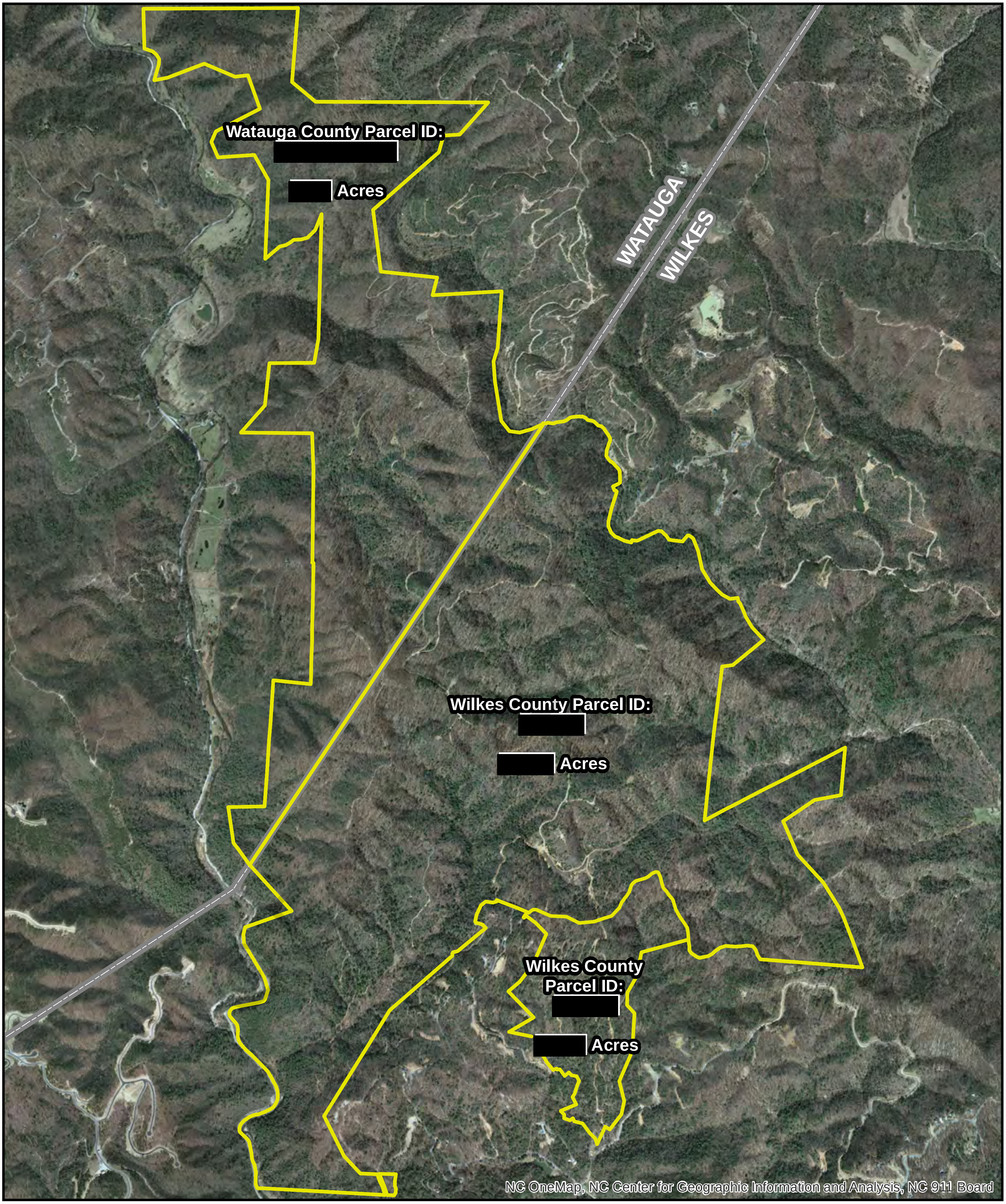


EcoForesters

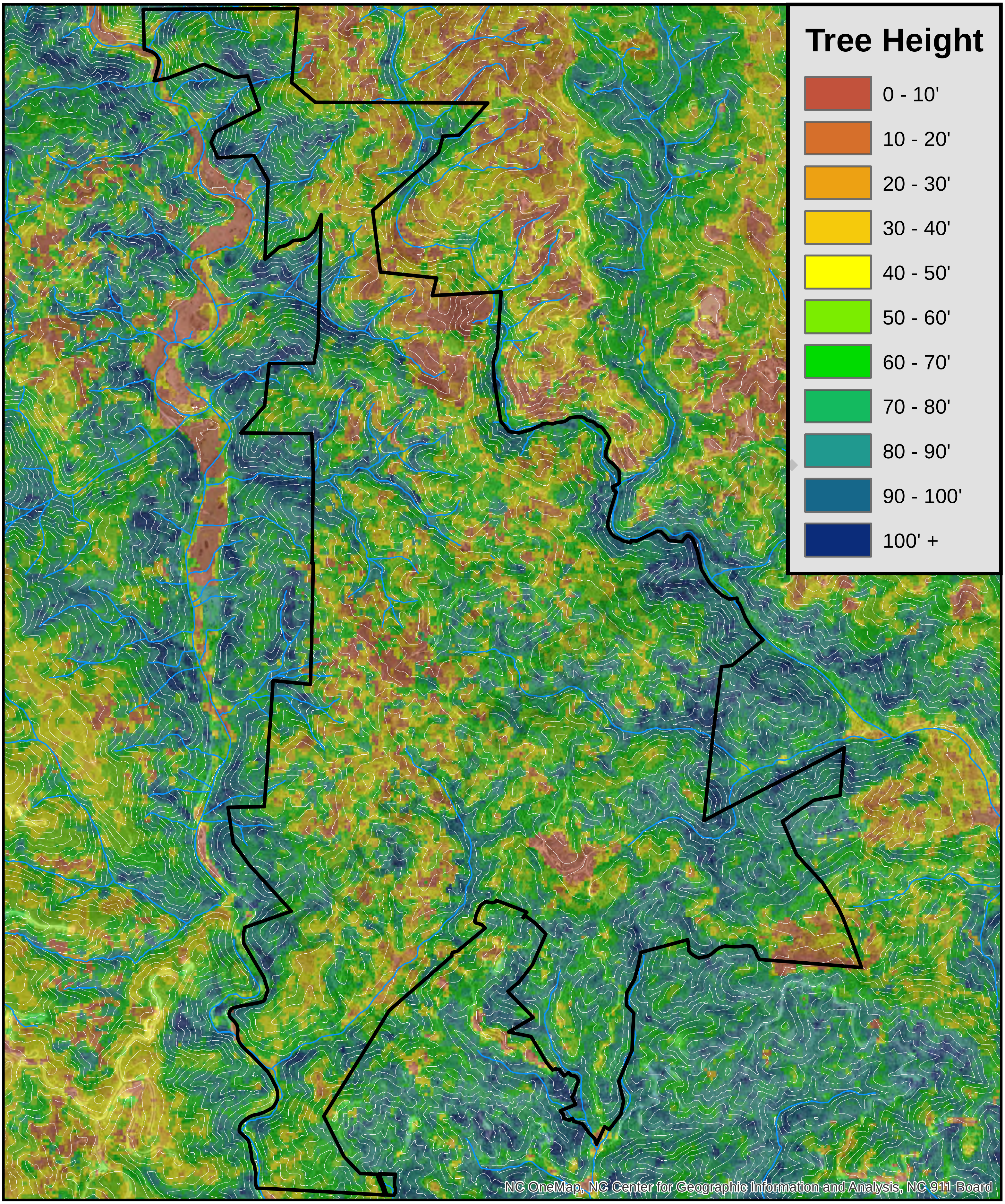
[redacted] Parcel ID Map

2010 True Color Aerial Orthoimagery

0 0.25 0.5 1 Miles

Map Created
12/15/2015

N W E S



EcoForesters

[redacted] Canopy Height Map

2005 LiDAR Data

Elevation Range: 1,350' - 2,275'
Contour Interval: 50'

Miles
0 0.25 0.5 1

Map Created
12/15/2015

N
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