Oak Ecological Zones – Composition

Information presented in this draft report is considered under development. It may be incomplete and is likely unedited. This may make some sections difficult to follow. An updated version if this report will be posted when it becomes available.

Oak dominated forests represent the greatest forest component across the planning area, covering about 37% of the Nantahala and Pisgah NFs and 40% of the non-Forest Service lands in the 18- county area. Oak forests have been affected more by the loss of American chestnut during the last century than any other ecological zones in the southern Appalachians. In order to describe and characterize this diversity they are delineated here in four ecological zones, one separated by elevation, the remaining three separated along a moisture continuum.

High Elevation Red Oak Ecological Zone

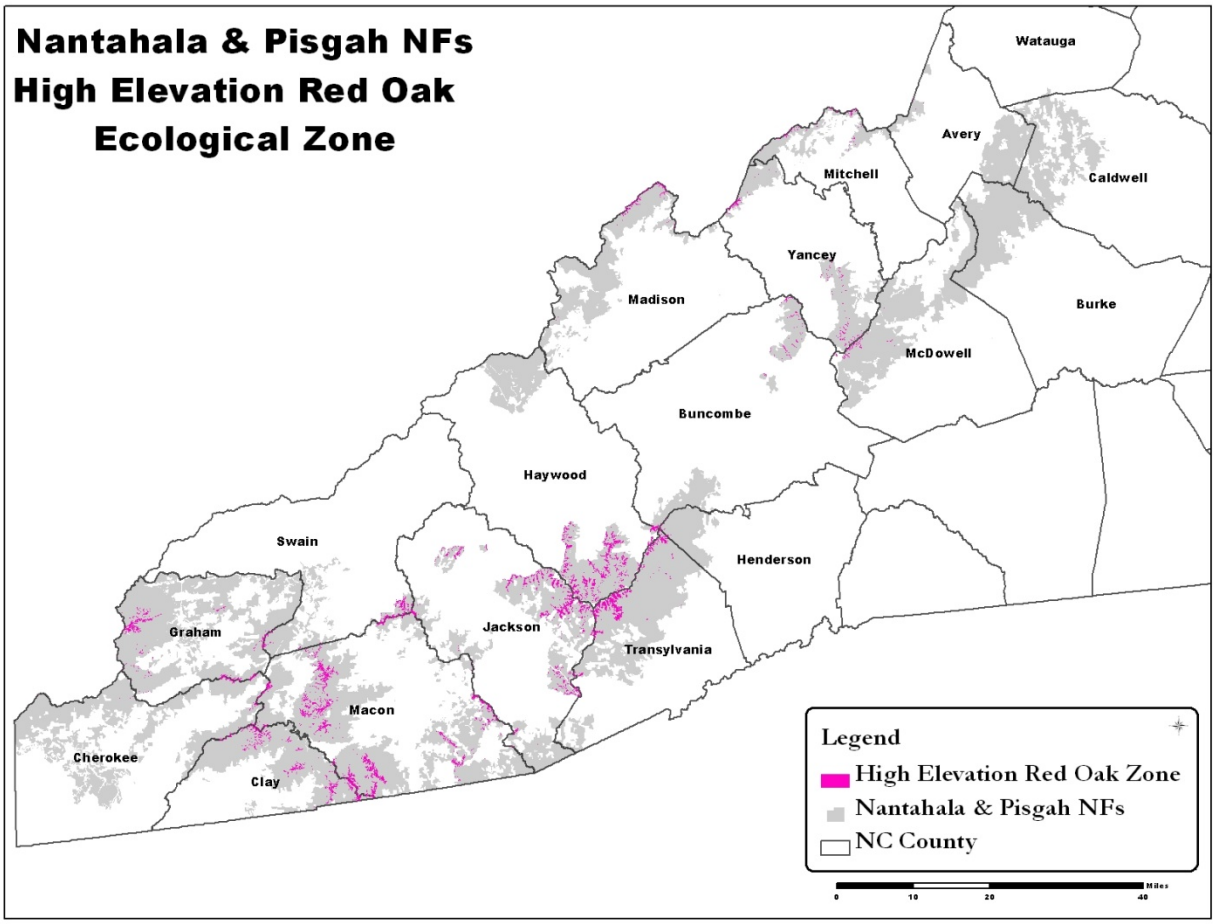
Environmental Setting: This ecological zone occurs on most of the major mountain ranges, generally at elevations from 3500-5500 feet, across broad primary ridges and steeper secondary and tertiary ridges (Natureserve 2013, Schafale and Weakley 1990). Delapp (1978) recorded this zone across most slope aspects but more commonly on southeast and south exposures. In general, the types occur on exposed landforms although the higher elevation helps to moderate extreme temperature fluctuations. Low temperatures, high winds, ice storms, and occasional wildfires are all important natural disturbance events influencing this ecozone.

Geographic Distribution: Five subtypes have been delineated in this type within the 18-county area. They are typic herb, rich herb, heath, orchard, and stunted woodland. In total distribution, subtypes of this ecozone occur across the southern Appalachians from southern Virginia to northern Georgia and possibly northern South Carolina (Natureserve 2013). The rich herb subtype is the rarest of the five, presently only known from North Carolina in three mountain ranges with an amphibolite substrate. It is globally ranked as G2 as are the orchard forest and the stunted woodland subtypes. Both the typic herb and the heath subtypes are relatively abundant and globally ranked as G4.

This ecozone covers approximately 3.5% (36,600 acres), of the Nantahala and Pisgah NFs. It is most common in the Balsam and Nantahala Mountain ranges but occurs dispersed across both forest units. On lands in the surrounding 18-county area, the type is less than half as abundant, covering about 1.3%. The typic herb and heath subtypes for this zone are the most commonly encountered types across the Nantahala and Pisgah NFs as well as for those other lands within the surrounding 18-county area. The Orchard forest subtype is less common and the stunted woodland and rich subtypes are very uncommon across both the Nantahala and Pisgah NFs and the surrounding lands.

Composition: Five main plant community associations have been delineated within the high elevation red oak ecozone, primarily differing by structure or vegetation (Natureserve 2103, Schafale 2012). This ecozone is dominated by more than 50% red oak (*Quercus rubra*), often up to 75%, with lesser amounts of white oak (*Quercus alba*), chestnut oak (*Quercus montana*), red maple (*Acer rubrum*), striped maple (*Acer pensylvanicum*), and yellow birch (*Betula allegheniensis*). For the rich herb subtype, tree species such as white ash (*Fraxinus americana*) and sugar maple (*Acer saccharum*) are also common. Chestnut (*Castanea dentata*) saplings and other small trees often persist in the subcanopy or shrub layer. Three of the subtypes have dense shrub layers, consisting of Catawba Rhododendron (*Rhododendron catawbiense*), great laurel (*Rhododendron maximum*), flame azalaea (*Rhododendron calendulaceum*), highbush blueberry (*Vaccinium simulatum*), highbush cranberry (*Vaccinium erythrocarpum*), or mountain laurel (*Kalmia latifolia*). Herb diversity is greatest within the remaining two subtypes and typically contains Pennsylvania sedge (*Carex pensylvanica*), white snakeroot (*Ageratina altissima var. roanensis)*, wood-nettle (*Laportea canadensis*), hay-scented fern (*Dennstaedtia punctilobula*), and New York fern (*Thelypteris noveboracensis*). In rich herb subtypes, black cohosh (*Actaea racemosa*), stoneroot (*Collinsonia canadensis*), and bloodroot (*Sanguinaria canadensis*) are common. Species richness varies greatly across the subtypes within this zone, from a low of 14 species in the shrub dominated ones, to greater than 85 species in the rich herb type (Ulrey 1999, Peet et al 2013).

Figure 1. Distribution of High Elevation Red Oak Ecological Zone across the Nantahala and Pisgah NFs.



Federally Listed Species: Few rare plant species have been documented within this ecozone on the Nantahala and Pisgah NFs, and none are federally listed.

Rare Species: The rarest plant located within this zone is the shrub Cumberland azalea (*Rhododendron cumberlandense)*. Fewer than five occurrences of this species are known in the National Forest in NC, all restricted to the Nantahala NF. Eight other rare plant species occur within the high elevation red oak forest zone. These include one tree, three shrubs, three herbs, and one lichen. Of these nine species, six are known to occur in large forest gaps or in early successional forest such as previously modified old fields or roadside edges. The remaining three species typically occur under shaded, closed canopy conditions.

Invasive Plant Species: In comparison to other ecozones, high elevation red oak forest is not as susceptible to non-native plant species infestations as the other oak forests, probably due to its presence at high elevations and relatively infrequently recent disturbance within the zone. Perhaps the most invasive species within this zone is oriental bittersweet.

Disturbance Dynamics: Chestnut diebacks has heavily influenced this zone and undoubtedly resulted in the current dominance by red oak. This zone is influenced by high winds with the stunted subtypes more heavily impacted. The creation of canopy gaps and large openings are

driven by wind events and ice storms. Patch sizes can vary from single trees to numerous trees, several acres in size. Fire is considered an important factor in maintaining this habitat with a fire return frequency as low as 15 years (Landfire 2009). In contrast, moderate to catastrophic fires are less frequent, at a 100 - 600 year interval, generally following a drought or a disturbance that has cause an abundance of downed woody debris.

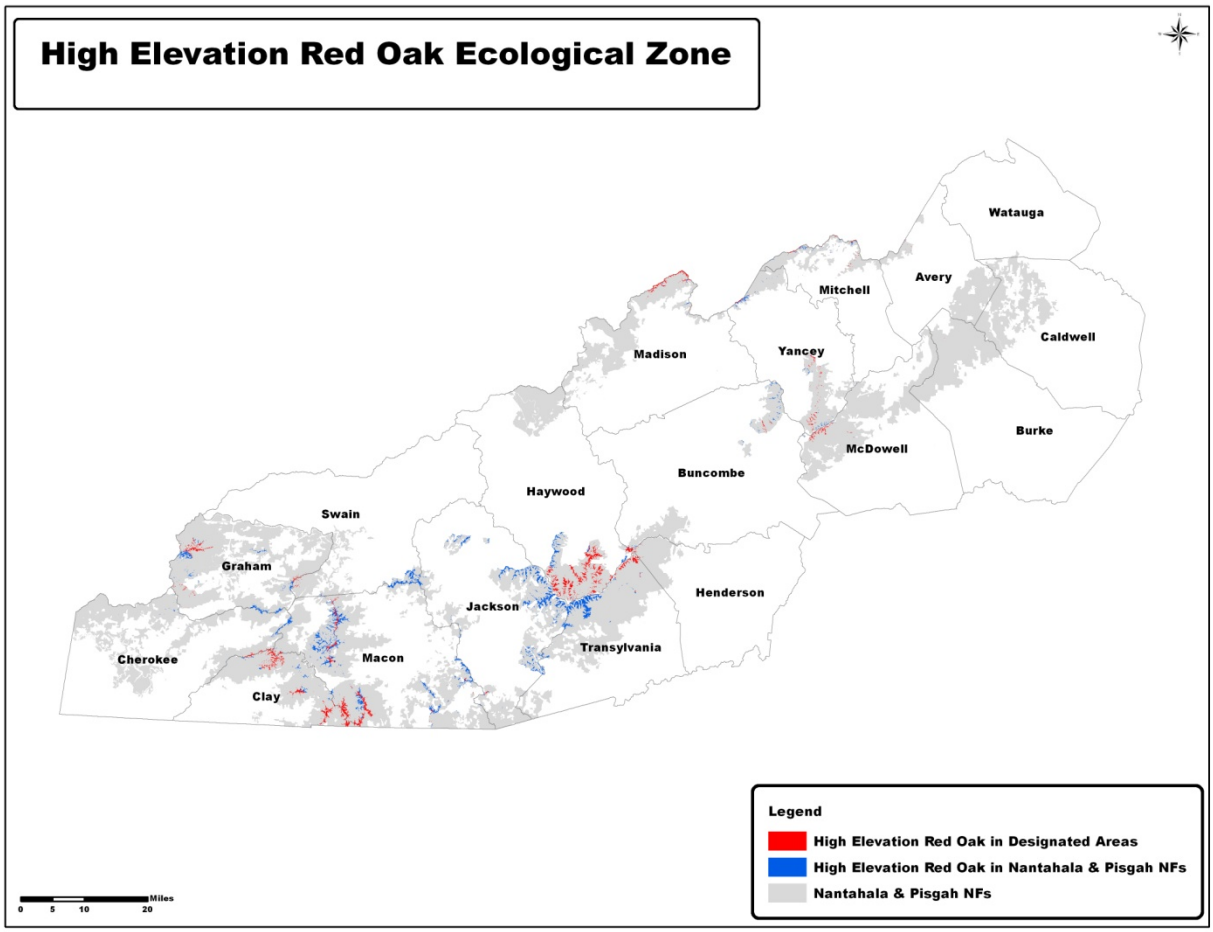
Fire suppression following the mid 1900s has affected the structure of this community, probably resulting in a greater shrub density and an increase in more mesic northern hardwood species. Shrub densities, consisting of both deciduous and evergreen species, exceed 50% in half of the zone. An emphasis on larger landscape burns during the last seven years across the Nantahala and Pisgah NFs has resulted in some burns within the northern hardwood ecozone, amounting to approximately 2,100 acres, which represents 5.7% of the zone across the two forests. Of the four dominant oak zones, a greater percent of this zone is being burned.

Connectiveness: At the highest elevations, above 5,500 feet, spruce-fir forest can be upslope. While red oak forest is often upslope of the drier subtype of northern hardwood forest it can intergrade to mesic oak or dry oak forest between 4,000-4,500 feet elevation. Heath balds can occur on adjacent drier steep thin-soil slopes. Open rock outcrops, such as high elevation granitic domes, are often surrounded by high elevation red oak forest. Portions of this zone have been converted to grassy balds with a mix of native and European grasses across both the Nantahala and Pisgah NFs. Patch sizes in this ecozone typically exceed 30 acres and can exceed 250 acres, across some of the flat primary and secondary ridges in the Balsam and Nantahala Mountains.

This habitat is not limited across the Nantahala and Pisgah NFs, however high quality fire-maintained habitat is very patchy. Some of the subtypes are being replaced in the understory with mesic tree species as sugar maple and yellow birch. As a result, fire adapted plant species that occur in openings across this type can be widely dispersed or only occur in very small populations.

Designated Areas: A little more than 42% of this high elevation ecozone is currently within existing designated areas (figure 3). Those acres within the designated areas are present across the two forests although sparse within the northern Nantahala Mountains, and the Cowee Mountains.

Figure 2. Distribution of the High Elevation Red Oak Ecological Zone within existing designated areas across the Nantahala and Pisgah National Forests.



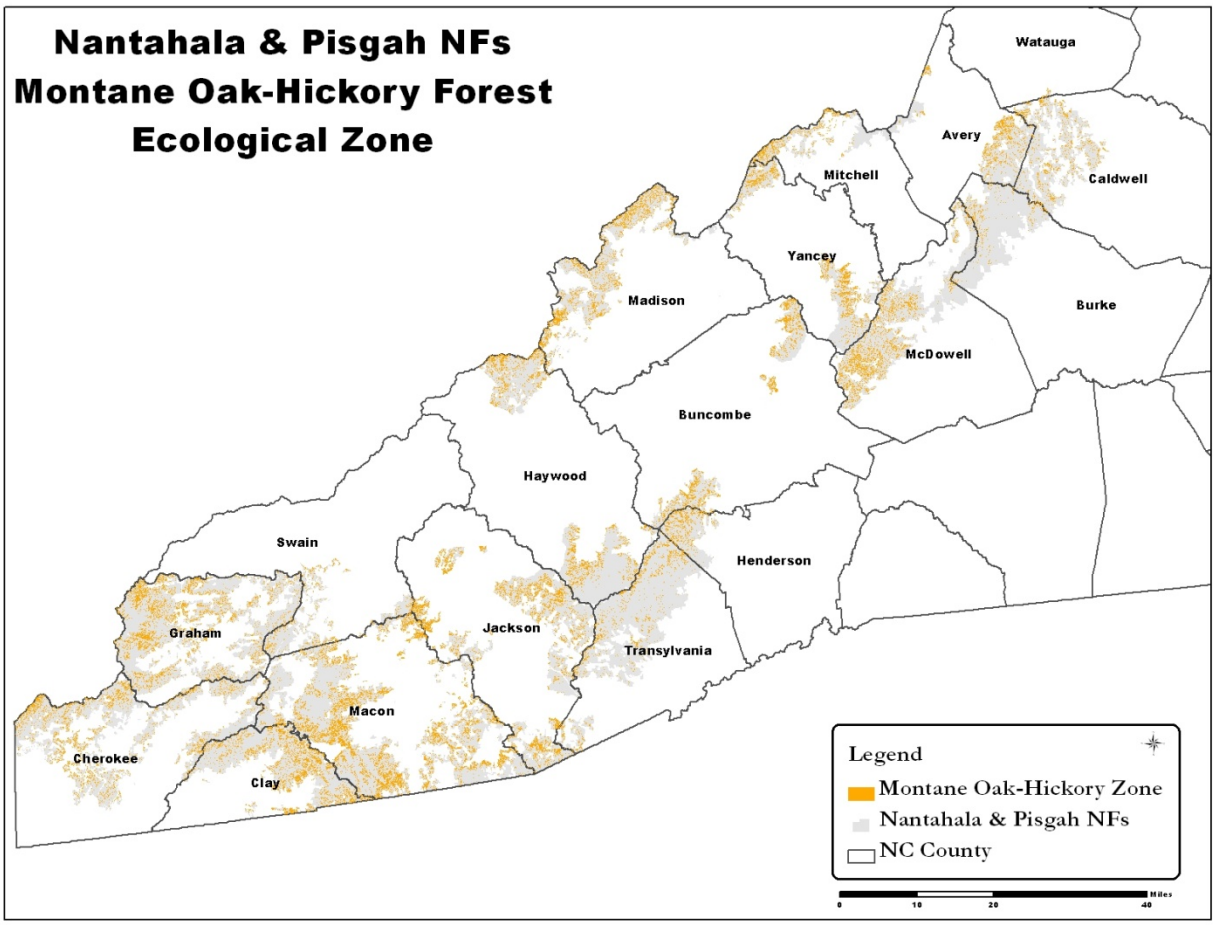
Mesic Oak Ecological Zone

Environmental Setting: This ecozone occurs from the low to mid elevations, 2000-4500 feet, on generally deep soils at all exposures, although it is more abundant on eastern aspects and topographic positions from 5,200 to 6,000 feet in elevation. In general, this ecozone occurs on somewhat protected to partially sheltered landforms that are convex in shape (Simon 2012).

Geographic Distribution: This ecozone has a widely distributed over the Southern Blue Ridge, the Blue Ridge/Piedmont transition, the higher ridges of the Cumberland Mountains, and Ridge and Valley in southwest Virginia (Natureserve 2013). It covers approximately 18% of the Nantahala and Pisgah National Forests (Figure 3). Within non- Forest Service lands in the surrounding 18-county area, the ecozone is slightly more abundant, covering about 23.5%, making it the most abundant zone on non-Forest Service lands. The acidic subtype of this zone is much more common across the Nantahala and Pisgah NFs as well as for those other lands within the surrounding 18-county area. The acidic subtype for this zone is considered globally secure, (ranked G4G5), while the basic subtype is considered more vulnerable, ranked globally as G3 (Natureserve 2013).

Composition: Two main plant community associations are included within this zone, an acidic subtype and a basic subtype (Natureserve 2103, Schafale 2012). This ecozone is dominated by white oak (*Quercus alba*), red oak (*Quercus rubra*), and chestnut oak (*Quercus montana*), with varying amount of red maple (*Acer rubrum*), pignut hickory (*Carya glabra*), red hickory (*Carya ovalis*), mockernut hickory (*Carya tomemtosa*), or tulip poplar (*Liriodendron tulipifera*). Shrub density varies across the two subtypes. Within the acidic subtype, shrub density can be moderate to dense, typically with many deciduous species such as bear huckleberry (*Gaylussacia ursina*), buffalo-nut (*Pyrularia pubera*) and mountain holly (*Ilex montana*). Herb species can be sparse in the acidic subtype with common herbaceous species including wood betony (*Pedicularis canadensis)*, featherbells (S*tenanthium gramineum*, New York fern (*Thelypteris noveboracensis*), squawroot (*Conopholis americana*), whorled loosestrife (*Lysimachia quadrifolia*), *Coreopsis major*, and cow-wheat (*Melampyrum lineare*). This compares to the basic subtype, which has much higher herb diversity, more reminiscent of rich cove forest including species such as black cohosh, bloodroot, and maiden-hair fern. Shrubs are generally sparse within this subtype. Herbaceous diversity is highly variable within the two subtypes, ranging from 29 to 115 species (Natureserve 2013).

Figure 3. Distribution of Mesic Oak Ecological Zone across the Nantahala and Pisgah National Forests.



Federally Listed Species: Many rare species occur within this ecozon. The rarest plant is small whorled pogonia (*Isotria medeloides*). It is uncertain if this zone provides optimal habitat for this rare orchid since it seems to be more influenced by past land use history and abundance of orchid associates. Two populations of *Isotria medeloides* have been located within mesic oak forests on the Nantahala and Pisgah NFs during the last 30 years. However, both populations have not persisted. Currently there are no known extant populations of this species on the Nantahala and Pisgah NFs.

Rare Species: Twenty-seven other rare plant species occur within the mesic zone. Of all the rare plants, 25 are vascular plants (four shrubs, four graminoids and 18 herbs); one is a liverwort, and one is a moss. Of these rare species 15 are known to occur within large gaps or have been located within the zone within successional forest such as previously modified old fields or roadside edges. The remaining species typically occur under shaded closed canopy conditions.

Invasive Plant Species: In comparison to other ecozones, mesic oak forest has a high potential for non-native invasive plant species infestation. It is the most susceptible of the oak dominated types; up to 14 targeted non-native invasive plants have been located within this zone. During the last 10 years, this zone and the dry-mesic oak zone had the most young forest habitat created within the oak-dominated zones. Only rich cove forest had more management activity. As a

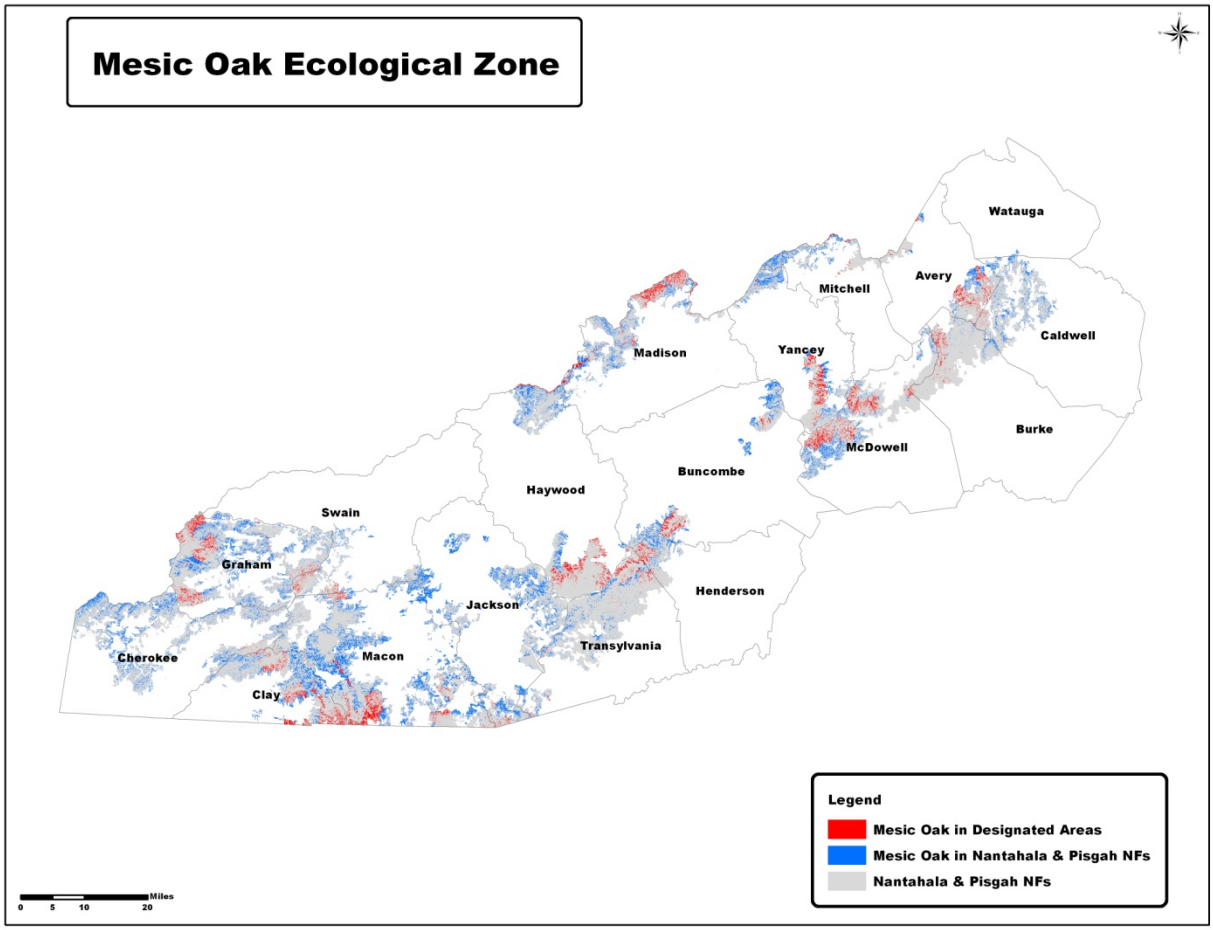
result this zone has the second largest problem with invasive plant outbreaks across the two forests.

Disturbance Dynamics: American chestnut occurred throughout this ecozone and its loss has influenced the present dominance of canopy species. In the absence of fire, gap-phase regeneration has the greatest influence on the canopy, creating small gaps while occasional ice storms or extreme wind events can result in larger canopy openings. Pre-settlement forests suggest a fire return interval with the predominance of low intensity fires every 15-25 years, and occasionally more intense fires would help to maintain and regenerate the fire tolerant oaks (Landfire 2011). Various research shows oaks need recurrent fire for long-term stability and regeneration (Lorimer 1985, Abrams 1992). Fire may have a beneficial influence on oaks by reducing competition from more fire-sensitive tree species in the sapling layer (Lorimer, 1985). Fire reduces the amount of litter under a stand, which, according to Lorimer, may discourage rodent predation of acorns. Fire may indirectly influence rodent populations as well, by reducing available nest sites and food availability. Fire disturbance can play a role in selecting against thin barked mesic hardwoods. In montane oak forests sampled in Shining Rock Wilderness, saplings of red maple and silverbell suggest dominance in the future canopy by these thin barked species with oak species diminishing (Newell and Peet 1996). Communities across the Chattooga River watershed appear to be changing from oak dominance to more shade tolerant red maple, black birch and blackgum (Meir and Bratton 1996). Fire suppression during the last 50-70 years has resulted in changing the canopy to a more even-aged structure and the dominance of more mesic midstory and canopy species, in particular red maple, blackgum and possibly tulip poplar within this ecozone. Given the abundance of this zone and its adjacency to other more fire-adapted types, the likelihood of this zone experiencing periodic surface fires is high. Within the oak dominated ecozones the mesic oak zone has a more open shrub layer (53% with less than 50% shrub cover), likely a result of intense shade from well-developed overstories and midstories. Within the last seven years, slightly less than 4% of this ecozone has had a prescribed burn conducted.

Connectiveness: Adjacent forests connected to this zone are variable. At its upper range it can grade to high elevation red oak forest. It is typically upslope of rich cove or acidic cove forest on convex slopes. It can grade to mesic-oak forest on moderate slopes and dry oak forest on steep slopes. Montane acidic and calcareous cliffs can occur embedded within this ecological zone. Patch sizes of this habitat are variable from under 25 acres to more than 200 acres, across some of the upper concave and convex slopes in the Balsam and Nantahala Mountains. This habitat is not limiting across the Nantahala and Pisgah NFs, however high quality fire-maintained habitat is very limited. Some of the subtypes are being replaced in the understory with more mesic tree species such as red maple and blackgum, and oaks are not effectively regenerating. As a result fire adapted plant species that occur in more openings across this type can be widely dispersed or only occur in very small population sizes.

Designated Areas: A little more than 24% of the mesic oak ecological zone is within existing designated areas (Figure 4). Those acres within the designated areas are present across the two forests although sparse within the northern Nantahala Mountains, and the Cowee Mountains.

Figure 4. Distribution of the Mesic Oak Ecological Zone within existing designated areas across the Nantahala and Pisgah National Forests.



Dry-Mesic Oak Ecological Zone

Environmental Setting: This ecozone occurs across low to mid-elevations, from 2,000-4,000 feet, ridges, concave upper slopes, and occasionally in narrow dry coves (Simon 2011). In general, the ecozone can occur in locations similar to where mesic oak occurs; however, the soils tend to be more acidic and less fertile.

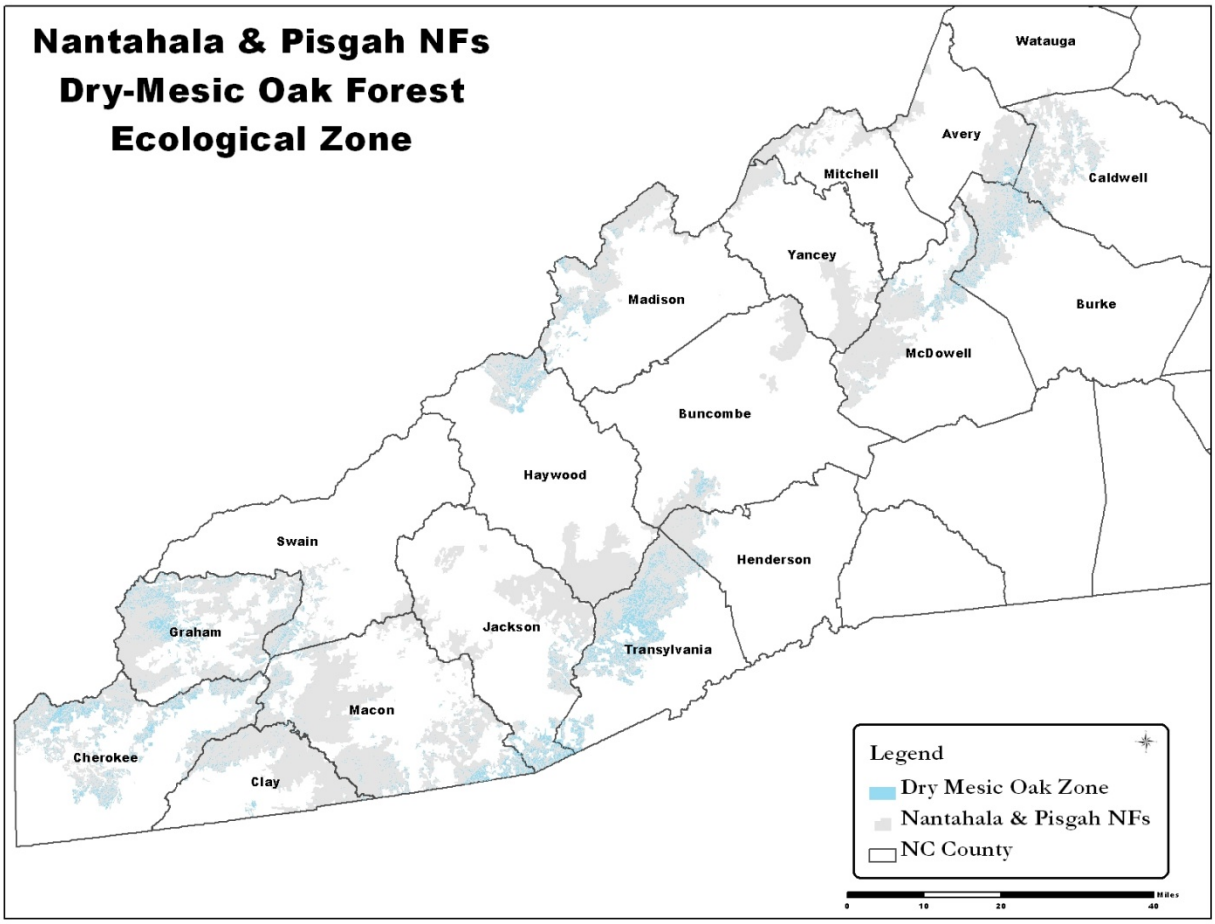
Geographic Distribution: Three separate communities have been distinguished within this ecozone; low montane red oak, and two subtypes, low dry and white pine, within montane oak-hickory forest. In total distribution, this type has a broad range, widely distributed over the Southern Blue Ridge, the Blue Ridge/Piedmont transition, and the higher ridges of the Cumberland Mountains and Ridge and Valley in southwest Virginia (Natureserve 2013). The ecozone covers approximately 105,300 acres, roughly 10% of the Nantahala and Pisgah NFs. On non-Forest Service lands in the surrounding 18-county area, the distribution is similar. It is more common in the Blue Ridge Escarpment and low elevation forests in Cherokee, Graham, Haywood, and Madison Counties. The white pine subtype for this zone is much more common across the Nantahala and Pisgah NFs as well as for those other lands within the surrounding 18-

county area. The white pine subtype for this zone is ranked G3G4, while the low dry is considered more vulnerable, ranked globally as G2G3 (Natureserve 2013). In comparison, the low montane red oak forest is globally ranked as G4, apparently being more common outside of North Carolina.

Composition: This ecozone is dominated by white oak (*Quercus alba*), mockernut hickory (*Carya tomemtosa*), red oak (*Quercus rubra*), southern red oak (*Quercus falcata*), scarlet oak (Quercus coccinea), and black oak (Quercus velutina), with varying amounts of red maple (*Acer rubrum*). Red oak dominates in low montane, white pine in its subtype, and scarlet oak and southern red oak in the low dry subtype.A heath shrub layer is often present, in particular bear huckleberry (*Gaylussacia ursina*), sweet-shrub (*Calycanthus floridus*), mountain laurel, or white laurel for either the montane red oak or the white pine subtype. Low bush blueberry (*Vaccinium pallidum*) and flame azalea (*Rhododendron calendulaceum*) are often present in the low dry subtype. More than half of the forests in this ecozone have a shrub density higher than 53% cover.

Herb diversity is highly variable across the three subtypes and dependent on the shrub density. Typically, diversity is low to moderate, but can be relatively high. Vascular plant counts within the community vary from a low of 33, to a high of 103 (Ulrey 1999). Fern diversity can be high within the ecozone. On the low dry subtype, grasses such as little bluestem, Indian grass (*Sorghastrum nutans*), and needle grass (*Piptochaetium avenaceum*), can be abundant if maintained with frequent fire.

Figure 5. Distribution of Dry –Mesic Ecological Zone across the Nantahala and Pisgah National Forests.



Federally Listed Species: Relatively few rare species occur within the ecozone. In the mesic oak zone, the rarest plant is the small whorled pogonia (*Isotria medeloides*). It is uncertain if the dry-mesic oak zone provides optimal habitat for this rare orchid since it seems to be more influenced by past land use history and abundance of orchid associates.

Other Rare Species: The most restricted plant species that occurs within this ecological zone is Arnot bristly locust (*R. hispida* var. *fertilis*). This shrub is endemic to about 10 counties in western NC and eastern Tennessee (Isley 1990, Weakley 2012). Little information is known about its current abundance because some of the occurrences are historical; others occur in denser forest and are not easily discernible since the species blooms more profusely in more open habitats. Other rare plant species include one liverwort, three shrubs, and eight herbs. Of these rare plant species, nine are known to bloom more profusely within gaps or open forest, or have been located within the zone along roadside edges. The remaining five species typically occur under shaded closed canopy conditions.

Invasive Plant Species: Compared to other ecozones, dry-mesic oak forest is moderate in susceptibly to non-native plant species infestations.While not as infested as open understory

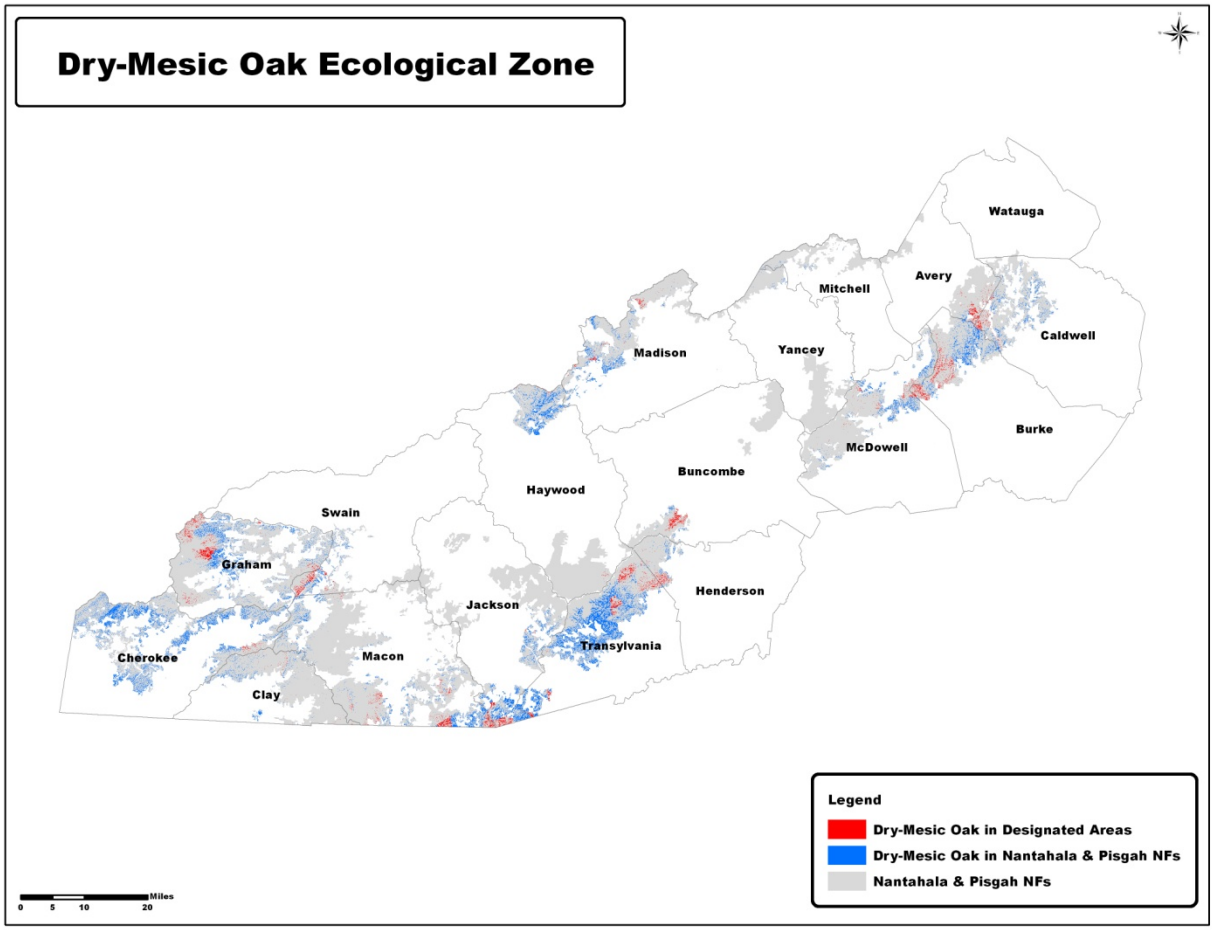
mesic forests, up to eight targeted non-native invasive plants have been located within the zone. In general, the spread of infestation is not as great as within rich cove forest, but large occurrences of Chinese silvergrass have been recorded.

Disturbance Dynamics: American chestnut occurred throughout this ecozone and its loss has influenced the present dominance of canopy species as well as influenced the spread of aggressive mesic species such as white pine and red maple. Gap-phase regeneration is the greatest influence on the canopy, creating small gaps while occasional ice storms or extreme wind events can result in larger canopy openings. Fire suppression during the last 50-70 years has resulted in a canopy of more even-aged structure, and the dominance of more mesic midstory and canopy species, in particular white pine across the Blue Ridge Escarpment. While the white pine subtype is the dominate forest in this ecological zone, it is uncertain what the natural occurrence of white pine was given the long history of fire suppression in the 1900's (Natureserve 2013, Schafale 2012). Pre-settlement forests suggest a fire return interval of low intensity fires every 10-15 years, and occasional more intense fires which would help to maintain and regenerate fire tolerant oaks (Landfire 2011). As previously mentioned for the mesic oak ecozone, fire would help to regenerate oak and allow the saplings to move into the overstory gaps. More than half of the dry-mesic oak ecozone has greater than 50% shrub cover, which is likely a consequence of fire suppression.Within the last seven years, a little more than 5% of this ecozone has had a prescribed burn conducted.

Connectiveness: This ecozone can occur upslope of either rich cove or acidic cove forest or mesic oak-hickory forest. On drier slopes, it can grade to dry oak forest or pine-oak forests, and can grade to high elevation red oak forest at upper elevations. Larger outcrops, such as low elevation or high elevation granitic domes, are often surrounded by dry-mesic oak forests. Patch sizes of this habitat are variable, from a few acres on steep narrow ridges to more than 50 acres on dry west or south-facing slopes. This ecozone is not limited across the Nantahala and Pisgah NFs, however, high quality fire-maintained habitat is patchy. As a result, fire-loving species that occur within this type can be widely dispersed or only occur in very small population sizes.

Designated Areas: A little less than 16% of dry-mesic oak ecological zone is currently within existing designated areas (Figure 6). Those acres within designated areas are present across both forests although very sparse on the Tusquitee and Appalachian Ranger Districts.

Figure 6. Distribution of the Dry-Mesic Oak Ecological Zone within existing designated areas across the Nantahala and Pisgah National Forests.



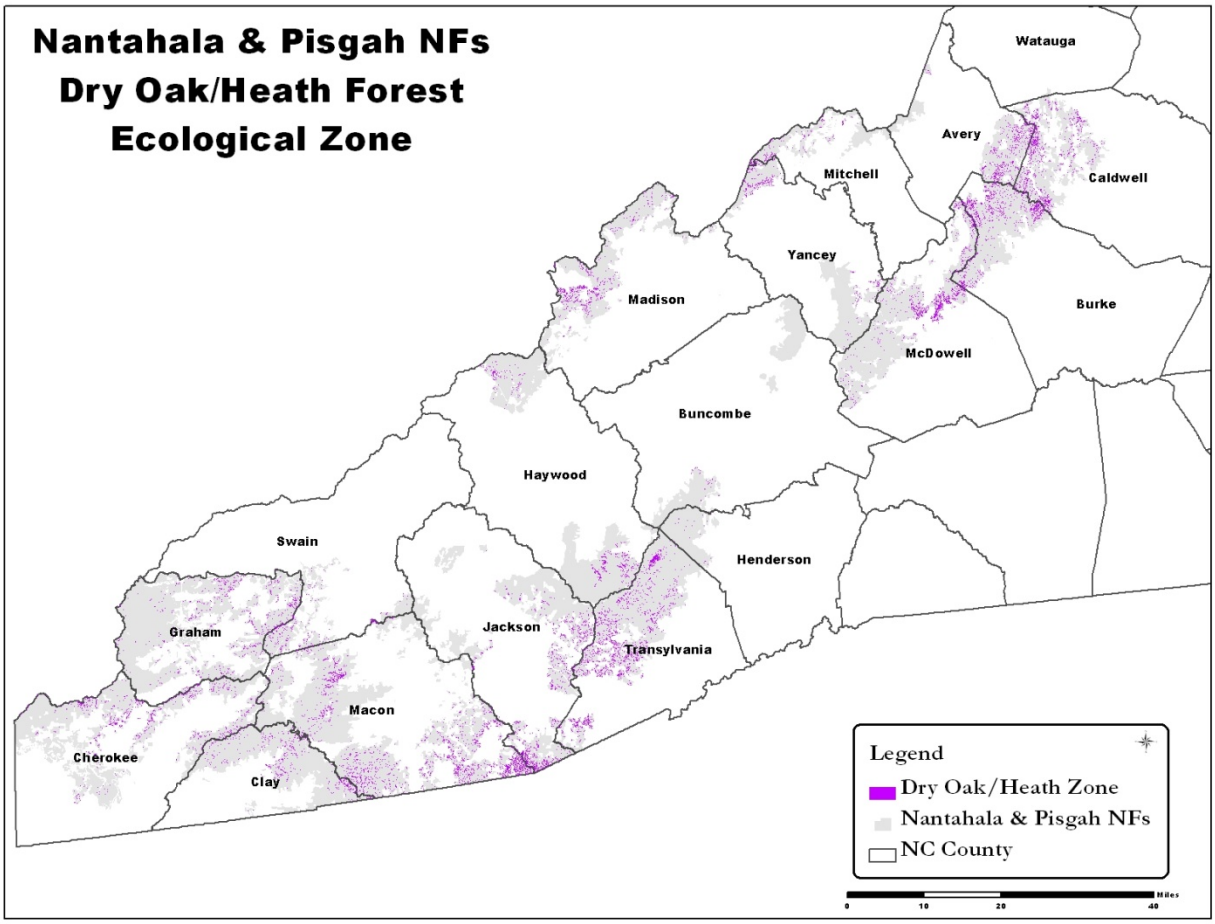
Dry Oak Ecological Zone

Environmental Setting: This zone occurs on plateaus, ridges, and steep slopes from low to mid elevations (1,000-4,000 feet) (Natureserve 2013). It occurs on rocky, acidic, infertile upland soils with low levels of calcium, magnesium, and total base saturation, along with moderately high iron and aluminum (Fleming and Patterson 2009). In general, the types occur on partially exposed landforms that are convex in shape (Simon 2012). Moisture content is the most limiting out of all the oak types. Winds, ice storms, and fire are all important natural disturbance events influencing this ecozone.

Geographic Distribution: Three chestnut oak subtypes have been identified within this ecozone, dry heath, herb, and white pine. In total distribution, this ecozone has a broad range, from West Virginia and Kentucky, south to Georgia and South Carolina, distributed over the Southern Blue Ridge, the Blue Ridge/Piedmont transition, the Cumberland Mountains, and the Ridge and Valley (Natureserve 2013). Across the Nantahala and Pisgah NFs, the ecozone covers about 60,000 acres, (approximately 6% of the Forest) (Figure 7). It is relatively evenly distributed across both forests, with greater abundance within the Grandfather Ranger District and along the Blue Ridge Escarpment in Jackson and Macon Counties. Within non-Forest Service lands in the surrounding 18-county area, the distribution is similar. The dry heath subtype for this ecozone is more common across the Nantahala and Pisgah NFs as well as for non-Forest Service lands in the surrounding 18-county area. This subtype is considered globally secure with a rank of G5. The herb subtype is less common in the planning area than the dry heath, but is abundant across its range, globally ranked as G4G5. The white pine subtype is the least common of the three and is ranked globally as G3 (Natureserve 2013).

Composition: This ecozone is dominated by chestnut oak and scarlet oak with varying amounts of black oak, white oak, red maple, mockernut hickory, pignut hickory, blackgum, Virginia pine (*Pinus virginiana*), and shortleaf pine (Schafale and Weakley 1990, Simon 2011). White pine is common in the white pine subtype and may be tied to the long absence of fire (Landfire 2009, Natureserve 2013). Ericaceous shrubs dominate white pine subtype, including bear huckleberry (*Gaylussacia ursina*), black huckleberry (*G. baccata*), hillside blueberry (*Vaccinium pallidum*) and mountain laurel (*Kalmia latifolia*). Herbaceous diversity is relatively sparse across the dry heath and white pine subtypes with cow-wheat (*Melampyrum lineare*), various Dichanthelium species, yellow stargrass (*Hypoxis hisutus*), trailing arbutus (*Epigaea repens*), spotted wintergreen (*Chimaphilia maculata*), Carolina lily (*Lilium michauxii*), wild indigo (*Baptisia tinctoria*) and bellwort (*Uvularia puberula*) most prevalent. Within the herb subtype, shrub density is typically less than 20% cover and consists of short shrubs such as low-bush blueberry or maple-leaf Viburnum (*Viburnum acerifolium*). Herb diversity within this subtype is moderate and more similar to dry-mesic oak types. Species richness varies across the zone from a low of 28 to over 65 species (Ulrey 1999).

Figure 7. Distribution of Dry Oak Ecological Zone across the Nantahala and Pisgah National Forests.



Federally Listed & Species and other rare species:
Few rare plant species have been documented within this ecozone on the Nantahala and Pisgah NFs. None are federally listed although one rock outcrop species, Heller's blazing-star (*Liatris helleri*), is often surrounded by this habitat. The rarest plant is worthy shield lichen (*Canoparmelia amabalis*). Two populations of this species occur within the Pisgah NF. Four other rare species occur within this habitat, including one shrub and three herbs. All five of these species are found in open woods and are adapted to fire-maintained habitat.

Invasive Plant Species: In comparison to other oak ecozones, dry oak forest is the least susceptible to non-native plant species infestations. The greatest threat from invasive plants to this ecozone occurs in areas where a high-intensity, high-severity wildfire has completely consumed the duff layer and removed the overstory canopy. Within these sites, princess tree (*Paulownia tomentosa*), tree-of-heaven (*Ailanthus altissima*), butterfly bush (*Buddleja davidii*), Chinese silvergrass (*Miscanthus sinensis*), and spotted knapweed (*Centaurea biebersteinii*) have rapidly invaded (Kuppinger and White 2007). In sites with less severe wildfires within this zone, the spread of invasive non-native species has not occurred.

Disturbance Dynamics: American chestnut occurred throughout this ecozone and its loss has influenced the present dominance of canopy species as well as influenced the spread of aggressive mesic species such as white pine and red maple. Gap-phase regeneration has the greatest influence on the canopy, creating small gaps while, occasional ice storms or extreme wind events can result in larger canopy openings. Fire suppression during the last 50-70 years has resulted in changes to the canopy resulting in a more even-aged structure and the dominance of more mesic midstory and canopy species, in particular white pine across the Blue Ridge Escarpment. As with the dry-mesic white pine subtype, it is uncertain what the natural occurrence of white pine was given the long history of fire suppression in the 1900's (Natureserve 2013, Schafale 2012). Pre-settlement forests suggest a fire return interval with the predominance of low intensity fires every 7-10 years, and occasional more intense fires would help to maintain and regenerate the fire tolerant oaks (Landfire 2011). The dry oak zone would have less competition from mesic species in comparison to other oak zones and may more easily regenerate oaks in the absence of fire. More than half of the dry oak zone has greater than 50% shrub cover, which is likely a consequence from a lack of recurrent burns. Within the last seven years, a little less than 4.5% of this ecozone has had a prescribed burn conducted.

Connectiveness: This ecozone typically occurs upslope of dry-mesic oak forest and occasionally mesic oak forest and can grade to high elevation red oak forest in upper elevations. Rock outcrop communities, including low and high elevation granitic domes, rocky summits, and glades are often found adjacent to this zone. Carolina hemlock bluffs may be found embedded within the zone. Patch sizes are variable, from a few acres on steep narrow ridges to more than 50 acres on dry west or south-facing slopes. This ecozone is not limited across the Nantahala and Pisgah NFs; however, high quality fire-maintained habitat is patchy.
It is uncertain the role of fire suppression and the abundance of this zone as well as the pine-oak/heath zone. In the absence of fire, pines may drop out of pine-oak/heath forests. As such, the forest resembles dry oak forest. Fire-loving species that occur within this type can be widely dispersed or only occur in very small populations.

Designated Areas: A little less than 25% of the dry oak ecological zone is currently within existing designated areas (Figure 8). Those acres within the designated areas are present across both forests although very sparse within the Cheoah, Tusquitee and Appalachian Ranger Districts.

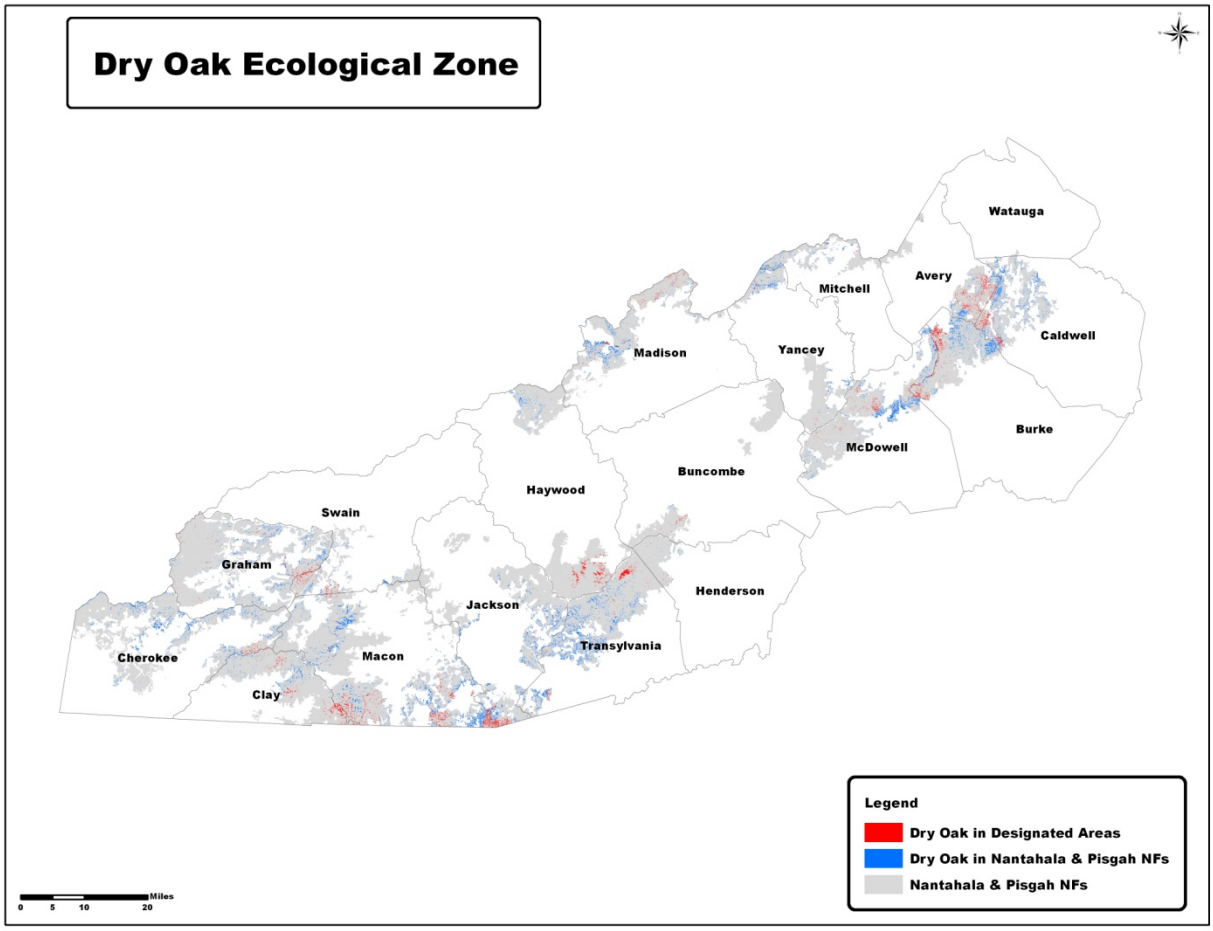



Figure 8. Distribution of the Dry Oak Ecological Zone within existing designated areas across the Nantahala and Pisgah National Forests