Vegetation Classification of Great Smoky Mountains National Park



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Electronic files have been provided to the National Park Service in addition to hard copies. Current information on all communities described here can be found on NatureServe Explorer at www.natureserve.org/explorer.

Cover photo: View from Charlie's Bunion area. Photo courtesy of Milo Pyne.

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VEGETATION SAMPLING AND CLASSIFICATION

INTRODUCTION

The following document summarizes the vegetation classification system developed for Great Smoky Mountains National Park through field work and analysis performed by ecologists from NatureServe (formerly part of The Nature Conservancy). Our effort combined earlier work performed in the Cades Cove and Mount Le Conte quadrangles by Nature Conservancy scientists during the pilot project in 1997-1999 with follow up work perfomed by NatureServe ecologists starting in 2000. The report draws from the International Classification of Ecological Communities (ICEC), a system developed by ecologists from NatureServe and The Nature Conservancy to describe, classify, and rank specific ecological community types. In this report, we describe sampling strategies, field methods, and data analysis, present the final vegetation classification for Great Smoky Mountains National Park, include a field key to the vegetation types, and list all photos taken of ecological communities at the park. As a supplement to this report we provide the raw plot data, digital images of all plot photos taken, and the originals of all data sheets. More information on the ICEC and its development and uses can be found in published sources (Grossman et al. 1998, Maybury 1999) or online at http://www.natureserve.org.

METHODS

The classification approach

Organizations such as NatureServe and The Nature Conservancy have been using a conservation approach called the "coarse filter/fine filter" to preserve biological diversity (Jenkins 1976, Hunter 1991). This approach involves the identification and protection of the best examples of all ecological communities (coarse filter) as well as rare species (fine filter). The International Classification of Ecological Communities (ICEC) was developed to address the "coarse" part of the "coarse filter/fine filter" approach to conservation. This project relies on work completed by a host of ecologists over the past few decades in developing and maintaining the ICEC. Identifying and protecting representative examples of highly ranked ecological communities assures the conservation and maintenance of biotic interactions and ecological processes, in addition to conservation of most species. Of course, many rare species fall through this filter, and so the fine filter approach is especially important as a tool to conserve rare species that may not be "caught" by the coarse filter.

Regional ecologists compiled regional classifications of ecological communities for specific sections of the United States, then worked together to fuse these classifications into a single system. Synthesis of the four regional classifications into a U.S. National Vegetation Classification was completed and the first iteration of that classification was published in the mid-1990s (Anderson et al. 1998).

There are a number of basic ideas that underlie the ICEC's terrestrial vegetation classification. First of all, the ICEC is based mostly on vegetation rather than soils or other non-biological features. The creators of this system recognized that there is a broad, complex continuum of vegetation types. The ICEC presents a practical set of methods to allow consistency in dealing with the description, modeling, and conservation of the diversity within this continuum. Second, the ICEC applies to all terrestrial vegetation, including wetland vegetation with rooted vascular plants. Third, the ICEC focuses on existing vegetation rather than natural vegetation. In addition, the ICEC emphasizes types that are natural or near-natural. The descriptions for heavily human modified community types are not very lengthy due to our focus on communities of conservation significance.

The Hierarchy

System level

The top division of the classification hierarchy separates vegetated communities (Terrestrial System) from those of unvegetated deepwater habitats (Aquatic System) and unvegetated subterranean habitats (Subterranean System). The Terrestrial System is broadly defined to include areas with rooted submerged vegetation of lakes, ponds, rivers, and marine shorelines, as well as the vegetation of uplands.

The hierarchy for the Terrestrial System has seven levels: the five highest (coarsest) levels are physiognomic and the two lowest (finest) levels are floristic. The levels of the terrestrial classification system are listed and described below.

Physiognomic levels

The physiognomic portion of the ICEC hierarchy is a modification of the UNESCO world physiognomic classification of vegetation (1973) and incorporates some of the revisions made by Driscoll et al. (1984) for the United States.

Formation class

The physiognomic class is based on the structure of the vegetation as defined by the type, height, and relative percentage of cover of the dominant, uppermost life-forms. There are seven mutually exclusive classes:

Forest:	Trees with their crowns overlapping (generally forming 60% - 100% cover).
Woodland:	Open stands of trees with crowns not usually touching (generally forming 25% - 60% cover).

Shrubland: Shrubs generally greater than 0.5 meter tall with individuals or clumps overlapping to not touching (generally forming greater than 25% cover, with trees generally less than 25% cover). Vegetation dominated by woody vines is generally treated in this class.

Dwarf-shrubland: Low-growing shrubs, usually less than 0.5 meter tall. Individuals or clumps overlapping to not touching (generally forming greater than 25% cover; with trees and tall shrubs generally less than 25% cover).

Herbaceous: Herbaceous plants dominant (generally forming at least 25% cover, with trees, shrubs, and dwarf-shrubs generally with less than 25% cover).

Nonvascular: Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming at least 25% cover).

Sparse Vegetation: Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 25%).

Formation subclass

The physiognomic subclass is determined by the predominant leaf phenology of the forest, woodland, shrubland and dwarf-shrubland classes. Subclass is determined by the persistence (perennial or annual) and growth form (graminoid, forb, hydromorphic) of the vegetation for the herbaceous vegetation class. The relative dominance of lichens, mosses, or algae is the determining factor in the nonvascular class, and particle size of the substrate is the determining factor for the sparse vegetation class Examples include: Evergreen Forest, Deciduous Forest, Deciduous Shrubland, Perennial Graminoid Vegetation, Annual Graminoid or Forb Vegetation, Lichen Vegetation, and Consolidated Rock Sparse Vegetation.

Formation group

The group generally represents vegetation units defined based on leaf characters, such as broad-leaf, needle-leaf, microphyllous, and xeromorphic. These units are identified and named with broadly defined macroclimatic types to provide a structural-geographic orientation, but the ecological climate terms do not define the groups *per se*. Examples include temperate or subpolar needle-leaved evergreen forest, cold-deciduous forest, cold-deciduous shrubland, temperate or subpolar grassland, and sparsely vegetated cliffs.

Formation subgroup

The subgroup (or formation subgroup) represents a distinction between planted/cultivated vegetation and natural/semi-natural vegetation. The latter is broadly defined to include all vegetation not actively planted or maintained through intensive management activities by humans. Examples of subgroups include: Natural temperate and subpolar needle-leaved evergreen forest; Cultural temperate and subpolar needle-leaved evergreen forest (e.g., pine and spruce plantations).

Formation

The formation represents a grouping of community types that share a definite physiognomy or structure and broadly defined environmental factors, such as elevation and hydrologic regime. Structural factors such as crown shape and lifeform of the dominant lower stratum are used in addition to the physiognomic characters already specified at the higher levels. The hydrologic regime modifiers were adapted from Cowardin et al. (1979). Examples include rounded-crowned temperate or subpolar needle-leaved evergreen forest, seasonally flooded cold-deciduous forest, semipermanently flooded cold-deciduous shrubland, tall sod temperate grassland, and cliffs with sparse vascular vegetation.

Floristic levels

Alliance

The alliance is a physiognomically uniform group of plant associations (see association below) sharing one or more dominant or diagnostic species, which as a rule are found in the uppermost strata of the vegetation (see Mueller-Dombois and Ellenberg 1974). Dominant species are often emphasized in the absence of detailed floristic information (such as quantitative plot data), whereas diagnostic species (including characteristic species, dominant differential, and other species groupings based on constancy) are used where detailed floristic data are available (Moravec 1993).

For forested communities, the alliance is roughly equivalent to the "cover type" of the Society of American Foresters (Eyre 1980), developed for use primarily by foresters to describe the forest types of North America. The alliance may be finer in detail than a cover type when the dominant tree species extend over large geographic areas and varied environmental conditions (e.g. the *Pinus ponderosa* Forest Alliance, *Pinus ponderosa* Woodland Alliance, and *Pinus ponderosa* Temporarily Flooded Woodland Alliance are all within the *Pinus ponderosa* Cover Type of the SAF). Alliances have also been developed for non-forested vegetation.

The alliance is similar in concept to the "*series*," as developed for the Habitat Type System to group habitat types that share the same dominant species under "climax" conditions (Daubenmire 1952, Pfister and Arno 1980). Alliances, however, are described by the dominant or diagnostic species for *all* existing vegetation types, whereas series are generally restricted to potential "climax" types and are described by the primary dominant species.

Association

The association is the lowest level, as well as the basic unit for vegetation classification, in the ICEC. The association is defined as "a plant community of definite floristic composition, uniform habitat conditions, and uniform physiognomy" (see Flahault and Schroter 1910 in Moravec 1993). This basic concept has been used by most of the schools of floristic classification (Whittaker 1962, Braun-Blanquet 1965, Westhoff and van der Maarel 1973, Moravec 1993).

The plant association is differentiated from the alliance level by additional plant species, found in any stratum, which indicate finer scale environmental patterns and disturbance regimes. This level is derived from analyzing complete floristic composition of the vegetation unit when plot data are available. In the absence of a complete data set, approximation of this level is reached by using available information on the dominant species or environmental modifiers, and their hypothesized indicator species.

Nomenclature for Alliances and Associations

Alliances are named for constant dominants, codominants, or diagnostic species identified from the dominant and/or top strata of the vegetation. Associations are named with one or more species from the alliance name, and have additional species that represent dominants or indicators from any layer of the vegetation. Species occurring in the same stratum are separated by a hyphen (-); those occurring in different strata are separated by a forward slash (/). Parentheses around one or more species in a name indicate that the species may or may not occur within all associations in the alliance, or an all occurrences (stands) of the association are placed within parentheses.

Vascular plant species nomenclature in the alliance names follows the nationally standardized list, Kartesz (1994), with very few exceptions. Nomenclature for nonvascular plants follows Anderson (1990), Anderson et al. (1990), Egan (1987, 1989, 1990), and Stotler and Crandall-Stotler (1977).

Ecological groups

Ecological groups are separate from the "standard" ICEC hierarchy. They are aggregations of associations that are being developed by ecologists in the different NatureServe regions. Also known as ecological systems, these aggregations are "mid-scale" units—there are about 225 in 25 southeastern and midwestern states as compared to about 800 alliances and 2000 associations in the same area. Each is unified by similar ecological conditions and processes (e.g., fire, riverine flooding), underlying environmental features (e.g., shallow soils, serpentine geology), and/or environmental gradients (e.g., elevation). Their distributions are bounded by broad biogeographic provinces. For example, low elevation riparian forests of the desert Southwestern United States, the Great Plains, the Southeastern Coastal Plain, and the Chaco would each constitute a different ecological group.

The groups are intended as landscape-scale conservation planning tools and as categories that will be more intuitively understandable and will facilitate communication. They can also be used to develop viability and ranking criteria in a more efficient way. Separate groups have been developed for the midwestern, southeastern, and eastern NatureServe regions. However, eventually, the groups will be crosswalked among NatureServe regions to achieve a single, non-duplicative set.

Conservation status ranking

Associations are given a conservation status rank based on factors such as present geographic extent, threats, number of distinct occurrences, degree of decline from historic extent, and degree of alteration of natural processes affecting the dynamics, composition, or function of the type. Ranks are customarily assigned by the various members of the Natural Heritage programs and the regional offices of NatureServe based on the best available data.

Associations are ranked on a global (G) scale of 1 to 5, with 1 indicating critical imperilment and 5 indicating little or no risk of extirpation or elimination. For example, a rank of G1 indicates critical imperilment on a rangewide basis, i.e., a great risk of "extinction" of the type worldwide; S1 indicates critical imperilment in the specific state, province, or other subnational unit, i.e., a great risk of extirpation of the type from the subnation.

Special attention is generally given to taxa of high endangerment, as opportunities for their conservation may be limited in space and time. However, occurrences of relatively secure communities can also be of critical conservation importance. In eastern North America, for example, a large tract of a common forest type in pristine condition that occurs in an intact landscape and with relatively intact ecological processes would be of high priority for conservation. Though the type itself is common, the opportunity to conserve such a high quality example may be very limited.

Global conservation status ranks for natural/near-natural communities are defined as follows:

GX **ELIMINATED** throughout its range, with no restoration potential due to extinction of dominant or characteristic species.

GH **PRESUMED ELIMINATED (HISTORIC)** throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration (e.g., *Castanea dentata* Forest).

G1 **CRITICALLY IMPERILED** Generally 5 or fewer occurrences and/or very few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).

G2 **IMPERILED** Generally 6-20 occurrences and/or few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).

G3 **VULNERABLE** Generally 21-100 occurrences. Either very rare and local throughout its range or found locally, even abundantly, within a restricted range or vulnerable to elimination throughout its range due to specific factors.

G4 **APPARENTLY SECURE** Uncommon, but not rare (although it may be quite rare in parts of its range, especially at the periphery). Apparently not vulnerable in most of its range.

G5 **SECURE** Common, widespread, and abundant (though it may be quite rare in parts of its range, especially at the periphery). Not vulnerable in most of its range.

GU **UNRANKABLE** Status cannot be determined at this time.

G? **UNRANKED** Status has not yet been assessed**.**

Modifiers and Rank Ranges

? A question mark added to a rank expresses an uncertainty about the rank in the range of 1 either way on the 1-5 scale. For example a G2? rank indicates that the rank is thought to be a G2, but could be a G1 or a G3.

G#G# Greater uncertainty about a rank is expressed by indicating the full range of ranks which may be appropriate. For example, a G1G3 rank indicates the rank could be a G1, G2, or a G3.

Q A"Q" added to a rank denotes questionable taxonomy. It modifies the degree of imperilment and is *only* used in cases where the type would have a *less imperiled* rank if it were not recognized as a valid type (i.e., if it were combined with a more common type). A GUQ rank often indicates that the type is unrankable *because of* daunting taxonomic/definitional questions.

GD **RUDERAL** Vegetation resulting from succession following anthropogenic disturbance of an area. Generally characterized by unnatural combinations of species (primarily native species, though often containing slight to substantial numbers and amounts of species alien to the region as well).

GM **MODIFIED/MANAGED** Vegetation resulting from the management or modification of natural/near natural vegetation, but producing a structural and floristic combination not clearly known to have a natural analogue.

GW **INVASIVE** Vegetation dominated by invasive alien species; the vegetation is spontaneous, self-perpetuating, and is not the (immediate) result of planting, cultivation, or human maintenance.

GC **PLANTED/CULTIVATED** Areas dominated by vegetation that has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation.

Sampling strategy for the pilot project (1997-1999)

This project occurred in two distinct phases. The first phase consisted of the pilot project (1997-1999). The second phase consisted of the final mapping work performed from 2000 to 2003. To avoid confusion in this document, we will generally refer to the first phase as the "pilot project".

Ecologists from The Nature Conservancy sampled ecological communities in the Cades Cove and Mount Le Conte quadrangles over the summers of 1997 and 1998. Field workers sampled plots prior to the acquisition and interpretation of final aerial photography, so sampling locations were targeted by means other than photosignatures. The sampling strategy for the first field season targeted major vegetation types with high variation and in need of further conceptual resolution (approximately 40 samples) or vegetation that the photointerpreters anticipated would be problematic in future signature delineation (about 20 of the plot samples). During the second field season, sampling objectives for the remaining 160 plot samples focused on associations or ecological groups in need of further documentation, undersampled geographic areas, and polygons

identified by the photointerpreters. For each association known to be on the pilot quadrangles, ecologists determined numbers of additional samples needed to properly document the communities and from which quadrangles those samples should come. Ecologists identified associations that were probable but not yet documented on the two pilot quadrangles and directed teams to areas where these associations were likely to occur. Ecologists also directed the field crews to sample five geographic areas that were undersampled in the previous field season and undersampled by historic sampling efforts. In addition, the photointerpreters identified 36 polygons on each pilot quadrangle that were in need of verification or characterization. While in the field, the teams collected plot samples at these polygons if the vegetation represented a type needing additional documentation for classification or a type not yet described in the classification.

Sampling strategy for the current project (2000-2003)

After the pilot project was completed, ecologists from NatureServe were asked to complete the vegetation sampling for the remainder of the park. In the first field season, NatureServe staff worked closely with photointerpreters from the Center for Remote Sensing and Mapping Science at the University of Georgia to identify polygons with unique signatures and place plots in those to determine their community type (25 plots). In the second season (2001), field workers met with photointerpreters in the field and again placed plots in areas with unique signatures that were problematic and difficult to reconcile with the past classification (17 plots). In 2002, ecologists placed some plots in areas with unique signatures as identified by the photointerpreters (11 plots) but also searched areas of the park with unique features to attempt to document any communities that may have not yet been seen in the park (52 plots). In 2002, teams also attempted to photograph any communities not previously photodocumented within the park. Including images that NPS already possesses, we now have digital images of over 75% of the associations found or potentially found in the park.

Data collection and field methods

Field workers collected vegetation samples in homogeneous stands of vegetation targeted by the sampling objectives. Sample plots were typically 20 X 50 meters (0.1 hectare). Where the spatial extent of homogeneous vegetation or topography could not accommodate a 0.1 ha plot, we sometimes made the plots smaller. When practical, we georeferenced each vegetation sample using a Global Positioning System (GPS). If a GPS unit was not available or a satellite reading could not be obtained, we derived UTM coordinates from the estimated position on a topographic quadrangle map. In cases where the community was of significance, we marked the sample plot's center point with PVC pipe or iron reinforcement bar and a numbered aluminum tag. In addition, we recorded the distance and bearing from the plot center to a tagged witness tree and written directions for relocating the sample plots.

Field workers in both phases of the project collected environmental data, site information, and data on vegetation structure and composition according to the standards outlined in *Field methods for vegetation mapping: USGS BRD/NPS Vegetation Mapping Program (*TNC and ESRI 1994). We estimated total coverage for each species (vertical projection onto the ground) visually, and recorded within ten cover classes: **1** (trace), **2** (0-1%), **3** (1-2%), **4** (2-5%), **5** (5-10%), **6** (10-25%), **7** (25-50%), **8** (50-75%), **9** (75-95%), and **10** (95-100%). We used the same ten cover classes to estimate species coverage by stratum. Additional vegetation information collected included the height and coverage of each stratum, the leaf type and leaf phenology of the dominant stratum, and the physiognomic class represented by the stand. The plot survey form used to collect quantitative vegetation samples is provided in Appendix I.

In the pilot project, field workers visited a total of 72 areas identified by the photointerpreters. We collected a standard vegetation sample if the polygon represented vegetation targeted by the sampling objectives. Otherwise, we made notes to describe the vegetation and environmental variation within the polygon and how the actual vegetation compared to what the photointerpreters inferred from air photos. Data entry specialists entered all field data for 223 vegetation samples into a PLOTS database (a Microsoft Access database developed for the NBS/NPS Vegetation Mapping Program).

In the second phase of the project, we took data just as with the pilot project, but we also collected some data based on "quickplots" in which we only took data on the dominant species in addition to selected environmental data (Appendix I). This allowed us to check on areas where the signatures were unique while also reserving time to collect more intensive plot data in the highest priority communities. In the second phase, we completed a total of 71 intensive plots and 34 quickplots (essentially observation points) for a total of 105 plots and points. We collected data using the same assumptions as in the first phase of the project and entered all of the intensive plot data into the PLOTS database (quickplot data were not entered into the database because those data cannot be directly compared to full plot data in a quantitative way). The PLOTS database and data were provided as a supplement to this report. The taxonomic nomenclature for this study follows Kartesz (1994).

Review and preparation of existing data

As part of an earlier task order (T.O. # 18, C.O.#1), TNC staff assessed all available vegetation data for Great Smoky Mountain National Park for compatibility with and usability in the NPS/USGS BRD Vegetation Mapping Program. The most compatible data sets were some of those collected by researchers associated with Great Smoky Mountains National Park Uplands Field Research Laboratory from 1977 to 1985 (hereafter Uplands data set). A Park Service technical report (White and Busing 1993) summarizes these studies and field methods used to collect these data. Staff from The Nature Consevancy acquired digital data for the Uplands data set from Dr. Peter S. White (University of North Carolina, Chapel Hill). In addition, they obtained digital data for an additional 32 vegetation samples representing 1996 remeasures of the historic Uplands plots from Bob Dellinger (GRSM). The Nature Conservancy team evaluated a total of

343 sample plots and eliminated 151 samples because they contained incomplete data or represented repeated measures of the same location.

In order to be compatible for quantitative analysis with the samples collected from the pilot project in 1997 and 1998, ecologists modified historic vegetation data to include a single, complete, species list for a sample plot, with a single estimate of abundance for each species, expressed as a percentage cover. We modified data from a total of 192 historic sample plots for use in quantitative analysis with the samples collected in 1997-98. Data modifications differed depending on the data set and the field measures used.

Modification of 1996 Dellinger Data

Bob Dellinger (GRSM), sampled 32 vegetation plots using methodology similar to that of the North Carolina Vegetation Survey (NCVS) (Peet et al. 1998). Dellinger subdivied each 0.1 hectare plot into 10, 10x10 meter modules, and in the corner of each, he established a set of nested plots. In four of the 10x10 m modules, referred to as "intensive modules", he estimated percentage cover using a ten point cover class scale. Dellinger modified the data to obtain a single coverage for each species by summing the midpoints of each cover class, and dividing by 4, the number of intensive modules. The species not present in the four intensive modules, but found elsewhere in the plot, were originally recorded without a coverage value. Based on experience with this type of sample plot, species outside the intensive modules usually have a low cover, therefore, he assigned these species a coverage class of 1. Nature Conservancy staff resolved plant species nomenclature to follow Kartesz (1994).

Modification of 1977 – 1979 Uplands Data

Dr. Peter White of UNC-Chapel Hill supplied data that were collected through a variety of methods and by a variety of researchers (see White and Busing 1993). Samples used to help characterize vegetation associations on the two pilot quadrangles included plots from three studies conducted by researchers at Great Smoky Mountains Uplands Field Research Laboratory from 1977 to 1979. Mark Harmon established plots in 1977 and 1978 to study to the effects of fire in the western portion of the Park (Harmon 1980; Harmon 1982; Harmon 1984; Harmon et al. 1983). Peter White and D. Kilgore established sample plots on Leadbetter and Davis Ridges (logged) and on Gregory Ridge (unlogged) to study logged and unlogged vegetation on ridges south of Cades Cove (1977-78). In 1979, Sue Bratton collected vegetation samples on the summit of Mount Le Conte to describe high elevation areas impacted by the Balsam Wooly Adelgid. Nature Conservancy staff modified the data from these studies to allow comparison with data collected as part of the mapping project. We then used the transformed, historic data in combination with the data collected in 1997-1998 to characterize vegetation types and to further explore the potential variation within vegetation types on the two pilot quadrangles.

The original Uplands data set contains diameter at breast height (DBH, cm) measurements for woody species greater than 1.0 cm diameter and percentage coverage

for shrubs and herbs, estimated from 25, 1 m^2 subplots. Nature Conservancy staff converted tree stem diameter data to a single percentage cover value for each species using regression models developed by Tom Wentworth and Chris Ulrey at North Carolina State University, Botany Department (Wentworth and Ulrey 1996; Newell 1997). The two-step regression model first relates stem diameter to crown diameter and then converts crown area to a ten point cover class scale (C. Ulrey pers. comm.). Data used to develop the model to predict tree crown area from stem diameter came from areas of the southern Blue Ridge south of the Great Smoky Mountains. During the process of transformation, researchers assumed that stem diameter to crown area relationships are similar between the different geographic areas. Nature Conservancy staff also resolved the Uplands data set to follow Kartesz 1994.

When originally sampled, the field workers estimated and marked the Uplands plot locations on topographic maps. They digitized plot locations off copies of the original quadrangle maps. They used the 192 transformed plot samples to help develop a preliminary vegetation classification for GRSM and, later, in the final characterization of associations on the two pilot quadrangles. Considering the age, low precision georeferencing, and highly transformed nature of these data, we do not recommend that they be used as primary plots for mapping purposes.

Data analysis from the pilot project (1997-1999)

In the initial quantitative analysis, we used coverage data from the 1997-98 samples combined with the 1996 Dellinger data. We considered these data of "high resolution" because they are the least modified and the most likely to represent existing vegetation conditions. We considered the modified 1977-79 Uplands data to be "low resolution" and were introduced secondarily to refine the classification developed with the high resolution data and to explore potential variation within vegetation types on the two pilot quadrangles.

In the cluster analysis, we identified groups of compositionally similar samples. We used the Bray-Curtis Dissimilarity (Bray and Curtis 1957) measure in conjuction with the Lance-Williams Flexible Beta linkage method (Lance and Williams, 1967) to achieve a hierarchical, agglomerative, polythetic clustering technique. We used PC-ORD v3.18 (McCune and Medford 1995) to implement this cluster analysis. We threw out any samples representing non-forested vegetation or spatially small ecological communities after initial exploratory analyses because they were compositional outliers and had an undesirable influence on the clustering results. We later analyzed these samples qualitatively and placed them within the National Classification framework. We further analyzed coverage data for compositionally similar groups of samples using indirect ordination techniques implemented by the program DECODA v3.00 (Minchin 1998). We used results from applying the ordination method Non-metric Multidimensional Scaling (global), with Bray-Curtis dissimilarity as a distance measure, to generate ordination diagrams. Ordination diagrams are useful for detecting compositional variation and trends that are otherwise obscured in cluster analysis so we used them to further examine compositional patterns within the data set.

Using the ordination diagrams, the results of the cluster analysis, and prior experience with ecological communities in the southern Blue Ridge region, we placed samples into compositionally similar groups approximating the scale of the community association. Where possible, we assigned historic samples to groups based on an additional cluster analysis (with all samples) and qualitative review. We used coverage data from samples within each group to create ordered stand tables and constancy tables that listed each species' average cover and frequency within the group. We also summarized environmental data for these groups of samples. After evaluating the compositional and environmental summaries, we placed each group either within an existing type in the National Vegetation Classification or we defined a new association from the available data.

In 2002, we classified vegetation using qualititative means, but then combined all plots with the exisiting plot data from past years and repeated the cluster analysis as outlined above. We examined the output of this analysis closely to confirm that our original placement of each plot fit within the cluster analysis "tree" and looked more closely at any plots that did not fall into the same group to which we had assigned it in the qualitative review. We then attempted to reclassify plots that were anomalies within the cluster analysis "tree" so that the qualitative and quantitative analyses corresponded to one another as closely as possible.

RESULTS AND SUMMARY

Broad ecological types (Ecogroups)

The classification is the result of literature review, expert interview, and analysis of over 500 vegetation samples from Great Smoky Mountains National park. The project began with a focus on the Cades Cove and Mount Le Conte quadrangles. From the original report, we worked to create a classification that would cover the entire park. On a very crude level, it is possible to split the park into nine easily mappable broad categories and further into 30 "ecogroups". These ecogroups are at a much coarser scale than the alliance and association level.

HIGH ELEVATION FORESTS include spruce-fir forests, beech gap forests, high elevation oak forests, northern hardwood forests, and forested boulderfields and are generally found at elevations above 4500 feet (though a few examples of these types may occur down to 3000 feet in elevation). Spruce- fir forests are dominated by different combinations of *Picea rubens* and *Abies fraseri* and occur from the very highest elevations down to 4000 feet in areas with deep enough soils to sustain a forest. High elevation summit ecogroups often occur as patches within a matrix of spruce-fir forests. High elevation red oak or white oak forests occur at lower elevations on average (typically 3500-5000 feet in elevation) and most of these communities occur on ridgelines and southern exposed slopes that are drier than the areas that harbor spruce-fir types. Northern hardwood forests occur at lower elevations on averate than spruce-fir forests and at similar elevations to high elevation oak communities. However, northern

hardwood communities are often on north facing slopes, upper slopes, and gaps in more mesic locations than high elevation oak communities. Boulderfields occur in the same general areas as northern hardwood forests, but contain shallower soils with boulders scattered throughout and often occur at even lower elevations than the other high elevation forest types (down to 3000 feet in some instances).

HIGH ELEVATION SUMMITS occur at the same high elevations as high elevation forests but usually occur in areas of either very thin soil or very high disturbance. In either case, they are often seen as a patchwork of communities within the matrix of high elevation forests. Grassy balds occur at the highest elevations (always above 4500 feet and usually higher) on south facing upper slopes, peaks, and saddles in areas with either shallow soils or some type of disturbance that has created the open environment. Heath balds occur at various elevations and are created and maintained by high solar irradiation, dessicating winds, shallow, nutrient-poor soils, landslides, fires, and/or succession following logging. Rocky summits occur in areas with large amounts of exposed bedrock and/or talus or on land that has been severely disturbed by landslides or fire and is recovering from that disturbance.

LOW ELEVATION, TOPOGRAPHICALLY PROTECTED FORESTS generally occur below 4500 feet in elevation in coves, sheltered slopes, and other areas that are not as exposed to the elements. Mountain cove forests, hemlock forests, montane oak-hickory forests, and acid hardwood forests all fit in this category and can occur in various topographic positions up to and sometimes including summit vegetation on the lower elevation hills in the park. For the most part, this group is dominated by communities with hardwood canopies (especially oak) or mixes of hardwood, hemlock, and pine canopies. Cove forests occur in the most protected positions on the landscape (north facing slopes and cove formations. Montane oak-hickory, hemlock, and acid hardwood forests all occur in slightly more exposed habitats such as lower slopes and sheltered mid and upper slopes at all topographic positions.

XERIC RIDGE FORESTS range from the lowest elevations to 4000 feet or sometimes more. Pitch and Table Mountain pine woodlands, Shortleaf pine/shortleaf pine-oak woodlands and forests, white pine/ white pine-oak forests, and chestnut oak forests are all art of this category. These communities are found on exposed ridgetops and ridges (especially south facing ones) and tend to be dominated by xeric pine species or xeric oak species. Subtypes within the xeric ridge forest type can be fairly difficult to distinguish based on environmental features. Table mountain pine/pitch pine woodlands occur from 4500 feet elevation to the lowest elevations in the park on some of the most exposed xeric south facing upper slopes and ridgetops in the park. This community depends upon fire for continued maintenance. Shorleaf pine/pine-oak forests occur below 2400 feet elevation, also on exposed south and west facing upper slopes and ridges; this type also generally depends upon occasional fire to keep from succeeding into other vegetation types. White pine/ white pine-oak forests occur below 3000 feet in elevation on ridgetops and upper slopes that are relatively well protected by adjacent ridges and landforms. Fire maintains some of the community types of this group. Chestnut oak

forests occur below 3500 feet elevation and occur in a range of habitats, mostly steep mid to upper slopes and ridge tops in areas that no longer have an intact fire regime.

GLADES AND BARRENS all occur at very low elevations (usually below 2500 feet but sometimes ranging above this) and are generally in areas with very shallow soil, steep slopes, unique soils, a heavy fire regime or a combination of the all of these characteristics.

ROCK OUTCROPS exist throughout the park, but are again generally relegated to the lower elevations below 2500 feet elevation. The include dry acid cliffs, spray cliffs , moist alkaline cliffs, and dry alkaline cliffs. They exist in areas where the underlying geology is exposed as rock formations and composition is determined by the character and moisture of the rock present.

NON ALLUVIAL WETLANDS occur throughout the park at all elevations. This group depends upon unique hydrology that keeps the soil wet most all year long. Emergent ponds and marshes include vegetation of ephemeral or permanent shallow ponds and edges of ponds and slow creeks. Sphagnum and shrub bogs and acid seeps may occur as small patches at all elevations within the park and are generally located on relatively flat open boggy/seepy locations. In contrast, forested seeps are generally located in more topographically complex habitats, often occurring along a slope with a steady water supply. Upland pools are very rare in the park but occur at low elevations in areas where there are broad sections of flat land adjacent to a creek that regularly floods.

ALLUVIAL WETLANDS occur along and in medium to large size rivers. Most of these communities exist at the lowest elevations in the park since these elevations are the only ones that contain creeks and rivers of the appropriate size to develop these community types. River scour vegetation occur in areas where large amounts of river gravel, cobble, or mud have been exposed and colonized by shrubs and herbaceous plants. Montane alluvial forests and shrublands occur adjacent to rivers in areas with more stable soils and the gravel and sand bars. These forests are in areas only occasionally flooded but continue to be influenced by the hydrology of the adjacent creek/river. Floodplain shrublands are very rare and are areas adjacent to creeks with regular flooding.

Finally, the **CULTURAL/SUCCESSIONAL/EXOTIC/MODIFED VEGETATION** group exists in portions of the park that have been heavily altered by human intervention such as plowing , mowing, or flooding.

Alliances and Associations

The vegetation classification for Great Smoky Mountains National Park describes 79 associations, including 50 Forests, 4 Woodlands, 5 Shrublands, 1 Vine-Shrubland, 16 Herbaceous Vegetation types, and 3 Sparsely Vegetated types. The classification includes natural and semi- natural vegetation as well as vegetation dominated by (or resulting from) exotic and/or invasive species. Seventy-three (92%) of these associations

are documented by plots within the park, while the other six described types are either known to occur in the Park but have not been documented or are probable in the park but were not seen by the teams over the past five years.

Although it was impossible for us to visit every location within the 500,000 acre+ boundary, we did visit a cross section of all possible environmental and geologic types in an attempt to complete the classification and add new associations where necessary. Additional inventory and analyses may still document additional vegetation types, but we do feel that this effort has identified, located, and documented at least 90% of the vegetation communities that currently exist within the park boundary.

In section II, we provide a field key for use by researchers and managers to help them determine which association(s) they may be looking at while in the park boundary. In section III, we include descriptions of all vegetation types currently found in the park. In addition, we provide an index to these descriptions, by database code and by major ecological group. In Appendices III and IV we outline the location of plots sampled and the digital images available from the plot sampling. In addition, we have included the PLOTS database with all permanent plot information collected as an electronic file.

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Vegetation Classification of Great Smoky Mountains National Park

I Forest
I.A Evergreen forest
I.A.8 Temperate or subpolar needle-leaved evergreen forest
I.A.8.N Natural/Semi-natural
I.A.8.N.b Rounded-crowned temperate or subpolar needle-leaved evergreen forest

I.A.8.N.b.5 PINUS ECHINATA FOREST ALLIANCE (A.119)
Pinus echinata / Vaccinium (pallidum, stamineum) - Kalmia latifolia Forest (CEGL007078)

I.A.8.N.b.13 PINUS STROBUS - TSUGA CANADENSIS FOREST ALLIANCE (A.127)
Pinus strobus - Tsuga canadensis / Rhododendron maximum - Leucothoe fontanesiana Forest (CEGL007102)

I.A.8.N.b.14 PINUS STROBUS FOREST ALLIANCE (A.128)
Pinus strobus / Kalmia latifolia - (Vaccinium stamineum, Gaylussacia ursina) Forest (CEGL007100)
Pinus strobus Successional Forest (CEGL007944)

I.A.8.N.b.17 PINUS VIRGINIANA FOREST ALLIANCE (A.131)
Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum Forest (CEGL007119)
Pinus virginiana Successional Forest (CEGL002591)

I.A.8.N.c Conical-crowned temperate or subpolar needle-leaved evergreen forest

I.A.8.N.c.1 ABIES FRASERI - PICEA RUBENS FOREST ALLIANCE (A.136)
Abies fraseri / (Rhododendron catawbiense, Rhododendron carolinianum) Forest (CEGL006308)
Abies fraseri / Viburnum lantanoides / Dryopteris campyloptera - Oxalis montana / Hylocomium splendens Forest (CEGL006049)
Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum) Forest (CEGL007130)
Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens Forest (CEGL007131)

I.A.8.N.c.3 PICEA RUBENS FOREST ALLIANCE (A.138)
Picea rubens - Tsuga canadensis / Rhododendron maximum Forest (CEGL006272)

I.A.8.N.c.8 TSUGA CANADENSIS FOREST ALLIANCE (A.143)
Tsuga canadensis / Rhododendron maximum - Leucothoe fontanesiana Forest (CEGL007136)

I.B Deciduous forest
I.B.2 Cold-deciduous forest
I.B.2.N Natural/Semi-natural

I.B.2.N.a Lowland or submontane cold-deciduous forest

I.B.2.N.a.104 BETULA ALLEGHANIENSIS - FAGUS GRANDIFOLIA - AESCULUS FLAVA FOREST ALLIANCE (A.266)

Aesculus flava - Betula alleghaniensis - Acer saccharum / Acer spicatum / Caulophyllum thalictroides - Laportea canadensis Forest (CEGL004973)

Betula alleghaniensis - Fagus grandifolia - Aesculus flava / Viburnum lantanoides / Aster chlorolepis - Dryopteris intermedia Forest (CEGL007285)

Betula alleghaniensis / Acer spicatum / Hydrangea arborescens - Ribes cynosbati / Dryopteris marginalis Forest (CEGL004982)

Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum Forest (CEGL006124)

Fagus grandifolia / Ageratina altissima var. roanensis Forest (CEGL006246)

Fagus grandifolia / Carex pensylvanica - Carex brunnescens Forest (CEGL006130)

I.B.2.N.a.107 JUGLANS NIGRA FOREST ALLIANCE (A.1932)

Juglans nigra / Verbesina alternifolia Forest (CEGL007879)

I.B.2.N.a.109 ACER RUBRUM – NYSSA SYLVATICA – MAGNOLIA FRASERI FOREST ALLIANCE (A.2009)

Acer rubrum var. rubrum - Nyssa sylvatica - Magnolia fraseri - Oxydendrum arboreum / (Rhododendron maximum, Kalmia latifolia) Forest (CEGL008558)

I.B.2.N.a.23 LIRIODENDRON TULIPIFERA - TILIA AMERICANA VAR. HETEROPHYLLA - AESCULUS FLAVA - ACER SACCHARUM FOREST ALLIANCE (A.235)

Aesculus flava - Acer saccharum - (Fraxinus americana, Tilia americana) / Hydrophyllum canadense - Solidago flexicaulis Forest (CEGL007695)

Liriodendron tulipifera - Aesculus flava - (Fraxinus americana, Tilia americana var. heterophylla) / Cimicifuga racemosa - Laportea canadensis Forest (CEGL007710)

I.B.2.N.a.24 LIRIODENDRON TULIPIFERA FOREST ALLIANCE (A.236)

Liriodendron tulipifera - Acer rubrum - Robinia pseudoacacia Forest (CEGL007219)

I.B.2.N.a.27 QUERCUS ALBA - (QUERCUS RUBRA, CARYA SPP.) FOREST ALLIANCE (A.239)

Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina) Forest (CEGL007230)

Quercus alba – Quercus rubra – Carya ovata / Cercis Canadensis – Juniperus virginiana vir. Virginana Forest (CEGL007240)

Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Sanguinaria canadensis Forest (CEGL007692)]

Quercus rubra - Acer rubrum / Calycanthus floridus - Pyrularia pubera / Thelypteris noveboracensis Forest (CEGL006192)

Quercus rubra - Tilia americana var. heterophylla - Halesia tetraptera var. monticola / Collinsonia canadensis – Tradescantia subaspera Forest (CEGL007878)

I.B.2.N.a.100 QUERCUS VELUTINA – QUERCUS ALBA – (QUERCUS COCCINEA) FOREST ALLIANCE (A.1911)

Quercus alba – Quercus coccinea – Quercus falcate / Kalmia latifolia – Vaccinium pallida Forest (CEGL007691)

I.B.2.N.a.103 QUERCUS ALBA MONTANE FOREST ALLIANCE (A.271)

Quercus alba / Kalmia latifolia Forest (CEGL007295)

I.B.2.N.a.36 QUERCUS PRINUS - (QUERCUS COCCINEA, QUERCUS VELUTINA) FOREST ALLIANCE (A.248)

(Quercus prinus, Quercus coccinea) / Kalmia latifolia / Galax urceolata Forest (CEGL006271)

I.B.2.N.a.38 QUERCUS PRINUS - QUERCUS RUBRA FOREST ALLIANCE (A.250)

Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida Forest (CEGL007267)

Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata Forest (CEGL006286)

I.B.2.N.a.8 QUERCUS RUBRA MONTANE FOREST ALLIANCE (A.272)

Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata Forest (CEGL007299)

Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis) Forest (CEGL007300)

Quercus rubra / Carex pensylvanica - Ageratina altissima var. roanensis Forest (CEGL007298)

I.B.2.N.d. Temporarily flooded cold-deciduous forest

I.B.2.N.d.13 PLATANUS OCCIDENTALIS - (FRAXINUS PENNSYLVANICA, CELTIS LAEVIGATA, ACER SACCHARINUM) TEMPORARILY FLOODED FOREST ALLIANCE (A.288)

Platanus occidentalis - Fraxinus pennsylvanica – Quercus imbricaria Forest (CEGL007339)

I.B.2.N.d.14 PLATANUS OCCIDENTALIS - (LIQUIDAMBAR STYRACIFLUA, LIRIODENDRON TULIPIFERA) TEMPORARILY FLOODED FOREST ALLIANCE (A.289)

Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana Forest (CEGL004691)

Liquidambar styraciflua - Liriodendron tulipifera (Platanus occidentalis) / Carpinus caroliniana – Halesia tetraptera var. monticola / Amphicarpaea bracteata Forest (CEGL007880)

I.B.2.N.e Seasonally flooded cold-deciduous forest

I.B.2.N.e.1 ACER RUBRUM – FRAXINUS PENNSYLVANICA SEASONALLY FLOODED FOREST ALLIANCE (A.316)

Acer rubrum var. triloba – Fraxinus pennsylvanica / Carex crinita – Peltandra virginica Forest

(CEGL004420)

I.B.2.N.e.6 LIQUIDAMBAR STYRACIFLUA - (ACER RUBRUM) SEASONALLY FLOODED FOREST ALLIANCE (A.321)

Liquidambar styraciflua / Sphagnum spp. Forest (CEGL007388)

I.C Mixed evergreen-deciduous forest
I.C.3 Mixed needle-leaved evergreen - cold-deciduous forest
I.C.3.N Natural/Semi-natural
I.C.3.N.a Mixed needle-leaved evergreen - cold-deciduous forest

I.C.3.N.a.4 PICEA RUBENS - BETULA ALLEGHANIENSIS FOREST ALLIANCE (A.384)

Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense) Forest (CEGL004983)

Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata Forest (CEGL006256)

I.C.3.N.a.15 PINUS ECHINATA – QUERCUS (COCCINEA, PRINUS) FOREST ALLIANCE

Pinus echinata – Quercus (prinus, falcate) / Oxydendrum arboreum / Vaccinium pallida Forest (CEGL007493)

I.C.3.N.a.21 PINUS STROBUS - QUERCUS (ALBA, RUBRA, VELUTINA) FOREST ALLIANCE (A.401)

[Pinus strobus - Quercus alba - (Carya alba) / Gaylussacia ursina Forest (CEGL007517)]

I.C.3.N.a.22 PINUS STROBUS - QUERCUS (COCCINEA, PRINUS) FOREST ALLIANCE (A.402)

Pinus strobus - Quercus (coccinea, prinus) / (Gaylussacia ursina - Vaccinium stamineum) Forest (CEGL007519)

I.C.3.N.a.28 PINUS VIRGINIANA - QUERCUS (COCCINEA, PRINUS) FOREST ALLIANCE (A.408)

Pinus virginiana - Quercus prinus - Quercus rubra / Vaccinium pallidum - Kalmia latifolia Forest (CEGL007539)

I.C.3.N.a.32 TSUGA CANADENSIS - BETULA ALLEGHANIENSIS FOREST ALLIANCE (A.412)

Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum Forest (CEGL007861)

I.C.3.N.a.33 TSUGA CANADENSIS - LIRIODENDRON TULIPIFERA FOREST ALLIANCE (A.413)

Tsuga canadensis - Halesia tetraptera - (Fagus grandifolia, Magnolia fraseri) / Rhododendron maximum / Dryopteris intermedia Forest (CEGL007693)

Tsuga canadensis - Liriodendron tulipifera / Rhododendron maximum / Tiarella cordifolia Forest (CEGL007543)

II Woodland
II.A Evergreen woodland
II.A.4 Temperate or subpolar needle-leaved evergreen woodland
II.A.4.N Natural/Semi-natural
II.A.4.N.a Rounded-crowned temperate or subpolar needle-leaved evergreen woodland

II.A.4.N.a.17 PINUS ECHINATA WOODLAND ALLIANCE (A.515)
Pinus echinata / Schizachyrium scoparium Appalachian Woodland (CEGL003560)

II.A.4.N.a.23 PINUS PUNGENS - (PINUS RIGIDA) WOODLAND ALLIANCE (A.521)
Pinus pungens - Pinus rigida (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum Woodland (CEGL007097)

II.B Deciduous woodland
II.B.2 Cold-deciduous woodland
II.B.2.N Natural/Semi-natural
II.B.2.N.a Cold-deciduous woodland

II.B.2.N.a.4 FRAXINUS AMERICANA – CARYA GLABRA – (JUNIPERUS VIRGINIANA VAR. VIRGINIANA) WOODLAND ALLIANCE (A.604)
Carya glabra – Fraxinus americana – Quercus prinus / Ostrya virginiana / Philadelphus hirsutus Woodland (CEGL004995)

II.C Mixed evergreen – deciduous woodland
II.C.3 Mixed needle-leaved evergreen – cold-deciduous forest
II.C.3.N Natural/Semi-natural
II.C.3.N.a Mixed needle-leaved evergreen – cold-deciduous forest

II.C.3.N.a.9 PINUS (RIGIDA, PUNGENS, VIRGINIANA) – QUERCUS PRINUS WOODLAND ALLIANCE (A.677)
Pinus virginiana / Schizachyrium scoparium – Carex pensylvanica Woodland (CEGL003624)

III Shrubland
III.A Evergreen shrubland
III.A.2 Temperate broad-leaved evergreen shrubland
III.A.2.N Natural/Semi-natural
III.A.2.N.b Hemi-sclerophyllous temperate broad-leaved evergreen shrubland

III.A.2.N.b.4 RHODODENDRON (CATAWBIENSE, CAROLINIANUM) - KALMIA LATIFOLIA SHRUBLAND ALLIANCE (A.744)
Kalmia latifolia - Rhododendron catawbiense – (Gaylussacia baccata, Pieris floribunda, Vaccinium corymbosum) Shrubland (CEGL003814)
Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium Shrubland (CEGL007876)

III.A.2.N.g Temporarily flooded temperate broad-leaved evergreen shrubland

III.A.2.N.g.1 ARUNDINARIA GIGANTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.795)

Arundinaria gigantea ssp. gigantea Shrubland (CEGL003836)

III.B Deciduous shrubland
III.B.2 Cold-deciduous shrubland
III.B.2.N Natural/Semi-natural
III.B.2.N.a Temperate cold-deciduous shrubland

III.B.2.N.a.18 VITIS AESTIVALIS VINE-SHRUBLAND ALLIANCE (A.911)

Vitis aestivalis Vine-Shrubland (CEGL003890)

III.B.2.N.b Subalpine or subpolar cold-deciduous shrubland

III.B.2.N.b.2 RUBUS ALLEGHENIENSIS - RUBUS CANADENSIS SHRUBLAND ALLIANCE (A.930)

Rubus canadensis - (Rubus idaeus ssp. strigosus) / Solidago glomerata Shrubland (CEGL003893)

III.B.2.N.d Temporarily flooded cold-deciduous shrubland

III.B.2.N.d.2 ALNUS SERRULATA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.943)

Alnus serrulata - Xanthorhiza simplicissima Shrubland (CEGL003895)

III.B.2.N.g.1 ALNUS SERRULATA SATURATED SHRUBLAND (A.1014)

Alnus serrulata – Lindera benzoin / Scutellaria lateriflora – Thelypteris noveboracensis Shrubland (CEGL003909)

V.A. Annual forb vegetation
V.A.5 Temperate grassland
V.A.5.N Natural/Semi-natural
V.A.5.N.c Medium-tall sod temperate or subpolar grassland

V.A.5.N.c.8 FESTUCA SPP. HERBACEOUS ALLIANCE (A.1213)

Lolium (arundinacea, pratense) Herbaceous Vegetation (CEGL004048)

V.A.5.N.e Short sod temperate grassland

V.A.5.N.e.7 DANTHONIA COMPRESSA HERBACEOUS ALLIANCE (A.1280)

Danthonia compressa - (Sibbaldiopsis tridentata) Herbaceous Vegetation (CEGL004242)

V.A.5.N.j Temporarily flooded temperate or subpolar grassland

V.A.5.N.j.4 CAREX TORTA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1340)

Carex torta Herbaceous Vegetation (CEGL004103)

V.A.5.N.k Seasonally flooded temperate or subpolar grassland

V.A.5.N.k.14 JUNCUS EFFUSUS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1375)

Juncus effusus – Chelone glabra – Scirpus spp. Southern Blue Ridge Beaver Pond Herbaceous Vegetation (CEGL008433)

Juncus effusus Seasonally Flooded Herbaceous Vegetation (CEGL004112)

V.A.5.N.m. Saturated temperate or subpolar grassland

V.A.5.N.m.101. CAREX RUTHII – CAREX GYNANDRA SATURATED HERBACEOUS ALLIANCE (A.1898)

Carex gynandra - Platanthera clavellata - Drosera rotundifolia - Carex ruthii - Carex atlantica / Sphagnum spp. Herbaceous Vegetation (CEGL007697)

Calamagrostis cainii – Carex ruthii – Parnassia asarifolia / Sphagnum spp. Herbaceous Vegetation (CEGL007877)

V.A.5.N.m.103 Symphyotrichum puniceum – Veronica noveboracensis – Solidago (patula, rugosa) Saturated Herbaceous Alliance (A.2016)

Glyceria striata – Carex gynandra – Chelone glabra – Symphyotrichum puniceum / Sphagnum spp. Herbaceous Vegetation (CEGL008438)

V.B Perennial forb vegetation
V.B.2 Temperate or subpolar perennial forb vegetation
V.B.2.N Natural/Semi-natural
V.B.2.N.b Low temperate or subpolar perennial forb vegetation

V.B.2.N.b.10 SAXIFRAGA MICHAUXII HERBACEOUS ALLIANCE (A.1621)

Saxifraga michauxii - Carex misera - Calamagrostis cainii Herbaceous Vegetation (CEGL004278)

Saxifraga michauxii – Carex misera – Oclomena acuminata – Solidago glomerata Herbaceous Vegetation (CEGL004277)

V.B.2.N.d Temporarily flooded temperate perennial forb vegetation

V.B.2.N.d.101 EUPATORIUM SEROTINUM – DIODIA VIRGINIANA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.2017)

(Diospyros virginiana, Platanus occidentalis) / Eupatorium serotinum – Diodia virginiana Herbaceous Vegetation (CEGL003910)

V.B.2.N.f Saturated temperate perennial forb vegetation

V.B.2.N.f.7 DIPHYLLEIA CYMOSA - SAXIFRAGA MICRANTHIDIFOLIA SATURATED HERBACEOUS ALLIANCE (A.1688)

Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis Herbaceous Vegetation (CEGL004296)

V.B.2.N.f.9 IMPATIENS (CAPENSIS, PALLIDA) - MONARDA DIDYMA SATURATED HERBACEOUS ALLIANCE (A.1690)

Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis Herbaceous Vegetation (CEGL004293)

V.B.2.N.f.15 VITTARIA APPALACHIANA - HEUCHERA PARVIFLORA SATURATED HERBACEOUS ALLIANCE (A.1696)

Vittaria appalachiana - Heuchera parviflora var. parviflora - Houstonia serpyllifolia / Plagiochila spp. Herbaceous Vegetation (CEGL004302)

V.B.2.N.h Seasonally flooded temperate perennial forb vegetation

V.B.2.N.h.100 POLYGONUM SPP. (SECTION PERSICARIA) SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1881)

Polygonum (hydropiperoides, punctatum) – Leersia (lenticularis, virginiana) Herbaceous Vegetation (CEGL004290)

VII Sparse Vegetation
VII.A Consolidated rock sparse vegetation
VII.A.1 Sparsely vegetated cliffs
VII.A.1.N Natural/Semi-natural
VII.A.1.N.a Cliffs with sparse vascular vegetation

VII.A.1.N.a.1 ASPLENIUM MONTANUM SPARSELY VEGETATED ALLIANCE (A.1831)

Asplenium montanum - Heuchera villosa Felsic Cliff Sparse Vegetation (CEGL004980)

VII.A.1.N.a.2 ASPLENIUM RUTA-MURARIA - PELLAEA ATROPURPUREA SPARSELY VEGETATED ALLIANCE (A.1832)

Asplenium ruta-muraria - Pellaea atropurpurea Sparse Vegetation (CEGL004476)

VII.A.1.N.c.4 CYSTOPTERIS BULBIFERA – (ASPLENIUM RHIZOPHYLLUM) SPARSELY VEGETATED ALLIANCE

Cystopteris bulbifera - (Asplenium rhizophyllum) Sparse Vegetation (CEGL004394)

FIELD KEYS

Keys to vegetation of Great Smoky Mountains National Park

1 Wetland (palustrine) communities: Wetland habitats either dominated by plants adapted to anaerobic conditions imposed by substrate saturation or inundation during 10% or more of the growing season, or non-vegetated with saturated or shallowly inundated substrate **Key A, p. 32**

1 Upland communities: Upland habitats either dominated by plants which are not adapted to anaerobic soil conditions imposed by saturation or inundation for more than 10% of the growing season, or non-vegetated with substrate that is not flooded or saturated.

2 Communities at greater than 4000 ft elevation (characteristic of high elevation landscapes, generally above 4000 ft - communities of intermediate, ambiguous character keyed in both leads).

3 Nonforested communities (trees generally less than 25% canopy coverage) **Key B, p. 36**

3 Forested communities (tree canopy coverage greater than 25%), dominated by species such as *Abies fraseri, Picea rubens, Betula alleghaniensis, Aesculus flava, Fagus grandifolia, Quercus rubra*.

4 Evergreen Forests and Woodlands -- stands with canopies dominated by evergreen trees (greater than 75% of the total tree cover)..... **Key C, p. 37**

4 Deciduous or Mixed Forests and Woodlands -- stands with less than 75% of the canopy coverage comprised of evergreen trees ..... **Key D, p.38**

2 Communities at less than 4000 ft elevation (characteristic of low to intermediate elevation landscapes, generally below 4000 ft - communities of intermediate, ambiguous character keyed in both leads).

5 Nonforested communities, or communities occurring within small forest openings (trees generally have less than 25% canopy coverage).....**Key E, p. 42**

5 Forested communities (tree canopy coverage greater than 25%).

6 Vegetation strongly altered by recent human disturbance, dominated by alien species (*Paulownia tomentosa* or *Ailanthus altissima*) or certain, disturbance-oriented native species, often in monospecific, even-aged, stands (*Pinus virginiana, Liriodendron tulipifera, Acer rubrum, Robinia pseudoacacia, Juglans nigra*). .....**Key F, p. 43**

6 Vegetation natural or relatively unaltered by recent disturbance, dominated by native species, usually in more diverse combinations (if with monospecific canopy, not generally of the above species, except *Pinus virginiana*).

7 Stands in exposed topographic positions; ridges and upper slopes. Dominated by species such as *Pinus pungens, Pinus rigida, Pinus virginiana, Pinus echinata, Pinus strobus, Quercus falcata, Quercus prinus, Quercus coccinea*, and occasionally *Acer rubrum, Nyssa sylvatica*, and *Magnolia fraseri*.

8 Evergreen-dominated.....**Key G, p. 44**

8 Deciduous or mixed (evergreen and deciduous) dominated.... **Key H, p. 46**

7 Stands in protected (sheltered) topographic positions; coves and lower slopes. Dominated by any one or a combination of these species: *Tsuga canadensis, Halesia tetraptera var. monticola, Liriodendron tulipifera, Tilia americana var. heterophylla, Fraxinus americana, Quercus alba, Quercus rubra, Quercus prinus, Acer saccharum*.

9 Evergreen Forests and Woodlands: Stands with canopies dominated by evergreen trees (greater than 75% of the total tree cover). ..... **Key I, p. 48**

9 Deciduous or Mixed Forests and Woodlands: Stands with less than 75% of the canopy coverage comprised of evergreen trees. ..... **Key J, p. 49**

Key A -- wetland (palustrine) communities

1 Non alluvial: Vegetation is seepage-fed (though often in close proximity to or originating with small streams), rarely if ever flooded by alluvial waters [Sphagnum and shrub bogs and seeps; forested seeps; upland pools and sinkhole ponds; spray cliffs]

2 Seasonally flooded upland depressions; water ponding to significant depths at least in winter season and following rainfall events.

3 Dominant or associated trees *Liquidambar styraciflua* or *Acer rubrum var. trilobum*; community in a flattish-bottomed depression with substantial tree cover of *Liquidambar styraciflua* and *Acer rubrum var. trilobum* ..... **Gum Swamp Upland Pool - CEGL007388, p. 185**

3 Forb dominated by *Polygonum* (section *Persicaria*), with miscellaneous (upland) canopy trees overhanging; community in small, steeply-sided sinkhole depression ..... **Sinkhole Depression - CEGL004290, p. 272**

2 Seeps, wet slopes, and wet cliffs, water rarely ponding to depths greater than a few centimeters.

4 Saturated vegetation associated with cliffs (vertical, overhanging, or very steep) in the spray zone of waterfalls, with little soil substrate and often little vascular plant biomass; often dominated by mosses and liverworts, with variable cover of vascular plants. ..... **Southern Blue Ridge Spray Cliff – CEGL004302, p. 269**

4 Saturated herbaceous and shrubland vegetation associated with level or moderately sloping seepage areas.

5 Vegetation at moderate to high elevations (3000-6000 feet), usually on moderate to steep slopes on the upper or middle slopes of the mountains, and not associated with streams (except perhaps high-gradient cascading streams); composition lacking *Juncus effusus*.

6 Vegetation dominated by graminoid species, especially *Calamagrostis cainii, Carex ruthii, Carex gynandra, Carex atlantica,* and other *Carex* species; occurring at over 5000 feet elevation and surrounded by, or formerly surrounded by, forests with *Picea rubens* and *Abies fraseri.*

7 High elevation herbaceous seepage slope dominated by *Calamagrostis cainii* **Blue Ridge High Elevation Seep (Mount Le Conte type) – CEGL007877, p. 252**

7 High elevation herbaceous seep dominated by a mix of *Carex* spp. *(Carex ruthii, Carex gynandra, Carex crinita*), well-developed *Sphagnum* mats, and forbs such as *Chelone* spp. ..... **……Blue Ridge High Elevation Seep (Sedge Type) – CEGL007697, p. 254**

6 Vegetation dominated by forbs such as *Diphylleia, Impatiens, Saxifraga, Rudbeckia,* and/or *Monarda,* occurring as inclusions in an otherwise forested landscape; occurring at below 5000 feet elevation and surrounded by, or formerly

surrounded by, hardwood forests dominated by *Aesculus flava, Tilia americana var. heterophylla, Liriodendron tulipifera, Betula alleghaniensis, Fagus grandifolia,* and *Acer* saccharum.

8 Forb dominated, shaded seep, at low elevations (below 4000 feet) with *Diphylleia cymosa* and/or *Saxifraga micranthidifolia,* occurring within forests dominated by *Aesculus flava, Tilia americana var. heterophylla, Liriodendron tulipifera,* and *Acer saccharum*..... ..... **Rich Montane Seep (Cove Type)– CEGL004296, p. 265**

8 Forb dominated shaded seep, at higher elevations (above 4000 feet), with *Impatiens capensis, Impatiens pallida, Monarda didyma, Rudbeckia laciniata var. humilis,* occurring on boulderfields or within forests dominated by *Betula alleghaniensis, Aesculus flava,* and *Fagus grandifolia*..... **Rich Montane Seep (High Elevation Type) – CEGL004293, p. 267**

5 Vegetation at low to moderate elevations (less than 3000 feet), usually on gentle to nearly flat slopes, and often associated with lower slopes and the edges of floodplains (though not alluvially flooded); composition generally including small to large amounts of *Juncus effusus* or *Juncus gymnocarpus*.

9 Vegetation dominated by *Juncus effusus*; at low elevations in disturbed (usually unforested) landscapes; few or no shrubs present ……**Rush Marsh – CEGL004112, p. 250**

9 Vegetation diverse and variable from place to place, usually with some *Juncus effusus* but not dominated by it; at low elevations in disturbed or more intact landscapes; shrubs (such as *Alnus serrulata, Salix sericea, Salix nigra,* and *Lindera benzoin*) often present and sometimes dominant.

10 Physiognomy highly variable, with shrubs and trees often significant to dominant; typical species include *Scutellaria lateriflora, Thelypteris noveboracensis, Lindera benzoin, Juncus gymnocarpus*…
Low Elevation Seep – CEGL003909, p. 238

10 Physiognomy generally strongly herb-dominated, especially tall forbs; typical species include *Symphyotrichum puniceum, Eupatorium fistulosum, Helenium autumnale, Solidago patula var. patula, Osmunda cinnamomea*
Appalachian Wet Forb Meadow – CEGL008438, p. 256

1 Alluvial: Vegetation associated with the banks or channels of rivers, streams, and impounded lakes and ponds with variable water levels, receiving occasional or more frequent alluvial flooding. [MONTANE ALLUVIAL FORESTS; RIVER GRAVEL / COBBLE BAR; UNFORESTED FLOODPLAIN CANEBRAKE]

11 Tree dominated; vegetation with tree canopy coverage greater than 25%.

12 Canopy dominated by *Acer rubrum,* occurring with other deciduous trees such as *Fraxinus spp.*, on seasonally flooded, disturbed flats near streams…..... .....**Montane Floodplain Slough Forest -CEGL004420, p. 183**

12 Canopy dominated by *Liquidambar styraciflua, Liriodendron tulipifera, Diospyros virginiana, Platanus occidentalis, Betula alleghaniensis, Betula lenta, Acer negundo var. negundo, Acer rubrum var. trilobum*, or *Quercus imbricaria*; hydrology is temporarily flooded (surface water present for brief periods during the growing season, but water table is usually well below the soil surface).

13 Canopy composed of combinations of *Platanus occidentalis, Acer negundo var. negundo, Acer rubrum var. trilobum, Liriodendron tulipifera*, and *Quercus imbricaria*; occurring along small streams in a landscape of pastures and fields in Cades Cove and the Oconaluftee area..... ..... **Montane Alluvial Forest (Cades Cove/Oconaluftee) - CEGL007339, p. 174**

13 Canopy variously dominated by *Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis, Diospyros virginiana, Betula alleghaniensis, Betula lenta*, or *Betula nigra*; sites are alluvial flats and high terraces along large rivers, small, disturbed flats along medium-sized perennial streams, or narrow, rocky floodplains and islands in medium-sized rivers, at elevations below 2000 feet.

14 Vegetation along drawdown zones along artificial lakeshores (e.g. Fontana Lake); canopy dominated by *Diospyros virginiana, Platanus occidentalis*, and *Betula nigra*; herbaceous species are weedy perennials and annuals..... ..... **Montane Lake Drawdown Zone – CEGL003910, p. 263**

14 Vegetation occurring in alluvial floodplains of rivers; canopy dominated by various mixtures of *Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis, Betula allegheniensis*, and/or *Betula lenta*; herbaceous species are non-weedy perennials.

15 Canopy is dominated by *Liquidambar styraciflua* and *Liriodendron tulipifera*, often with *Platanus occidentalis; Carpinus caroliniana* is characteristic; shrub stratum can be dense but is more often sparse; sites are large alluvial flats and high terraces along large rivers (e.g. Little Pigeon River) or on small, disturbed flats along medium-sized perennial streams, often areas that were formerly cleared for farming or settlement. .... **Montane Sweetgum Alluvial Flat - CEGL007880, p. 176**

15 Canopy dominated by various combinations of *Platanus occidentalis, Liriodendron tulipifera, Liquidambar styraciflua, Betula alleghaniensis*, and *Betula lenta*; shrub stratum is usually very dense (100% cover of *Rhododendron* and/or *Leucothoe* is not unusual); characteristic shrubs are *Leucothoe fontanesiana, Rhododendron maximum, Alnus serrulata, Xanthorhiza simplicissima, Hydrangea arborescens*; sites are narrow, rocky floodplains and islands in medium-sized rivers, at elevations below 2000 feet. ..... **Montane Alluvial Forest (Large River Type) – CEGL004691 p. 180**

11 Not tree dominated, open vegetation with less than 25 % tree canopy coverage.
16 Vegetation dominated by herbs; with little or no woody coverage;
17 Vegetation dominated strongly by weedy perennials and annuals; Community occurs exclusively along draw-down zones of artificial lakeshores (Fontana Lake).....
..... …….. **Montane Lake Drawdown Zone – CEGL003910, p. 263**

18 Vegetation dominated by non-weedy perennials. Communities found along medium to large rivers and small ponds made by beavers or human construction.

19 Community found exclusively along medium to large sized rocky rivers (e.g. Oconaluftee River); vegetation dominated by *Carex torta*, forming dense, extensive colonies .....
..... **Rocky Bar and Shore (Twisted Sedge Type)– CEGL004103, p. 245**

19 Community found exclusively within impounded shallow ponds created by beaver or human disturbance; vegetation dominated by a mixture of forbs including but not limited to *Juncus effuses, Chelone glabra*, and *Scirpus spp.* … .....
..... **Southern Blue Ridge Beaver Pond Marsh – CEGL008433, p. 248**

16 Vegetation dominated by shrubs (including bamboo); hydrology is seasonally to temporarily flooded.
19 Vegetation dominated by dense, monospecific stand of *Arundinaria gigantea*. .....
..... **Interior Highlands Canebrake – CEGL003836, p. 228**

[19]Vegetation dominated shrubs characteristic of rocky or gravelly substrates along narrow river margins; common shrubs include *Alnus serrulata, Xanthorhiza simplicissima, Salix (nigra, sericea), Leucothoe fontanesiana, Itea virginica, Viburnum nudum var. cassinoides*
……Rocky Bar and Shore (Alder-Yellowroot Type) – CEGL003895, p. 236

Key B -- high elevation, nonforested, terrestrial communities [Grass Balds, Heath Balds, Rocky Summits]

1 Nonforested vegetation supported by significant soil substrate without large areas of exposed rock; shrubs, if present, are primarily deciduous
  2 Vegetation is mainly graminoid dominated; with local dominance by shrubs; sites are gentle, broad ridges; *Danthonia compressa* is the common grass*; Rhododendron calendulaceum* and *Vaccinium corymbosum* are common shrubs. ....**Grassy Bald (Southern Grass Type)– CEGL004242, p. 242**

  2 Successional vegetation resulting from the death of *Abies fraseri*; vegetation is variously dominated by dense shrubs (*Rubus canadensis, Diervilla sessilifolia*) or dense forbs (*Athyrium filix-femina, Solidago glomerata*); standing dead trees are common ....**High Elevation Blackberry Thicket – CEGL003893, p.233**

1 Nonforested vegetation associated with rock outcroppings; vegetation is rooted in crevices or within shallow organic accumulations.
  3 Dense shrub thickets sometimes with inclusions of bare rock or with scattered, small trees; shrubs are predominantly evergreen, although deciduous species may be locally dominant.
    4 Dense shrub thickets one to four meters tall; mostly evergreen, but may have local dominance by deciduous shrubs, or scattered deciduous trees. Dominant shrubs are *Kalmia latifolia, Rhododendron maximum, Gaylussacia baccata, Pieris floribunda*, or *Vaccinium corymbosum*; sites are southerly exposed ridges and steep slopes typically below 5000 feet elevation ....**Southern Appalachian Mountain Laurel Bald – CEGL003814, p. 223**

    4 Open to dense shrub dominated vegetation 0.5 to four meters tall. Dominant shrubs include *Rhododendron carolinianum, Rhododendron catawbiense*, *Leiophyllum buxifolium* and very occasionally *Menziesia pilosa*; sites are typically above 5000 feet elevation, in the Spruce-Fir zone. ....**Southern Appalachian Heath Bald – CEGL007876, p. 226**

  3 Sparse to moderate vegetation coverage on landslide scars, cliffs, rock outcrops; vegetation is comprised of grasses, forbs and shrubs rooted in rock fissures.
    5 Characteristic species include *Calamagrostis cainii, Carex misera, Carex debilis, Saxifraga michauxii, Solidago glomerata, Rhododendron carolinianum, Leiophyllum buxifolium, Abies fraseri*; known from Mount LeConte and other outcrops of Anakeesta Slate at high elevations in the central Great Smokies……..... .**So. App High Elevation Rocky Summit (Anakeesta Type)– CEGL004278, p. 258**

    5 Characteristic species include *Carex misera*, *Saxifraga michauxii*, but lack *Calamagrostis cainii*; occurences on other peaks of the Great Smokies (such as Mount Buckley), and on non-Anakeesta lithologies..... .....**Southern Appalachian High Elevation Rocky Summit (High Peak Type) -- CEGL004277, p. 260**

Key C -- high elevation, terrestrial evergreen forests and woodlands [Spruce / Fir Forests, Table Mountain Pine Woodlands]

1 Stands dominated by *Abies fraseri, Picea rubens,* or *Tsuga canadensis.*
  2 The most abundant trees are *Abies fraseri* and the communities exists almost exclusively above 6000 feet in elevation.
    3 Shrub strata are relatively open and composed of deciduous species, although *Abies fraseri* regeneration may be dense in patches; common shrubs include *Betula alleghaniensis, Prunus pensylvanica, Sorbus americana, Diervilla sessilifolia, Rubus canadensis, Sambucus racemosa var. pubens, Vaccinium erthyrocarpum, Viburnum lantanoides* Community tends towards steep ridges and mesic north facing slopes. .... **Fraser Fir Forest (Deciduous Shrub Type) – CEGL006049, p. 86**

    3 Shrub strata are dense and dominated by evergreen ericads (*Rhododendron catawbiense, Rhododendron carolinianum, Rhododendron maximum*); sites are rocky, steep ridges and exposed south facing slopes over 6000 feet elevation .... **Fraser Fir Forest (Evergreen Shrub Type) – CEGL006308, p. 83**

  2 The most abundant trees are *Picea rubens*, with or without *Abies fraseri* or *Tsuga Canadensis* and the communities exist below 6200 feet in elevation.
    4 Understory heavily dominated by evergreen shrubs.
      5 Canopy dominated by *Picea rubens* and *Tsuga canadensis* (although Northern Hardwood species can be present). Evergreen shrubs not typically dominant in understory. Elevation ranges approximately from 4500 – 5000 feet. .... **Red Spruce - Fraser Fir Forest (Hemlock Type)– CEGL006272, p. 96**

      5 Canopy dominated by *Picea rubens* and sometimes codominated with *Abies fraseri* or standing dead *Abies fraseri.* Evergreen shrubs dominant in understory. Elevation ranges approximately from 5100 – 6000 feet ..... **Red Spruce - Fraser Fir Forest (Evergreen Shrub Type) – CEGL007130, p. 89**

    4 Understory not heavily dominated by evergreen shrubs
      7 Shrub strata are absent to dense, but dominated by deciduous shrubs and patches of *Abies fraseri* and *Picea rubens* regeneration; common shrubs include *Rubus canadensis, Vaccinium erythrocarpum, Diervilla sessilifolia, Sorbus americana, Prunus pensylvanica*; bryophyte cover may be high; typical herbs include *Aster acuminatus, Athyrium asplenioides, Oxalis montana*. Elevation ranges approximately from 5500-6200 feet…**Red Spruce - Fraser Fir Forest (Deciduous Shrub Type)–CEGL007131, p. 92**

1 Stands dominated by *Pinus pungens*; canopy is dominated by *Pinus pungens* (including standing dead pine) with dense shrub strata and sparse herbaceous coverage; common shrubs are *Pieris floribunda, Kalmia latifolia, Gaylussacia baccata, Vaccinium pallidum*; other typical species are *Galax urceolata,* Community usually not seen above 4000 feeet in elevation, though occasionally it can exist at slightly higher elevations.sites are exposed slopes and ridges. ..... **Blue Ridge Table Mountain Pine-Pitch Pine Woodland (Typic Type) –CEGL007097, p. 214**

Key D -- high elevation, terrestrial deciduous and mixed forests and woodlands [Boulderfield Forests, Beech Gaps, High Elevation Red Oak, Northern Hardwood Forests]

1 Canopy composed of a mix of evergreen and deciduous trees.
  2 Dominant species are *Picea rubens, Betula alleghaniensis,* and *Tsuga canadensis*; evergreen trees may overtop deciduous trees in the canopy.
    3 Canopy without significant coverage by *Tsuga canadensis,* but dominated by *Picea rubens* and deciduous trees, *Betula alleghaniensis, Fagus grandifolia, Aesculus flava, Prunus pensylvanica.*
      4 Shrub strata are dense and dominated by evergreen ericads (*Rhododendron maximum, Leucothoe fontanesiana*) although deciduous shrubs may be present (e.g. *Ilex montana*); herbaceous cover is sparse; bryophyte cover may be high (greater than 50%). Note: this community is difficult to distinguish from pure spruce forests such as Red Spruce Forest (Protected Slope Type) – CEGL006152 and Red Spruce - Fraser Fir Forest (Evergreen Shrub Type) – CEGL007130 where they meet. The main difference will be the presence of deciduous trees in the canopy in this community…. **Red Spruce - Northern Hardwood Forest (Shrub Type) – CEGL004983. P. 187**

      4 Shrub strata are sparse to dense (20-90% coverage) and dominated by deciduous species; common shrubs are *Acer spicatum, Vaccinium erythrocarpum, Viburnum lantanoides, Sorbus americana*, and *Rubus canadensis;* herbaceous cover is moderate to dense (30-90% coverage); typical herbs are *Dryopteris campyloptera, Oxalis montana, Solidago glomerata, Clintonia borealis,* and *Rugelia nudicaulis, Athyrium filix-femina, Huperzia lucidula*. Note: this community is difficult to distinguish from pure spruce forests such as Red Spruce Forest (Protected Slope Type) – CEGL006152 and Red Spruce - Fraser Fir Forest (Evergreen Shrub Type) – CEGL007130. The main difference will be the presence of deciduous trees in the canopy…..... **...Red Spruce-Northern Hardwood Forest (Herb Type) -CEGL006256, p. 189**

    3 Canopy with coverage by *Tsuga canadensis,* occurring with *Picea rubens* or *Betula alleghaniensis.*
      5 Canopy dominated by *Tsuga canadensis* and *Betula alleghaniensis* with a dense evergreen shrub stratum and sparse herb coverage; generally below 4500 feet elevation and without significant *Picea rubens* .... **Blue Ridge Hemlock - Northern Hardwood Forest – CEGL007861, p. 201**

      5 Canopy dominated by a mixture of *Picea rubens, Tsuga canadensis,* and *Betula alleghaniensis* with a dense evergreen shrub stratum and very sparse herb coverage; generally above 4500 feet elevation and with significant *Picea rubens*..... ..... **Red Spruce - Fraser Fir Forest (Hemlock Type)– CEGL006272, p. 96**

  2 Dominant species *are Pinus pungens, Pinus rigida*, (including standing dead Pines) *Acer rubrum, Quercus coccinea, Quercus prinus, Oxydendrum arboreum,* and/or *Nyssa sylvatica* **Blue Ridge Table Mountain Pine - Pitch Pine Woodland (Typic Type) – CEGL007097, p. 214**

1 Canopy dominated by deciduous trees
  6 Canopy dominated by *Quercus* spp.
    7 Canopy strongly dominated by *Quercus alba*..... ..... **High Elevation White Oak Forest - CEGL007295, p. 151**

    7 Canopy strongly dominated by *Quercus rubra*, although *Quercus alba* may be present (as well as other deciduous trees)
      8 Shrub stratum is dense and dominated by evergreen ericads (e.g. *Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum*); herbaceous cover is sparse **High Elevation Red Oak Forest (Evergreen Shrub Type) – CEGL007299, p. 162**

      8 Shrub strata are sparse to dense and dominated by deciduous species (e.g. *Ilex montana, Rhododendron calendulaceum, Vaccinium corymbosum*); herbaceous cover is moderate to dense and dominated by ferns, tall forbs, and sedges.
        9 Shrub stratum is absent or very sparse and herb coverage is dense, approaching 100 % and dominated by *Carex* spp., although ferns and tall forbs may be present ..**High Elevation Red Oak Forest (Tall Herb Type) – CEGL007298, p. 169**

        9 Shrub stratum is moderate to dense and dominated by deciduous species (e.g. *Ilex montana, Rhododendron calendulaceum, Vaccinium corymbosum*); herbaceous cover is moderate to dense and dominated by ferns, tall forbs, and sedges; common species are *Dennstaedtia punctilobula, Thelypteris noveboracensis, Ageratina altissima var. roanensis, Clintonia umbellulata, Silene stellata, Solidago caesia var. curtisii.* ..... **High Elevation Red Oak Forest (Deciduous Shrub Type) – CEGL007300, p. 165**

  6 Canopy not dominated by Oaks (*Quercus* spp.), but other broad leaved deciduous species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava, Acer saccharum*).
    10 Substrate is bouldery talus of periglacial boulderfields; with limited soil development; often associated with small creeks and seepage; vines and shrubs associated with bouldery habitats are well represented; characteristic species are *Ribes* spp., *Acer spicatum, Hydrangea arborescens, Euonymus obovata;* Stand is more open than the surrounding forest (often less than 60% coverage).
      11 Canopy is stunted and strongly dominated by *Betula alleghaniensis*; other canopy species can include *Aesculus flava, Prunus pensylvanica, Sorbus americana, Acer spicatum*, and *Picea rubens;* associated species are characteristic of high elevations (*Diervilla sessilifolia, Dryopteris campyloptera, Ribes glandulosum, Rugelia nudicaulis, Streptopus amplexifolius*); site is exposed, generally over 5000 feet elevation..... **Southern Appalachian Boulderfield Forest (Currant and Rockcap Fern Type) – CEGL006124, p. 113**

11 Canopy is dominated by *Betula alleghaniensis* or *Aesculus flava*; other canopy species can include *Betula lenta, Tilia americana var. heterophylla*; common shrubs are *Acer spicatum, Hydrangea arborescens, Euonymus obovata, Ribes rotundifolium, Ribes cynosbati*; sites are generally below 5000 feet elevation..... ..... **Southern Appalachian Hardwood Boulderfield Forest (Typic Type) – CEGL004982, p. 110**

10 Substrate is relatively well developed soils, although soils may be rocky; species characteristic of bouldery habitats are not common; Canopy is closed (generally greater than 60% coverage).

12 Canopy strongly dominated by short to medium stature *Fagus grandifolia*; sites are upper slopes, gaps, and ridges.

13 Herbaceous cover is strongly dominated by *Carex* spp. (e.g. *Carex aestivalis, Carex brunnescens, Carex debilis, Carex intumescens, Carex pensylvanica*); sites are concave slopes, flat ridgetops, or upper south to southwest-facing slopes. **Southern Appalachian Beech Gap (South Slope Sedge Type) – CEGL006130, p. 120**

13 Herbaceous cover is dominated by large herbs and patches of ferns, with lesser amounts of sedges; other canopy species can include *Aesculus flava* and *Betula alleghaniensis*; common species include *Ageratina altissima var. roanensis, Aster chlorolepis, Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera, Phacelia bipinnatifida, Prenanthes altissima, Prenanthes roanensis, Stellaria pubera, Thelypteris noveboracensis, Trillium erectum*; sites are northerly facing, steep, upper slopes and the north side of gaps. ....**Southern Appalachian Beech Gap (North Slope Tall Herb Type) – CEGL006246, p. 117**

12 Canopy dominated by various combinations of *Betula alleghaniensis, Fagus grandifolia, Aesculus flava, Acer saccharum* **but usually not dominated by any single species**.

14 Shrub stratum is dense and herb cover is absent or sparse.

15 Canopy a mixture of Northern Hardwood species occurring with *Tsuga canadensis* and little or no *Picea rubens*; with a dense shrub stratum dominated by evergreen ericads (*Rhododendron maximum, Leucothoe fontanesiana*) and sparse to absent herb coverage; generally below 4500 feet elevation ..... **Blue Ridge Hemlock - Northern Hardwood Forest – CEGL007861, p. 201**

15 Canopy a mixture of Northern Hardwood species occurring with *Picea rubens* and *Tsuga canadensis*, with a dense shrub stratum and sparse to absent herb coverage; generally above 4500 feet elevation..... . **Red Spruce - Fraser Fir Forest (Hemlock Type)– CEGL006272, p. 96**

14 Shrub stratum is absent or has sparse to moderate coverage and dominated by deciduous species; herb coverage is moderate to high.

16 Elevational range of 3500 to 4700 feet. Canopy is dominated by *Betula alleghaniensis, Fagus grandifolia, Aesculus flava, Acer saccharum, Halesia tetraptera var. monticola*; herb cover is lush and diverse with species such as *Deparia acrostichoides, Viola canadensis, Cimicifuga americana, Cimicifuga racemosa, Dryopteris intermedia, Laportea canadensis, Disporum lanuginosum;* sites are relatively protected landforms, such as upper portions of draws and coves, protected slopes, and gaps..... ..... **Southern Appalachian Northern Hardwood Forest (Rich Type) – CEGL004973, p. 103**

16 Elevational range of 4300 – 5400 feet. Canopy is dominated by *Betula alleghaniensis, Fagus grandifolia, Aesculus flava*, occurring singly or in combination; less often with *Halesia tetraptera var. monticola, Quercus rubra*, or *Acer saccharum*; common shrubs are *Acer spicatum, Viburnum lantanoides*, and *Ilex montana*; herb coverage is a mix of sedges, ferns, and forbs (less lush and diverse than CEGL004973), typically *Ageratina altissima, Athyrium filix-femina ssp. asplenioides, Carex* spp. *(e.g. Carex debilis, Carex intumescens, Carex pensylvanica), Dryopteris intermedia, Aster divaricatus, Stellaria pubera*; on relatively exposed landforms, such as high, exposed slopes, ridges, and gaps, typically with northerly exposures...... **.....Southern Appalachian Northern Hardwood Forest (Typic Type) – CEGL007285, p. 106**

Key E – low elevation, nonforested, terrestrial communities [Grape Holes, Cliffs and Forested Outcrops]

1 Community has large areas of exposed rock; vegetation is scattered or nearly absent; vascular plants have less than 10% cover and are rooted in cracks and on ledges; sites are vertical rock faces which may be shaded by overhanging trees.

2 Substrate is of felsic, metamorphic, or igneous geology; species are characteristic of dry, acidic substrates; characteristic species are *Asplenium montanum* and *Heuchera villosa.* .....**Southern Blue Ridge Felsic Cliff – CEGL004980, p. 274**

[2] Substrate is of limestone or dolomite geology; characteristic species are calciphilic.

3 North facing slope surrounded by a matrix of drier pine communities. Calciphilic herbs such as *Asplenium ruta-muraria, Pellaea atropurpurea, Asplenium resiliens, Aquilegia canadensis* occur in this community. .... **Montane Cliff (Calcareous Type) – CEGL004476, p. 276**

3 South facing slope occurring in a matrix of mesic calcareous forests. Calciphilic herbs such as *Cystopteris bulbifera* and shrubs such as *Physocarpus opulifolius* common…. ..... **Appalachian Wet Limestone Cliff – CEGL004394, p. 278**

1 Vegetation supported by significant soil substrate without large areas of exposed rock; well developed vegetation dominated by shrubs, herbs, or vines;

4 Graminoid dominated vegetation associated with pastures and hayfields; more-or-less cultural, though sometimes no longer actively maintained.....**Cultivated Meadow – CEGL004048, p. 240**

4 Vine dominated vegetation resulting from disturbance by ice storms, wind, or logging; the dominant species is *Vitis aestivalis*; sites are steep north and northeast facing slopes..... .....**Montane Grape Opening – CEGL003890, p. 231**

Key F – altered / anthropogenic / cultural / semi-natural Forests

1 Canopy mainly evergreen, although may contain admixtures of deciduous trees.
  2 Canopy with *Pinus virginiana* (25-100%) with other early successional species (*Acer rubrum, Liriodendron tulipifera, Pinus strobus*) as well as deciduous species from the surrounding forest vegetation (*Quercus alba, Quercus velutina, Quercus coccinea*); sites are former fields, pastures, clearcuts, burned or eroded areas..... .....**Successional Virginia Pine Forest – CEGL002591, p. 81**

  2 Canopy with *Pinus strobus* (25-100%) with other early successional species (*Liriodendron tulipifera, Acer rubrum, Pinus rigida, Liquidambar styraciflua*); *Tsuga canadensis* often forms a dense shrub strata; sites are former fields and pastures..... .....**Pinus strobus Successional Forest - CEGL007944, p. 75**

1 Canopy mainly deciduous, dominated by various broadleaf deciduous trees.
  3 Canopy dominated by *Juglans nigra*; open forests on former homesites below 3000 feet elevation. .....**Successional Black Walnut Forest – CEGL007879, p. 121**

  3 Canopy dominated by *Liriodendron tulipifera,* sometimes sharing the canopy with other successional species (*Acer rubrum, Robinia pseudoacacia, Acer saccharum, Halesia tetraptera var. monticola, Betula lenta*); sites are low slopes and flats, typically below 3000 feet elevation and particularly in areas of heavy settlement, past logging, or past farming activities. This community is often difficult to distinguish and intergrades into CEGL002591. It is easily distinguished from CEGL002591 since its canopy composition is primarly hardwood rather than evergreen..... .....**Early Successional Appalachian Hardwood Forest – CEGL007219, p. 133**

Key G – low elevation terrestrial xeric evergreen forest and woodlands in exposed topographic positions [Table Mountain Pine/Pitch Pine Woodlands, Shortleaf Pine Forests, White Pine Forests]

1 Successional vegetation resulting from recent disturbance.
  2 Canopy dominated by *Pinus virginiana* sometimes with other successional species; sites are former fields, pastures, clearcuts, burned, or eroded areas .... **Successional Virginia Pine Forest – CEGL002591, p. 81**

  2 Canopy dominated *Pinus strobus* with other early successional species (*Liriodendron tulipifera, Acer rubrum, Pinus rigida, Liquidambar styraciflua*); *Tsuga canadensis* often forms a dense shrub strata; sites are former fields and pastures .... **Pinus strobus Successional Forest - CEGL007944, p. 75**

1 Mature, relatively undisturbed vegetation; canopy variously dominated by *Pinus* spp. (including *P. virginiana*).

  3 Canopy dominated by *Pinus strobus;* subcanopy commonly contains *Oxydendrum arboreum, Acer rubrum, Nyssa sylvatica, Cornus florida;* shrubs are patchy to continuous and dominated by ericaceous species (*Gaylussacia ursina, Vaccinium stamineum, Kalmia latifolia*)..... ..... **Southern Appalachian White Pine Forest – CEGL007100, p. 73**

  3 Canopy dominated by *Pinus virginiana, Pinus rigida, Pinus pungens,* or *Pinus echinata.*
    4 Stands dominated by *Pinus echinata*; may have minor coverage by *Pinus virginiana* or *Pinus rigida.*
      5 Closed canopy
        [6] Understory with shrub stratum dominated by ericacous species with scattered grasses and forbs ..... **[Appalachian Shortleaf Pine Forest] – CEGL007078, p. 280 (not mapped)**

        6 Understory with only scattered ericaceous shrubs and a sparse to medium coverage of herbs....**Southern Blue Ridge Escarpment Shortleaf Pine - Oak Forest - CEGL007493, p. 192**

      [5] Open canopy with understory dominated by herbs..... **[Shortleaf Pine / Little Bluestem Appalachian Woodland] – CEGL003560, p. 212 (not mapped)**

    4 Stands dominated by *Pinus virginiana, Pinus rigida,* or *Pinus pungens*; may have minor coverage by *Pinus echinata.*

      7 Open canopy typically with a poorly developed shrub stratum .... **Blue Ridge Acid Shale Woodland – CEGL003624, p. 221**

      7 Closed canopy with shrub stratum dominated by ericaceous species.
        8 Canopy dominated by *Pinus virginiana*; sometimes with lesser amounts of *Pinus*

rigida or *Pinus echinata*; sites are typically below 2300 feet elevation on gentle slopes and low ridges ....**Appalachian Low Elevation Mixed Pine Forest – CEGL007119, p. 77**

8 Canopy dominated by *Pinus pungens* or *Pinus rigida*, sites are typically above 2000 feet elevation on exposed ridgetops and slopes with west to southeast aspects… ..**Blue Ridge Table Mountain Pine - Pitch Pine Woodland (Typic Type) – CEGL007097, p. 214**

Key H -- low elevation terrestrial deciduous and mixed xeric forests and woodlands in exposed topographic positions [Shortleaf Pine – Oak Forests, White Pine – Oak Forests, Chestnut Oak Forests, Shale Barrens]

1 Successional vegetation resulting from recent disturbance.

2 Canopy composed of *Pinus virginiana* (>25%) with other successional species (*Acer rubrum, Liriodendron tulipifera, Pinus rigida*) as well as deciduous species from the surrounding forest vegetation (*Quercus alba, Quercus velutina, Quercus coccinea)*; sites are former fields, pastures, clearcuts, burned or eroded areas..... .....**Successional Virginia Pine Forest – CEGL002591, p. 81**

2 Canopy with *Pinus strobus* (>25) with other early successional species (*Liriodendron tulipifera, Acer rubrum, Pinus rigida, Liquidambar styraciflua*); *Tsuga canadensis* often forms a dense shrub strata; sites are former fields and pastures ....**Pinus strobus Successional Forest - CEGL007944, p. 75**

1 Mature, relatively undisturbed vegetation or vegetation resulting from disturbance over 70 years ago.

3 Vegetation associated with significant areas of exposed mineral substrate; sites are steep, shaley slopes .....**Blue Ridge Acid Shale Forest – CEGL007539, p. 199**

3 Vegetation supported by significant soil substrate, without large areas of exposed rock.

4 Canopy dominated by a mix of evergreen and deciduous trees; dominant species are *Pinus virginiana, Pinus rigida, Pinus pungens, Pinus strobus,Pinus echinata, Acer rubrum, Quercus prinus, Quercus coccinea,* and *Quercus falcata*..

5 Canopy usually dominated or co-dominated by *Pinus strobus*..... .....**Appalachian White Pine - Xeric Oak Forest – CEGL007519, p. 196**

5 Canopy dominated by a mixture of xeric oak and pine species, but usually not containing *Pinus* strobus.

6 Closed canopy….

7 Canopy dominated by *Pinus virginiana*; sometimes with lesser amounts of *Pinus rigida* or *Pinus echinata* and with mixes of deciduous species (*Quercus prinus, Quercus coccinea, Quercus alba, Quercus marilandica, Quercus velutina*); sites are typically below 2300 feet elevation on gentle slopes and low ridges…..... ..**Appalachian Low Elevation Mixed Pine Forest – CEGL007119, p. 77**

7 Canopy dominated by *Pinus echinata,* but often co-dominated or dominated by low elevation dry site oaks such as *Quercus prinus, Quercus falcata,* and *Quercus stellata*. Typically only a poorly developed shrub stratum **…. Southern Blue Ridge Escarpment Shortleaf Pine - Oak Forest – CEGL007493, p. 192**

6 Open to closed canopy. Canopy dominated by *Pinus pungens* or *Pinus rigida*, with *Quercus prinus* or *Quercus coccinea*; evergreen trees may overtop the deciduous canopy trees; sites are typically above 2000 feet elevation on exposed ridgetops and slopes with west to southeast aspects ....**Blue Ridge Table Mountain Pine - Pitch Pine Woodland (Typic Type) – CEGL007097, p. 214**

4 Canopy is dominated by deciduous species.

7 Canopy dominated by hardwoods, but not oaks (mainly a mix of *Acer rubrum, Halesia tetraptera var. monticola, Magnolia fraseri,* and *Nyssa sylvatica* … **Southern Appalachian Mixed Hardwood Forest – CEGL008558, p. 100**

7 Oak dominated canopy.

8 Mesic community of north facing slopes; canopy dominated by *Quercus prinus* occurring with *Quercus rubra* and/or *Acer rubrum* over dense, tall *Rhododendron maximum*; sparse herb cover; sites are very steep, northerly slopes and adjacent ridge tops. ..... **Chestnut Oak Forest (Mesic Slope Heath Type) – CEGL006286, p. 159**

8 Xeric communities generally of south facing slopes and dry ridgetops. Canopy dominated by *Quercus prinus, Quercus coccinea,* or *Quercus alba*.

9 Canopy dominated by *Quercus prinus, Quercus coccinea,* and *Acer rubrum*, occurring singly or in various combinations over a dense ericaceous shrub layer (*Kalmia latifolia, Gaylussacia ursina*); may have standing dead *Pinus* spp.; sites are middle to upper convex slopes and ridges with southwest and western exposures. Sites generally occur below 3000 feet but may occur as high as 4000 feet. ..... **Chestnut Oak Forest (Xeric Ridge Type) – CEGL006271, p. 153**

9 Canopy dominated by *Quercus alba, Quercus coccinea,* and *Quercus falcata*. Shrub layer is ericaceous but is rarely dense. Sites are on convex slopes and ridges at elevations below 2500 feet. **Appalachian Montane Oak – Hickory Forest (Low Elevation Xeric Type) – CEGL007691, p. 172**

Key I -- low elevation terrestrial evergreen forest and woodlands in protected topographic positions

1 Successional vegetation resulting from recent disturbance; canopy dominated by *Pinus virginiana* sometimes with other successional species; sites are former fields, pastures, clearcuts, burned or eroded areas….....**Successional Virginia Pine Forest – CEGL002591, p. 81**

1 Mature, relatively undisturbed vegetation.

2 Canopy dominated by *Pinus strobus* and *Tsuga canadensis* occurring over a shrub stratum dominated by *Rhododendron maximum*; deciduous species may be present in the canopy, but make up less than 25 % of the canopy coverage – very difficult to distinguish from CEGL007136).....
Southern Appalachian Eastern Hemlock Forest (White Pine Type) – CEGL007102, p. 71

2 Canopy dominated by *Tsuga canadensis* ONLY and occurring over a shrub stratum dominated by *Rhododendron maximum*; deciduous species may be present in the canopy, but make up less than 25 % of the canopy coverage (very difficult to distinguish from CEGL007102) **Southern Appalachian Eastern Hemlock Forest (Typic Type) – CEGL007136, p. 98**

Key J -- low elevation terrestrial deciduous and mixed forest and woodlands in protected topographic positions [Mountain Cove Forests, Montane Oak –Hickory Forests]

1 Vegetation strongly altered by recent human disturbance, dominated by disturbance-oriented native and non-native species, often in monospecific stands (*Pinus virginiana, Liriodendron tulipifera, Acer rubrum, Robinia pseudoacacia, Juglans nigra*).

2 Canopy a mix of evergreen and deciduous trees; canopy dominated by *Pinus virginiana* with other successional species *(Acer rubrum, Liriodendron tulipifera, Pinus strobus*) as well as deciduous species from the surrounding forest vegetation (*Quercus alba, Quercus velutina, Quercus coccinea*); sites are former fields, pastures, clearcuts, burned or eroded areas..... .....**Successional Virginia Pine Forest – CEGL002591, p. 81**

2 Canopy mainly deciduous, dominated by various broadleaf deciduous trees.

3 Canopy dominated by *Juglans nigra*; open forests on former homesites below 3000 feet .....**Successional Black Walnut Forest – CEGL007879, p. 121**

3 Canopy dominated by *Liriodendron tulipifera*, sometimes sharing the canopy with other successional species (*Acer rubrum, Robinia pseudoacacia, Acer saccharum, Halesia tetraptera var. monticola, Betula lenta*); sites are low slopes and flats, typically below 3000 feet elevation and particularly in areas of heavy settlement, past logging, or past farming activities ...**Early Successional Appalachian Hardwood Forest – CEGL007219, p. 133**

1 Mature, relatively undisturbed vegetation; vegetation natural or relatively unaltered by recent disturbance, dominated by native species, usually in diverse combinations.

4 Canopy dominated by a mixture of evergreen (*Tsuga canadensis, Pinus strobus*) and deciduous (*Betula alleghaniensis, Halesia tetraptera var. monticola, Magnolia fraseri, Fagus grandifolia, Liriodendron tulipifera, Quercus alba, Carya alba*) trees.

5 Canopy dominated by *Pinus strobus* and deciduous (*Quercus alba, Carya alba, Acer rubrum*) species; *Pinus strobus* may over top the deciduous trees; sites are protected ridges, middle to upper slopes, and disturbed bottoms. .... **Appalachian White Pine - Mesic Oak Forest – CEGL007517, p. 194**

5 Canopy dominated by *Tsuga canadensis* with deciduous species (*Betula alleghaniensis, Betula lenta, Halesia tetraptera var. monticola, Magnolia fraseri, Fagus grandifolia, Liriodendron tulipifera*).

6 (1 of 3 leads) Canopy dominated by *Tsuga canadensis* and *Betula alleghaniensis* with a dense evergreen shrub stratum and sparse herb coverage; sites are above 3000 feet elevation, on steep, mostly north-facing slopes, and on slopes and flats along and above streams.....**Blue Ridge Hemlock - Northern Hardwood Forest – (CEGL007861), p. 201**

6 (2 of 3 leads) Canopy dominated by *Tsuga canadensis* and *Halesia tetraptera var. monticola*; other canopy species can include *Acer saccharum, Fagus grandifolia, Magnolia fraseri, Betula alleghaniensis,* and *Acer rubrum*; the evergreen canopy may

overtop the deciduous trees or occur beneath the deciduous canopy; the shrub stratum is either dense, tall *Rhododendron maximum* or open and dominated by canopy saplings or *Acer pensylvanicum*; the herb stratum has moderate coverage; common species are *Aster divaricatus, Dryopteris intermedia, Huperzia lucidula, Medeola virginiana, Mitchella repens, Oxalis montana, Solidago curtisii, Tiarella cordifolia,* and *Viola blanda*; sites are protected slopes and coves, typically above 3000 feet elevation, but may extend to lower elevations. ..... **Southern Appalachian Acid Cove Forest (Silverbell Type) – CEGL007693, p. 209**

6 (3 of 3 leads) Canopy is dominated by *Tsuga canadensis,* occurring with *Liriodendron tulipifera, Betula lenta,* and/or *Acer rubrum*; the shrub stratum has scattered to dominant *Rhododendron maximum*; other characteristic species are *Euonymus americanus, Ilex opaca, Leucothoe fontanesiana, Mitchella repens, Polystichum acrostichoides*; sites are low slopes and flats, is often associated with small streams, mostly below 3000 feet elevation. ..... **Southern Appalachian Acid Cove Forest (Typic Type) – CEGL007543, p. 205**

4 Canopy mainly dominated by deciduous trees (less than 25% evergreen coverage in the canopy).

7 Canopy dominated by oaks (*Quercus* spp.) sometimes codominating with *Carya* spp.

8 Canopy dominated by *Quercus alba* or *Quercus rubra.*

9 Canopy mainly to strongly dominated by *Quercus rubra,* sites are intermediately exposed slopes, sheltered slopes, and steep coves.

10 Canopy is strongly dominated by *Quercus rubra* and *Acer rubrum*; *Carya* spp. may be present but do not dominate; other canopy species may include *Liriodendron tulipifera, Quercus prinus*; shrub strata are well-developed and may be quite dense; common shrubs are *Gaylussacia ursina, Castanea dentata, Calycanthus floridus, Pyrularia pubera, Rhododendron calendulaceum; Tsuga canadensis* saplings often have moderate coverage in the shrub stratum; herbaceous cover is sparse to moderate but species rich; sites are at intermediate elevations (between 2000 and 4000 feet) and on slopes of intermediate to protected exposure. .... **Appalachian Montane Oak - Hickory Forest (Red Oak Type) – CEGL006192, p. 145**

10 Canopy is dominated by *Quercus rubra; Quercus rubra* may be the sole canopy tree or occur with lesser amounts of *Tilia americana var. heterophylla, Halesia tetraptera var. monticola, Acer saccharum,* or *Liriodendron tulipifera;* herbs are sparse to moderate in coverage and characteristic of rich forests in cove landforms; characteristic species include *Collinsonia canadensis, Actaea pachypoda, Caulophyllum thalictroides, Laportea canadensis, Maianthemum racemosum, Phegopteris hexagonoptera, Tradescantia subaspera*; sites are protected steep slopes, often rocky; below 4000 feet elevation. .... **Southern Appalachian Red Oak Cove Forest – CEGL007878, p. 148**

9 Canopy dominated by *Quercus alba* or by *Quercus alba* and *Quercus rubra*

codominating.

11 Community either exists in an exposed location or a south facing slope. Communities found at very low elevations ranging from 1000-2000 feet. Soils very calcium rich. Shrub layer dominated by *Cercis canadensis*. Herb layer dense to sparse and very species rich…….....
Ridge-and-Valley Dry-Mesic White Oak-Hickory Forest-CEGL7240,p 140

11 Community exists in a protected slope or cove. Communities found at elevations ranging from 1500 – 4000 feet).

12 Canopy and subcanopy dominated by *Quercus alba*, with *Carya glabra* and *Acer rubrum*; *Carya alba* can share canopy dominance at low elevations (below 2500 feet), *Quercus rubra* often codominates at the highest elevations (over 3800 feet); associated species are typical of montane acidic forests; indicators of circumneutral soils are lacking. ... ..**Appalachian Montane Oak Hickory Forest (Typic Acidic Type) – CEGL007230, p. 137**

12 Canopy dominated by *Quercus alba*, occurring with other *Quercus spp*. and *Carya spp*.; occasionally with typical "cove" species (e.g. *Fraxinus americana* or *Magnolia acuminata*); heath species (*Rhododendron maximum* or *Kalmia latifolia*) are absent or very minor in the shrub stratum; herbaceous stratum can be quite diverse and is characterized by mesic herbs and species associated with circumneutral soils; characteristic species are *Podophyllum peltatum, Arisaema triphyllum, Amphicarpaea bracteata, Adiantum pedatum, Collinsonia canadensis, Cimicifuga racemosa, Caulophyllum thalictroides, Sanguinaria canadensis*..... ..... **Appalachian Montane Oak - Hickory Forest (Rich Type) – CEGL007692, p. 143**

8 Canopy mainly dominated by *Quercus prinus*.

13 Canopy dominated by *Quercus prinus* and *Acer rubrum*; occasionally *Carya glabra, Liriodendron tulipifera, Quercus velutina; Carya spp.* can have high coverage in the canopy or subcanopy; subcanopy is dominated by *Cornus florida;* shrub stratum is sparse, lacking dense, ericaceous cover; herbaceous cover is sparse to moderate but species rich; characteristic or dominant herbs include *Maianthemum racemosum ssp. racemosum, Thalictrum thalictroides, Desmodium nudiflorum, Polystichum acrostichoides, Thelypteris noveboracensis.*..... ..... **Appalachian Montane Oak Hickory Forest (Chestnut Oak Type)-- CEGL007267, p. 156**

13 Canopy dominated by *Quercus prinus* occurring with *Quercus rubra* and/or *Acer rubrum* over dense, tall *Rhododendron maximum*; sparse herb cover; sites are very steep, northerly slopes.....
.....**Chestnut Oak Forest (Mesic Slope Heath Type) – CEGL006286, p. 159**

7 Canopy not dominated by Oaks (*Quercus spp*.), but dominated by other broad leaved

deciduous species (*Acer saccharum, Aesculus flava, Betula alleghaniensis, Betula lenta, Fraxinus americana, Carya glabra, Liriodendron tulipifera, Halesia tetraptera var. monticola, Tilia americana var. heterophylla*).

14 Open canopy/shrubland mainly comprised of *Carya glabra, Fraxinus spp.,* and some *Quercus prinus*. Found only on the Kinzel Springs quadrangle .....**Blue Ridge Calcareous Shale Slope Woodland (Shrubby Type) – CEGL004995, p. 218**

14 Closed canopy dominated by *Acer saccharum, Aesculus flava, Betula alleghaniensis, Betula lenta, Liriodendron tulipifera, Halesia tetraptera var. monticola, Tilia americana var. heterophylla*.

15 Herb layer is absent to sparse; dense ericaceous shrub layer is dominated by *Rhododendron maximum*; canopy is dominated by *Liriodendron tulipifera* and *Betula lenta*; sites are associated with small streams, below 3000 feet elevation. **Southern Appalachian Acid Cove Forest (Typic Type) – CEGL007543, p. 205**

15 Herb layer species rich, typically with high coverage; shrub layer is absent to open, lacking evergreen ericads.

16 Canopy with *Betula alleghaniensis* or *Fagus grandifolia* sharing dominance with *Aesculus flava, Acer saccharum, Halesia tetraptera var. monticola*; herb cover is lush and diverse with species such as *Deparia acrostichoides, Viola canadensis, Cimicifuga americana, Cimicifuga racemosa, Dryopteris intermedia, Laportea canadensis, Disporum lanuginosum, Viola canadensis;* sites upper portions of draws and coves with northerly aspects, over 3500 feet elevation. .... **Southern Appalachian Northern Hardwood Forest (Rich Type) – CEGL004973, p. 103**

16 Canopy without *Betula alleghaniensis* and *Fagus grandifolia*.

17 Canopy is dominated either *by Acer saccharum, Aesculus flava, Fraxinus americana, Halesia tetraptera var. monticola,* or *Tilia americana var. heterophylla*, or by various combinations of these species; herb stratum is lush and diverse; characteristic herbs include *Deparia acrostichoides, Disporum lanuginosum, Hydrophyllum canadense, Laportea canadensis, Solidago flexicaulis, Hepatica nobilis var. acuta, Osmorhiza claytonii, Aristolochia macrophylla, Dryopteris goldiana, Asarum canadense, Viola canadensis*; sites are steep, middle to low protected slopes and coves, mostly below 4000 feet elevation. ....**Southern Appalachian Cove Forest (Rich Montane Type) – CEGL007695, p. 125**

17 Canopy dominated by various mixtures of *Liriodendron tulipifera, Halesia tetraptera var. monticola, Tilia americana var. heterophylla, Acer rubrum, Fraxinus americana*; other canopy tree can include *Acer saccharum, Aesculus flava, Betula lenta, Prunus serotina, Tsuga canadensis*; shrub cover is sparse to moderate; herbaceous stratum is sparse to moderate, but always diverse, composed of a mix of species characteristic of high base

status soils and those more typical of acidic forests; typically ***lacking*** strong calciphiles such as *Diplazium pycnocarpon, Asplenium rhizophyllum, Dryopteris goldiana, Aquilegia canadensis, Solidago flexicaulis*, *Deparia acrostichoides*, and *Cystopteris protrusa*; sites are on low, protected topographic positions, often near streams on gentle to moderate slopes with northerly aspects..... ..... **Southern Appalachian Cove Forest (Typic Montane Type) - CEGL007710, p. 129**

VEGETATION DESCRIPTIONS

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ELCODE	ASSOCIATION	COMMUNITYNAME	Page	GRank
CEGL002591	Pinus virginiana Successional Forest	Virginia Pine Successional Forest	81	GD
CEGL003560	Pinus echinata / Schizachyrium scoparium Appalachian Woodland	Shortleaf Pine/Little Bluestem Appalachian Woodland	212	G2
CEGL003624	Pinus virginiana / Schizachyrium scoparium - Carex pensylvanica Woodland	Blue Ridge Acid Shale Woodland	221	G2?
CEGL003814	Kalmia latifolia - Rhododendron catawbiense - (Gaylussacia baccata, Pieris floribunda, Vaccinium corymbosum) Shrubland	Southern Appalachian Mountain Laurel Bald	223	G2G3
CEGL003836	Arundinaria gigantea ssp. gigantea Shrubland	Floodplain Canebrake	228	G2?
CEGL003890	Vitis aestivalis Vine-Shrubland	Montane Grape Opening	231	G2G3
CEGL003893	Rubus canadensis - (Rubus idaeus ssp. strigosus) / Athyrium filix-femina - Solidago glomerata Shrubland	High-Elevation Blackberry Thicket	233	GM
CEGL003895	Alnus serrulata - Xanthorhiza simplicissima Shrubland	Rocky Bar and Shore (Alder - Yellowroot Type)	236	G3G4
CEGL003909	Alnus serrulata - Lindera benzoin / Scutellaria lateriflora - Thelypteris noveboracensis Shrubland	Montane Low-Elevation Seep	238	G2?
CEGL003910	(Diospyros virginiana, Platanus occidentalis) / Eupatorium serotinum - Diodia virginiana Herbaceous Vegetation	Artificial Lake Drawdown Zone	263	GW
CEGL004048	Lolium (arundinaceum, pratense) Herbaceous Vegetation	Cultivated Meadow	240	GW
CEGL004103	Carex torta Herbaceous Vegetation	Rocky Bar and Shore (Twisted Sedge Type)	245	G3G4
CEGL004112	Juncus effusus Seasonally Flooded Herbaceous Vegetation	Rush Marsh	250	G5
CEGL004242	Danthonia compressa - (Sibbaldiopsis tridentata) Herbaceous Vegetation	Grassy Bald (Southern Grass Type)	242	G1
CEGL004277	Saxifraga michauxii - Carex misera - Oclemena acuminata - Solidago glomerata Herbaceous Vegetation	Southern Appalachian High-Elevation Rocky Summit (High Peak Type)	260	G1
CEGL004278	Saxifraga michauxii - Carex misera - Calamagrostis cainii Herbaceous Vegetation	Southern Appalachian High-Elevation Rocky Summit (Anakeesta Type)	258	G1

ELCODE	ASSOCIATION	COMMUNITYNAME	Page	GRank
CEGL004290	Polygonum (hydropiperoides, punctatum) - Leersia (lenticularis, virginica) Herbaceous Vegetation	Smartweed - Cutgrass Beaver Pond	272	G4?
CEGL004293	Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis Herbaceous Vegetation	Rich Montane Seep (High-Elevation Type)	267	G3
CEGL004296	Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis Herbaceous Vegetation	Rich Montane Seep (Cove Type)	265	G3
CEGL004302	Vittaria appalachiana - Heuchera parviflora var. parviflora - Houstonia serpyllifolia / Plagiochila spp. Herbaceous Vegetation	Southern Blue Ridge Spray Cliff	269	G2
CEGL004394	Cystopteris bulbifera - (Asplenium rhizophyllum) Sparse Vegetation	Appalachian Wet Limestone Cliff	278	G?
CEGL004420	Acer rubrum var. trilobum - Fraxinus pennsylvanica / Carex crinita - Peltandra virginica Forest	Montane Floodplain Slough Forest	183	G1
CEGL004476	Asplenium ruta-muraria - Pellaea atropurpurea Sparse Vegetation	Montane Cliff (Calcareous Type)	276	G3G4
CEGL004691	Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana Forest	Appalachian Montane Alluvial Forest	180	G2?
CEGL004973	Aesculus flava - Betula alleghaniensis - Acer saccharum / Acer spicatum / Caulophyllum thalictroides - Laportea canadensis Forest	Southern Appalachian Northern Hardwood Forest (Rich Type)	103	G3
CEGL004980	Asplenium montanum - Heuchera villosa Felsic Cliff Sparse Vegetation	Appalachian Felsic Cliff	274	G3G4
CEGL004982	Betula alleghaniensis / Acer spicatum / Hydrangea arborescens - Ribes cynosbati / Dryopteris marginalis Forest	Southern Appalachian Hardwood Boulderfield Forest (Typic Type)	110	G3
CEGL004983	Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense) Forest	Red Spruce - Northern Hardwood Forest (Shrub Type)	187	G1?
CEGL004995	Carya glabra - Fraxinus americana - Quercus prinus / Ostrya virginiana / Philadelphus hirsutus Woodland	Blue Ridge Calcareous Shale Slope Woodland (Shrubby Type)	218	G2

ELCODE	ASSOCIATION	COMMUNITYNAME	Page	GRank
CEGL006049	Abies fraseri / Viburnum lantanoides / Dryopteris campyloptera - Oxalis montana / Hylocomium splendens Forest	Fraser Fir Forest (Deciduous Shrub Type)	86	G1
CEGL006124	Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum Forest	Southern Appalachian Boulderfield Forest (Currant and Rockcap Fern Type)	113	G3
CEGL006130	Fagus grandifolia / Carex pensylvanica - Carex brunnescens Forest	Southern Appalachian Beech Gap (South Slope Sedge Type)	120	G1
CEGL006192	Quercus rubra - Acer rubrum / Calycanthus floridus - Pyrularia pubera / Thelypteris noveboracensis Forest	Appalachian Montane Oak - Hickory Forest (Red Oak Type)	145	G4?
CEGL006246	Fagus grandifolia / Ageratina altissima var. roanensis Forest	So. Appalachian Beech Gap (North Slope Tall Herb Type)	117	G1
CEGL006256	Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata Forest	Red Spruce - Northern Hardwood Forest (Herb Type)	189	G2
CEGL006271	Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens) Forest	Chestnut Oak Forest (Xeric Ridge Type)	153	G5
CEGL006272	Picea rubens - Tsuga canadensis / Rhododendron maximum Forest	Red Spruce - Fraser Fir Forest (Hemlock Type)	96	G2?
CEGL006286	Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata Forest	Chestnut Oak Forest (Mesic Slope Heath Type)	159	G4
CEGL006308	Abies fraseri / (Rhododendron catawbiense, Rhododendron carolinianum) Forest	Fraser Fir Forest (Evergreen Shrub Type)	83	G1
CEGL007078	Pinus echinata / Vaccinium (pallidum, stamineum) - Kalmia latifolia Forest	Appalachian Shortleaf Pine Forest	69	G4?
CEGL007097	Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum Woodland	Blue Ridge Table Mountain Pine - Pitch Pine Woodland (Typic Type)	214	G3
CEGL007100	Pinus strobus / Kalmia latifolia - (Vaccinium stamineum, Gaylussacia ursina) Forest	Southern Appalachian White Pine Forest	73	G2G3
CEGL007102	Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana) Forest	Southern Appalachian Eastern Hemlock Forest (White Pine Type)	71	G4

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CEGL007119	Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum Forest	Appalachian Low-Elevation Mixed Pine / Hillside Blueberry Forest	77	G4?
CEGL007130	Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum) Forest	Red Spruce - Fraser Fir Forest (Evergreen Shrub Type)	89	G1
CEGL007131	Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens Forest	Red Spruce - Fraser Fir Forest (Deciduous Shrub Type)	92	G2
CEGL007136	Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana) Forest	Southern Appalachian Eastern Hemlock Forest (Typic Type)	98	G3G4
CEGL007219	Liriodendron tulipifera - Acer rubrum - Robinia pseudoacacia Forest	Early Successional Appalachian Hardwood Forest	133	GD
CEGL007230	Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina) Forest	Appalachian Montane Oak Hickory Forest (Typic Acidic Type)	137	G5
CEGL007240	Quercus alba - Quercus rubra - Carya ovata / Cercis canadensis - Juniperus virginiana var. virginiana Forest	Ridge-and-Valley Dry-Mesic White Oak - Hickory Forest	140	G4
CEGL007267	Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida Forest	Appalachian Montane Oak Hickory Forest (Chestnut Oak Type)	156	G4G5
CEGL007285	Betula alleghaniensis - Fagus grandifolia - Aesculus flava / Viburnum lantanoides / Eurybia chlorolepis - Dryopteris intermedia Forest	Southern Appalachian Northern Hardwood Forest (Typic Type)	106	G3G4
CEGL007295	Quercus alba / Kalmia latifolia Forest	Southern Blue Ridge High-Elevation White Oak Forest	151	G2Q
CEGL007298	Quercus rubra / Carex pensylvanica - Ageratina altissima var. roanensis Forest	High-Elevation Red Oak Forest (Tall Herb Type)	169	G2
CEGL007299	Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata Forest	High-Elevation Red Oak Forest (Evergreen Shrub Type)	162	G4

ELCODE	ASSOCIATION	COMMUNITYNAME	Page	GRank
CEGL007300	Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis) Forest	High-Elevation Red Oak Forest (Deciduous Shrub Type)	165	G4
CEGL007339	Platanus occidentalis - Fraxinus pennsylvanica - Quercus imbricaria Forest	Montane Alluvial Forest (Cades Cove/Ocanaluftee)	174	G2Q
CEGL007388	Liquidambar styraciflua - Acer rubrum / Carex spp. - Sphagnum spp. Forest	Upland Sweetgum - Red Maple Pond	185	G2Q
CEGL007493	Pinus echinata - Quercus (prinus, falcata) / Oxydendrum arboreum / Vaccinium pallidum Forest	Southern Blue Ridge Escarpment Shortleaf Pine - Oak Forest	192	G3G4
CEGL007517	Pinus strobus - Quercus alba - (Carya alba) / Gaylussacia ursina Forest	Appalachian White Pine - Mesic Oak Forest	194	G2G3
CEGL007519	Pinus strobus - Quercus (coccinea, prinus) / (Gaylussacia ursina, Vaccinium stamineum) Forest	Appalachian White Pine - Xeric Oak Forest	196	G3
CEGL007539	Pinus virginiana - Quercus prinus - Quercus rubra / Vaccinium pallidum - Kalmia latifolia Forest	Blue Ridge Acid Shale Forest	199	G2?
CEGL007543	Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum Forest	Southern Appalachian Acid Cove Forest (Typic Type)	205	G5
CEGL007691	Quercus alba - Quercus coccinea - Quercus falcata / Kalmia latifolia - Vaccinium pallidum Forest	Appalachian Montane Oak - Hickory Forest (Low-Elevation Xeric Type)	172	G2G3
CEGL007692	Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata Forest	Appalachian Montane Oak - Hickory Forest (Rich Type)	143	G3
CEGL007693	Tsuga canadensis - Halesia tetraptera - (Fagus grandifolia, Magnolia fraseri) / Rhododendron maximum / Dryopteris intermedia Forest	Southern Appalachian Acid Cove Forest (Silverbell Type)	209	G2
CEGL007695	Aesculus flava - Acer saccharum - (Fraxinus americana, Tilia americana) / Hydrophyllum canadense - Solidago flexicaulis Forest	Southern Appalachian Cove Forest (Rich Montane Type)	125	G3G4

ELCODE	ASSOCIATION	COMMUNITYNAME	Page	GRank
CEGL007697	Carex gynandra - Platanthera clavellata - Drosera rotundifolia - Carex ruthii - Carex atlantica / Sphagnum spp. Herbaceous Veg	Blue Ridge High-Elevation Seep (Sedge Type)	254	G2
CEGL007710	Liriodendron tulipifera - Aesculus flava - (Fraxinus americana, Tilia americana var. heterophylla) / Actaea racemosa - Laportea canadensis Forest	Southern Appalachian Cove Forest (Typic Montane Type)	129	G4
CEGL007861	Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana Forest	Blue Ridge Hemlock - Northern Hardwood Forest	201	G3G4Q
CEGL007876	Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium Shrubland	Southern Appalachian Heath Bald	226	G1
CEGL007877	Calamagrostis cainii - Carex ruthii - Parnassia asarifolia / Sphagnum spp. Herbaceous Vegetation	Blue Ridge High-Elevation Seep (Mt. Le Conte Type)	252	G1Q
CEGL007878	Quercus rubra - Tilia americana var. heterophylla -Halesia tetraptera var. monticola / Collinsonia canadensis - Tradescantia subaspera Forest	Southern Appalachian Red Oak Cove Forest	148	G3?
CEGL007879	Juglans nigra / Verbesina alternifolia Forest	Successional Black Walnut Forest	121	GD
CEGL007880	Liquidambar styraciflua - Liriodendron tulipifera - (Platanus occidentalis) / Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata Forest	Montane Sweetgum Alluvial Flat	176	G?
CEGL007944	Pinus strobus Successional Forest	Eastern White Pine Successional Forest	75	GD
CEGL008433	Juncus effusus - Chelone glabra - Scirpus spp. Southern Blue Ridge Beaver Pond Herbaceous Vegetation	Southern Blue Ridge Beaver Pond Marsh	248	G4?
CEGL008438	Glyceria striata - Carex gynandra - Chelone glabra - Symphyotrichum puniceum / Sphagnum spp. Herbaceous Vegetation	Southern Appalachian Wet Seepage Meadow	256	G2G3
CEGL008558	Acer rubrum var. rubrum - Nyssa sylvatica - Magnolia fraseri - Oxydendrum arboreum / (Rhodo maximum, Kalmia latifolia) Forest	Southern Appalachian Mixed Hardwood Forest	100	GM

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CEGL006272	Picea rubens - Tsuga canadensis / Rhododendron maximum Forest	96
CEGL006308	Abies fraseri / (Rhododendron catawbiense, Rhododendron carolinianum) Forest	83
CEGL007130	Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum) Forest	89
CEGL007131	Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens Forest	92
CEGL004983	Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense) Forest	187
CEGL006256	Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata Forest	189
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CEGL006130	Fagus grandifolia / Carex pensylvanica - Carex brunnescens Forest	120
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CEGL007861	Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana Forest	201
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CEGL006124	Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum Forest	113

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CEGL007119	Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum Forest	77
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CEGL007543	Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum Forest	205
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CEGL006286	Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata Forest	159
CEGL007230	Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina) Forest	137
CEGL007240	Quercus alba - Quercus rubra - Carya ovata / Cercis canadensis - Juniperus virginiana var. virginiana Forest	140
CEGL007267	Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida Forest	156
CEGL007691	Quercus alba - Quercus coccinea - Quercus falcata / Kalmia latifolia - Vaccinium pallidum Forest	172
CEGL007692	Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata Forest	143
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CEGL008558	Acer rubrum var. rubrum - Nyssa sylvatica - Magnolia fraseri - Oxydendrum arboretum / (Rhodo maximum, Kalmia latifolia) Forest	100
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ELCODE	ASSOCIATION	PAGE
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Vegetation Descriptions for Great Smoky Mountains National Park

INTERNATIONAL CLASSIFICATION OF ECOLOGICAL COMMUNITIES:

Great Smoky Mountains National Park

Report from
Biological Conservation Datasystem
February, 2003

by

NatureServe
1101 Wilson Blvd., 15th floor
Arlington, VA 22209

This subset of the International Classification of Ecological Communities (ICEC) covers vegetation alliances and associations attributed to Great Smoky Mountains National Park**.** This community classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. A fully searchable and periodically updated on-line source for the ICEC is at http://www.natureserveexplorer.org. Comments and suggestions regarding the contents of this subset should be directed to Rickie White at the Southern regional office of NatureServe in Durham, North Carolina.

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Pinus echinata / Vaccinium (pallidum, stamineum) - Kalmia latifolia Forest

Shortleaf Pine / (Hillside Blueberry, Deerberry) - Mountain Laurel Forest

Appalachian Shortleaf Pine Forest

Ecological Group (SCS;MCS): Appalachian Highlands Xeric Shortleaf Pine Woodlands and Forests (401-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes forest vegetation with greater than 75% of the canopy cover of *Pinus echinata*, occurring over a shrub stratum dominated by ericaceous species, typically *Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia*. Deciduous species make-up less than 25% of the canopy coverage and may include *Quercus falcata, Quercus coccinea*, or, in the southern part of this association's range, *Quercus stellata* and *Quercus marilandica*. This community often has a midstory tree stratum with *Oxydendrum arboreum, Carya pallida, Cornus florida*, or *Diospyros virginiana*. Other characteristic species include *Smilax glauca, Silphium compositum, Pteridium aquilinum var. latiusculum, Scleria oligantha, Piptochaetium avenaceum*, and *Tephrosia virginiana*. These forests occur in the lower elevations (below 2400 feet) of the southern Appalachian Mountains on ridges and upper slopes, typically with southern to western exposures.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: If this community exists within the park boundary, it exists below 2400 feet elevation.

Global Environment: These forests occur in the lower elevations (below 2400 feet) of the southern Appalachian Mountains on ridges and upper slopes, typically with southern to western exposures.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global description

Global Vegetation: The closed canopy is dominated by *Pinus echinata*. Deciduous species make up less than 25% of the canopy coverage and may include *Quercus falcata, Quercus coccinea*, or, in the southern part of this association's range, *Quercus stellata* and *Quercus marilandica*. This community often has a midstory tree stratum with *Oxydendrum arboreum, Carya pallida, Cornus florida*, or *Diospyros virginiana*. The shrub stratum is dominated by ericaceous species, typically *Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia*. Other characteristic species include *Smilax glauca, Silphium compositum, Pteridium aquilinum var. latiusculum, Scleria oligantha, Piptochaetium avenaceum*, and *Tephrosia virginiana*. In a sample from the Southern Blue Ridge in Union County, Georgia (Chattahoochee National Forest), *Pinus echinata* occupies 75-95% of the canopy which also occasionally includes *Quercus falcata, Quercus coccinea*, and *Pinus strobus*. The subcanopy is codominated by *Acer rubrum, Oxydendrum arboreum*, and *Cornus florida*. The open shrub layer is characterized by *Ilex opaca, Cornus florida, Vaccinium pallidum, Diospyros virginiana, Prunus serotina, Sassafras albidum*, and *Viburnum dentatum*. The sparse herb layer includes *Coreopsis major, Chimaphila maculata, Maianthemum racemosum, Lespedeza violacea (= Lespedeza intermedia)*, and *Trillium catesbaei*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Pinus echinata*
TREE SUB-CANOPY	*Diospyros virginiana, Nyssa sylvatica, Oxydendrum arboreum*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Vaccinium pallidum, Vaccinium stamineum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Pinus echinata*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Vaccinium pallidum*

GRank & Reasons: G4? (97-12-01).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park: This community most likely exists within the park boundaries but was never encountered. However, communities that were transitional between this community and Appalachian Montane Oak - Hickory Forest (Low Elevation Xeric Type), *Quercus alba - Quercus coccinea - Quercus falcata / Kalmia latifolia - Vaccinium pallidum* Forest (CEGL007691), were documented from this project. It is likely that the community is a more xeric, more fire-adapted version of CEGL007691.

Global Classif Comments: Includes successional forests with a hardwood shrub/sapling stratum.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was not observed or sampled. However, forests dominated by *Pinus echinata* are thought to occur within the park boundary, especially in the area around Calderwood quadrangle. It should be looked for on dry south-facing fire-prone slopes and will most likely be found near ocurrences of Appalachian Montane Oak - Hickory Forest (Low Elevation Xeric Type) (CEGL007691).

Global Range: These forests occur in the lower elevations of the southern Appalachian Mountains.

Nations: US
States/Provinces: GA:S?, KY:S?, MD:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 51:C, 52:P
USFS Ecoregions: 222Hc:CCC, M221A:CC, M221Ce:CCC, M221Dc:CCC, M221Dd:CCP
Federal Lands: NPS (Great Smoky Mountains?); USFS (Chattahoochee, Cherokee?, Nantahala, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: S. Simon, G. Kauffman, D. Danley, SCS **Confidence:** 2 **Identifier:** CEGL007078
REFERENCES (type in full citation below if reference is new): Allard 1990, CAP pers. comm. 1998, Evans 1991, NatureServe Ecology - Southeast U.S. unpubl. data, Nelson 1986, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990

Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana) Forest

Eastern White Pine - Eastern Hemlock / Great Rhododendron - (Mountain Doghobble) Forest
Southern Appalachian Eastern Hemlock Forest (White Pine Type)
Ecological Group (SCS;MCS): Appalachian Highlands Upland Eastern Hemlock Forests (420-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This forest vegetation has a canopy dominated by *Pinus strobus*, sometimes codominating with *Tsuga canadensis*, occurring over a shrub stratum dominated by *Rhododendron maximum*. This is an evergreen forest, but deciduous trees may form a minor part of the canopy. Other minor canopy species may include *Liriodendron tulipifera, Betula lenta, Magnolia fraseri* (within its range), *Acer rubrum*, and *Tilia americana var. heterophylla*. Other shrub species may include *Kalmia latifolia, Leucothoe fontanesiana, Lindera benzoin*, and *Ilex opaca var. opaca*. Herbaceous cover is typically sparse. This community occurs on creek and river margins and on lower or protected slopes. This association occurs in the Southern Blue Ridge and may extend into adjacent ecoregions, such as the Cumberlands of Kentucky. These Kentucky examples lack *Leucothoe fontanesiana* and have *Magnolia macrophylla* rather than *Magnolia fraseri*. Large stems of *Smilax rotundifolia* may be present in stands of this vegetation.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community is found at low elevations on low, protected slopes, and flats along streams. Samples of this community had a mean elevation of 1800 feet and ranged from 1400 to 2100 feet in elevation. Samples had southwest, west, northwest, and northeast aspects.

Global Environment: This community occurs on creek and river margins and on lower or protected slopes in the Southern Blue Ridge; it may extend into adjacent ecoregions, such as the Cumberlands of Kentucky.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest is dominated by *Pinus strobus* and *Tsuga canadensis*. Other species that may have coverage in the subcanopy include *Acer rubrum, Liriodendron tulipifera, Magnolia fraseri, Oxydendrum arboreum*, and *Quercus alba*. The tall-shrub stratum is dominated by *Rhododendron maximum*. *Leucothoe fontanesiana* sometimes dominates a short-shrub stratum. Other shrubs can include *Calycanthus floridus, Clethra acuminata, Ilex opaca, Kalmia latifolia*, and *Pyrularia pubera*. Herb coverage is sparse. Typical species include *Chimaphila maculata, Galax urceolata, Goodyera pubescens, Hexastylis arifolia var. ruthii*, and *Mitchella repens*.

Global Vegetation: This forest vegetation has a canopy dominated by *Pinus strobus*, sometimes codominating with *Tsuga canadensis*, occurring over a shrub stratum dominated by *Rhododendron maximum*. This is an evergreen forest, but deciduous trees may form a minor part of the canopy. Other minor canopy species may include *Liriodendron tulipifera, Betula lenta, Magnolia fraseri* (within its range), *Acer rubrum*, and *Tilia americana var. heterophylla*. Other shrub species may include *Kalmia latifolia, Leucothoe fontanesiana, Lindera benzoin*, and *Ilex opaca var. opaca*. Herbaceous cover is typically sparse. Typical herbs include *Thelypteris noveboracensis, Chimaphila maculata, Mitchella repens, Polystichum acrostichoides, Medeola virginiana*, and *Tiarella cordifolia*. Kentucky Cumberland examples lack *Leucothoe fontanesiana* and have *Magnolia macrophylla* rather than *Magnolia fraseri*. Large stems of *Smilax rotundifolia* may be present in stands of this vegetation.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus strobus, Tsuga canadensis*
TREE SUB-CANOPY	*Acer rubrum, Oxydendrum arboreum*
TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

Global

Stratum	Species
TREE CANOPY	*Pinus strobus, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus strobus, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*

Global

Stratum	Species
TREE CANOPY	*Pinus strobus*
TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana) Forest (CEGL007136)--dominated by *Tsuga canadensis*.

GRank & Reasons: G4 (97-12-01).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: It is unclear if there is an environmental factor that distinguishes forests codominated by *Tsuga canadensis* and *Pinus strobus* and those dominated by only *Tsuga canadensis*. It is possible that those codominated by *Pinus strobus* occur on drier, more westerly exposed sites or perhaps on previously disturbed sites. It is unlikely that the signature of this association will be distinguishable from that of *Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana)* Forest (CEGL007136).

Global Classif Comments: Similar forests in the Cumberlands of Kentucky lack *Leucothoe fontanesiana*, and have *Magnolia macrophylla* rather than *Magnolia fraseri*. This forest is common in the Chattooga River basin.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove and Mount Le Conte quadrangles and is likely in other areas of the park. Samples on the Cades Cove quadrangle ranged in elevation from 1600 to 2100 feet, mostly in the northwest portion of the quadrangle. Samples of this community came from slopes above More Licker Branch; from slopes along Abrams Creek, northeast of Spruce Double; from slopes above Arbutus Branch; from a ravine south of Coon Butt; and from low slopes in the vicinity of Wildcat Branch. This community is uncommon on the Mount Le Conte quadrangle and was sampled from a single location in the northeastern portion of the quadrangle, on steep, southwest slopes above the Little Pigeon River (1400 feet). This may be the only location for this community on the Mount Le Conte quadrangle.

Global Range: This community occurs in the Southern Blue Ridge, but extends into adjacent Cumberland Plateau or Ridge and Valley (?) ecoregions.

Nations: US
States/Provinces: GA:S?, KY:S?, NC:S?, SC:S?, TN:S?, VA?
TNC Ecoregions: 50:C, 51:C, 59:C
USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Eo:CCC, M221Be:CPP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 2 **Identifier:** CEGL007102
REFERENCES (type in full citation below if reference is new): Allard 1990, CAP pers. comm. 1998, Eyre 1980, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Pinus strobus / Kalmia latifolia - (Vaccinium stamineum, Gaylussacia ursina) Forest

Eastern White Pine / Mountain Laurel - (Deerberry, Bear Huckleberry) Forest
Southern Appalachian White Pine Forest
Ecological Group (SCS;MCS): Appalachian Highlands Upland White Pine Forests (401-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes natural stands of forest vegetation with a canopy dominated by *Pinus strobus*. This community occurs at lower elevations (below 900 m (3000 feet)) in the Southern Blue Ridge region of the southern Appalachians on upper slopes and ridgetops protected by higher landforms. Other minor canopy species may include *Pinus rigida, Quercus coccinea,* and *Acer rubrum*. These forests often have open subcanopies composed of *Oxydendrum arboreum, Acer rubrum, Nyssa sylvatica*, and *Cornus florida*. The shrub stratum is patchy to continuous and dominated by ericaceous species, typically *Gaylussacia ursina,* or *Vaccinium stamineum*, and *Kalmia latifolia*. Other common species in the shrub/sapling stratum may include *Gaylussacia baccata, Vaccinium pallidum, Acer rubrum,* and *Castanea dentata*. Typical herbaceous species include *Galax urceolata, Chimaphila maculata, Goodyera pubescens, Epigaea repens, Medeola virginiana, Lysimachia quadrifolia, Uvularia puberula*, and *Chamaelirium luteum.*

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community occurs below 900 m (*2700 ft) in the park on drier south-facing slopes.*

Global Environment: *This community occurs at lower elevations (below 900 m (3000 feet)) in the Southern Blue Ridge region of the southern Appalachians on upper slopes and ridgetops protected by higher landforms.*

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: *Within the park, examples of this association are mostly pure Pinus strobus* with the occasional *Quercus coccinea* and *Pinus virginiana* in the canopy. In addition, *Acer rubrum* is increasing in abundance in the understory and may eventually overtake the current canopy species in the absence of fire. *Kalmia latifolia* is the dominant shrub. Herbaceous species are uncommon and are characteristic of dry acid environments.

Global Vegetation: This association includes natural stands of forest vegetation with a canopy dominated by *Pinus strobus*. Other minor canopy species may include *Pinus rigida, Quercus coccinea*, and *Acer rubrum.* These forests often have open subcanopies composed of *Oxydendrum arboreum, Acer rubrum, Nyssa sylvatica*, and *Cornus florida*. The shrub stratum is patchy to continuous and dominated by ericaceous species, typically *Gaylussacia ursina* or *Vaccinium stamineum*, and *Kalmia latifolia*. Other common species in the shrub/sapling stratum may include *Gaylussacia baccata, Vaccinium pallidum, Acer rubrum,* and *Castanea dentata*. Typical herbaceous species include *Galax urceolata, Chimaphila maculata, Goodyera pubescens, Epigaea repens, Medeola virginiana, Lysimachia quadrifolia, Uvularia puberula*, and *Chamaelirium luteum.*

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus strobus*
TREE SUB-CANOPY	*Acer rubrum, Oxydendrum arboreum*
TALL SHRUB	*Kalmia latifolia*

Global

Stratum	Species
TREE CANOPY	*Pinus strobus*
TREE SUB-CANOPY	*Acer rubrum, Oxydendrum arboreum*
TALL SHRUB	*Kalmia latifolia*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Pinus strobus*
TREE SUB-CANOPY	*Oxydendrum arboreum*
TALL SHRUB	*Kalmia latifolia*
SHRUB	*Vaccinium stamineum*
FORB	*Chimaphila maculata*

GRank & Reasons: G2G3 (00-01-04). This community is geographically restricted and uncommon within its range.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community may have photosignatures similar to *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102) but is distinguished by occurring on low ridges and upper slopes. This community is compositionally and ecologically similar to *Pinus strobus - Quercus (coccinea, prinus) / (Gaylussacia ursina, Vaccinium stamineum)* Forest (CEGL007519).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was observed on the north side of the park in the Deep Creek drainage on an exposed south-facing slope.

Global Range: This community is known from the escarpment region of the Southern Blue Ridge and the Great Smoky Mountains of Tennessee.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Nantahala, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL007100
REFERENCES (type in full citation below if reference is new): Allard 1990, DeYoung 1979, Govus 1982, NatureServe Ecology - Southeast U.S. unpubl. data, Patterson 1994, Peet et al. 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990

Pinus strobus Successional Forest

Eastern White Pine Successional Forest
Eastern White Pine Successional Forest
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This forest is an early successional forest dominated by *Pinus strobus*, typically with a very dense canopy and little understory. This successional forest is commonly associated with anthropogenic disturbance and could potentially occur anywhere within the range of the *Pinus strobus* Forest Alliance (A.128). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species that favor openings or disturbance. In the Southern Blue Ridge, where this association was originally defined, typical canopy and subcanopy associates include *Liriodendron tulipifera, Acer rubrum, Pinus rigida,* and *Liquidambar styraciflua,* with *Tsuga canadensis* often forming a dense shrub stratum. In this ecoregion, it occurs in former old fields and on formerly cleared flats along streams. In the Daniel Boone National Forest of Kentucky, *Pinus strobus* is spreading from plantings, especially in the Red River Gorge.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community is generally found in areas previously cleared as farms and plowed at one point in time. They can also range up onto heavily disturbed slopes, but are best developed on flats near creeks and rivers.

Global Environment: This wide-ranging successional forest is commonly associated with anthropogenic disturbance and could potentially occur anywhere within the range of the *Pinus strobus* Forest Alliance (A.128). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species that favor openings or disturbance.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy is dominated by *Pinus strobus* and is sometimes codominated by other ruderal species such as *Liriodendron tulipifera*. Understory varies with age and stand characteristics.

Global Vegetation: In the Southern Blue Ridge, where this association was originally defined, typical canopy and subcanopy associates include *Liriodendron tulipifera, Acer rubrum, Pinus rigida,* and *Liquidambar styraciflua,* with *Tsuga canadensis* often forming a dense shrub stratum. In this ecoregion, it occurs in former old fields and on formerly cleared flats along streams. In the Daniel Boone National Forest of Kentucky, *Pinus strobus* is spreading from plantings, especially in the Red River Gorge.

GRank & Reasons: GD (01-02-11). This forest represents early successional vegetation and is thus not of conservation concern and does not receive a conservation status rank.

CLASSIFICATION COMMENTS

Global Classif Comments: This weedy type may be expected to occur throughout the range of the alliance but has only been attributed in areas where Nature Conservancy ecoregional planning or other project-specific needs have documented its occurrence. Rangewide review should greatly expand its geographic scope.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community exists throughout the low elevations of the park that have been previously cleared and allowed to grow back with time. Examples of this community sampled in this project were from areas near Oconaluftee River (Smokemont quad) and Abrams Creek (Calderwood quad).

Global Range: This weedy type may be expected to occur throughout the range of the alliance (i.e., from Michigan, northern Wisconsin, northern and eastern Minnesota, extreme northeastern Iowa, Maine and New Hampshire south to North Carolina, South Carolina, Georgia, Tennessee, Kentucky (?), and Virginia,

as well as in Ontario, Canada). It has only been documented in areas where project-specific needs have required it

Nations: US
States/Provinces: GA:S?, KY?, MI?, MN:S?, NC:S?, NY?, PA?, SC:S?, TN:S?, VA:S?, WI?, WV:S?
TNC Ecoregions: 47:P, 48:P, 49:C, 50:C, 51:C, 59:C, 60:P
USFS Ecoregions: 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222En:CCC, 222Eo:CCC, M221Aa:CCC, M221Ab:CCC, M221Cd:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Cherokee?, Daniel Boone, George Washington, Jefferson)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 2 **Identifier:** CEGL007944
REFERENCES (type in full citation below if reference is new): Fleming and Coulling 2001, NatureServe Ecology - Southeast U.S. unpubl. Data

Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum Forest

Virginia Pine - (Pitch Pine, Shortleaf Pine) - (Rock Chestnut Oak) / Hillside Blueberry Forest

Appalachian Low-Elevation Mixed Pine / Hillside Blueberry Forest

Ecological Group (SCS;MCS): Appalachian Highlands Xeric Virginia / Shortleaf Pine Woodlands (401-27; 2.5.3.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community includes *Pinus virginiana*-dominated forests of low-elevation ridges and steep upper slopes, occurring primarily in the Appalachian provinces of the eastern United States, from central Pennsylvania, south and west to northern Georgia and northern Alabama. This community occurs on narrow ridges, steep slopes, and other exposed topographic positions, over shallow, infertile soils. This mainly evergreen forest is often of low stature, with a somewhat open to closed canopy, sparse to very dense shrub cover dominated by ericaceous species, and a sparse herb stratum. *Pinus virginiana* is the canopy dominant throughout the range of the type. In some parts of the range, other *Pinus* species may be canopy associates, as well as dry site *Quercus* species (e.g., *Quercus prinus, Quercus coccinea*). Deciduous species may form a subcanopy or sapling stratum, particularly in areas where fire has been excluded. Common shrub dominants include *Vaccinium pallidum, Vaccinium stamineum,* and *Kalmia latifolia*. Herbs vary with geography but are typical of infertile, xeric habitats. Some typical herbs in this forest are *Baptisia tinctoria, Chimaphila maculata, Dichanthelium commutatum, Epigaea repens, Euphorbia corollata, Galax urceolata, Hypoxis hirsuta, Iris verna, Pityopsis graminifolia var. latifolia, Pteridium aquilinum var. latiusculum,* and *Schizachyrium scoparium.*

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found at elevations below 2300 feet on gentle to moderately steep slopes and low ridges. Sites supporting this community are exposed, typically with southern and western aspects. This forest is frequently fire-suppressed or affected by Southern pine beetle (*Dendroctonus frontalis*) and will have standing dead trees, thick litter layers, and much understory encroachment by hardwood species.

Global Environment: Stands of this forest occur on narrow ridges and knobs, steep, upper slopes, bluff and cliff tops, and other exposed sites throughout the range of the type. They are found primarily on south-, southeast- or southwest-facing aspects on excessively drained, shallow soils. In the Blue Ridge Escarpment region, the western margin of the Blue Ridge, and west into the Ridge and Valley and Cumberland Mountains, this xeric forest occurs on convex slopes and ridges below 610 meters (2000 feet) elevation, over soils classed as Inceptisols, typically Lithic Dystrochrepts originating from sandstone, shale and other noncalcareous parent material. Its environmental situation in the western Alleghenies is not known. In the Interior Low Plateau of Kentucky, Tennessee, and Indiana, this association occurs in edaphically extreme situations, including bluff tops and narrow ridges in thin soils weathered from relatively acidic caprocks with southern and western aspects, as well as other similar slopes, over cherty limestone, siltstones, sandstones, and shales. In particular, in the Knobstone Escarpment Subsection (a few Indiana counties just north of Louisville, Kentucky) it occurs in glade-like situations on steep slopes with thin soils.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Forests with canopies dominated by *Pinus virginiana*, sometimes with lesser amounts of *Pinus rigida* or *Pinus echinata*. *Acer rubrum* often dominates the subcanopy. Other canopy and subcanopy trees increase with fire suppression and include *Quercus prinus, Quercus coccinea, Quercus alba, Quercus marilandica, Quercus velutina, Pinus strobus, Oxydendrum arboreum, Nyssa sylvatica,* and *Tsuga canadensis*. The tall-shrub stratum can be open to moderately dense and is typically dominated by *Kalmia latifolia* and/or *Vaccinium stamineum*. The short-shrub stratum is typically dense and dominated by *Vaccinium pallidum* and/or *Gaylussacia ursina*. Fire-suppressed examples often have dense *Pinus strobus* in the shrub stratum. Other shrubs include saplings of canopy and subcanopy species as well as *Ilex opaca, Viburnum acerifolium, Vaccinium hirsutum, Amelanchier laevis,* and *Sassafras albidum*. Common vines are *Smilax glauca* and *Smilax rotundifolia*. Herb cover is sparse, and leaf litter often dominates the ground layer. Typical species in the herb stratum are *Galax urceolata,*

Pteridium aquilinum, Schizachyrium scoparium, Epigaea repens, Chimaphila maculata, and *Dichanthelium commutatum*.

Global Vegetation: This community is a needle-leaved evergreen forest with a somewhat open to closed canopy. A deciduous subcanopy may be present, especially in areas where fire has been excluded. The shrub layers can be sparse to very dense and are composed of tall and short shrubs, predominantly ericaceous species. Herb cover is sparse, and leaf litter often dominates the ground layer. *Pinus virginiana* is the canopy dominant throughout the range of the type. In the southern Appalachians and southern Ridge and Valley it may occur with mixes of *Pinus rigida, Pinus echinata,* or *Pinus strobus*. Within its range, *Pinus pungens* may be present as a very minor component. Small stems of *Quercus prinus, Quercus coccinea, Acer rubrum, Nyssa sylvatica*, and *Oxydendrum arboreum* are common in the subcanopy and sapling strata, particularly in areas where fire has been excluded. In the southern Blue Ridge/Piedmont and southern Blue Ridge/Ridge and Valley transition regions, *Quercus marilandica, Quercus falcata*, and *Quercus stellata* can be deciduous components. Common shrub dominants include *Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia*. Other typical shrubs can include *Gaylussacia ursina, Gaylussacia baccata, Sassafras albidum*, and *Vaccinium hirsutum* (southwestern North Carolina and southeastern Tennessee only). *Smilax glauca* and *Smilax rotundifolia* can be common vines. Characteristic herbaceous species from the southern Blue Ridge and southern Ridge and Valley include *Baptisia tinctoria, Chimaphila maculata, Dichanthelium commutatum, Epigaea repens, Euphorbia corollata, Galax urceolata, Hypoxis hirsuta, Iris verna, Pityopsis graminifolia var. latifolia, Pteridium aquilinum var. latiusculum*, and *Schizachyrium scoparium*. Typical herbs from examples in the western portion of the range (Interior Low Plateau) include *Antennaria plantaginifolia, Antennaria solitaria, Carex albicans var. albicans (= Carex artitecta), Danthonia spicata, Dichanthelium dichotomum, Lespedeza violacea (= Lespedeza intermedia), Hieracium gronovii, Hieracium venosum, Krigia biflora, Solidago erecta*, and *Tephrosia virginiana* (M. Homoya pers. comm. 1999). In some of these examples *Opuntia humifusa, Calamagrostis porteri ssp. insperata*, and *Solidago squarrosa* may occur locally.

Global Dynamics: This xeric, evergreen forest community will be maintained on sites where local soil conditions, topographic extremes, or occasional fire function to retard hardwood invasion. Infestations of southern pine beetle (*Dendroctonus frontalis*) can cause mortality of canopy trees. Examples affected by southern pine beetle in the Great Smoky Mountains can have up to 80-90% standing dead pine. Throughout most of its range, this community occurs as linear features along ridge tops and may be adjacent to or grade into xeric forests dominated by *Quercus coccinea* or *Quercus prinus* or more mesic forests dominated by *Quercus alba, Quercus rubra, Quercus velutina, Carya glabra*, and *Carya alba*. In the Interior Low Plateau, individual stands can be small in size, occurring in a matrix of *Quercus prinus* or *Quercus prinus - Quercus alba* forest (e.g., *Quercus prinus / Smilax* spp. Forest (CEGL005022) or *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)), but in more edaphically extreme circumstances.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus virginiana*
TREE SUB-CANOPY	*Acer rubrum*
TALL SHRUB	*Kalmia latifolia, Vaccinium stamineum*
SHORT SHRUB	*Vaccinium pallidum*
VINE/LIANA	*Smilax rotundifolia*

Global

Stratum	Species
TREE CANOPY	*Pinus virginiana*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Gaylussacia baccata, Vaccinium pallidum, Vaccinium stamineum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus virginiana*
TALL SHRUB	*Kalmia latifolia, Vaccinium stamineum*
SHRUB	*Vaccinium hirsutum*
SHORT SHRUB	*Vaccinium pallidum*
FORB	*Solidago odora, Tephrosia virginiana*
FERN	*Pteridium aquilinum*

Global

Stratum	Species
TREE CANOPY	*Pinus virginiana*
SHORT SHRUB	*Comptonia peregrina, Gaultheria procumbens*
FORB	*Xerophyllum asphodeloides*
FERN	*Pteridium aquilinum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Pinus virginiana Successional Forest (CEGL002591)
- Pinus virginiana / Quercus marilandica Serpentine Forest (CEGL006266)
- Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens) Forest (CEGL006271)
- Pinus virginiana - Quercus (coccinea, prinus) Forest (CEGL005040)
- Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum Woodland (CEGL007097)
- Pinus virginiana - Quercus falcata - Carya pallida Forest (CEGL006354)

GRank & Reasons: G4? (01-02-11). This xeric evergreen forest community will be maintained on sites where local soil conditions, topographic extremes, or occasional fire function to retard hardwood invasion. Infestations of southern pine beetle (*Dendroctonus frontalis*) can cause mortality of canopy trees. Examples affected by southern pine beetle in the Great Smoky Mountains can have up to 80-90% standing dead pine.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community is often bordered by mixed oak forests.

Global Classif Comments: Some vegetation formerly placed (at least conceptually) in the *Pinus virginiana - Quercus (coccinea, prinus)* Forest Alliance (A.408) and its provisional association *Pinus virginiana - Quercus (coccinea, prinus)* Forest (CEGL005040), has been transferred here, with this association (CEGL007119) becoming more geographically inclusive. In Indiana examples, the substrate is primarily a matrix of acidic siltstone, shale, and sandstone. Rarely are cliffs formed; instead the setting is mostly very steep slopes with high hills and deep ravines. This association also includes vegetation from the transition between the Cumberland Plateau / Southern Ridge and Valley and the Upper East Gulf Coastal Plain in Alabama. Though located in the Coastal Plain, these occurrences are physiographically and floristically similar to this montane association.

Early successional vegetation associated with old fields, old pastures, clearcuts, and burned or eroded areas and dominated by *Pinus virginiana* is classified as *Pinus virginiana* Successional Forest (CEGL002591). Appalachian xeric oak forests with similar floristics, but with a mainly deciduous canopy are classed in *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271). Appalachian shale forests and woodlands with *Pinus virginiana* occur on steep, shaley slopes and have a stunted canopies and sparse herb and shrub strata, characterized by species adapted to shaley substrates. These shale communities are classed in *Pinus virginiana - Quercus (coccinea, prinus)* Forest Alliance (A.408) and *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was sampled on the Cades Cove quadrangle but not found on the Mount Le Conte quadrangle. On the Cades Cove quadrangle it was sampled or observed

on the northern half of the quadrangle, below 2300 feet elevation, on south-facing slopes and low ridges. It was found north of the Cades Cove Loop Road in the vicinity of Copper Road, Rich Mountain Road, Tater Ridge, and the lower slopes around Allnight Ridge. West and south of the Cades Cove Loop Road this association was found on the southwest slopes above Forge Creek Road and on the south slopes and ridges of Boring Ridge. This community is more common elsewhere in the park, especially on the western end of the park. Many historic samples from the western portion of the park (Calderwood quadrangle) represent this community.

Global Range: This community occurs primarily in the Appalachian region of the United States, ranging from central Pennsylvania, south and west through the Ridge and Valley, Blue Ridge, and Cumberland Plateau to northern Georgia and Alabama, extending westward to scattered areas in the Interior Low Plateau and eastward into the upper Piedmont. It is reported from the states of Georgia, North Carolina, South Carolina, Tennessee, Kentucky, Pennsylvania, Indiana, Ohio, and is probably in Maryland, Virginia, and West Virginia.

Nations: US

States/Provinces: AL:S?, GA:S?, IN:S?, KY:S?, MD?, NC:S?, OH?, PA:S?, SC:S?, TN:S?, VA?, WV:S?
TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 59:C, 61:C
USFS Ecoregions: 221Ec:CCP, 221Ed:CCP, 221Ef:CCP, 221Eg:CCC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCP, 221He:CCC, 221Ja:CCC, 221Jb:CCC, 222Da:CCC, 222Dc:CCC, 222Dg:CCC, 222Dj:CCC, 222Eg:CCC, 222Ej:CCC, 222El:CCC, 222En:CCC, 222Eo:CCC, 222Fd:CCC, 222Ff:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCC, 231Bc:CCC, 231Cd:CCC, 231Da:CCC, 231Dc:CCC, M221Aa:CCP, M221Ab:CCC, M221Ac:CCC, M221Bd:CCP, M221Be:CCP, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Chickamauga-Chattanooga, Great Smoky Mountains, Kennesaw Mountain, Kings Mountain, Mammoth Cave); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, Land Between the Lakes?, Nantahala, Pisgah, Sumter, Talladega)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL007119
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, Barden 1977, Burns and Honkala 1990a, CAP pers. comm. 1998, Cooper 1963, Core 1966, Evans 1991, Eyre 1980, Gettman 1974, Homoya pers. comm., Malter 1977, NatureServe Ecology - Southeast U.S. unpubl. data, Nelson 1986, Patterson et al. 1999, Peet et al. 2002, Pyne 1994, Racine 1966, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Walton et al. 1997, Whittaker 1956

Pinus virginiana Successional Forest

Virginia Pine Successional Forest
Virginia Pine Successional Forest
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs in areas where canopy removal has created dry, open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana*. These habitats include old fields, old pastures, clearcuts, and burned or eroded areas. This forest typically has a very dense canopy of *Pinus virginiana* and little understory vegetation. The dense canopy may also include admixtures of other *Pinus* species (e.g., *Pinus taeda, Pinus echinata*) or other early successional deciduous trees (e.g., *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera*). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. Shrub and herb layers are frequently very sparse. Stands are short-lived, generally less than 75 years.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Potential sites for this community include low-elevation (below 2000 feet) areas that have been subject to anthropogenic disturbance in the past 50 years. Examples around the Cades Cove Loop Road have been heavily browsed by deer.

Global Environment: This community occurs in areas where canopy removal has created open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana*. These conditions can include old fields, old pastures, clearcuts, and burned or eroded areas. In the Ridge and Valley of Tennessee, northeastern Monroe County, early successional forests with *Pinus virginiana* dominance were found on low slopes in areas that were cleared for agriculture prior to the 1970s, when Tellico Lake was created (Andreu and Tukman 1995). In the Central Appalachians, this vegetation occurs where soft shales have been farmed (primarily in valleys), resulting in stands with nothing but successional species in the understory. Soils underlying these communities are of two general types, i.e., those derived in residuum from calcareous shale and calcareous sandstone of the Middle Ordovician and those of some other origin. Series of the former type include Dandridge (Lithic Ruptic-Alfic Eutrochrepts), Tellico (Typic Rhododults), and Steekee (Ruptic-Ultic Dystrochrepts). Other soil series that this forest type may occur on include Litz, Dewey, Alcoa, Bland, Etowah, Lobdell and Neubert. All of these soils are well-drained and range in pH from moderate acid to very strongly acidic.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: *Pinus virginiana* Successional Forests have a dense canopy of *Pinus virginiana* but may have an admixture of other successional species (*Acer rubrum, Liriodendron tulipifera, Pinus strobus*) as well has deciduous species from the surrounding forest vegetation (*Quercus alba, Quercus velutina, Quercus coccinea*). The understory is typically open with little herb or shrub coverage, although *Tsuga canadensis* or *Pinus strobus* may be locally dominant in the shrub strata. The forest floor is covered with leaf litter and coarse woody debris.

Global Vegetation: This forest typically has a very dense canopy of *Pinus virginiana* and little understory vegetation. *Pinus taeda* or *Pinus echinata* may co-occur with *Pinus virginiana* in the canopy. The canopy can also have significant admixtures of early successional deciduous trees (e.g., *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera*). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. Shrub and herb strata are absent to sparse in coverage. In eastern Tennessee the subcanopy may contain *Acer saccharum* and *Cornus florida*; other associated species may include *Cercis canadensis, Parthenocissus quinquefolia, Lonicera japonica*, and *Microstegium vimineum* (Andreu and Tukman 1995). In the Central Appalachians, associates include *Pinus taeda, Pinus echinata*, and *Pinus rigida*. The dense ericaceous shrub stratum contains *Vaccinium* spp., *Gaylussacia* spp., *Kalmia latifolia*, and *Rhododendron* spp.

Global Dynamics: This is an early successional forest type. Damage from ice storms was the main disturbance observed in these stands in the Tellico Pilot Project study area. In addition, fire and insect infestation are likely damaging agents.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus virginiana*

Global

Stratum	Species
TREE CANOPY	*Pinus virginiana*
TREE SUB-CANOPY	*Acer rubrum, Cornus florida, Juniperus virginiana, Nyssa sylvatica, Oxydendrum arboreum*
TALL SHRUB	*Cornus florida, Nyssa sylvatica, Oxydendrum arboreum, Vaccinium arboreum, Vaccinium stamineum*
SHORT SHRUB	*Cercis canadensis, Cornus florida, Oxydendrum arboreum, Quercus alba, Sassafras albidum*
HERBACEOUS	*Lonicera japonica, Smilax glauca, Toxicodendron radicans*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Pinus virginiana - Juniperus virginiana var. virginiana - Ulmus alata Forest (CEGL007121)--on more calcareous or circumneutral substrates.

GRank & Reasons: GD (00-06-13). This forest represents early successional vegetation and is thus not of conservation concern.

CLASSIFICATION COMMENTS

Global Classif Comments: Early successional *Pinus virginiana* vegetation occurring over calcareous substrates is classed in *Pinus virginiana - Juniperus virginiana var. virginiana - Ulmus alata* Forest (CEGL007121) and has species indicative of calcareous substrates.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was not sampled on the Mount Le Conte or Cades Cove quadrangles. However, it was observed at low elevations, in disturbed areas, around the Cades Cove Loop Road.

Global Range: This successional community is possible in the Piedmont from Pennsylvania south to Alabama, and ranges west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and in scattered locales of the Interior Low Plateau.

Nations: US
States/Provinces: AL:S?, GA:S?, IN:S?, KY:S?, MD:S?, NC:S?, NJ:S?, PA:S?, SC:S?, TN:S?, VA:S?, WV:S?
TNC Ecoregions: 50:C, 51:C, 52:C, 58:P, 59:C, 61:C
USFS Ecoregions: 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 221J:CC, 222Ej:CCC, 222En:CCC, 222Eo:CCC, 231Cd:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ca:CCP, M221Cb:CCP, M221Cc:CCP, M221Cd:CCC, M221Ce:CCP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains, Shiloh); TVA (Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Sumter, Uwharrie?)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: M. Andreu and M. Tukman, mod. K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL002591
REFERENCES (type in full citation below if reference is new): Allard 1990, Andreu and Tukman 1995, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 2000, Patterson et al. 1999, Pyne 1994

Abies fraseri / (Rhododendron catawbiense, Rhododendron carolinianum) Forest

Fraser Fir / (Catawba Rhododendron, Carolina Rhododendron) Forest

Fraser Fir Forest (Evergreen Shrub Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Spruce-Fir Forests (410-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs as island-like stands in the southern Appalachian Mountains of eastern Tennessee, and western North Carolina. It occurs on rocky spurs, steep ridges, and south-facing slopes above 1830 m (6000 feet) elevation, often adjacent to montane shrublands. This forest has a canopy strongly dominated by *Abies fraseri*, occurring over a shrub stratum dominated by evergreen species, typically *Rhododendron catawbiense, Rhododendron carolinianum*, or *Rhododendron maximum*. *Abies fraseri* in the canopy are 17-23 cm in diameter and 10-11 m tall, giving these forests a stunted appearance. Other species that may occur with low coverage in the canopy or subcanopy are *Picea rubens, Sorbus americana, Betula alleghaniensis, Prunus pensylvanica*. Herbaceous cover is typically sparse. On steep, rocky, northerly slopes, coverage by mosses, liverworts, and lichens can approach 100%. Bryophyte species include *Hylocomium splendens, Ptilium crista-castrensis, Sphagnum* spp., and *Polytrichum ohioense*. This forest may grade into forests dominated by *Picea rubens* and *Abies fraseri*, montane grasslands, high-elevation shrublands, or high-elevation rock outcrop communities.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This forest is extremely rare in the Great Smoky Mountains, but at least one example of this community occurs on a summit as a relatively small island within a matrix of herb-dominated spruce-fir forest. The community has become even rarer on the landscape as a direct result of the effects of the balsam wooly adelgid on fir populations throughout the park.

Global Environment: These forests occur on rocky spurs, steep ridges, and south-facing slopes above 6000 feet (1830 m) elevation, often adjacent to montane shrublands. These forests occur on all topographic positions except the steepest rocky cliffs of the highest summits. Soils that support this community are classified as Inceptisols and are shallow, rocky, and often have a thick organic layer. Moisture regimes are mesic to wet, due to high rainfall, abundant cloud cover, fog deposition, and low temperatures. This forest may grade into forests dominated by *Picea rubens* and *Abies fraseri*, montane grasslands, high elevation shrublands, or high elevation rock outcrop communities.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community is dominated by *Abies fraseri* with small amounts of *Picea rubens, Betula alleghaniensis*, and *Prunus pensylvanica* as well. *Rhododendron maximum* forms a very tall shrub layer under which some low light herbaceous species such as *Oxalis montana, Clintonia borealis*, and *Dryopteris campyloptera* exist. In addition, lichen and moss species cover at least 20% of the ground and tree stumps.

Global Vegetation: This needle-leaved evergreen forest has greater than 75% canopy coverage by *Abies fraseri*. *Abies fraseri* in the canopy are 17-23 cm in diameter and 10-11 m tall, giving these forests a stunted appearance. Other species that may occur with low coverage in the canopy or subcanopy are *Picea rubens, Sorbus americana, Betula alleghaniensis, Prunus pensylvanica*. The tall-shrub stratum is dominated by evergreen species and, although there may be considerable variation, is usually quite dense. Typical shrub dominants include *Rhododendron catawbiense, Rhododendron carolinianum*, and *Rhododendron maximum*. Herbaceous cover is typically sparse. On steep, rocky, northerly slopes, coverage by mosses, liverworts, and lichens can approach 100%. Bryophyte species include *Hylocomium splendens, Ptilium crista-castrensis, Sphagnum* spp., and *Polytrichum ohioense*.

Global Dynamics: This community is affected by debris avalanches, wind disturbance and lightning fire. Because of the shallow soils and extreme wind exposure, this forest is susceptible to large blowdowns. Logging and damage by the Balsam Woolly Adelgid has greatly increased the effect of natural windfall.

This community is a late-successional type, but it is subject to repeated disturbance. *Prunus pennsylvanica* is a dominant species immediately following disturbance. In later successional stages, *Betula alleghaniensis* increases in dominance. In areas where mature *Abies fraseri* has been lost to woolly adelgid infestation, thickets of *Rubus* spp., *Abies fraseri* seedlings and saplings, *Betula alleghaniensis*, and *Sorbus americana* are dominant. Over time, *Picea rubens, Betula alleghaniensis, Abies fraseri, Acer spicatum*, and *Sorbus americana* increase in the tree layer, while *Abies fraseri, Menziesia pilosa, Rubus idaeus ssp. strigosus*, and *Sambucus racemosa var. pubens* increase in the shrub layer (White et al. 1993). Succession is especially slow after severe disturbance such as logging and slash fires. The most severely disturbed sites are predominately *Prunus pensylvanica* and *Rubus* spp. and may remain in a non-forested stage of succession for 60 years or more.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Abies fraseri*
TALL SHRUB	*Rhododendron maximum*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri*
TALL SHRUB	*Rhododendron carolinianum, Rhododendron catawbiense, Rhododendron maximum*
NON-VASCULAR	*Hylocomium splendens*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Abies fraseri*
TALL SHRUB	*Rhododendron carolinianum, Rhododendron catawbiense, Rhododendron maximum*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Betula papyrifera var cordifolia*
GRAMINOID	*Poa palustris*
FORB	*Streptopus amplexifolius*
FERN	*Phegopteris connectilis*
NON-VASCULAR	*Metzgeria temperata, Nardia scalaris, Plagiochila corniculata*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Abies fraseri / Viburnum lantanoides / Dryopteris campyloptera - Oxalis montana / Hylocomium splendens Forest (CEGL006049)--is a similar forest with a canopy dominated by *Abies fraseri* but lacking an evergreen-dominated shrub stratum.
- Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum) Forest (CEGL007130)--*Abies fraseri* can codominate with *Picea rubens*.
- Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens Forest (CEGL007131)--*Abies fraseri* can codominate with *Picea rubens*.

GRank & Reasons: G1 (00-01-04). This community has a naturally restricted distribution, occurring only on the highest elevation peaks of the southern Appalachian Mountains. It exists in only a small portion of its original range due to the impact of early 20th century, post-logging fires and the ongoing outbreak of the Balsam Woolly Adelgid, an exotic pest that infests and kills mature *Abies fraseri*. Well-developed,

undisturbed examples of this community are extremely rare. Most remaining examples of this community exist as patches of dense young trees or dense *Rubus* thickets beneath forests of dead snags or tangles of fallen logs.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: This community is extremely rare and occurs in such small patches that it is only subtly detectable. It most likely will not be picked up as an individual mapping unit but may be combined with the other *Abies fraseri / Picea rubens* categories.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled above 6000 feet on Spruce Mountain (Bunches Bald quadrangle). It may occur in isolated patches elsewhere but is swiftly declining due to the continuing decline of *Abies fraseri* in the plots. This community may be extinct in the park within the next decade.

Global Range: This community occurs as island-like stands on the highest areas, above 1830 m (6000 feet), in the southern Appalachian Mountains of eastern Tennessee, western North Carolina, and southwestern Virginia. It is extremely limited in distribution and is restricted to the following mountain areas: Great Smoky Mountains, Black Mountains, Balsam Mountains, Plott Balsams, Grandfather Mountain, and Mount Rogers (Ramseur 1960).

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL006308
REFERENCES (type in full citation below if reference is new): Allard 1990, Anderson et al. 1990, Braun 1950, Brown 1941, Bruck 1988, Busing et al. 1988, Crandall 1958, Davis 1930, Eyre 1980, McLeod 1988, NCNHP 1993, Nicholas et al. 1992, Oosting and Billings 1951, Pyne 1994, Ramseur 1960, Schafale 1998b, Schafale and Weakley 1990, USFS 1988, Weakley 1993, White 1984a, White 1984b, White and Pickett 1985, White et al. 1993, Whittaker 1956

Abies fraseri / Viburnum lantanoides / Dryopteris campyloptera - Oxalis montana / Hylocomium splendens Forest

Fraser Fir / Hobblebush / Mountain Woodfern - Common Wood Sorrel / Stairstep Moss Forest

Fraser Fir Forest (Deciduous Shrub Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Spruce-Fir Forests (410-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs as island-like stands in the southern Appalachian Mountains. It occurs on steep ridges and mesic, north-facing slopes above 1830 m (6000 feet) elevation, although it may extend lower on some sites. Occurrences of this community have shallow, rocky soils and are often steep and bouldery with seepage areas. This forest has at least 75% of the canopy coverage composed of *Abies fraseri*, occurring over a sparse to moderate shrub stratum dominated by deciduous species, a diverse herb stratum, and, typically, a well-developed bryophyte layer. The tree canopy has standing dead stems of *Abies fraseri* and extensive patches of *Abies fraseri* saplings in canopy gaps. *Oxalis montana, Dryopteris campyloptera*, and *Athyrium filix-femina* are often dominant in the herbaceous stratum. Other characteristic species include *Vaccinium erythrocarpum, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Rubus allegheniensis, Rubus idaeus ssp. strigosus, Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Clintonia borealis, Solidago glomerata, Rugelia nudicaulis, Ageratina altissima var. roanensis, Chelone lyonii, Circaea alpina ssp. alpina, Streptopus lanceolatus var. roseus (= Streptopus roseus), Viola macloskeyi ssp. pallens, Geum radiatum, Huperzia lucidula, Ptilium crista-castrensis, Rhytidiadelphus triquetrus*, and *Hylocomium splendens*. This is a relatively broadly defined community element with much structural and compositional variation.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found on and around the summit of Mount Le Conte, on exposed, broad, flat ridges and on moderately steep, north-facing slopes. This forest typically occurs at elevations over 6000 feet (1830 m), but samples ranged from 5880 to 6540 feet elevation.

Global Environment: This community typically occurs on steep ridges and north-facing slopes above 1830 m (6000 feet) elevation, although it may extend lower on some sites. These forests occur on all topographic positions except the steepest rocky cliffs of the highest summits. Soils that support this community are classified as Inceptisols and are shallow, rocky, and often have a thick organic layer. Moisture regimes are mesic to wet, due to high rainfall, abundant cloud cover, fog deposition, and low temperatures.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a canopy strongly dominated by *Abies fraseri*, often with many standing dead and fallen individuals. Minor amounts of other tree species (*Picea rubens, Betula alleghaniensis, Prunus pensylvanica*, and *Sorbus americana*) may occur in the canopy, subcanopy, or as tall shrubs/saplings. The shrub stratum is typically open and sparse but can have moderately dense coverage, especially in areas disturbed by past logging, deer browsing, or Balsam Woolly Adelgid (*Adelges piceae*). Shrubs can include *Diervilla sessilifolia, Rubus canadensis, Sambucus racemosa var. racemosa (= var. pubens), Vaccinium erythrocarpum*, and *Viburnum lantanoides*. The shrub stratum may also have areas of dense *Abies fraseri* regeneration, particularly in areas of canopy tree mortality. The herbaceous stratum has moderately dense coverage, with ferns and tall forbs locally dominant. Typical herbaceous dominants include *Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina, Oxalis montana, Clintonia borealis, Dryopteris campyloptera*, and *Solidago glomerata*. Other herbaceous species include *Carex brunnescens, Carex debilis, Huperzia lucidula, Rugelia nudicaulis*, and, in seepage areas, *Chelone lyonii, Impatiens pallida*, and the shrub, *Ribes rotundifolium*. In stands with intact *Abies fraseri* canopies, mosses have high coverage on fallen logs and tree trunks.

Global Vegetation: This needle-leaved evergreen forest has greater than 75% canopy coverage by *Abies fraseri*, typically with many standing dead stems. Canopy trees are of small diameter (less than 20 cm) and short stature (less than 10 m tall), giving these forests a stunted appearance. Other species that may occur in the canopy or subcanopy with low coverage are *Picea rubens, Sorbus americana, Betula alleghaniensis,*

Prunus pensylvanica, and *Acer spicatum*. There may be considerable variation in the density of shrub cover, but it is typically low (<20%) and dominated by deciduous species. Typical shrub species include *Viburnum lantanoides, Vaccinium erythrocarpum, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Menziesia pilosa, Rubus allegheniensis*, and *Rubus idaeus ssp. strigosus*. Where shrubs are sparse, herb cover is usually dense, with *Oxalis montana, Athyrium filix-femina ssp. asplenioides*, and *Dryopteris campyloptera* often dominant. Other common herbs include *Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Clintonia borealis, Solidago glomerata, Rugelia nudicaulis, Ageratina altissima var. roanensis, Chelone lyonii, Circaea alpina ssp. alpina, Streptopus lanceolatus (= Streptopus roseus), Viola macloskeyi ssp. pallens, Geum radiatum*, and *Huperzia lucidula*. Mosses, liverworts, and lichens grow densely on fallen logs, tree trunks, and the forest floor, giving the community a distinctive carpeted appearance. Characteristic bryophyte species include *Hylocomium splendens, Ptilium crista-castrensis, Rhytidiadelphus triquetrus*, and *Hylocomiastrum umbratum*.

Global Dynamics: This community is affected by debris avalanches, wind disturbance and lightning fire. Because of the shallow soils and extreme wind exposure, this forest is susceptible to large blowdowns. Logging and damage by the Balsam Woolly Adelgid has greatly increased the effect of natural windfall.

This community is a late successional type, but it is subject to repeated disturbance. *Prunus pennsylvanica* is a dominant species immediately following disturbance. In later successional stages, *Betula alleghaniensis* increases in dominance. In areas where mature *Abies fraseri* has been lost to woolly adelgid infestation, thickets of *Rubus* spp., *Abies fraseri* seedlings and saplings, *Betula alleghaniensis*, and *Sorbus americana* are dominant. Over time, *Picea rubens, Betula alleghaniensis, Abies fraseri, Acer spicatum*, and *Sorbus americana* increase in the tree layer, while *Abies fraseri, Menziesia pilosa, Rubus idaeus ssp. strigosus*, and *Sambucus racemosa var. pubens* increase in the shrub layer (White et al. 1993). Succession is especially slow after severe disturbance such as logging and slash fires. The most severely disturbed sites are predominately *Prunus pensylvanica* and *Rubus* spp. and may remain in a non-forested stage of succession for 60 years or more.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Abies fraseri*
TALL SHRUB	*Rubus allegheniensis, Vaccinium erythrocarpum, Viburnum lantanoides*
FORB	*Aster acuminatus, Clintonia borealis, Oxalis montana*
FERN	*Athyrium filix-femina, Dryopteris campyloptera*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri*
TALL SHRUB	*Rubus allegheniensis, Sambucus racemosa ssp pubens, Viburnum lantanoides*
FORB	*Athyrium filix-femina ssp asplenioides, Dryopteris campyloptera, Huperzia lucidula, Oxalis montana*
NON-VASCULAR	*Hylocomium splendens, Ptilium crista-castrensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Abies fraseri*
SHRUB	*Diervilla sessilifolia, Rubus allegheniensis, Sambucus racemosa ssp pubens*
FORB	*Rugelia nudicaulis, Solidago glomerata*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri*
TALL SHRUB	*Rubus allegheniensis, Vaccinium erythrocarpum, Viburnum lantanoides*
SHRUB	*Ribes rotundifolium*
FORB	*Angelica triquinata, Eurybia chlorolepis, Houstonia serpyllifolia, Oxalis montana, Rugelia nudicaulis, Solidago glomerata*

FERN *Dryopteris campyloptera*
NON-VASCULAR *Hylocomium splendens*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Betula papyrifera var cordifolia*
GRAMINOID	*Poa palustris*
FORB	*Streptopus amplexifolius*
FERN	*Phegopteris connectilis*
NON-VASCULAR	*Metzgeria temperata, Nardia scalaris, Plagiochila corniculata*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Abies fraseri / (Rhododendron catawbiense, Rhododendron carolinianum) Forest (CEGL006308)--is a similar forest with a canopy dominated by *Abies fraseri* but with a shrub stratum dominated by evergreen species.
- Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum) Forest (CEGL007130)--*Abies fraseri* can codominate with *Picea rubens*.
- Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens Forest (CEGL007131)--*Abies fraseri* can codominate with *Picea rubens*.

GRank & Reasons: G1 (94-07-15). This community occurs as island-like stands in the southern Appalachian Mountains. It has a naturally restricted distribution and exists in only a small portion of its original range due to the impact of early 20th century, post-logging fires and the ongoing outbreak of the Balsam Woolly Adelgid (*Adelges piceae*). Well-developed, undisturbed examples of this community are extremely rare.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: On Mount Le Conte, this community occurs as discontinuous stands in a mosaic of standing dead *Abies fraseri* and areas variously dominated by shrubs (*Rubus canadensis* and/or *Diervilla sessilifolia*) or herbaceous species (*Athyrium filix-femina* and/or *Solidago glomerata*) - see *Rubus canadensis - (Rubus idaeus ssp. strigosus) / Athyrium filix-femina - Solidago glomerata* Shrubland (CEGL003893).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community is restricted to high-elevation areas within the park such as the summit and high slopes of Mount Le Conte. *Abies fraseri* Forests occur elsewhere within the park boundary and should be looked for at elevations over 6000 feet (1830 m).

Global Range: This community occurs as island-like stands on the highest areas (>6000 feet) in the southern Appalachian Mountains of eastern Tennessee, western North Carolina, and southwestern Virginia. It is extremely limited in distribution and is restricted to the following mountain areas: Great Smoky Mountains, Black Mountains, Balsam Mountains, Plott Balsams, Grandfather Mountain, and Mount Rogers (Ramseur 1960).

Nations: US
States/Provinces: NC:S?, TN:S?, VA:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL006049
REFERENCES (type in full citation below if reference is new): Adams and Stephenson 1991, Adams et al. 1985, Allard 1990, Anderson et al. 1990, Belden et al. 1994, Braun 1950, Brown 1941, Bruck 1988, Busing et al. 1988, Crandall 1958, Davis 1930, Dull et al. 1988a, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, McLeod 1988, NCNHP 1993, Nicholas et al. 1992, Oosting and Billings 1951, Peet et al. 2002, Pyne 1994, Ramseur 1960, Rawinski 1992, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990, Stephenson and Adams 1984, USFS 1988, Weakley 1993, White 1984a, White 1984b, White and Pickett 1985, White et al. 1993, Whittaker 1956

Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum) Forest

Red Spruce - (Fraser Fir) / (Catawba Rhododendron, Great Rhododendron) Forest
Red Spruce - Fraser Fir Forest (Evergreen Shrub Type)
Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Spruce-Fir Forests (410-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee and western North Carolina. These forests are typically found on moderately steep to steep, convex slopes at elevations between 1550 and 1830 m (5100-6000 feet). This association includes forests of the southern Appalachians, within the range of *Abies fraseri*, dominated by *Picea rubens* with or without *Abies fraseri*, over a shrub stratum dominated by evergreen species, typically *Rhododendron catawbiense* and *Rhododendron maximum*. Herb coverage is characteristically low, but on moist north-facing sites mosses, ferns, and forbs may be dense beneath the shrub stratum.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found on steep, middle to high slopes at elevations between 5100 and 6000 feet (samples ranged in elevation from 5320 to 5780 feet) over organic soils with thick litter layers. In some areas ice storms and Balsam Woolly Adelgid (*Adelges piceae*) affect the canopy structure.

Global Environment: This forest is best developed between 1550-1830 m elevation (5100-6000 feet) but may occur at lower elevations and is typically found on moderately steep to steep, convex slopes. Soils are highly variable, from deep mineral soils to well-developed boulderfields, where a thin organic layer and moss mat overlie the rocks and there are pockets of mineral soil in deep crevices between boulders. The dominant soils are Inceptisols with scattered occurrences of Spodosols at the highest elevations (White et al. 1993). Generally, soils can be described as shallow and rocky, with well-developed organic and A horizons. All soils in these high elevation forests are low in base saturation, high in organic matter, and are acid in reaction (pH 3-5), with a high aluminum content. The moisture regimes of these areas are mesic to wet due to high rainfall, abundant cloud cover, fog deposition, and low temperatures. The climate has been classified as perhumid, with the temperature varying elevationally from mesothermal to microthermal. The regional geology is dominated by complexly folded metamorphic, sedimentary, and igneous rocks of the Precambrian and early Paleozoic age, including phyllites, slates, schists, sandstones, quartzites, granites, and gneisses.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community has a closed canopy dominated by large *Picea rubens*. Some occurrences may have standing dead *Abies fraseri* and a more open canopy due to *Abies* mortality or damage by ice storms. The subcanopy may have scattered stems of *Betula alleghaniensis* or *Prunus pensylvanica*, but these species form a minor part of the canopy coverage (less than 25%). The shrub stratum is dense (70-100% coverage) and dominated by *Rhododendron catawbiense*. In some occurrences on the flanks of Mount Le Conte, *Leucothoe fontanesiana* can dominate the short-shrub stratum. Other species that may be present as a minor part of the shrub stratum include *Abies fraseri, Ilex montana, Kalmia latifolia, Picea rubens, Rhododendron maximum, Rubus canadensis, Sorbus americana, Vaccinium corymbosum, Vaccinium erythrocarpum*, and *Viburnum lantanoides*. The herbaceous stratum is sparse, typically with less than 10% coverage. Herbaceous species include *Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina, Dryopteris campyloptera, Dryopteris intermedia, Monotropa uniflora*, and *Oxalis montana*. The ground cover is dominated by thick and spongy litter and duff layers and by downed woody debris.

Global Vegetation: This association includes forests of the southern Appalachians, within the range of *Abies fraseri*, dominated by *Picea rubens* with or without *Abies fraseri*. Other species may occur in the canopy/subcanopy but with low coverage. The shrub stratum is moderate to dense and dominated by evergreen species such as *Rhododendron catawbiense, Rhododendron maximum*, and *Rhododendron carolinianum*. Shrub coverage is most dense on drier, convex slopes. Other shrub species with minor coverage may include *Vaccinium simulatum, Vaccinium erythrocarpum, Viburnum nudum var. cassinoides,*

Diervilla sessilifolia, and *Viburnum lantanoides*. Extensive patches of *Abies fraseri* seedlings and standing dead stems of *Abies fraseri* may be common. Herb coverage is typically low, but moist, north-facing sites may have *Oxalis montana, Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera,* and mosses dominating beneath the shrub stratum.

Global Dynamics: Natural disturbances in this community include lightning fire, debris avalanches, wind disturbance, and ice storms (White and Pickett 1985, Nicholas and Zedaker 1989). The natural fire regime is estimated at longer than 500-1000 years. Human-initiated disturbances have included logging, slash fires, livestock grazing, damage by the Balsam Woolly Adelgid (*Adelges piceae*), and atmospheric pollutants.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Picea rubens*
TALL SHRUB	*Rhododendron catawbiense*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri, Picea rubens*
TALL SHRUB	*Rhododendron carolinianum, Rhododendron catawbiense, Rhododendron maximum*
NON-VASCULAR	*Hylocomium splendens, Polytrichum ohioense*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Picea rubens*
TALL SHRUB	*Rhododendron catawbiense*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri, Picea rubens*
TALL SHRUB	*Rhododendron catawbiense*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Betula papyrifera var cordifolia*
GRAMINOID	*Calamagrostis canadensis, Carex projecta, Poa palustris*
FORB	*Chelone lyonii, Stellaria corei, Streptopus amplexifolius*
FERN	*Botrychium oneidense, Phegopteris connectilis*
NON-VASCULAR	*Metzgeria temperata, Nardia scalaris, Plagiochila corniculata*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens Forest (CEGL007131)--is a similar forest that has an understory dominated by deciduous shrubs, herbs, and bryophtyes and occurs on more mesic sites than the one described here. Similar forests occur in the central and northern Appalachians, but have *Abies balsamea* as the fir component, less dense herb and bryophyte cover, and lack a *Rhododendron*-dominated understory (Oosting and Billings 1951, Whittaker 1956, Crandall 1958).
- Picea rubens - Tsuga canadensis / Rhododendron maximum Forest (CEGL006272)--is a similar forest that has a shrub stratum dominated by evergreen species, mostly *Rhododendron maximum*. In addition, the canopy includes a mix of *Picea rubens* and other northern hardwood species and *Tsuga canadensis*.

GRank & Reasons: G1 (99-02-23). This community has a naturally restricted distribution and has been subject to major acreage reduction during the early part of the 20th century and rapid condition decline in the past 30

years. Modern threats include atmospheric pollution deposition and damage by *Adelges piceae*, the exotic Balsam Woolly Adelgid. Well-developed, undisturbed examples of this community are extremely rare.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: On the Mount Le Conte quadrangle, this forest grades into forests dominated by *Picea rubens* and *Betula alleghaniensis* or forests dominated by *Picea rubens, Tsuga canadensis*, and *Betula alleghaniensis*. Some occurrences of this community may be floristically similar to *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata* Forest (CEGL006256). Examples on the Mount Le Conte quadrangle include stands of old-growth forest.

Global Classif Comments: This community includes forest vegetation where *Picea rubens* and *Abies fraseri* make up 75% of the canopy cover, each contributing 25-75% to the total canopy cover and occurring over a shrub stratum dominated by evergreen species. Other species total less than 25% of the canopy.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte quadrangle on steep, exposed, south-facing slopes in an area north of Mount Kephart known as "The Boulevard," on steep slopes above Rocky Spur, and on steep slopes on the southern flanks of Mount Le Conte. It does not occur on the Cades Cove quadrangle but is likely in other high elevation areas (above 5500 feet elevation) of the park. It is an uncommon component of the spruce-fir complex.

Global Range: This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee and western North Carolina.

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL007130
REFERENCES (type in full citation below if reference is new): Allard 1990, Anderson et al. 1990, Brown 1941, Bruck 1988, Busing et al. 1988, Cogbill and White 1991, Crandall 1958, Crandall 1960, Davis 1930, Dull et al. 1988b, Eagar and Adams 1992, Eyre 1980, Korstian 1937, McLeod 1988, NCNHP 1993, NatureServe Ecology - Southeast U.S. unpubl. data, Nicholas and Zedaker 1989, Nicholas et al. 1992, Oosting and Billings 1951, Peet et al. 2002, Pyne 1994, Ramseur 1960, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Schofield 1960, Stephenson and Adams 1984, Stephenson and Clovis 1983, Stotler and Crandall-Stotler 1977, USFS 1988, Wentworth et al. 1988, White 1984a, White 1984b, White and Cogbill 1992, White and Pickett 1985, White et al. 1993, Whittaker 1956, Zedaker et al. 1988

Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens Forest

Red Spruce - (Fraser Fir) / Highbush Cranberry / Common Wood Sorrel - Mountain Woodfern / Stairstep Moss Forest

Red Spruce - Fraser Fir Forest (Deciduous Shrub Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Spruce-Fir Forests (410-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee, western North Carolina, and southwestern Virginia. It is found on all topographic positions and is best developed between 1680-1990 m elevation (5500-6200 feet). This association includes forests of the southern Appalachians, within the range of *Abies fraseri*, dominated by *Picea rubens*, with or without *Abies fraseri*, occurring over deciduous shrubs, herbs, and bryophytes. This community has a characteristic understory of southern Appalachian endemic species and a conspicuous bryophyte layer. The tree canopy may have standing dead stems of *Abies fraseri* and extensive patches of *Abies fraseri* seedlings in canopy gaps. Characteristic species include *Sorbus americana, Acer spicatum, Viburnum lantanoides, Athyrium filix-femina ssp. asplenioides, Eurybia chlorolepis (= Aster chlorolepis), Rugelia nudicaulis, Houstonia serpyllifolia, Solidago glomerata, Ptilium crista-castrensis*, and *Bazzania trilobata*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found on steep, middle to high slopes above 5500 feet to just over 6000 feet. Stands were affected by wind, ice, and Balsam Woolly Adelgid.

Global Environment: Over much of its range, this forest community reaches its best development between 1680 and 1990 m (5500-6200 feet) elevation, but it is also found at somewhat lower elevations. Stands occur on all topographic positions. Soils are highly variable, from deep mineral soils to well-developed boulderfields, where a thin organic layer and moss mat overlie the rocks, and there are pockets of mineral soil in deep crevices between boulders. The dominant soils are Inceptisols with scattered occurrences of Spodosols at the highest elevations. Generally, soils are shallow and rocky, with well-developed organic and A horizons. All soils in these high-elevation forests are low in base saturation, high in organic matter, and are acid in reaction (pH 3.0-5.0), with high aluminum content. The moisture regimes of these areas are mesic to wet due to high rainfall, abundant cloud cover, fog deposition, and low temperatures. The climate has been classified as perhumid, with the temperature varying elevationally from mesothermal to microthermal. The regional geology is dominated by complexly folded metamorphic, sedimentary, and igneous rocks of Precambrian and early Paleozoic age, including phyllites, slates, schists, sandstones, quartzites, granites, and gneisses.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: These forests have canopies that are strongly dominated by *Picea rubens* and rather open due to *Abies fraseri* mortality. The shrub strata are dense and composed of a mix of deciduous shrubs and regenerating *Picea rubens* and *Abies fraseri*. Other shrub species include *Amelanchier laevis, Betula alleghaniensis, Diervilla sessilifolia, Menziesia pilosa, Prunus pensylvanica, Vaccinium erythrocarpum, Rubus allegheniensis, Sambucus racemosa var. racemosa (= var. pubens), Sorbus americana*, and *Viburnum lantanoides*. Standing dead trees are common, as is abundant coarse woody debris on the forest floor. The litter layer is thick, and bryophyte cover can be high, while herbaceous cover is sparse. Herbaceous species include *Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina, Clintonia borealis, Dennstaedtia punctilobula, Dryopteris campyloptera, Oxalis montana, Solidago glomerata*, and *Viola blanda*.

Global Vegetation: These forests are dominated by needle-leaved evergreen trees and have a characteristic understory of southern Appalachian endemic species and a conspicuous bryophyte layer. Canopies are dominated by *Picea rubens*, with or without *Abies fraseri*, sometimes with lesser amounts of *Betula alleghaniensis* and *Sorbus americana*. The subcanopy contains canopy species as well as *Acer spicatum*

and *Amelanchier laevis*. The shrub strata are dominated by deciduous species and can be sparse to dense. Typical shrub species include *Viburnum lantanoides, Vaccinium erythrocarpum, Vaccinium simulatum, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Rubus allegheniensis, Ilex montana, Rhododendron catawbiense,* and *Rubus canadensis*. Extensive patches of *Abies fraseri* seedlings and standing dead stems of *Abies fraseri* are common. Herb density can be high but is inversely related to the density of the shrub layer. Common herbaceous species include *Oxalis montana, Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera*, and *Clintonia borealis*. Other herbs include *Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Carex gynandra, Carex pensylvanica, Chelone lyonii, Circaea alpina ssp. alpina, Houstonia serpyllifolia, Huperzia lucidula, Maianthemum canadense, Rugelia nudicaulis, Solidago glomerata, Solidago glomerata, Streptopus lanceolatus var. roseus (= Streptopus roseus var. roseus)*, and *Viola macloskeyi ssp. pallens*. Bryophytes and lichens make up a considerable percent of the vegetative coverage in this community, occurring on the surface of the soil, trees, and fallen logs. Characteristic nonvascular species include *Hylocomium splendens, Ptilium crista-castrensis, Leptodontium excelsum, Bazzania trilobata, Bazzania nudicaulis, Alectoria fallacina, Hypotrachyna virginica, Dicranum scoparium,* and *Dicranum fuscescens.*

Global Dynamics: Natural disturbances in this community include lightning fire, debris avalanches, wind disturbance, and ice storms (White and Pickett 1985, Nicholas and Zedaker 1989). The natural fire regime is estimated at longer than 500-1000 years. Human-initiated disturbances have included logging, slash fires, livestock grazing, damage by the Balsam Woolly Adelgid (*Adelges piceae*), and atmospheric pollutants.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Picea rubens*
TALL SHRUB	*Abies fraseri, Picea rubens, Rubus canadensis, Vaccinium erythrocarpum*
FORB	*Aster acuminatus, Oxalis montana*
FERN	*Athyrium filix-femina*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri, Picea rubens*
TREE SUB-CANOPY	*Abies fraseri, Acer spicatum, Amelanchier laevis, Betula alleghaniensis, Sorbus americana*
TALL SHRUB	*Vaccinium erythrocarpum, Viburnum lantanoides*
FORB	*Oxalis montana*
FERN	*Athyrium filix-femina ssp asplenioides, Dryopteris campyloptera*
NON-VASCULAR	*Bazzania trilobata, Hylocomium splendens, Ptilium crista-castrensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Abies fraseri, Picea rubens*
SHRUB	*Rubus allegheniensis, Vaccinium erythrocarpum*
FORB	*Clintonia borealis, Solidago glomerata*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri, Picea rubens*
TALL SHRUB	*Vaccinium erythrocarpum, Viburnum lantanoides*
SHORT SHRUB	*Ribes rotundifolium, Vaccinium erythrocarpum*
FORB	*Angelica triquinata, Clintonia borealis, Eurybia chlorolepis, Houstonia serpyllifolia, Oxalis montana, Rugelia nudicaulis, Solidago glomerata*
FERN	*Dryopteris campyloptera, Huperzia lucidula*
NON-VASCULAR	*Bazzania trilobata, Hylocomium splendens, Ptilium crista-castrensis*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species

Same as global

Global

Stratum	Species
TREE CANOPY	*Betula papyrifera var cordifolia*
GRAMINOID	*Calamagrostis canadensis, Carex projecta, Poa palustris*
FORB	*Chelone lyonii, Stellaria corei, Streptopus amplexifolius*
FERN	*Botrychium oneidense, Phegopteris connectilis*
NON-VASCULAR	*Metzgeria temperata, Nardia scalaris, Plagiochila corniculata*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum) Forest (CEGL007130)--is a similar forest that has a shrub stratum dominated by evergreen species and occurs on less mesic sites than the one described here. Similar forests occur in the central and northern Appalachians, but have *Abies balsamea* as the fir component and less dense herb and bryophyte cover (Oosting and Billings 1951, Whittaker 1956, Crandall 1958).
- Picea rubens - Tsuga canadensis / Rhododendron maximum Forest (CEGL006272)--is a similar forest that has a shrub stratum dominated by evergreen species, especially *Rhododendron maximum* and occurs with other northern hardwood species and *Tsuga canadensis*.

GRank & Reasons: G2 (98-04-30). This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee, western North Carolina, and southwestern Virginia. It has a naturally restricted distribution and has been subject to major acreage reduction during the early part of the 20th century and rapid condition decline in the past 30 years. Modern threats include atmospheric pollution deposition and damage by *Adelges piceae*, the exotic Balsam Woolly Adelgid. Well-developed, undisturbed examples of this community are extremely rare.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Examples of this community observed on the Mount Le Conte quadrangle were formerly codominated by *Picea rubens* and *Abies fraseri*. On the Mount Le Conte quadrangle, this forest grades into lower elevation forests dominated by *Picea rubens* and/or *Betula alleghaniensis* or forests dominated by *Picea rubens, Tsuga canadensis*, and *Betula alleghaniensis*. Some occurrences of this community may be floristically similar to *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata* Forest (CEGL006256).

Global Classif Comments: An occurrence on the edge of the Ridge and Valley province in southwestern Virginia occurs over sandstone on Clinch Mountain.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte, Clingmans Dome, and Bunches Bald quadrangle and may occur in other quadrangles that contain land above 5500 feet elevation. This forest was found on the steep slopes and ridges in the vicinity of Mount Kephart and on steep slopes south of the Mount Le Conte summit. It should be looked for at other locations in the park from approximately 5500 to just over 6000 feet elevation. Above this elevation, forests are dominated by *Abies fraseri*.

Global Range: This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee, western North Carolina, and southwestern Virginia.

Nations: US
States/Provinces: NC:S?, TN:S?, VA:S?
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Aa:CCC, M221Ba:CCC, M221Bc:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL007131
REFERENCES (type in full citation below if reference is new): Adams and Stephenson 1991, Allard 1990, Anderson et al. 1990, Belden et al. 1994, Brown 1941, Bruck 1988, Busing et al. 1988, Cogbill and White 1991, Crandall 1958, Crandall 1960, Davis 1930, Dull et al. 1988b, Eagar and Adams 1992, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Golden 1974, Korstian 1937, McLaughlin et al. 1987,

McLeod 1988, NCNHP 1993, NatureServe Ecology - Southeast U.S. unpubl. data, Nicholas and Zedaker 1989, Nicholas et al. 1992, Oosting and Billings 1951, Peet et al. 2002, Pyne 1994, Ramseur 1960, Rawinski 1992, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990, Schofield 1960, Stephenson and Adams 1984, Stephenson and Clovis 1983, USFS 1988, Wentworth et al. 1988, White 1984a, White 1984b, White and Cogbill 1992, White and Pickett 1985, White et al. 1993, Whittaker 1956, Zedaker et al. 1988

Picea rubens - Tsuga canadensis / Rhododendron maximum Forest

Red Spruce - Eastern Hemlock / Great Rhododendron Forest

Red Spruce - Fraser Fir Forest (Hemlock Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Spruce-Fir Forests (410-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This needle-leaved evergreen forest has a canopy dominated by mixtures of *Picea rubens* and *Tsuga canadensis*. *Betula alleghaniensis, Acer rubrum,* or *Prunus pensylvanica* may form a minor part of the canopy or subcanopy. Typically, there is a dense subcanopy/tall-shrub stratum of *Rhododendron maximum*. Other shrub species can include *Rhododendron catawbiense, Ilex montana, Rubus canadensis,* and *Amelanchier laevis*. The herb stratum is typically very sparse with scattered ferns and other forbs. The ground cover is dominated by leaf litter and may have scattered large rocks or exposed bedrock. This community is known to occur in the Great Smoky Mountains in the vicinity of Mount Le Conte on steep, middle to high slopes between 4500 and 5000 feet elevation. Sites may be relatively exposed and rocky and subject to disturbance by wind and ice. Soils are well-drained and high in organic matter.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community is known to occur in the Great Smoky Mountains in the vicinity of Mount Le Conte on steep, middle to high slopes between 4500 and 5000 feet elevation. Sites may be relatively exposed and rocky and subject to disturbance by wind and ice. Soils are well-drained and high in organic matter.

Global Environment: This community is known to occur in the Great Smoky Mountains in the vicinity of Mt. LeConte on steep, middle to high slopes between 4500 and 5000 feet elevation. Sites may be relatively exposed and rocky and subject to disturbance by wind and ice. Soils are well-drained and high in organic matter.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This needle-leaved, evergreen forest has a canopy dominated by mixtures of *Picea rubens* and *Tsuga canadensis. Betula alleghaniensis, Acer rubrum,* or *Prunus pensylvanica* may form a minor part of the canopy or subcanopy. Typically, there is a dense subcanopy/tall-shrub stratum of *Rhododendron maximum*. Other shrub species can include *Rhododendron catawbiense, Ilex montana, Rubus canadensis,* and *Amelanchier laevis*. The herb stratum is typically very sparse with scattered ferns and other forbs. The ground cover is dominated by leaf litter and may have scattered large rocks or exposed bedrock.

Global Vegetation: This needle-leaved evergreen forest has a canopy dominated by mixtures of *Picea rubens* and *Tsuga canadensis*. *Betula alleghaniensis, Acer rubrum,* or *Prunus pensylvanica* may form a minor part of the canopy or subcanopy. Typically, there is a dense subcanopy/tall-shrub stratum of *Rhododendron maximum*. Other shrub species can include *Rhododendron catawbiense, Ilex montana, Rubus canadensis,* and *Amelanchier laevis*. The herb stratum is typically very sparse with scattered ferns and other forbs. The ground cover is dominated by leaf litter and may have scattered large rocks or exposed bedrock.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Picea rubens, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*

Global

Stratum	Species

TREE CANOPY	*Picea rubens, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Picea rubens, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*

Global

Stratum	Species
TREE CANOPY	*Picea rubens, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Picea rubens / Rhododendron maximum Forest (CEGL006152)

GRank & Reasons: G2? (99-02-15). In the Southern Blue Ridge, this forest is nearly or entirely restricted to Great Smoky Mountains National Park. While the total distribution of this community is uncertain, the total acreage is certainly small, less than 10,000 hectares. The only known location with substantial, high-quality occurrences is Great Smoky Mountains National Park.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: On the Mount Le Conte quadrangle, these forests may grade into lower-elevation forests dominated by *Betula alleghaniensis* or *Tsuga canadensis*. At least some examples are old-growth forest. On more exposed sites, this community may border heath shrublands.

Global Classif Comments: These forests are known from the steep upper slopes of Mount LeConte in the Great Smoky Mountains. Forests with *Picea rubens* and *Tsuga canadensis* occur in Virginia, but in a different topographic and hydrologic situation than this association. Gary Fleming describes occurrences at Salt Pond Mountain that are in valley bottoms, within streamheads, and have an unclear hydrology. This association may not be distinct enough from *Picea rubens / Rhododendron maximum* Forest (CEGL006152) to warrant recognition from it.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte quadrangle and was not found on the Cades Cove quadrangle. It occurs on the northern slopes of Mount Le Conte and on slopes east of Peregrine Peak. It should be looked for in other areas of the park between 4500 and 5000 feet elevation.

Global Range: This community is known to occur in the Great Smoky Mountains in the vicinity of Mount Le Conte.

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Aa:CPP, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee?, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson and A.S. Weakley, SCS **Confidence:** 2 **Identifier:** CEGL006272
REFERENCES (type in full citation below if reference is new): Allard 1990, Peet et al. 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990

Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana) Forest

Eastern Hemlock / Great Rhododendron - (Mountain Sweet-pepperbush, Mountain Doghobble) Forest

Southern Appalachian Eastern Hemlock Forest (Typic Type)

Ecological Group (SCS;MCS): Appalachian Highlands Upland Eastern Hemlock Forests (420-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: Forests of lower or protected slopes and terraces with *Tsuga canadensis* occurring over a dense to patchy shrub stratum of *Rhododendron maximum*. Other canopy species of minor importance may include *Liriodendron tulipifera, Tilia americana var. heterophylla, Pinus strobus, Betula lenta, Magnolia fraseri, Acer rubrum*, and *Fraxinus americana*; these would total less than 25% of the canopy cover. In the Southern Blue Ridge, *Leucothoe fontanesiana* is often a shrub component, and sometimes occurs densely. Other typical shrubs can include *Ilex opaca, Clethra acuminata*, and *Kalmia latifolia*. Herbs are sparse to moderate, depending on the shrub cover. Typical herbs include *Chimaphila maculata, Goodyera pubescens, Medeola virginiana, Hexastylis shuttleworthii, Mitchella repens, Polystichum acrostichoides, Viola blanda*, and *Galax urceolata*. Bryophyte cover is often dense. In the southern Appalachians, this forest occurs at elevations greater than 1800 feet. In Kentucky, disturbed areas may have abundant *Betula lenta* and *Betula alleghaniensis* in the subcanopy. Stands in the southern Cumberlands of Kentucky and Tennessee would lack *Leucothoe fontanesiana*; instead, *Clethra acuminata* is a characteristic shrub of these stands.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This forest is found in association with streams on low slopes with north aspects. Samples were found from 1705 and 2277 feet elevation, but this forest is likely to occur at higher elevations.

Global Environment: Forests of lower or protected slopes and terraces with *Tsuga canadensis* occurring over a dense to patchy shrub stratum of *Rhododendron maximum*. In the southern Appalachians, this forest occurs at elevations greater than 1800 feet.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy of this community is strongly dominated by *Tsuga canadensis*. Other species that have minor coverage in the canopy and subcanopy include *Betula lenta, Magnolia fraseri*, and *Liriodendron tulipifera*. The dominant shrubs are *Rhododendron maximum* and *Leucothoe fontanesiana*. Other shrubs include *Hamamelis virginiana, Halesia tetraptera var. monticola, Clethra acuminata*, and *Oxydendrum arboreum*. Herbs are sparse; typical species include *Dryopteris intermedia, Goodyera pubescens, Medeola virginiana, Mitchella repens, Polystichum acrostichoides*, and *Thelypteris noveboracensis*.

Global Vegetation: Forests with *Tsuga canadensis* occurring over a dense to patchy shrub stratum of *Rhododendron maximum*. Other canopy species of minor importance may include *Liriodendron tulipifera, Tilia americana var. heterophylla, Pinus strobus, Betula lenta, Magnolia fraseri, Acer rubrum*, and *Fraxinus americana*; these would total less than 25% of the canopy cover. *Leucothoe fontanesiana* is often a shrub component, and sometimes occurs densely. Other typical shrubs include *Ilex opaca, Clethra acuminata*, and *Kalmia latifolia*. Herbs are sparse to moderate, depending on the shrub cover. Typical herbs include *Chimaphila maculata, Goodyera pubescens, Medeola virginiana, Hexastylis shuttleworthii, Mitchella repens, Polystichum acrostichoides*, and *Galax urceolata*. Bryophyte cover is often dense. In Kentucky, disturbed areas may have abundant *Betula lenta* and *Betula alleghaniensis* in the subcanopy. Stands in the southern Cumberlands of Tennessee would lack *Leucothoe fontanesiana*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Tsuga canadensis*

TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

Global

Stratum	Species
TREE CANOPY	*Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

Global

Stratum	Species
TREE CANOPY	*Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana) Forest (CEGL007102)--dominated by *Pinus strobus* or codominated by *Pinus strobus* and *Tsuga canadensis*.

GRank & Reasons: G3G4 (98-04-30).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This association can occur adjacent to and grade in and out of *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543). It is unclear if there is an environmental factor that distinguishes forests codominated by *Tsuga canadensis* and *Pinus strobus* and those dominated by only *Tsuga canadensis*. It is possible that those codominated by *Pinus strobus* occur on drier, more westerly exposed sites or perhaps on previously disturbed sites. It is unlikely that the signature of this association can be distinguished from that of *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102).

Global Classif Comments: In Kentucky, this association occurs in the eastern part of the state (Appalachian plateaus, Cumberland Mountains).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove quadrangle. It is unlikely to occur on the Mount Le Conte quadrangle but occurs elsewhere in the park. This community was sampled in two locations on the Cades Cove quadrangle; in the northwest along More Licker Branch and in the central portion of the quadrangle along Tipton's Sugar Cove Branch.

Global Range: This community is found in the Southern Appalachians, from North Carolina west into Kentucky.

Nations: US
States/Provinces: GA:S?, KY:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 50:C, 51:C, 52:C
USFS Ecoregions: 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222D:??, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Cumberland Gap, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL007136
REFERENCES (type in full citation below if reference is new): Allard 1990, Caplenor 1965, Evans 1991, Eyre 1980, Golden 1974, Golden 1981, Lorimer 1980, McLeod 1988, Newell et al. 1997, Oosting and Bourdeau

1955, Patterson 1994, Peet et al. 2002, Pyne 1994, Quarterman et al. 1972, Racine and Hardin 1975, Schafale 1998b, Schafale and Weakley 1990, Whittaker 1956

*Acer rubrum var. rubrum - Nyssa sylvatica - Magnolia fraseri - Oxydendrum arboreum / (Rhododendron maximum, Kalmia latifolia) Forest*Red Maple - Blackgum - Fraser Magnolia - Sourwood / (Great Rhododendron, Mountain Laurel) Forest

Southern Appalachian Mixed Hardwood Forest
Ecological Group (SCS;MCS): Appalachian Highlands Mesic Acid Hardwood Forests (420-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes mesic to dry-mesic, potentially fire-exposed mid and upper slopes in the Great Smoky Mountains National Park and possibly adjacent areas (Cherokee National Forest?). Canopy dominance may be shared by a number of species including *Acer rubrum var. rubrum, Magnolia fraseri, Nyssa sylvatica, Betula alleghaniensis var. alleghaniensis, Betula lenta, Oxydendrum arboreum*, and *Tsuga canadensis*, but the community's most distinctive character is the relative lack of dominance by any one species and the lack of oak species in the canopy. The understory shrub layer is composed of a combination of *Kalmia latifolia* and *Rhododendron maximum*, though the cover is not consistently 100%. The proportion of *Kalmia* to *Rhododendron* varies widely through this association, with more xeric sites having a higher concentration of *Kalmia latifolia* than *Rhododendron maximum*. In addition, drier versions of this association tend to contain abundant *Sassafras albidum* in the understory, whereas the more mesic versions have lower densities of *Sassafras albidum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Same as global.

Global Environment: This is a mesic to dry-mesic forest found on moderate to steep terrain on upper slopes of many different aspects and positions in the Great Smoky Mountains National Park area (2500-4500 feet in elevation). Although tree sizes can be very large, this community is in essence a successional community that developed in mid-elevation areas that were historically dominated by *Castanea dentata*. As the *Castanea dentata* senesced, the tree species we now see in the canopy began to be released from the understory to the canopy. This may explain why the community is so variable in its slope position, moisture regime, and elevation. The areas were historically fire-exposed sites before the suppression of landscape-scale fires. Soils are usually very deep.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global.

Global Vegetation: The canopy of this alliance is typically shared by a wide range of species including *Acer rubrum var. rubrum, Betula alleghaniensis var. alleghaniensis, Betula lenta, Magnolia fraseri, Oxydendrum arboreum, Nyssa sylvatica*, and *Tsuga canadensis*. The understory includes some subcanopy trees such as *Ilex opaca var. opaca* or *Ilex montana*, and shrub species such as *Kalmia latifolia* and *Rhododendron maximum* can be very dense. The proportion of *Kalmia* to *Rhododendron* varies widely through this association, with more xeric sites having a higher concentration of *Kalmia latifolia* than *Rhododendron maximum*. In addition, drier versions of this association tend to contain abundant *Sassafras albidum* in the understory, whereas the more mesic versions have lower densities of *Sassafras albidum*. Although the herb layer is comprised mostly of small shrubs, seedlings, and evergreens, *Trillium undulatum, Goodyera pubescens*, and other acid-loving species can occasionally be found in this association.

Global Dynamics: Since this association appears on fire-exposed slopes, it is assumed that these areas burned in the past. The lack of oak trees in this alliance is poorly understood. Some examples of this association occur in virgin forest areas, though there are areas where large chestnut stumps are present; these stands may represent a post-chestnut-blight replacement forest. Other stands occur in areas with a previous logging history, and may reflect stands developing after logging, with failed oak regeneration.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum var rubrum, Betula alleghaniensis var alleghaniensis, Betula lenta, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Tsuga canadensis*

SHRUB	*Kalmia latifolia, Rhododendron maximum*

Global

Stratum	Species
TREE CANOPY	*Acer rubrum var rubrum, Betula alleghaniensis var alleghaniensis, Betula lenta, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Tsuga canadensis*
SHRUB	*Kalmia latifolia, Rhododendron maximum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata Forest (CEGL006286)
- Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina) Forest (CEGL007230)
- Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida Forest (CEGL007267)--oak-dominated.
- Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens) Forest (CEGL006271)--oak-dominated.

SYNONYMY [OtherName (short citation) relationship. Note]:

- (NatureServe Ecology - Southeast U.S. unpubl. data) UNDNAT01ICEC
- (NatureServe Ecology - Southeast U.S. unpubl. data) UNDABI01ICEC

GRank & Reasons: GM (01-10-09). Ranked as modified due to the heavy effects logging had on most of these stands over the past 100 years. Stands of this type appear to have been modified by a combination of logging, chestnut death, and fire suppression. These are mature stands in the Great Smoky Mountains National Park.

CLASSIFICATION COMMENTS

Global Classif Comments: Neither of the communities listed as similar associations are very close to this association in canopy composition, but the understory of all of these associations is similar.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community exists throughout the park (possibly every quadrangle with the appropriate elevation ranges) but has yet to be found outside of the park.

Global Range: This association is documented only from the western Great Smoky Mountains National Park, but it may occur throughout the mid- to higher elevation exposed slopes of eastern Tennessee and western North Carolina, and possibly also into adjacent parts of Virginia and West Virginia.

Nations: US
States/Provinces: NC:S?, TN:S?, VA?, WV?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CC?, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: R. White, SCS **Confidence:** 2 **Identifier:** CEGL008558
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data

Aesculus flava - Betula alleghaniensis - Acer saccharum / Acer spicatum / Caulophyllum thalictroides - Laportea canadensis Forest

Yellow Buckeye - Yellow Birch - Sugar Maple / Mountain Maple / Blue Cohosh - Wood Nettle Forest

Southern Appalachian Northern Hardwood Forest (Rich Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Northern Hardwood Forests (410-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes forests on high but sheltered slopes in the Southern Blue Ridge, with canopies dominated by species typically known as 'northern hardwoods' (*Aesculus flava, Fagus grandifolia, Betula alleghaniensis, Acer saccharum*), but with a rich herbaceous flora dominated by forbs and more typical of lower elevation 'cove' forests. This forest occurs on deep, rocky soils on the upper slopes of coves, and on other protected landforms, at elevations of 3500-5000 feet, and can be associated with mafic substrates. Other canopy species can include *Tilia americana var. heterophylla* and *Quercus rubra*. In the Great Smoky Mountains, *Halesia tetraptera var. monticola* is an important canopy component. The shrub stratum is typically open, but small trees such as *Acer spicatum, Acer pensylvanicum*, and *Amelanchier laevis* are common. Herbaceous cover can be lush, quite diverse, and is typically dominated and characterized by large forbs such as *Caulophyllum thalictroides, Actaea racemosa (= Cimicifuga racemosa), Collinsonia canadensis, Ageratina altissima var. roanensis, Laportea canadensis, Campanulastrum americanum*, and *Tiarella cordifolia*. The canopy of these forests always has a component of *Betula alleghaniensis* and/or *Fagus grandifolia*, occurring with *Acer saccharum*, over a lush and diverse herbaceous stratum.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community occurs on concave or protected landforms such as the upper portions of draws and coves, protected slopes, and gaps. Sites sampled had northerly aspects and a mean elevation of 4200 feet, ranging from 3580 to 4620 feet.

Global Environment: This association includes forests on high but sheltered slopes in the Southern Blue Ridge. This forest occurs on deep, rocky soils on the upper slopes of coves, and on other protected landforms, at elevations of 3500-5000 feet, and can be associated with mafic substrates.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy of these forests always have a component of *Betula alleghaniensis* and *Fagus grandifolia*, codominating with *Acer saccharum, Aesculus flava*, and *Halesia tetraptera var. monticola*. Occasionally *Quercus rubra, Tilia americana var. heterophylla*, and *Fraxinus americana* may have coverage in the canopy, but this situation is not typical. The subcanopy, if present, contains species from the canopy as well as *Prunus pensylvanica* and *Prunus serotina*. The shrub stratum is typically open with scattered shrubs, but shrubs can dominate in patches. Typical shrub species include *Acer pensylvanicum, Acer saccharum, Acer spicatum, Aesculus flava, Cornus alternifolia, Fagus grandifolia, Hydrangea arborescens, Ilex montana, Rubus allegheniensis, Rubus canadensis*, and *Viburnum lantanoides*. The herbaceous stratum is lush and diverse. Species with the highest coverage and constancy include *Ageratina altissima (var. altissima* and *var. roanensis), Eurybia divaricata (= Aster divaricatus), Actaea podocarpa (= Cimicifuga americana), Actaea racemosa (= Cimicifuga racemosa), Deparia acrostichoides, Dryopteris intermedia, Laportea canadensis, Solidago curtisii (= Solidago caesia var. curtisii), Tiarella cordifolia*, and *Viola blanda*. Other species with greater than 50% constancy include *Arisaema triphyllum ssp. triphyllum, Athyrium filix-femina ssp. asplenioides, Carex* spp. (e.g., *Carex aestivalis, Carex debilis, Carex laxiflora var. laxiflora, Carex pensylvanica, Carex plantaginea), Prosartes lanuginosa (= Disporum lanuginosum), Eupatorium* spp. (e.g., *Eupatorium dubium, Eupatorium fistulosum, Eupatorium purpureum, Eupatorium steelei), Galium* spp. (e.g., *Galium lanceolatum, Galium latifolium, Galium triflorum), Impatiens* spp., *Polygonatum pubescens, Polystichum acrostichoides var. acrostichoides, Stellaria corei, Stellaria pubera*, and *Viola canadensis.*

Global Vegetation: The canopy of these forests always has a component of *Betula alleghaniensis* and/or *Fagus grandifolia*, occurring with *Acer saccharum*, over a lush and diverse herbaceous stratum. The canopies of stands are dominated by species typically known as 'northern hardwoods' (*Aesculus flava, Fagus grandifolia, Betula alleghaniensis, Acer saccharum*), but with a rich herbaceous flora dominated by forbs and more typical of lower elevation 'cove' forests. Other canopy species can include *Tilia americana var. heterophylla* and *Quercus rubra*. In the Great Smoky Mountains, *Halesia tetraptera var. monticola* is an important canopy component. The shrub stratum is typically open, but small trees such as *Acer spicatum, Acer pensylvanicum*, and *Amelanchier laevis* are common. Herbaceous cover can be lush, quite diverse, and is typically dominated and characterized by large forbs such as *Caulophyllum thalictroides, Actaea racemosa (= Cimicifuga racemosa), Collinsonia canadensis, Ageratina altissima var. roanensis, Laportea canadensis, Campanulastrum americanum*, and *Tiarella cordifolia*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer saccharum, Aesculus flava, Betula alleghaniensis, Fagus grandifolia*

Global

Stratum	Species
TREE CANOPY	*Acer saccharum, Aesculus flava, Betula alleghaniensis, Fagus grandifolia*
HERBACEOUS	*Actaea racemosa, Laportea canadensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer saccharum, Betula alleghaniensis, Fagus grandifolia, Halesia tetraptera var monticola*
FORB	*Viola canadensis*
FERN	*Deparia acrostichoides*

Global

Stratum	Species
Same as local	

GRank & Reasons: G3 (99-12-29). This community is naturally uncommon due to specific habitat requirements and a restricted geographic range. It only occurs at moderate to high elevations, on protected landforms, in the Southern Blue Ridge. Most documented occurrences are of moderate to high quality, although destructive silvicultural practices could threaten remaining occurrences. The European gypsy moth (*Lymantria dispar*) is predicted to spread within the range of this community by 2005 and poses a threat to this community.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Some examples of this community, particularly at low elevations, may begin to resemble forests in the *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235). The canopy of this forest is distinguished by *Betula alleghaniensis* and *Fagus grandifolia* occurring in combination with *Aesculus flava* and *Acer saccharum*. In some areas, signature distinctions between this association and *Betula alleghaniensis - Fagus grandifolia - Aesculus flava / Viburnum lantanoides / Eurybia chlorolepis - Dryopteris intermedia* Forest (CEGL007285) may be difficult to make, and mapping may have to be done at the alliance level.

Global Classif Comments: These forests occur above the elevational limit of some of the typical "cove" canopy species [see I.B.2.N.a *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)] such as *Fraxinus americana, Liriodendron tulipifera*, and *Carya cordiformis*.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte, Cades Cove, Thunderhead Mountain, and Clingmans Dome quadrangles and is widespread throughout the intermediate elevations of the park. On the Cades Cove quadrangle, historic and recent samples of this community ranged from 3580 to 4610 feet elevation. Samples from the southern portion of the Cades Cove

quadrangle came from upper coves north of Gregory Bald; slopes below Rich Gap; and the western slopes of Forge Knob. In the central and eastern portion of the Cades Cove quadrangle this community was sampled from the protected high slopes on the west side of Mud Gap; a cove north of Ekaneetlee Gap; high slopes in the vicinity of Devil's Tater Patch; McCampbell Gap, McCampbell Knob, an upper cove north of McCampbell Gap; northwest slopes below McCampbell Knob; and a cove in the upper reaches of Pole Knob Branch. This community was sampled in the southwest portion of the Mount Le Conte quadrangle on the low slopes above Alum Cave Creek (4050 feet) and Walker Camp Prong (3990 feet); on the low slopes above Road Prong in the vicinity of Beech Flats (3650 feet); and in a upper cove below Chimney Tops (4620 feet). It was found on Davis Ridge on the Thunderhead Mountain quad and near Newfound Gap Road on the Clingmans Dome quad.

Global Range: This community is a regional endemic, found only in the high-mountain areas of the Southern Blue Ridge, south through western North Carolina, eastern Tennessee, and northeastern Georgia.

Nations: US
States/Provinces: GA:S?, NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004973
REFERENCES (type in full citation below if reference is new): Major et al. 1999, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Betula alleghaniensis - Fagus grandifolia - Aesculus flava / Viburnum lantanoides / Eurybia chlorolepis - Dryopteris intermedia Forest

Yellow Birch - American Beech - Yellow Buckeye / Hobblebush / Appalachian Heartleaf Aster - Fancy Fern Forest

Southern Appalachian Northern Hardwood Forest (Typic Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Northern Hardwood Forests (410-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This is a broadly defined association meant to cover typical 'northern hardwood forests' over 4000 feet in elevation of the Southern Blue Ridge. This deciduous forest association occurs on exposed landforms such as open, north-facing slopes. The canopy is dominated by various mixtures of *Betula alleghaniensis, Fagus grandifolia,* and sometimes *Aesculus flava*. Other canopy trees may be present but are of minor importance (e.g., *Acer saccharum, Prunus serotina, Quercus rubra, Halesia tetraptera var. monticola*). Common subcanopy trees include *Acer pensylvanicum, Acer spicatum,* and *Acer saccharum*. A shrub stratum may be absent to moderately dense. *Viburnum lantanoides* is a common shrub. Other possible shrub species include, but are not limited to, *Hydrangea arborescens, Ilex montana, Rubus canadensis,* and *Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens)*. Herbaceous cover can be dominated by sedges or ferns or be comprised of a mixture of sedges, ferns, and other forbs. Typical herbaceous species include *Ageratina altissima var. roanensis, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides (= Athyrium asplenioides), Carex pensylvanica, Dryopteris intermedia, Solidago curtisii (= Solidago caesia var. curtisii), Stellaria pubera, Stellaria corei,* and *Streptopus lanceolatus var. roseus (= Streptopus roseus).*

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Samples of this community ranged from 4320 to 5400 feet elevation, averaging 4720 feet. Examples are found on high, exposed slopes, ridges, and gaps, typically with northerly exposures, but occasionally on eastern or western upper slopes.

Global Environment: This deciduous forest association occurs at high elevations (typically over 4000 feet) in the Southern Blue Ridge, on exposed landforms such as open, north-facing slopes. Virginia examples of the type occur at elevations from 1100-1600 m (3600-5200 feet). Mean elevation of 28 plot-sampled Virginia stands is 1342 m (4400 feet). Habitats include a wide range of slope positions and aspects. Surface cover of bedrock and boulders is typically less than 25%, but occasionally higher. Soil samples collected from plot-sampling sites are consistently extremely acidic (mean pH = 3.8) with low base status.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy is dominated by various mixtures of *Betula alleghaniensis, Fagus grandifolia,* and *Aesculus flava*. Other species that may occasionally have high coverage in the canopy include *Halesia tetraptera var. monticola, Quercus rubra,* and *Acer saccharum.* The subcanopy is usually not well-developed and consists of canopy species. Additional species that may be present in the subcanopy include *Acer pensylvanicum, Amelanchier laevis,* and *Prunus serotina.* At the highest elevations *Picea rubens* may be part of the subcanopy, while at lower elevations *Magnolia acuminata* may be present in the subcanopy. Shrubs are typically sparse but can be moderately dense. Common shrubs include *Fagus grandifolia, Rubus canadensis, Acer spicatum, Viburnum lantanoides,* and *Ilex montana,* although other species may occur. Herb coverage varies between occurrences but is composed of a mix of sedges, ferns, and other forbs. Species richness is low in comparison with other deciduous forests, with typically less than 30 total species per 0.1 hectare. Common herbaceous dominants include *Ageratina altissima, Athyrium filix-femina ssp. asplenioides, Carex* spp. (e.g., *Carex debilis, Carex intumescens, Carex pensylvanica*), and *Dryopteris intermedia*. Other typical herbs include *Eurybia divaricata (= Aster divaricatus), Solidago curtisii (= Solidago caesia var. curtisii), Stellaria pubera,* and *Viola* spp. (e.g., *Viola blanda, Viola canadensis, Viola hastata, Viola pubescens*), although other species may occur.

Global Vegetation: Over most of this community's range, the canopy is dominated by various mixtures of *Betula alleghaniensis, Fagus grandifolia* and, less commonly, *Aesculus flava*. Other canopy trees, including *Acer*

saccharum, Prunus serotina, Quercus rubra, and *Halesia tetraptera var. monticola*, may be present but are of minor importance. Common subcanopy trees include *Acer pensylvanicum, Acer spicatum,* and *Acer saccharum*. The shrub stratum may vary from nearly undeveloped to moderately dense. *Viburnum lantanoides* is a common shrub throughout the range. Other potential shrub components include, but are not limited to, *Hydrangea arborescens, Ilex montana, Rubus canadensis,* and *Sambucus racemosa (= Sambucus pubens)*. Herbaceous cover is variably dominated by sedges, ferns, and forbs. Typical herbaceous species include *Ageratina altissima var. roanensis, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides (= Athyrium asplenioides), Carex pensylvanica, Dryopteris intermedia, Solidago curtisii, Stellaria pubera, Stellaria corei,* and *Streptopus lanceolatus var. roseus (= Streptopus roseus)*.

In Virginia, two distinct, compositional and environmental variants of this community type are well-supported by quantitative analyses of plot data. These are tentatively segregated as different community types in the Virginia State Classification, but are treated here as global subtypes of the *Betula alleghaniensis - Fagus grandifolia - Aesculus flava / Viburnum lantanoides / Eurybia chlorolepis - Dryopteris intermedia* Forest (CEGL007285).

The *Acer saccharum - Aesculus flava - Betula alleghaniensis / Athyrium filix-femina ssp. asplenioides - Ageratina altissima var. roanensis* Subtype (1) of Virginia is widespread throughout the higher elevations of the southern Virginia Blue Ridge and also represents outliers of the global type in the adjacent Ridge and Valley. *Acer saccharum* and *Aesculus flava* are prominent in the canopy of this subtype, along with *Betula alleghaniensis* and *Fagus grandifolia*. *Prunus serotina, Fraxinus americana,* and *Quercus rubra* are very minor canopy associates. *Acer saccharum, Acer pensylvanicum* and, more locally, *Acer spicatum* are abundant understory species. *Rubus canadensis* is the only common shrub. Herb layers are moderately dense and usually contain nutrient-demanding species such as *Caulophyllum thalictroides* and *Laportea canadensis* at low cover. However, the most abundant and constant herbs of this subtype are *Ageratina altissima var. roanensis, Dryopteris intermedia, Athyrium filix-femina ssp. asplenioides*, and *Viola blanda*. Other more of less constant and characteristic herbs are *Arisaema triphyllum, Festuca subverticillata, Solidago curtisii, Eurybia chlorolepis (= Aster chlorolepis), Viola affinis, Maianthemum canadense, Prosartes lanuginosa (= Disporum lanuginosum), Polygonatum pubescens,* and *Carex leptonervia*. This unit generally occurs on straight to concave slopes with west, north, or east aspects and soils with slightly higher base status (particularly manganese levels) than those of the following subtype. Mean species richness of plot-sampled stands is 41 taxa per 400 m2. The *Fagus grandifolia - Betula alleghaniensis - Acer saccharum / Viburnum lantanoides / Carex lucorum var. austrolucorum - Viola rotundifolia* Subtype (2) of Virginia is also widespread but is somewhat more localized and found only on the Blue Ridge. This subtype is typically associated with convex, often southerly slopes and ridge spurs with very infertile soils. *Fagus grandifolia* is the clear (sometimes overwhelming) canopy dominant, although *Betula alleghaniensis* and *Acer saccharum* are constant, less abundant canopy associates. *Aesculus flava* is essentially absent from this unit, while *Magnolia fraseri, Tsuga canadensis,* and *Picea rubens* are locally important canopy associates. Understory and shrub layers are dominated by young *Fagus* and *Acer saccharum*, in addition to *Acer pensylvanicum* and *Acer rubrum*. This subtype often has a well-developed shrub layer with *Viburnum lantanoides* dominant. Herb layers are moderately sparse to moderately dense and graminoid-rich; large patches of *Carex lucorum var. austrolucorum* are particularly characteristic. Other frequent or abundant herbs are *Viola rotundifolia, Dryopteris intermedia, Eurybia chlorolepis (= Aster chlorolepis), Oclemena acuminata (= Aster acuminatus), Huperzia lucidula, Oxalis montana, Thelypteris noveboracensis, Dennstaedtia punctilobula, Carex aestivalis, Carex debilis var. rudgei,* and *Brachyelytrum septentrionale*. Mean species richness of plot-sampled stands is 37 taxa per 400 m2.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis, Fagus grandifolia*
SHORT SHRUB	*Rubus canadensis*
FORB	*Ageratina altissima*
FERN	*Athyrium filix-femina ssp asplenioides, Dryopteris intermedia*

Global

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis, Fagus grandifolia*
TREE SUB-CANOPY	*Acer pensylvanicum, Acer saccharum, Acer spicatum*

TALL SHRUB	*Viburnum lantanoides*
GRAMINOID	*Carex pensylvanica*
FORB	*Ageratina altissima var roanensis, Eurybia chlorolepis*
FERN	*Athyrium filix-femina ssp asplenioides, Dryopteris intermedia*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis, Fagus grandifolia*
SHRUB	*Acer spicatum, Ilex montana, Viburnum lantanoides*
GRAMINOID	*Carex pensylvanica*
FORB	*Ageratina altissima var roanensis, Allium burdickii, Eurybia chlorolepis, Oxalis montana, Solidago glomerata, Stellaria corei, Stellaria pubera, Streptopus amplexifolius*
FERN	*Dryopteris intermedia*

Global

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis, Fagus grandifolia, Magnolia fraseri*
TREE SUB-CANOPY	*Acer pensylvanicum, Acer saccharum, Acer spicatum*
TALL SHRUB	*Viburnum lantanoides*
SHRUB	*Ilex montana, Rubus canadensis*
GRAMINOID	*Carex lucorum var austrolucorum, Carex pensylvanica*
FORB	*Ageratina altissima var roanensis, Eurybia chlorolepis, Viola blanda, Viola rotundifolia*
FERN	*Athyrium filix-femina ssp asplenioides, Dryopteris intermedia*

OTHER NOTEWORTHY SPECIES

Global

Stratum	Species
FORB	*Arnoglossum muehlenbergii*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Aesculus flava - Betula alleghaniensis - Acer saccharum / Acer spicatum / Caulophyllum thalictroides - Laportea canadensis Forest (CEGL004973)

GRank & Reasons: G3G4 (98-12-14). This is a broadly defined association meant to cover typical "northern hardwood forests" of the Southern Blue Ridge. If needed, more subassociations may be recognized based on differences related to geology and other environmental variables. Even if broadly defined, this type is limited in distribution to western North Carolina, eastern Tennessee, and southwestern Virginia, and in extent by its requirement for higher elevations (typically over 4000 feet). Most of the area of this community type is on public lands administered by the U.S. Forest Service (Pisgah, Nantahala, Cherokee, and Jefferson national forests) and National Park Service (Great Smoky Mountains National Park and Blue Ridge Parkway). Most sites for this community are relatively secure from most threats. Exotics plants and animals, such as garlic mustard (*Alliaria petiolata*) and the gypsy moth may represent significant threats to this community.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community intergrades with both *Fagus grandifolia / Carex pensylvanica - Carex brunnescens* Forest (CEGL006130) and *Aesculus flava - Betula alleghaniensis - Acer saccharum / Acer spicatum / Caulophyllum thalictroides - Laportea canadensis* Forest (CEGL004973). The beech gap (CEGL006130) often occurs upslope from this community and transitions into this with lower elevation. Generally the beech gap is dominated almost 100% by *Fagus grandifolia* in the canopy and contains a *Carex pensylvanica* herbaceous layer. On the other hand, the rich northern hardwood forest (CEGL004973) can often be confused with and occasionally intergrades with this community. CEGL004973 tends to have a more lush herbaceous stratum and tends to occur at lower elevations (3580-4620 feet) whereas this community has a less diverse herbaceous stratum and occurs at higher elevations (4320-5300 feet). Lower elevation examples of this community on Cades Cove (below 4600 feet) have high canopy coverage by *Quercus rubra* and may grade into forests in the *Quercus rubra* Montane Forest Alliance (A.272). Examples are often disturbed by European Wild Boar (*Sus scrofa*).

Global Classif Comments: High dominance by *Tilia* and *Fraxinus* in stands of this association may be an artifact of disturbance (K. Patterson pers. comm.).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Thunderhead Mountain, Clingmans Dome, Mount Le Conte, and Cades Cove quadrangles. Historic samples are from the Thunderhead Mountain quadrangle (4360 to 5000 feet elevation). On the Cades Cove quadrangle, historic and recent samples of this community ranged from 4320 to 4840 feet elevation. Samples from the southern portion of the Cades Cove quadrangle came from the upper slopes of Gregory Bald; upper slopes north and west of Gregory Bald; a gap west of Forge Knob; and Gregory Ridge, northwest of Rich Gap. In the central and eastern portion of the Cades Cove quadrangle, this community was sampled from the exposed slopes and ridges in the vicinity of Devil's Tater Patch; a ridge east of Mollies Ridge Shelter; and from the northwest slope of McCampbell Knob. In the southern portion of the Mount Le Conte quadrangle this community was sampled on the high north slopes of Masa Knob (5400 feet) and on steep west-facing slopes north of Mount Le Conte (5100 feet).

Global Range: The type is nearly endemic to high elevations of the Southern Blue Ridge in eastern Tennessee, western North Carolina, and southwestern Virginia. In the Virginia Blue Ridge, it is prevalent in the Mount Rogers - Whitetop Mountain area and at high elevations of the Iron Mountains. Local outliers also occur at the highest elevations of Clinch Mountain in the adjacent Ridge and Valley province.

Nations: US
States/Provinces: NC:S?, TN:S?, VA:S?
TNC Ecoregions: 51:C, 59:P
USFS Ecoregions: M221Da:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: G. Fleming and P. Coulling, SCS **Confidence:** 1 **Identifier:** CEGL007285
REFERENCES (type in full citation below if reference is new): Allard 1990, Brown 1941, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, McLeod 1988, NatureServe Ecology - Southeast U.S. unpubl. data, Newell et al. 1997, Peet et al. 2002, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990

Betula alleghaniensis / Acer spicatum / Hydrangea arborescens - Ribes cynosbati / Dryopteris marginalis Forest

Yellow Birch / Mountain Maple / Smooth Hydrangea - Eastern Prickly Gooseberry / Marginal Woodfern Forest

Southern Appalachian Hardwood Boulderfield Forest (Typic Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Northern Hardwood Forests (410-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes boulderfield forests of the southern Appalachians, strongly dominated by *Betula alleghaniensis*, but in habitats that allow for more diverse canopies, including other species such as *Aesculus flava, Betula lenta,* and *Tilia americana var. heterophylla*. This community occurs in a cool, humid climate, on steep, rocky, northwest- to northeast-facing, middle to upper concave slopes, or in saddles between ridges, at moderate to high elevations (2000-4000 feet) of the Blue Ridge and possibly ranging into the Cumberland Mountains and adjacent Ridge and Valley and Appalachian Plateau provinces. It grows on bouldery talus and is often associated with small streams and seepage. *Betula alleghaniensis* in the canopy are often stunted and gnarled, with roots that may have grown to encircle the boulders. The canopy is much more open than the surrounding forest and tree windthrow is common, leaving patches of exposed mineral soil and gaps in the canopy. A woody layer of shrubs and vines is usually well-developed. Rooting opportunities for most herbaceous plants is limited because of the development of this community on periglacial boulderfields of blocky talus, thus herbaceous cover is only sparse to moderate. Typical shrubs and vines which are more abundant in this type than in other associations in this alliance include *Acer spicatum, Aristolochia macrophylla, Hydrangea arborescens, Parthenocissus quinquefolia, Ribes cynosbati,* and *Ribes rotundifolium*. *Dryopteris marginalis* is often an abundant herb. This type is conceptually similar to *Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum* Forest (CEGL006124), which is more restricted to more extreme boulderfield situations at high elevations (4500-5300 feet). The association described here generally occurs at lower elevations in less extreme environmental situations and lacks species characteristic of high elevations. Similar *Betula alleghaniensis*-dominated forests occur on glaciated rocky slopes in the upper mid-Atlantic and in the northeastern United States. The *Betula alleghaniensis*-dominated periglacial boulderfields of the southern Appalachian Mountains are distinguished from the northern forests by the occurrence of southern Appalachian endemic species, better developed shrub layers and slightly less species diversity.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found on steep to moderately steep slopes, in draws, and on periglacial boulderfields from 4000 to 5000 feet elevation. Aspects were north and west. Disturbance by wind and ice is common. There is little soil development, and the substrate is rubble, large rocks, and boulders. This community is associated with small creeks and seeps.

Global Environment: This community occurs in a cool, humid climate, on steep, rocky, northwest- to northeast-facing, middle to upper concave slopes, or in saddles between ridges, at moderate to high elevation (2000-4000 feet). These forests grow over bouldery talus and are often associated with small streams and seepage.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a canopy dominated by *Betula alleghaniensis* and/or *Aesculus flava*. *Betula alleghaniensis* in the canopy are often stunted and gnarled, with roots that may have grown to encircle the boulders. Tree windthrow is common, leaving patches of exposed mineral soil and gaps in the canopy. Other species in the canopy and subcanopy can include *Tilia americana var. heterophylla, Fagus grandifolia, Acer saccharum, Acer spicatum, Tsuga canadensis,* and *Picea rubens*. Shrub density is typically high but may vary between occurrences. The shrub stratum is dominated by the tall shrub *Acer spicatum* and the short shrubs *Hydrangea arborescens* and *Euonymus obovata*. *Ribes rotundifolium* and *Ribes cynosbati* are conspicuous in the shrub stratum. Other shrubs include *Viburnum lantanoides, Sambucus racemosa var. racemosa (= var. pubens),* and *Rubus canadensis*. Herb cover is moderate to dense, and herb strata tend to be diverse. Herbs and mosses cover the rocks and boulders. *Dryopteris intermedia, Stellaria pubera,* and the epiphyte *Polypodium appalachianum* are the

most constant species in the stands sampled. Other common herbs include *Ageratina altissima var. roanensis, Allium tricoccum, Angelica triquinata, Arisaema triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Actaea podocarpa (= Cimicifuga americana), Diphylleia cymosa, Galium triflorum, Hydrophyllum canadense, Laportea canadensis, Melanthium parviflorum, Oxalis montana, Solidago curtisii (= Solidago caesia var. curtisii), Tiarella cordifolia*, and *Trillium erectum.*

Global Vegetation: This association includes boulderfield forests of the southern Appalachians, strongly dominated by *Betula alleghaniensis*, but in habitats that allow for more diverse canopies, including other species such as *Aesculus flava, Betula lenta*, and *Tilia americana var. heterophylla*. *Betula alleghaniensis* in the canopy are often stunted and gnarled, with roots that may have grown to encircle the boulders. The canopy is much more open than the surrounding forest and tree windthrow is common, leaving patches of exposed mineral soil and gaps in the canopy. A woody layer of shrubs and vines is usually well-developed. Rooting opportunities for most herbaceous plants is limited because of the development of this community on periglacial boulderfields of blocky talus, thus herbaceous cover is only sparse to moderate. Typical shrubs and vines which are more abundant in this type than in other associations in this alliance include *Acer spicatum, Aristolochia macrophylla, Hydrangea arborescens, Parthenocissus quinquefolia, Ribes cynosbati*, and *Ribes rotundifolium*. *Dryopteris marginalis* is often an abundant herb.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis*
TALL SHRUB	*Acer spicatum*
SHORT SHRUB	*Euonymus obovatus, Hydrangea arborescens*
FERN	*Dryopteris intermedia, Polypodium appalachianum*

Global

Stratum	Species
TREE CANOPY	*Betula alleghaniensis*
TALL SHRUB	*Acer spicatum*
SHORT SHRUB	*Ribes cynosbati, Ribes rotundifolium*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis*
TREE SUB-CANOPY	*Acer spicatum*
SHORT SHRUB	*Euonymus obovatus*
FERN	*Polypodium appalachianum*

Global

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis, Betula lenta*
TREE SUB-CANOPY	*Acer spicatum*
TALL SHRUB	*Hydrangea arborescens*
SHORT SHRUB	*Ribes cynosbati*
FERN	*Dryopteris marginalis*
VINE/LIANA	*Aristolochia macrophylla*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum Forest (CEGL006124)

GRank & Reasons: G3 (99-02-15). This community is scattered throughout the high mountains but fairly uncommon. Unlike many other forest types in the southern Appalachians, this community has not historically been threatened by logging because of the stunted nature of the trees and the inaccessibility of boulderfields to loggers.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Examples of this community in Great Smoky Mountains National Park, particularly ones at high elevations, are compositionally similar to *Betula*

alleghaniensis / Ribes glandulosum / Polypodium appalachianum Forest (CEGL006124). In the park, this latter community is distinguished by occurring over 5000 feet elevation and by the occurrence of high-elevation species such as *Abies fraseri, Dryopteris campyloptera, Ribes glandulosum, Rugelia nudicaulis, Streptopus amplexifolius, Prunus pensylvanica,* and *Sorbus americana*. The community is not distinguishable from other northern hardwood forest types from aerial photography. Therefore, the only occurrences that are mapped are the ones that were visited by photointerpreters.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was found on both the Cades Cove and Mount Le Conte quadrangles, and it should occur elsewhere in the park on boulderfields below 5000 feet elevation. It was sampled on the southwestern portion of the Cades Cove quadrangle, at the headwaters of Forge Knob Branch. On the southwestern portion of the Mount Le Conte quadrangle, this association was sampled southwest of Rocky Spur in the vicinity of Le Conte Creek and also southwest of Balsam Point. This community was also sampled in the central portion of the Mount Le Conte quadrangle, in a north-facing ravine west of Trillium Gap.

Global Range: This community occurs in the southern Appalachian Mountains of the eastern United States.

Nations: US
States/Provinces: GA:S?, KY?, NC:S?, TN:S?, VA?
TNC Ecoregions: 50:?, 51:C
USFS Ecoregions: M221C:CC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL004982
REFERENCES (type in full citation below if reference is new): Allard 1990, Chafin and Jones 1989, Evans 1991, Major et al. 1999, Peet et al. 2002, Pyne 1994, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm.

Betula alleghaniensis / Ribes glandulosum / Polypodium appalachianum Forest

Yellow Birch / Skunk Currant / Appalachian Rockcap Fern Forest
Southern Appalachian Boulderfield Forest (Currant and Rockcap Fern Type)
Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Northern Hardwood Forests (410-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes high-elevation boulderfield forests of the southern Appalachians, strongly dominated by *Betula alleghaniensis*, with few or no other species in the canopy, and with other species indicative of high elevations. This community occurs in a cool, humid climate, on steep, rocky, northwest- to northeast-facing, middle to upper concave slopes, or in saddles between ridges, at elevations of 1370-1600 m (4500-5300 feet). It is known from the high elevations of the Blue Ridge from West Virginia south to eastern Tennessee and western North Carolina. This forest is distinguished by a closed to somewhat open canopy dominated by *Betula alleghaniensis*, occurring over angular rocks (0.25-1 m diameter) covered by thin soil, lichens, mosses or vines. The rocks may be almost totally covered by moss. *Betula alleghaniensis* in the canopy are often stunted and gnarled, with roots that may have grown to encircle the boulders. Tree density is typically less than that of the surrounding forests. Other species that may form a minor canopy component include *Aesculus flava, Prunus pensylvanica, Sorbus americana, Acer spicatum, Picea rubens, Tilia americana var. heterophylla, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens),* or *Quercus rubra*. Tree windthrow is common, leaving patches of exposed mineral soil and gaps in the canopy. The shrub density is typically high but may vary between occurrences. Herbaceous cover is generally sparse because of thin, rocky soil, but herbs and mosses may cover the rocks and boulders. Characteristic species include, in the herb stratum, *Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Aconitum reclinatum, Cardamine clematitis, Carex aestivalis, Actaea podocarpa (= Cimicifuga americana), Claytonia caroliniana, Clintonia borealis, Dryopteris campyloptera, Dryopteris marginalis, Huperzia lucidula, Oxalis montana, Polypodium appalachianum, Streptopus amplexifolius*, and in the shrub stratum, *Acer pensylvanicum, Acer spicatum, Amelanchier arborea var. austromontana, Diervilla sessilifolia, Hydrangea arborescens, Ilex montana, Lonicera canadensis, Ribes glandulosum, Ribes rotundifolium, Rubus canadensis, Sambucus racemosa var. racemosa, Vaccinium erythrocarpum*, and *Viburnum lantanoides.* Seepage areas are common, producing wet microhabitats with unique species assemblages (*Chelone lyonii, Chrysosplenium americanum, Circaea alpina, Rudbeckia laciniata, Impatiens pallida*, and *Monarda didyma*). This association is distinguished by being strongly dominated by *Betula alleghaniensis*, with few or no other species in the canopy, and with other species indicative of high elevations (e.g., *Abies fraseri, Dryopteris campyloptera, Ribes glandulosum, Rugelia nudicaulis, Streptopus amplexifolius, Prunus pensylvanica,* and *Sorbus americana*. On less extreme sites, generally at lower elevations in the Blue Ridge and adjacent montane ecoregions, a similar boulderfield forest is *Betula alleghaniensis / Acer spicatum / Hydrangea arborescens - Ribes cynosbati / Dryopteris marginalis* Forest (CEGL004982). Similar *Betula alleghaniensis*-dominated forests occur on glaciated rocky slopes in the upper mid-Atlantic and in the northeastern United States. The *Betula alleghaniensis*-dominated periglacial boulderfields of the southern Appalachian Mountains are distinguished from the northern forests by the occurrence of southern Appalachian endemic species, better developed shrub layers and slightly less species diversity.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community is found on steep, north- and northwest-facing, periglacial boulderfields, above 5000 feet elevation. Disturbance by ice and wind is common.

Global Environment: This community occurs in rocky habitats with cool, humid microclimates. Typical sites are steep, boulder-strewn slopes; northwest- to northeast-facing, middle to upper concave slopes; or in saddles between ridges. Elevations range from 1200-1600 m (4000-5300 feet). Surface substrate is characterized by angular boulders (0.25-1 m diameter) derived from various bedrock types and covered by thin soil, lichens, mosses or vines. The rocks may be almost totally covered by moss. Seepage areas are frequent, producing wet microhabitats with unique species assemblages. Extreme winter temperatures, high winds, and ice storms periodically affect these forests.

Mean elevation of plot-sampled Virginia sites is 1450 m (4760 feet) and aspect ranges from northwest to north. Mean surface cover of exposed bedrock and boulders is 42% and mean cover of bryophytes and lichens is 37%. Soil samples collected from these sites are extremely acidic (mean pH = 3.5), with high organic matter content (mean = 40%) and low base saturation (mean = 10%).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a canopy strongly dominated by *Betula alleghaniensis*. Canopy trees are often stunted and gnarled, with roots that may have grown to encircle the boulders. Tree windthrow is common, leaving patches of exposed mineral soil and gaps in the canopy. Other species in the canopy and subcanopy can include *Aesculus flava, Prunus pensylvanica, Sorbus americana, Acer spicatum*, and *Picea rubens*. The shrub stratum is dominated by *Acer spicatum, Hydrangea arborescens, Viburnum lantanoides*, and *Ribes glandulosum*. Other shrubs include *Sambucus racemosa var. racemosa (= var. pubens), Diervilla sessilifolia, Lonicera canadensis, Vaccinium erythrocarpum, Ribes rotundifolium*, and *Rubus canadensis.* Herbs and mosses cover the rocks and boulders. Characteristic herbaceous species include *Eurybia chlorolepis (= Aster chlorolepis), Dryopteris campyloptera, Actaea podocarpa (= Cimicifuga americana), Clintonia borealis, Cystopteris protrusa, Cardamine clematitis, Huperzia lucidula, Rugelia nudicaulis, Streptopus amplexifolius*, and *Polypodium appalachianum*.

Global Vegetation: Stands of this association are distinguished by a closed to somewhat open canopy overwhelmingly dominated by *Betula alleghaniensis*. Canopy trees are often stunted and gnarled, with roots that have grown to encircle the boulders. Tree density is typically less than that of the surrounding forests. Minor canopy associates include *Aesculus flava, Prunus pensylvanica, Sorbus americana, Acer spicatum, Picea rubens, Tilia americana var. heterophylla*, and *Quercus rubra*. Tree windthrow is common, creating canopy gaps and patches of exposed mineral soil. Shrub density is typically high but varies between occurrences. Characteristic shrubs are *Acer pensylvanicum, Acer spicatum, Amelanchier arborea var. austromontana, Diervilla sessilifolia, Hydrangea arborescens, Ilex montana, Lonicera canadensis, Ribes glandulosum, Ribes rotundifolium, Rubus canadensis, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Vaccinium erythrocarpum*, and *Viburnum lantanoides*. Herbaceous cover is generally sparse because of the rocky substrate, but specially adapted herbs and mosses may cover the rocks and boulders. Characteristic herbs over the range of this community include *Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Aconitum reclinatum, Cardamine clematitis, Carex aestivalis, Actaea podocarpa (= Cimicifuga americana), Claytonia caroliniana, Clintonia borealis, Dryopteris campyloptera, Dryopteris marginalis, Huperzia lucidula, Oxalis montana, Polypodium appalachianum*, and *Streptopus amplexifolius*. Local seepage areas may support *Chelone lyonii, Chrysosplenium americanum, Circaea alpina, Rudbeckia laciniata, Impatiens pallida*, and *Monarda didyma*.

Virginia occurrences of this association appear to be similar to those of the Blue Ridge further south. In plot-sampled stands, *Acer spicatum, Acer pensylvanicum, Viburnum lantanoides, Ribes glandulosum*, and *Rubus canadensis* are the most constant and abundant lower woody species, while *Oclemena acuminata* and *Dryopteris intermedia* are the most important herbs. Mean species richness in these samples is 21 taxa per 400 m2.

Global Dynamics: Windthrow of trees and damage to the canopy caused by lightning strikes and ice storms are common phenomena in boulderfields. The ice-fractured boulderfields that characterize this community in the upper elevations of the Southern Appalachians are believed to be remnants of Pleistocene periglacial activity. During this time, the high elevations (4000-5000 feet) of the Southern Appalachians were covered by treeless snow fields and exposed rock. Frost and ice action resulted in the accumulation of boulders that persist on the upper slopes (King and Stupka 1950). Farther north, such as in Pennsylvania, boulderfields are on flat surfaces and are the result of glacial deposition (Allard 1984).

Betula alleghaniensis is well-adapted to the environmental dynamics of boulderfields and can perpetuate because it takes advantage of canopy gaps formed during periodic natural disturbances. This species produces a large number of seeds and is able to germinate on logs and rocks in a minimum amount of soil. The roots of trees develop to form false trunks that encircle the rocks. It is possible that over time, due to soil formation and weathering, these forests may succeed to forests dominated by a mixture of northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Acer saccharum, Aesculus flava*). However, many *Betula alleghaniensis* forests and the boulderfields on which they occur appear fairly stable. Chafin and Jones (1989) found that despite large trees growing on top of boulders, there is no evidence of rock shattering.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis*
TALL SHRUB	*Acer spicatum, Hydrangea arborescens, Viburnum lantanoides*
SHORT SHRUB	*Ribes glandulosum*
FORB	*Eurybia chlorolepis*
FERN	*Dryopteris campyloptera, Polypodium appalachianum*

Global

Stratum	Species
TREE CANOPY	*Betula alleghaniensis*
TALL SHRUB	*Acer pensylvanicum, Acer spicatum*
SHORT SHRUB	*Ribes glandulosum, Ribes rotundifolium*
GRAMINOID	*Carex aestivalis*
FORB	*Eurybia chlorolepis, Oxalis montana*
FERN	*Dryopteris marginalis, Polypodium appalachianum*
NON-VASCULAR	*Hylocomium splendens*
VINE/LIANA	*Aristolochia macrophylla*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis*
TREE SUB-CANOPY	*Sorbus americana*
SHRUB	*Diervilla sessilifolia, Ribes glandulosum*
FORB	*Rugelia nudicaulis, Streptopus amplexifolius*
FERN	*Dryopteris campyloptera*
EPIPHYTE	*Polypodium appalachianum*

Global

Stratum	Species
TREE CANOPY	*Betula alleghaniensis*
TALL SHRUB	*Acer spicatum*
SHRUB	*Aesculus flava, Amelanchier arborea var austromontana, Ilex montana, Ribes rotundifolium, Rubus canadensis, Vaccinium erythrocarpum, Viburnum lantanoides*
SHORT SHRUB	*Ribes glandulosum*
FORB	*Aster acuminatus, Circaea alpina, Lonicera canadensis*
FERN	*Dryopteris campyloptera, Dryopteris intermedia, Polypodium appalachianum*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
None	

Global

Stratum	Species
FORB	*Cuscuta rostrata*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Betula alleghaniensis / Acer spicatum / Hydrangea arborescens - Ribes cynosbati / Dryopteris marginalis Forest (CEGL004982)
- Betula alleghaniensis / Sorbus americana - Acer spicatum / Polypodium appalachianum Forest (CEGL008504)

GRank & Reasons: G3 (99-02-15). This community is scattered throughout the high mountains but fairly uncommon. Unlike many other forest types in the Southern Appalachians, this community has not historically been threatened by logging because of the stunted nature of the trees and the inaccessibility to loggers of boulderfields.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Examples of this community in Great Smoky Mountains National Park are compositionally similar to *Betula alleghaniensis / Acer spicatum / Hydrangea arborescens - Ribes cynosbati / Dryopteris marginalis* Forest (CEGL004982). In the park, this latter community is distinguished by occurring below 5000 feet elevation, having a somewhat more diverse canopy, and by lacking many of the high-elevation species such as *Abies fraseri, Dryopteris campyloptera, Ribes glandulosum, Rugelia nudicaulis, Streptopus amplexifolius, Prunus pensylvanica*, and *Sorbus americana*. This community is surrounded by forests dominated by *Picea rubens* and *Betula alleghaniensis*. The community is not distinguishable from other northern hardwood forest types from aerial photography. Therefore, the only occurrences that are mapped are the ones that were visited by photointerpreters.

Global Classif Comments: Unlike many other forest types in the Southern Appalachians, this community has not been threatened by logging because of the stunted nature of the trees and the inaccessibility of boulderfields to loggers.

This association is similar to *Betula alleghaniensis / Sorbus americana - Acer spicatum / Polypodium appalachianum* Forest (CEGL008504) of the Central Appalachians, but appears to occupy more mesic boulderfields and contains a number of Southern Appalachian species (e.g., *Ribes glandulosum, Eurybia chlorolepis, Heuchera villosa, Abies fraseri, Prenanthes roanensis, Vaccinium erythrocarpum, Aesculus flava*, etc.) that are generally absent from CEGL008504.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte and Clingman's Dome quadrangles. It is likely in other areas of the park and should be sought on steep slopes and boulderfields at elevations over 5000 feet, particularly in areas adjacent to spruce (*Picea rubens*) and fir (*Abies fraseri*) forests. On the Mount Le Conte quadrangle, this community was sampled on the north slope of Mount Le Conte, on the Rainbow Falls Trail, at 5300 feet elevation. On the Clingman's Dome quadrangle, it was sampled off of Forney Ridge Trail south of Andrews Bald at an elevation of approximately 5200 feet.

Global Range: This community type ranges at high elevations of the Blue Ridge from eastern Tennessee and western North Carolina north to southwestern Virginia. In the southern Virginia Blue Ridge, it occurs frequently on steep, north-facing slopes of Mount Rogers, Whitetop, and Pine Mountain. Small, highly localized outliers also occur at the highest elevations of Clinch Mountain in the adjacent Ridge and Valley province.

Nations: US
States/Provinces: GA?, NC:S?, TN:S?, VA:S?, WV:S?
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Aa:CCC, M221B:C?, M221C:C?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains?); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, mod. G. Fleming and P. Coulling, SCS **Confidence:** 1 **Identifier:** CEGL006124
REFERENCES (type in full citation below if reference is new): Allard 1984, Allard 1990, Ambrose 1990a, CAP pers. comm. 1998, Chafin and Jones 1989, Dellinger 1992, Fleming and Coulling 2001, Fleming et al. 2001, Golden 1981, King and Stupka 1950, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Pittillo and Smathers 1979, Pyne 1994, Rawinski 1992, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Stamper 1976, Wharton 1978, Wood 1975

Fagus grandifolia / Ageratina altissima var. roanensis Forest

American Beech / Appalachian White Snakeroot Forest
Southern Appalachian Beech Gap (North Slope Tall Herb Type)
Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Northern Hardwood Forests (410-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes stunted beech forests of the southern Appalachians, occurring on north-facing upper slopes and in gaps in scattered, higher elevation (1370 m) sites. This community is a stunted, broad-leaved deciduous forest with a canopy dominated by *Fagus grandifolia*, with lesser amounts of *Aesculus flava* and *Betula alleghaniensis*. The subcanopy may include small stems of canopy species, as well as *Acer spicatum, Acer pensylvanicum, Amelanchier laevis*, and *Sorbus americana*. Typically there is little shrub development (2-10%) with such species as *Crataegus punctata, Ribes* spp., *Viburnum lantanoides, Rubus canadensis, Hydrangea arborescens*, and *Cornus alternifolia*. The herbaceous stratum is moderately dense (40-60% cover), dominated by large herbs and patches of ferns, with lesser amounts of sedges. Typical herbs include *Athyrium filix-femina ssp. asplenioides, Ageratina altissima var. roanensis, Eurybia chlorolepis (= Aster chlorolepis)*, and *Actaea racemosa (= Cimicifuga racemosa)*. This community commonly occurs as small patches surrounded by other forest types.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: In the Smokies, this community is a rare variant of the more common beech gap community and occurs only on north and northeast upper slopes at elevations of around 4600-4800 feet.

Global Environment: This community typically occurs on north-facing, steep, upper slopes and on the north and northeast side of gaps, at elevations greater than 1370 m (4500 feet) (Whittaker 1956, Crandell 1958). High rainfall and low temperatures create mesic conditions. Strong winds and ice storms periodically damage these forests, creating canopy gaps and contributing to its stunted appearance. The soil is generally greater than 20 cm deep, with pH values ranging from 4.5-6.0, considerably less acidic than soils of the adjacent spruce-and-fir-dominated forests (Russell 1953). This community commonly occurs as small patches surrounded by other forest types.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Stands of this type consist of low-stature, small-stemmed *Fagus grandifolia*, even smaller than the individual trees in the more common beech gap type. Many of the occurrences of this type no longer have living *Fagus grandifolia* trees and so the vegetation has changed to close to 100% *Rubus canadensis* and other light-loving species. However, in the very few instances where there are still live *Fagus grandifolia* in the canopy, this community consists of large amounts of *Dryopteris intermedia, Maianthemum racemosum, Trillium* spp., *Silene stellata, Eurybia chlorolepis*, and other species associated with mesic slopes such as *Impatiens pallida* and *Trautvetteria caroliniensis*.

Global Vegetation: This community is a broad-leaved deciduous forest with a canopy dominated by low-stature, small-stemmed (<38 cm) *Fagus grandifolia*, with lesser amounts of *Aesculus flava* and *Betula alleghaniensis*. The subcanopy may include small stems of canopy species as well as *Acer spicatum, Acer pensylvanicum, Amelanchier laevis*, and *Sorbus americana*. Typically there is little shrub development (2-10%) with such species as *Crataegus punctata, Ribes* spp., *Viburnum lantanoides, Rubus canadensis, Hydrangea arborescens*, and *Cornus alternifolia*. The herbaceous stratum is moderately dense (40-60% cover) and is dominated by large herbs and patches of ferns, with lesser amounts of sedges (Bratton 1975, Crandall 1958, Whittaker 1956). Herbaceous species in this community are typical of rich southern Appalachian forests and may include *Ageratina altissima var. roanensis, Anemone quinquefolia, Arisaema triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides, Carex aestivalis, Carex brunnescens, Carex debilis, Carex intumescens, Carex pensylvanica, Actaea racemosa (= Cimicifuga racemosa), Dryopteris campyloptera, Epifagus virginiana, Impatiens pallida, Oxalis montana, Laportea canadensis, Luzula acuminata, Phacelia bipinnatifida, Poa alsodes, Prenanthes altissima, Prenanthes roanensis, Stellaria pubera, Thelypteris noveboracensis*, and *Trillium erectum*.

Global Dynamics: Due to the extreme environment, growth and reproduction of *Fagus grandifolia* are relatively slow in this mid- to late- successional community. Despite their small size, canopy trees may be quite old. Although beech nuts may be produced by the larger trees, reproduction of beech appears to be almost entirely vegetative from root or stump sprouts (Russell 1953). Small canopy gaps within this type are commonly invaded by a dense thicket of *Rubus canadensis*.

The origin and maintenance of this community has been debated by ecologists. It has been proposed that beech gaps became established during warmer climates of 7000-900 BC, and that they were once more extensive than today (Flint 1957 in Schofield 1960). Russell (1953) concluded that cold and high winds were responsible for the occurrence of these forests. Fuller (1977) suggested that the allelopathic effects of beech litter may be a factor in maintaining this community.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Fagus grandifolia*
FORB	*Eurybia chlorolepis, Maianthemum racemosum*

Global

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis, Fagus grandifolia*
TREE SUB-CANOPY	*Acer pensylvanicum, Acer spicatum, Amelanchier laevis*
FORB	*Actaea racemosa, Ageratina altissima var roanensis, Eurybia chlorolepis*
FERN	*Athyrium filix-femina ssp asplenioides*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Fagus grandifolia*
FORB	*Eurybia chlorolepis, Melanthium latifolium*

Global

Stratum	Species
TREE CANOPY	*Fagus grandifolia*
FORB	*Ageratina altissima var roanensis, Epifagus virginiana*
FERN	*Athyrium filix-femina ssp asplenioides*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
FORB	*Trillium* spp.

Global

Stratum	Species
FORB	*Platanthera grandiflora, Stellaria corei*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Fagus grandifolia / Carex pensylvanica - Carex brunnescens Forest (CEGL006130)

GRank & Reasons: G1 (02-11-01). This community has a very restricted range with scattered occurrences of small acreage. Many occurrences have been, and continue to be, severely damaged by the European wild boar (*Sus scrofa*). Grazing and soil disturbance by this animal reduces understory herb cover to 10-30 percent of undisturbed levels and may affect tree growth and nutrient cycling (Singer et al. 1984). Beech bark disease, a complex made up of the Beech scale insect (*Crytococcus fagisuga*) and a closely associated fungus (*Nectria coccinea var. faginata*) poses a serious threat to this community. Another potential threat to this high-elevation community is atmospheric deposition of air pollutants, which may result in tree growth decline. Most all of the beech gap communities in the Great Smoky Mountains had succumbed to the beech bark disease or a combination of the beech bark disease and pollution by 2002 (R. White pers. comm.). Presumably this trend is being seen throughout the southern Appalachians, resulting in the

possible extinction of this community in the next few years. Therefore, this community was assigned a rank of G1.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park: This community exists on the mesic upper north slopes and so tends to be distinguished from *Fagus grandifolia / Carex pensylvanica - Carex brunnescens* Forest (CEGL006130) by its more mesic nature and lack of a high cover of *Carex pensylvanica*. It is also easily distinguished by its low stature.

Global Classif Comments: This mesic north-slope community is thought to be more similar to northern hardwood forests, having a more diverse canopy and subcanopy, and to extend farther into the southwestern mountain ranges than does the south-slope, sedge-dominated variant, *Fagus grandifolia / Carex pensylvanica - Carex brunnescens* Forest (CEGL006130). *Ageratina altissima var. roanensis* was chosen as a nominal to represent the tall forbs that dominate the herbaceous stratum, and is not necessarily the dominant species in this stratum.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was observed on the Bunches Bald quad and may exist throughout the park in areas of high elevation (above 4600 feet). However, the community is rare within the park, and healthy examples of this community may be rare to nonexistent at the time of publication.

Global Range: This community is found in scattered sites on high elevations of the southern Appalachian Mountains. The majority of this community is distributed within the mountains of North Carolina, but it also occurs in Tennessee and may extend into Georgia and Virginia.

Nations: US
States/Provinces: GA?, NC:S?, TN:S?, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221A:C?, M221B:C?, M221C:C?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee?, Cherokee, Jefferson?, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL006246
REFERENCES (type in full citation below if reference is new): Allard 1984, Allard 1990, Allard et al. 1990, Bratton 1975, Churchill and Wolfe 1993, Crandall 1958, Eyre 1980, Fuller 1977, Golden 1981, McLeod 1988, Peet et al. 2002, Pittillo and Smathers 1979, Pyne 1994, Ramseur 1960, Rawinski 1992, Rheinhardt 1981, Russell 1953, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Schofield 1960, Singer et al. 1984, USFS 1988, White et al. 1993, White pers. comm., Whittaker 1956

Fagus grandifolia / Carex pensylvanica - Carex brunnescens Forest

American Beech / Pennsylvania Sedge - Brown Sedge Forest
Southern Appalachian Beech Gap (South Slope Sedge Type)
Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Northern Hardwood Forests (410-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association is often referred to as a classic "beech gap" forest and includes vegetation with short-statured canopies dominated by *Fagus grandifolia*, occurring over a dense, graminoid-dominated herbaceous stratum. This forest is thought to be limited to the range of *Picea rubens* and *Abies fraseri* (Whittaker 1956) and occurs on concave slopes, flat ridgetops, or upper south- to southwest-facing slopes, at elevations of greater than 1370 m (4500 feet) in the southern Blue Ridge. The majority of this community is distributed within the mountains of North Carolina, but it also occurs in Tennessee and possibly in Virginia. This community is a broad-leaved deciduous forest with a canopy dominated by stunted, gnarled *Fagus grandifolia*, often with lesser amounts of *Halesia tetraptera var. monticola* or *Betula alleghaniensis*. Typically, there are not significant understory or shrub strata, but scattered shrubs such as *Hydrangea arborescens* may occur. Herbaceous cover is dense, often approaching 100% coverage, and dominated by species of *Carex* (*Carex aestivalis, Carex brunnescens, Carex debilis, Carex intumescens, Carex pensylvanica*). Ferns and other herbs form 5-20% of the herbaceous cover and may include *Ageratina altissima var. roanensis, Anemone quinquefolia, Angelica triquinata, Arisaema triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera, Epifagus virginiana, Erythronium umbilicatum ssp. monostolum, Impatiens pallida, Medeola virginiana, Oxalis montana, Laportea canadensis, Luzula acuminata, Phacelia bipinnatifida, Phacelia fimbriata, Poa alsodes, Prenanthes altissima, Prenanthes roanensis, Rugelia nudicaulis, Solidago glomerata, Stellaria corei, Thelypteris noveboracensis*, and *Trillium erectum*. This community commonly occurs as small patches surrounded by other forest types, montane grasslands and shrublands.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Occurrences of this forest were documented from the Mount Le Conte and Bunches Bald quadrangles, but occur in other high-elevation areas of the park. They all occurred on the high slopes or saddles of high ridges above 4500 feet. In every occurrence, the beech trees were all infected with Beech Bark Disease. The occurrences were surrounded by heath shrublands, spruce-hemlock forests, and northern hardwood forests.

Global Environment: This community typically occurs on concave slopes, flat ridgetops, or upper south- to southwest-facing slopes, at elevations of greater than 1370 m (4500 feet) (Whittaker 1956, Russell 1953). High rainfall and low temperatures create mesic conditions. Strong winds and ice storms periodically damage these forests, creating canopy gaps and contributing to its stunted appearance. This community commonly occurs as small patches surrounded by other forest types, montane grasslands and shrublands.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a 10-m canopy of *Fagus grandifolia*. The subcanopy is not well-developed, but *Acer pensylvanicum* has the highest coverage. Other species in the subcanopy include *Halesia tetraptera var. monticola, Picea rubens*, and *Tsuga canadensis*. The herbaceous stratum is strongly dominated by *Carex pensylvanica* (75-85% coverage). Other species present in minor amounts include *Ageratina altissima var. roanensis, Angelica triquinata, Arisaema triphyllum ssp. triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides, Brachyelytrum septentrionale, Dryopteris intermedia, Laportea canadensis, Luzula acuminata, Poa alsodes, Prenanthes* sp., *Rubus canadensis, Rugelia nudicaulis, Solidago curtisii (= Solidago caesia var. curtisii), Stellaria pubera*, and *Viola rotundifolia*.

Global Vegetation: This community is a broad-leaved deciduous forest with a canopy dominated by stunted, gnarled *Fagus grandifolia*, often with lesser amounts of *Halesia tetraptera var. monticola*. Typically, there are not significant understory or shrub strata, but scattered shrubs such as *Hydrangea arborescens* may occur. Herbaceous cover is dense, often approaching 100% coverage, and dominated by species of *Carex* including *Carex aestivalis, Carex brunnescens, Carex debilis, Carex intumescens*, and *Carex pensylvanica*.

Ferns and other herbs form 5-20% of the herbaceous cover and may include *Ageratina altissima var. roanensis, Anemone quinquefolia, Arisaema triphyllum, Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina ssp. asplenioides, Dryopteris campyloptera, Epifagus virginiana, Impatiens pallida, Medeola virginiana, Oxalis montana, Laportea canadensis, Luzula acuminata, Phacelia bipinnatifida, Poa alsodes, Prenanthes altissima, Prenanthes roanensis, Stellaria pubera, Thelypteris noveboracensis*, and *Trillium erectum* (Whittaker 1956, Crandall 1958, Schafale and Weakley 1990).

Global Dynamics: The origin and maintenance of this community has been debated by ecologists. It has been proposed that beech gaps became established during warmer climates of 7000-900 BC, and that they were once more extensive than today (Flint 1957 in Schofield 1960). Russell (1953) concluded that cold and high winds were responsible for the occurrence of these forests. Fuller (1977) suggested that the allelopathic effects of beech litter may be a factor in maintaining this community.

Due to the extreme environment, growth and reproduction of *Fagus grandifolia* are relatively slow in this mid to late successional community. Despite their small size, canopy trees may be quite old. Although beech nuts may be produced by the larger trees, reproduction of beech appears to be almost entirely vegetative from root or stump sprouts (Russell 1953). Small canopy gaps within this type are commonly invaded by a dense thicket of *Rubus canadensis*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Fagus grandifolia*
TREE SUB-CANOPY	*Acer pensylvanicum*
GRAMINOID	*Carex pensylvanica*

Global

Stratum	Species
TREE CANOPY	*Fagus grandifolia, Halesia tetraptera var monticola*
GRAMINOID	*Carex aestivalis, Carex brunnescens, Carex debilis, Carex intumescens, Carex pensylvanica*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	Fagus grandifolia
TREE SUB-CANOPY	Halesia tetraptera var monticola
GRAMINOID	Carex pensylvanica
FORB	Rugelia nudicaulis

Global

Stratum	Species
TREE CANOPY	Fagus grandifolia, Halesia tetraptera var monticola
GRAMINOID	Carex aestivalis, Carex albicans, Carex brunnescens, Carex debilis, Carex intumescens, Carex pensylvanica
FORB	Ageratina altissima var roanensis, Epifagus virginiana, Eurybia chlorolepis

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
None	

Global

Stratum	Species
FORB	*Phacelia fimbriata, Platanthera grandiflora, Stellaria corei*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]: Fagus grandifolia / Ageratina altissima var. roanensis Forest (CEGL006246)--is dominated by short-stature *Fagus grandifolia*, occurring with *Betula alleghaniensis* and *Aesculus flava*, and occurs on mesic, north-facing slopes in the southern Appalachian Mountains of North Carolina, Tennessee, and Virginia. This mesic north slope community is thought to be more similar to northern hardwood forests, having a more diverse canopy and subcanopy, and

to extend farther into the southwest mountain ranges than does the south slope, sedge-dominated variant described here (Whittaker 1956).

GRank & Reasons: G1 (02-11-01). This community has a very restricted range with scattered occurrences of small acreage. Many occurrences have been, and continue to be, severely damaged by the European wild boar (*Sus scrofa*). Grazing and soil disturbance by this animal reduces understory herb cover to 10-30 percent of undisturbed levels and may affect tree growth and nutrient cycling (Singer et al. 1984). Beech bark disease, a complex made up of the Beech scale insect (*Crytococcus fagisuga*) and a closely associated fungus (*Nectria coccinea var. faginata*) poses a severe threat to this community. Most all of the beech gap communities in the Great Smoky Mountains had succumbed to the beech bark disease or a combination of the beech bark disease and pollution by 2002 (R. White pers. comm.). Presumably this trend is being seen throughout the southern Appalachians, resulting in the possible extinction of this community in the next few years. Therefore, this community was assigned a rank of G1.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park: This community can intergrade into the northern hardwood community *Betula alleghaniensis - Fagus grandifolia - Aesculus flava / Viburnum lantanoides / Eurybia chlorolepis - Dryopteris intermedia* Forest (CEGL007285). This community is distinguished from CEGL007285 by the dominance of *Fagus grandifolia* in the canopy to the exclusion of other species. As the *Fagus grandifolia* continues to die and other species take its place, there may be a need to clarify what the new community is classified as since it fits neither community neatly. The other beech gap community, *Fagus grandifolia / Ageratina altissima var. roanensis* Forest (CEGL006246), is uncommon and possesses an herbaceous stratum mainly comprised of forbs instead of *Carex pensylvanica*.

Global Classif Comments: This community includes forest vegetation with short-statured canopies dominated by *Fagus grandifolia*, occurring over a dense, graminoid-dominated herbaceous stratum. This community is thought to be limited to the range of *Picea rubens* and *Abies fraseri* (Whittaker 1958).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from a single location on the Mount Le Conte quadrangle, on the south slope of Trillium Gap (4719 feet elevation). It was not observed on the Cades Cove quadrangle, but it does occur in other areas of the park. In addition, it was sampled from the Bunches Bald quadrangle.

Global Range: The majority of this community is distributed within the mountains of North Carolina, but it also occurs in Tennessee and possibly in Virginia.

Nations: US
States/Provinces: NC:S?, TN:S?, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221A:C?, M221B:C?, M221C:C?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Jefferson?, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL006130
REFERENCES (type in full citation below if reference is new): Allard 1984, Allard 1990, Allard et al. 1990, Bratton 1975, Crandall 1958, Davis 1930, Eyre 1980, Fuller 1977, Golden 1981, Lindsay and Bratton 1979a, McLeod 1988, Peet et al. 2002, Pittillo and Smathers 1979, Pyne 1994, Ramseur 1960, Rawinski 1992, Rheinhardt 1981, Russell 1953, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Schofield 1960, Singer et al. 1984, USFS 1988, White et al. 1993, White pers. comm., Whittaker 1956

Juglans nigra / Verbesina alternifolia Forest

Black Walnut / Common Wingstem Forest
Successional Black Walnut Forest
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This is a potentially widespread association. It is currently defined only for North Carolina and Tennessee but likely ranges into adjacent states. This community was sampled on former homesites along streams, possibly in association with circumneutral soils, at 1500-2000 feet elevation. It was originally defined from former homesites in Great Smoky Mountains National Park, where this association is an open, successional forest. *Juglans nigra* is often the sole canopy tree, though *Liriodendron tulipifera*, *Juglans cinerea*, and *Aesculus flava* are dominants or codominants in some examples. The herb stratum is dominated by *Verbesina alternifolia*. Other herbs include *Amphicarpaea bracteata* and *Ambrosia trifida*. The exotics *Rosa multiflora* and *Microstegium vimineum* can be common in this community.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was sampled on former homesites along streams, possibly in association with circumneutral soils, at 1500-2000 feet elevation. So far it has only been seen in areas where old homesites are present. The "circumneutral" soils, therefore, might be an artifact of the enrichment of the soil from livestock and other anthropogenic nutrient input.

Global Environment: This community often occurs on former homesites along streams, possibly in association with circumneutral soils, at 1500-2000 feet elevation. It was originally defined from former homesites in Great Smoky Mountains National Park, where this association is an open, successional forest.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: *Juglans nigra* is usually the sole canopy tree in this open, successional forest. Occasionally *Liriodendron tulipifera* codominates. Canopy trees are around 30 cm in diameter. The herb stratum is dominated by *Verbesina alternifolia*. Other herbs include *Amphicarpaea bracteata* and *Ambrosia trifida*. Both *Verbesina alternifolia* and *Microstegium vimineum* are very common in this community. It is possible that high populations of deer such as those in the Smokies reduce competition for these plants and increase their dominance since deer do not eat either of these species but eat many of the other species which would potentially grow on these sites (Keith Langdon, personal communication).

Global Vegetation: *Juglans nigra* is often the sole canopy tree, though *Liriodendron tulipifera*, *Juglans cinerea*, and *Aesculus flava* are dominant or codominant in some examples. The herb stratum is dominated by *Verbesina alternifolia*. Other herbs include *Amphicarpaea bracteata* and *Ambrosia trifida*. The exotics *Rosa multiflora* and *Microstegium vimineum* can be common in this community.

Global Dynamics: Since this community was the product of an anthropogenic catastrophic disturbance, the canopy is likely to change drastically as new species of trees colonize gaps left by senescent walnuts.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Juglans nigra*
FORB	*Verbesina alternifolia*

Global

Stratum	Species
Same as local	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Juglans nigra*
SHRUB	*Rosa multiflora*
FORB	*Verbesina alternifolia*

Global

Stratum	Species
Same as local	

GRank & Reasons: GD (01-04-02). This vegetation represents vegetation created by anthropogenic disturbance and is thus not a conservation priority. Grank changed from GW to GD 2001-04-02 MP.

CLASSIFICATION COMMENTS

Global Classif Comments: This association was described from Great Smoky Mountains National Park where this association is distinguished on air photography.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte and Bryson City quadrangles and was not sampled on the Cades Cove quadrangle. It is likely in other areas of the park. On the Mount Le Conte quadrangle, this community was sampled on flats along Baskins Creek and was observed on other former homesites in the northern half of the quadrangle. In the Bryson City quadrangle, it was observed along Goldmine Branch near the confluence with Fontana Lake.

Global Range: This potentially widespread association is currently defined only for Tennessee but likely ranges into adjacent states.

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 3 **Identifier:** CEGL007879
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002

Aesculus flava - Acer saccharum - (Fraxinus americana, Tilia americana) / Hydrophyllum canadense - Solidago flexicaulis Forest

Yellow Buckeye - Sugar Maple - (White Ash, American Basswood) / Mapleleaf Waterleaf - Zigzag Goldenrod Forest

Southern Appalachian Cove Forest (Rich Montane Type)

Ecological Group (SCS;MCS): Appalachian Highlands Mixed Mesophytic/Cove Forests (420-30; 2.5.3.3)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes forests of protected coves in the southern Appalachian Mountains of eastern Tennessee, western North Carolina, and southwest Virginia. This type extends peripherally into the Cumberland Mountains of southwestern Virginia. These forests are associated with nutrient-rich soils and, often, mafic geologies, and occur on steep, middle to low protected slopes and coves at 2000-4600 feet elevation. Examples of this association have deciduous forest canopies dominated by either *Acer saccharum, Aesculus flava, Fraxinus americana, Halesia tetraptera var. monticola*, or *Tilia americana var. heterophylla*, or by various combinations of these species. Other common canopy species can include *Carya cordiformis* and *Quercus rubra*. A shrub stratum is vary sparse or absent, and the herbaceous stratum is dense and luxurious, with high species richness. The defining feature of this association is the lush herbaceous flora with many calciphilic species indicative of high pH or circumneutral soils. Characteristic species include *Asarum canadense, Carex plantaginea, Cymophyllus fraserianus, Cystopteris protrusa, Deparia acrostichoides, Diplazium pycnocarpon, Prosartes lanuginosa (= Disporum lanuginosum), Dryopteris goldiana, Hepatica nobilis var. acuta, Hydrophyllum canadense, Osmorhiza claytonii, Solidago flexicaulis*, and *Viola canadensis*. The herbaceous stratum can have local dominance by *Laportea canadensis, Viola canadensis, Dryopteris intermedia, Actaea podocarpa (= Cimicifuga americana), Actaea racemosa (= Cimicifuga racemosa)*, and *Caulophyllum thalictroides*. This forest lacks dominance by *Betula alleghaniensis* and *Fagus grandifolia*, and has an herbaceous flora indicative of high-base status soils. This association typically has a much more diverse herbaceous stratum than other deciduous cove forests of the Southern Blue Ridge.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This association is found on steep to moderately steep, middle to low protected slopes and coves, on sites with northerly aspects, although it can occur at all aspects. Samples of this community had a mean elevation of 2430 feet, ranging from 2000 to 3960 feet. This community can occur on moist, bouldery situations or over well-developed, but rocky, nutrient-rich soils.

Global Environment: In the southern part of its range, this vegetation type occurs on protected, concave, landforms, at elevations ranging from 600-1400 m (2000-4600 feet). It is associated with nutrient-rich soils and often with mafic substrates, occurring on steep, middle to lower, protected slopes and in coves. In Virginia, the type is restricted to an elevation range from 1100-1400 m (3600-4600 feet). Virginia sites supporting this community are on strongly concave, moderately steep (mean = 17 degrees) slopes with north to east aspects. Underlying bedrock includes igneous metamorphic formations, shale, mudstone, and calcareous sandstone. Surface cover of bedrock and boulders ranges from 0-40%. Dark, apparently fertile, loamy soils at plot sampling sites are very strongly acidic (mean pH = 4.7) but have high levels of calcium, magnesium, and manganese.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a canopy dominated by various combinations of *Acer saccharum, Aesculus flava, Tilia americana var. heterophylla, Halesia tetraptera var. monticola*, and *Fraxinus americana*. Occasionally *Carya cordiformis* or *Quercus rubra* may have high coverage in the canopy. The subcanopy is dominated by the canopy species, occasionally with high coverage by *Cladrastis kentukea* or *Ostrya virginiana*. The shrub stratum is absent or very sparse, with scattered woody saplings, commonly *Acer saccharum, Aesculus flava*, and *Halesia tetraptera var. monticola*. The herbaceous stratum is lush and diverse, with dominance varying among occurrences. Herbaceous species that commonly have high coverage include *Adiantum pedatum, Ageratina altissima, Asarum canadense, Eurybia divaricata (=*

Aster divaricatus), Caulophyllum thalictroides, Actaea racemosa (= Cimicifuga racemosa), Cystopteris protrusa, Deparia acrostichoides, Prosartes lanuginosa (= Disporum lanuginosum), Dryopteris intermedia, Dryopteris marginalis, Hydrophyllum canadense, Impatiens pallida, Laportea canadensis, Parthenocissus quinquefolia, Polystichum acrostichoides, Sedum ternatum, Solidago curtisii (= Solidago caesia var. curtisii), Solidago flexicaulis, Stellaria pubera, Tiarella cordifolia, and *Viola canadensis.* Additional species with at least 50% constancy include *Arisaema triphyllum ssp. triphyllum, Galium triflorum, Hepatica nobilis var. acuta, Osmorhiza claytonii, Polygonatum pubescens, Thalictrum* spp. (e.g., *Thalictrum clavatum, Thalictrum dioicum, Thalictrum pubescens, Thalictrum thalictroides), Trillium* spp. (e.g., *Trillium catesbaei, Trillium erectum, Trillium grandiflorum, Trillium rugelii, Trillium undulatum), Uvularia* spp. (e.g., *Uvularia grandiflora, Uvularia perfoliata)*, and *Monarda* spp. (e.g., *Monarda clinopodia, Monarda didyma*). *Aristolochia macrophylla* is a common vine. Other species found in this association that are indicative of high base-status soils include *Dryopteris goldiana, Sanguinaria canadensis*, and *Panax quinquefolius.*

Global Vegetation: This association represents forests of medium- to high-elevation protected coves in the southern Appalachian Mountains. Tree canopies are dominated by variable mixtures of *Acer saccharum, Aesculus flava, Fraxinus americana, Halesia tetraptera var. monticola,* and *Tilia americana var. heterophylla*. In the Great Smoky Mountains of North Carolina and Tennessee, relative dominance of canopy species varies from site to site, with some stands strongly dominated by *Halesia tetraptera var. monticola*. Other common canopy species are *Carya cordiformis* and *Quercus rubra*. The shrub layer is very sparse or absent, but the herb layer is dense and luxuriant, with relatively high species richness. A defining feature of this association is the lush herbaceous flora with many calciphilic species indicative of high pH or base-rich soils. Characteristic herbs include *Asarum canadense, Carex plantaginea, Cymophyllus fraserianus, Cystopteris protrusa, Deparia acrostichoides, Diplazium pycnocarpon, Prosartes lanuginosa (= Disporum lanuginosum), Dryopteris goldiana, Hepatica nobilis var. acuta, Hydrophyllum canadense, Osmorhiza claytonii, Solidago flexicaulis*, and *Viola canadensis*. The herb layer can also have local dominance by *Laportea canadensis, Dryopteris intermedia, Actaea podocarpa (= Cimicifuga americana), Actaea racemosa (= Cimicifuga racemosa), Ageratina altissima*, and *Caulophyllum thalictroides*. This association typically has a much more diverse herbaceous stratum than other deciduous cove forests of the Southern Blue Ridge.

Virginia stands of this association entirely lack *Halesia tetraptera var. monticola* and are dominated by *Acer saccharum, Tilia americana var. heterophylla, Fraxinus americana*, and *Aesculus flava.* The most abundant herbs, at least locally, are *Actaea podocarpa, Caulophyllum thalictroides, Deparia acrostichoides, Dryopteris intermedia, Geranium maculatum, Hydrophyllum canadense, Hydrophyllum virginianum, Impatiens pallida, Laportea canadensis, Phacelia fimbriata, Sanicula odorata, Solidago flexicaulis, Uvularia grandiflora, Viola canadensis*, and *Viola pubescens.* Many additional herbs occur at low cover. Mean species richness of plot-sampled stands is 51 taxa per 400 m2.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer saccharum, Aesculus flava, Fraxinus americana, Halesia tetraptera var monticola, Tilia americana var heterophylla*

Global

Stratum	Species
Same as local	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer saccharum, Aesculus flava, Carya cordiformis, Halesia tetraptera var monticola, Tilia americana var heterophylla*
TREE SUB-CANOPY	*Cladrastis kentukea, Ostrya virginiana*
GRAMINOID	*Cymophyllus fraserianus*
FORB	*Asarum canadense, Disporum lanuginosum, Hepatica nobilis var acuta, Hydrophyllum canadense, Laportea canadensis, Osmorhiza claytonii, Solidago flexicaulis, Viola canadensis*
FERN	*Deparia acrostichoides, Dryopteris goldiana*
VINE/LIANA	*Aristolochia macrophylla*

Global

Stratum	Species
TREE CANOPY	*Aesculus flava*
FORB	*Caulophyllum thalictroides, Cimicifuga americana, Diphylleia cymosa, Impatiens pallida Phacelia fimbriata, Sanicula odorata, Stachys nuttallii, Trillium sulcatum, Viola pubescens*
FERN	*Deparia acrostichoides*

GRank & Reasons: G3G4 (99-12-29). This community is naturally uncommon within its range due to specific habitat requirements. It only occurs in protected, concave, topographic positions over high-base status soils in the Southern Blue Ridge, a region of predominantly nutrient-poor (acidic) soils. Although relatively secure and not highly threatened today, most remaining examples of this community have been affected by past logging, thus much of the remaining acreage is not of high quality.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Relative dominance of canopy species varies among examples of this association. Some examples may have canopies strongly dominated by *Halesia tetraptera var. monticola*, while others have major canopy dominance by either *Acer saccharum*, *Aesculus flava*, *Tilia americana var. heterophylla*, or *Fraxinus americana*. Some examples may have signatures similar to *Aesculus flava - Betula alleghaniensis - Acer saccharum / Acer spicatum / Caulophyllum thalictroides - Laportea canadensis* Forest (CEGL004973). However, *Aesculus flava - Acer saccharum - (Fraxinus americana, Tilia americana) / Hydrophyllum canadense - Solidago flexicaulis* Forest (CEGL007695) is distinguished by a characteristic herbaceous flora, by lacking canopy dominance of *Betula alleghaniensis* and *Fagus grandifolia*, and by overall occurring at lower elevations, or on less extreme landforms.

Global Classif Comments: This association was originally defined for the richest cove forests in the Great Smoky Mountains and may need revision to apply more generally to similar forests in the Southern Blue Ridge. In the Smokies, relative dominance of canopy species varies among examples of this association. Some examples may have canopies strongly dominated by *Halesia tetraptera var. monticola*, while others have major canopy dominance by either *Acer saccharum*, *Aesculus flava*, *Tilia americana var. heterophylla*, or *Fraxinus americana*. Deciduous cove forests are perhaps the most complex group of communities to classify in the Southern Blue Ridge, due to a combination of wide environmental range, high species richness, and high biogeographic variability. The recognition of associations based on fertility and elevation is provisional and will likely need further refinement.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte, Cades Cove, and Kinzel Springs quadrangles. Additional historic samples are from the Calderwood quadrangle (2780 feet elevation). On the Cades Cove quadrangle, historic and recent samples of this community ranged from 2880 to 3960 feet elevation. Samples from the southern portion of the Cades Cove quadrangle came from an east-facing cove of lower Gregory Ridge; protected upper slopes of the Gregory Ridge Trail; lower slopes above Forge Creek; and protected slopes north of Ekaneetlee Gap. In the western portion of the quadrangle, this community was sampled on the north slope of Pine Ridge. In the northern portion of the Cades Cove quadrangle, this community was sampled from a cove above Bunting Branch, north of Coon Butt; from a cove below the north side of Coon Butt; and from upper Fanny Branch. An additional sample of this community was taken from the southern portion of the Kinzel quadrangle, in a cove along Scotts Mountain Trail. Samples from the Mount Le Conte quadrangle ranged from 2508 to 3890 feet elevation. In the central and eastern portion of the Mount Le Conte quadrangle this community was sampled from a cove below Rocky Spur; from broad, protected slopes below Rainbow Falls; west of Porters Flat on middle cove slopes above Long Branch; and on the west slope above Porters Creek In the southwestern portion of the Mount Le Conte quadrangle this community was sampled on a southwest-facing cove above Highway 441 in the vicinity of Fort Harry; on a slope east and south of Balsam Point; from a low Cove above the west Prong of the Pigeon River; on a cove northwest of Bullhead; and on a lowslope/cove above Le Conte Creek, north of Bullhead. Additional examples of this community were found in the western portion of the quadrangle in a cove north of Mt. Winnesoka, and on the north slopes of Piney Mountain, above Cherokee Orchard Road.

Global Range: This association occurs in the southern Appalachian Mountains of eastern Tennessee, western North Carolina and southwestern Virginia. It likely ranges into the Blue Ridge of Georgia and extends peripherally into Virginia's Cumberland Mountains.

Nations: US

States/Provinces: GA?, NC:S?, TN:S?, VA:S?
TNC Ecoregions: 50:C, 51:C
USFS Ecoregions: M221Aa:CCC, M221Bd:C??, M221Cc:CC?, M221Ce:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: G. Fleming and P. Coulling, SCS **Confidence:** 1 **Identifier:** CEGL007695
REFERENCES (type in full citation below if reference is new): Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, NatureServe Ecology - Southeast U.S. unpubl. data, Patterson et al. 1999, Peet et al. 2002, Rheinhardt and Ware 1984, Schafale 1998b, Schafale and Weakley 1990

Liriodendron tulipifera - Aesculus flava - (Fraxinus americana, Tilia americana var. heterophylla) / Actaea racemosa - Laportea canadensis Forest

Tuliptree - Yellow Buckeye - (White Ash, Appalachian Basswood) / Black Cohosh - Wood Nettle Forest

Southern Appalachian Cove Forest (Typic Montane Type)

Ecological Group (SCS;MCS): Appalachian Highlands Mixed Mesophytic/Cove Forests (420-30; 2.5.3.3)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association represents deciduous forests of concave lower slopes and flats at middle elevations (2000-4500 feet) in the Southern Blue Ridge. The canopy is dominated by some mixture of rich site mesophytic species such as *Aesculus flava, Fraxinus americana, Tilia americana var. heterophylla*, and *Magnolia acuminata*, occurring with more widely tolerant tree species such as *Liriodendron tulipifera, Acer rubrum, Tsuga canadensis*, and *Betula lenta*. The herbaceous stratum is diverse and often very lush. Typical herbaceous species include *Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Prosartes lanuginosa (= Disporum lanuginosum), Aruncus dioicus, Adiantum pedatum, Collinsonia canadensis, Osmorhiza claytonii*, and *Laportea canadensis*. This association is distinguished by the absence or scarcity of calciphilic species, such as *Diplazium pycnocarpon, Asplenium rhizophyllum, Dryopteris goldiana, Aquilegia canadensis, Solidago flexicaulis, Deparia acrostichoides*, and *Cystopteris protrusa*, by generally occurring at elevations above 2000 feet, and by lacking species typical of lower elevation forests.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This forest was found in low, protected topographic positions, often near small streams, on gentle to moderate slopes with northerly aspects. Samples of this community had a mean elevation of 2500 feet, ranging from 1440 to 3740 feet. Perhaps because of the generally more accessible locations of these forests, many of the sites were logged in the past.

Global Environment: This association is characteristic of concave lower slopes and flats at middle elevations (600-1200 m or 2000-4500 feet) in the Southern Blue Ridge. At the northern end of the range in Virginia, elevation of the few known occurrences decreases from 760 m (2500 feet) in the Southern Blue Ridge to as low as 300 m (1000 feet) at the extreme north end of the Blue Ridge in Clarke County. Five plot-sampled stands occupy sites underlain by base-rich substrates, including metabasalt (greenstone), amphibolite, and dolomite. These sites are mostly situated on moderately steep (mean slope = 17 degrees), straight or concave slopes with east to northeast aspects. Soils are deep, dark, and fertile, with the highest mean pH (6.3), calcium (2466 ppm), and magnesium (296 ppm) levels among strictly montane cove forests in Virginia.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy of this forest is dominated by various mixtures of *Liriodendron tulipifera, Halesia tetraptera var. monticola, Tilia americana var. heterophylla, Acer rubrum*, and *Fraxinus americana*. Other species that occasionally have high canopy coverage include *Acer saccharum, Aesculus flava, Betula lenta*, and *Tsuga canadensis*. If a subcanopy is present it has species from the canopy and often *Cornus florida*. The shrub stratum is sparse to moderate and is often composed of saplings of canopy species, but composition varies from site to site. Some of the more common shrub species include *Acer pensylvanicum, Calycanthus floridus*, and *Rhododendron maximum*. The herbaceous stratum has sparse to moderate coverage but is always diverse and contains a mix of species characteristic of high base-status soils occurring with those more typical of acidic forests. Dominance is variable among occurrences and may relate to varying levels of disturbance. Species that most often have moderate to high coverages include *Adiantum pedatum, Ageratina altissima, Amphicarpaea bracteata, Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex austrocaroliniana, Carex digitalis, Carex laxiflora var. laxiflora, Carex pensylvanica, Carex plantaginea, Carex virescens), Caulophyllum thalictroides, Actaea podocarpa (= Cimicifuga americana), Collinsonia canadensis, Dryopteris intermedia, Galium triflorum, Laportea canadensis, Maianthemum racemosum ssp. racemosum, Mitchella repens, Osmorhiza claytonii, Polystichum acrostichoides var. acrostichoides, Solidago curtisii (= Solidago caesia var. curtisii), Stellaria*

pubera, Thelypteris noveboracensis, Tiarella cordifolia, and *Viola* spp. (e.g., *Viola blanda, Viola canadensis, Viola cucullata, Viola hastata, Viola pubescens, Viola rotundifolia*). Other species commonly found include *Arisaema triphyllum, Arisaema triphyllum ssp. triphyllum, Botrychium virginianum, Deparia acrostichoides, Dioscorea quaternata, Prosartes lanuginosa (= Disporum lanuginosum), Panax quinquefolius, Parthenocissus quinquefolia, Phegopteris hexagonoptera, Sanguinaria canadensis, Sanicula canadensis, Thalictrum thalictroides*, and *Uvularia perfoliata*. Common vines include *Aristolochia macrophylla, Smilax rotundifolia*, and *Vitis aestivalis*. Particularly on disturbed sites, *Vitis aestivalis* can have high coverage.

Global Vegetation: In the heart of its Southern Blue Ridge range, canopies of this community type are dominated by variable mixtures of nutrient-demanding mesophytic species such as *Aesculus flava, Fraxinus americana*, and *Tilia americana var. heterophylla*, in association with more wide-ranging tree species such as *Liriodendron tulipifera, Acer rubrum, Tsuga canadensis*, and *Betula lenta*. Herb layers are diverse and often very lush. Typical herbaceous species include *Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Aruncus dioicus, Adiantum pedatum, Collinsonia canadensis, Laportea canadensis, Osmorhiza claytonii*, and *Prosartes lanuginosa (= Disporum lanuginosum).* In the Southern Blue Ridge, this association is distinguished by the scarcity of calciphilic species such as *Diplazium pycnocarpon, Asplenium rhizophyllum, Dryopteris goldiana, Aquilegia canadensis, Solidago flexicaulis, Deparia acrostichoides*, and *Cystopteris protrusa*; by generally occurring at elevations above 600 m (2000 feet); and by lacking species typical of lower-elevation forests.

Virginia examples may represent somewhat transitional or depauperate variants in the northern periphery of the association's range. *Aesculus sylvatica* is entirely absent from the documented stands, in which *Liriodendron tulipifera, Fraxinus americana, Tilia americana*, and *Quercus rubra* are the most important canopy species. *Acer saccharum, Betula lenta, Carya glabra*, and *Carya cordiformis* are minor canopy associates. *Ulmus rubra* is constant understory tree that occasionally reaches the overstory. All occurrences have a moderately dense shrub layer dominated exclusively by *Lindera benzoin* (25-50% cover in plots). The herbaceous flora is extremely lush and forb-rich throughout the entire growing season, with constantly changing suites of patch-dominants flowering, fruiting, and evanescing. *Trillium grandiflorum* is characteristically abundant in the vernal herbaceous complex, which also includes *Arisaema triphyllum, Maianthemum racemosum, Galearis spectabilis, Viola pubescens, Sanguinaria canadensis, Stellaria pubera, Podophyllum peltatum, Asarum canadense, Hybanthus concolor*, and *Thalictrum dioicum*. During the summer, prevalent herbs are *Actaea racemosa, Impatiens pallida, Circaea lutetiana ssp. canadensis, Monarda clinopodia, Sanicula odorata*, and *Collinsonia canadensis*. Species richness of plot-sampled stands ranges from 46 to 59 taxa per 400 m2 (mean = 52).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Fraxinus americana, Halesia tetraptera var monticola, Liriodendron tulipifera,Tilia americana var heterophylla*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Carya cordiformis, Fraxinus americana, Halesia tetraptera var monticola, Liriodendron tulipifera, Tilia americana var heterophylla*
SHRUB	*Lindera benzoin*
FORB	*Actaea racemosa, Collinsonia canadensis, Disporum lanuginosum, Hepatica nobilis var acuta, Hydrophyllum canadense, Laportea canadensis, Osmorhiza claytonii, Panax quinquefolius, Viola canadensis*
FERN	*Deparia acrostichoides, Polystichum acrostichoides, Thelypteris noveboracensis*

Global

Stratum	Species
SHRUB	*Lindera benzoin*
FORB	*Actaea racemosa, Cardamine angustata, Galearis spectabilis, Hybanthus concolor, Ranunculus allegheniensis, Sanicula odorata, Trillium cernuum, Trillium grandiflorum, Viola pubescens*

GRank & Reasons: G4 (98-04-30). This community is uncommon due to specialized habitat requirements, but it is not rare. It is secure throughout its range, but susceptible to impacts by logging due to its location in accessible topographic positions.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: Some examples described from Great Smoky Mountains National Park may be more closely related to the global concept of *Liriodendron tulipifera - Tilia americana var. heterophylla - (Aesculus flava) / Actaea racemosa* Forest (CEGL007291), but because of the range in elevation (mostly above 2000 feet) and compositional variation among examples, they were placed in *Liriodendron tulipifera - Aesculus flava - (Fraxinus americana, Tilia americana var. heterophylla) / Actaea racemosa - Laportea canadensis* Forest (CEGL007710), which has a more general concept. Many examples of this community are disturbed and have canopy coverage of early successional species such as *Liriodendron tulipifera, Acer rubrum*, and *Robinia pseudoacacia*, which may tend to make a photosignature similar to *Liriodendron tulipifera - Acer rubrum - Robinia pseudoacacia* Forest (CEGL007219).

Global Classif Comments: Deciduous cove forests are perhaps the most complex group of communities to classify in the Southern Blue Ridge, due to a combination of wide environmental range, high species richness, and high biogeographic variability. The recognition of associations based on fertility and elevation is provisional and will likely need further refinement. This association is distinguished by the absence or scarcity of calciphilic species, such as *Diplazium pycnocarpon, Asplenium rhizophyllum, Dryopteris goldiana, Aquilegia canadensis, Solidago flexicaulis, Deparia acrostichoides*, and *Cystopteris protrusa*, by generally occurring at elevations above 2000 feet, and by lacking species typical of lower elevation forests.

Although represented only by a few geographically disparate examples, this community type seems to have a remarkably consistent composition over nearly the entire length of the Blue Ridge in Virginia. These stands have all recovered from logging in the past, but remain threatened by future timber harvests because of excellent site productivity. Shade-tolerant, invasive exotics, especially *Alliaria petiolata*, pose a serious threat to the integrity of this community's herbaceous flora.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community is widespread throughout the park in coves. It was sampled on multiple quadrangles throughout the park and most likely exists at least in part on all quadrangles. Historic samples are from the Calderwood (1440-1940 feet elevation) and Thunderhead Mountain (2390-3420 feet elevation) quadrangles. On the Cades Cove quadrangle, historic and recent samples of this community ranged from 1680-3740 feet elevation. Samples from the southern portion of the Cades Cove quadrangle came from the vicinity of Forge Creek in coves along and above the creek, east and north of Gregory Ridge and below Doe Ridge; and from slopes in the lower portion of Gregory Ridge Trail; and on a slope northeast of Birch Springs Gap. In the northeast portion of the quadrangle this community was sampled from a cove at the head of Maynard Creek; a cove above Rowans Creek; a cove along Cork branch, above Rowans Branch; and from a cove below Anthony Ridge. An additional sample of this community was taken from the northwest portion of the Cades Cove quadrangle northeast of Spruce Double on a low slope above Abrams Creek. Only two examples of this community were sampled on the Mount Le Conte quadrangle, and the community is uncommon on this quadrangle. The community was sampled in the central portion of the quadrangle, northwest of Mt. Winnesoka, in a cove near Indian Camp Branch (2935 feet elevation) and in the western portion of the quadrangle, on a steep, low slope above Baskins Creek (1950 feet elevation).

Global Range: This association occurs in the southern Appalachian Mountains of eastern Tennessee, western North Carolina, northeastern Georgia, and southwestern Virginia. Scattered outliers occur on the northern Virginia Blue Ridge and in the southwestern Virginia Ridge and Valley region adjacent to the Blue Ridge.

Nations: US
States/Provinces: GA:S?, NC:S?, TN:S?, VA:S?
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Ab:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:

Authors: G. Fleming and P. Coulling, SCS **Confidence:** 2 **Identifier:** CEGL007710

REFERENCES (type in full citation below if reference is new): Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Major et al. 1999, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm.

Liriodendron tulipifera - Acer rubrum - Robinia pseudoacacia Forest

Tuliptree - Red Maple - Black Locust Forest
Early Successional Appalachian Hardwood Forest
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This vegetation occurs in areas that have been cleared and primarily revegetated from root and stump sprouts. Stands are dominated primarily by early successional species. Canopies are typically dominated by *Liriodendron tulipifera* and *Acer rubrum*, with lesser amounts of *Robinia pseudoacacia*. Some examples may contain *Pinus virginiana*. Associated species vary, but these forests are typical of areas which were once clearcut, old fields, strip-mined, graded for road construction, or cleared by fire or other natural disturbances. The relative absence of *Quercus* species in these stands indicates more severe disturbance to this type in contrast to *Liriodendron tulipifera - Acer rubrum - Quercus* spp. Forest (CEGL007221). Tall shrubs (*Rhododendron periclymenoides, Rhododendron calendulaceum, Kalmia latifolia, Calycanthus floridus)* sprout from root stocks and occur as scattered, dense clumps, while shorter shrubs (*Gaylussacia ursina, Leucothoe fontanesiana, Rubus* spp., *Vaccinium* spp.) can have dense, continuous cover. Composition of the herbaceous stratum varies with site conditions and moisture regime and may contain field-adapted species, tolerant of high light intensities, as well as many shade-tolerant forest herbs. *Lycopodium digitatum* may also form dense cover. This successional forest occurs on upland areas in the southern Appalachian Mountains and Appalachian Plateaus. It typically occurs as 8-16 ha patches in the landscape.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This forest is found on low slopes and flats, typically below 3000 feet elevation and particularly in areas of heavy settlement or past logging or farming activities. It also can occur in isolated patches on steep slopes in areas where road construction destroyed the previous community and the slope was regraded.

Global Environment: This community occurs on gentle to moderately steep, middle to upper slopes at approximately 850-1200 m (2300-4000 feet) elevation. Important environmental factors, such as solar irradiation, soil moisture/temperature, and air temperature, vary within and between sites and are related to the size of the opening, age of the stand, and slope direction (Phillips and Shure 1990). Soils are primarily Hapludults and Dystrochrepts. This successional forest occurs on upland areas in the southern Appalachian Mountains and Appalachian Plateaus. It typically occurs as 8- to 16-ha patches in the landscape. These forests are typical of areas which were once clearcut, old fields, strip-mined, or cleared by fire or other natural disturbances.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a canopy strongly dominated by *Liriodendron tulipifera*. Other canopy and subcanopy species include *Acer rubrum, Robinia pseudoacacia, Acer saccharum, Halesia tetraptera var. monticola, Pinus strobus*, and *Betula lenta*. Shrubs can be sparse to moderate in coverage, with composition varying from site to site, but often composed of saplings of canopy species. *Tsuga canadensis* and *Quercus* spp. can be dominant in the shrub stratum. Herbaceous cover can be sparse to moderate, with no clear dominant, although *Amphicarpaea bracteata, Desmodium nudiflorum*, and *Thelypteris noveboracensis* may be dominant in patches. Vines are common and often abundant. Typical vine species are *Aristolochia macrophylla, Parthenocissus quinquefolia, Smilax glauca, Smilax rotundifolia, Toxicodendron radicans ssp. radicans*, and *Vitis aestivalis*. A more mesic and nutrient-rich version of this association contained large amounts of *Hydrangea arborescens, Impatiens pallida*, and *Symphyotrichum prenanthoides*.

Global Vegetation: Stands of this successional vegetation have canopies which are typically dominated by *Liriodendron tulipifera* and *Acer rubrum*, with lesser amounts of *Robinia pseudoacacia*. Some examples may contain *Pinus virginiana.* Associated species vary. The relative absence of *Quercus* species in these stands indicates more severe disturbance to this type in contrast to *Liriodendron tulipifera - Acer rubrum - Quercus* spp. Forest (CEGL007221). Taller shrubs include *Rhododendron periclymenoides, Rhododendron*

calendulaceum, Kalmia latifolia, and *Calycanthus floridus*; shorter shrubs include *Gaylussacia ursina, Leucothoe fontanesiana, Rubus* spp., and *Vaccinium* spp. Composition of the herbaceous stratum varies with site conditions and moisture regime and may contain field-adapted species which are tolerant of high light intensities, as well as many shade-tolerant forest herbs. *Lycopodium digitatum* may also form dense cover.

This mainly deciduous forest has a canopy dominated by *Liriodendron tulipifera, Acer rubrum,* and *Robinia pseudoacacia* and may contain lesser amounts of *Betula lenta, Cornus florida, Nyssa sylvatica*, and *Magnolia fraseri*. Most of the regeneration is from stump and root sprouts, however, *Liriodendron tulipifera* establishment is primarily from seedlings. The upper canopy ranges from 5-9 m, but most of the regeneration is in a shrub/sapling layer at 1-3 m. Cover of woody species may be patchy to dense and is characterized by clumps of *Robinia pseudoacacia* and *Acer rubrum*, occurring as stump sprouts. Scattered thickets of evergreen ericads (*Rhododendron* and *Kalmia*) are also typical. Other species occurring as shrubs/saplings include *Calycanthus floridus, Halesia carolina, Pinus strobus, Castanea dentata, Prunus serotina, Pyrularia pubera, Sassafras albidum, Castanea pumila, Hydrangea arborescens, Viburnum acerifolium, Gaylussacia ursina, Rubus* spp., and *Vaccinium* ssp. Short shrubs (<2 m), such as *Gaylussacia ursina, Rubus* spp. and, *Vaccinium* ssp., often form a dense, continuous vegetation layer. Herbaceous species and tree seedlings occur in openings and beneath the shrub cover and include ferns (*Thelypteris noveboracensis, Dennstaedtia punctilobula, Polystichum acrostichoides*, and *Pteridium aquilinum*), other forests forbs (*Potentilla* spp., *Viola* spp., *Ageratina altissima*, Asteraceae spp., *Solidago* spp., *Galium latifolium, Lysimachia quadrifolia*, and *Desmodium* spp.) and grasses (*Arundinaria gigantea, Panicum* spp., and *Dichanthelium* spp.). Vines are also an important component in these forests with *Vitis* spp., *Smilax* spp., *Parthenocissus quinquefolia*, and *Dioscorea villosa* typical.

Global Dynamics: Presumably, individuals arising from sprouts are more susceptible to wind breakage because of constricted vascular tissue at the stump attachment (Phillips and Shure 1990). This is an early successional forest, on recently cut-over land, dominated by pioneer species. Prior to cutting these areas were dominated by *Pinus strobus* and/or *Quercus* spp. (*Quercus alba, Quercus prinus, Quercus rubra*), occurring with other upland hardwood species such as *Carya* spp. and *Liriodendron tulipifera*. Canopy closure occurs rapidly after time of harvest, and by the fourth year, little unshaded, unvegetated area remains. Mid- and late-successional species will slowly re-establish dominance. Considerable competition of tree species with *Vitis* spp. and *Rhododendron* spp. may affect future stand development on some sites (McGee and Hooper 1970).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Liriodendron tulipifera, Robinia pseudoacacia*
SHORT SHRUB	*Acer pensylvanicum, Acer saccharum, Betula lenta, Tsuga canadensis*
FORB	*Amphicarpaea bracteata, Impatiens pallida*
FERN	*Thelypteris noveboracensis*
VINE/LIANA	*Toxicodendron radicans ssp radicans, Vitis aestivalis*

Global

Stratum	Species
TREE CANOPY	*Acer rubrum, Liriodendron tulipifera, Robinia pseudoacacia*
TALL SHRUB	*Acer rubrum, Calycanthus floridus, Kalmia latifolia, Magnolia fraseri, Robinia pseudoacacia*
SHORT SHRUB	*Gaylussacia ursina*
GRAMINOID	*Arundinaria gigantea*
FORB	*Ageratina altissima*
FERN	*Dennstaedtia punctilobula, Thelypteris noveboracensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Liriodendron tulipifera, Robinia pseudoacacia*
VINE/LIANA	*Toxicodendron radicans ssp radicans, Vitis aestivalis*

Global

Stratum	Species

TREE CANOPY *Acer rubrum, Liriodendron tulipifera, Robinia pseudoacacia*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
CANOPY	*Quercus* spp. are also dominant short shrubs.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Liriodendron tulipifera - Acer rubrum - Quercus spp. Forest (CEGL007221)--resulting from less severe disturbance.

GRank & Reasons: GD (00-12-07). This forest represents early successional vegetation or vegetation resulting from anthropogenic activities and is thus not a conservation priority. These forests are typical of areas which were once clearcut, old fields, strip-mined, or cleared by fire or other natural disturbances.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: The signature of this vegetation may be similar to some stands of *Liriodendron tulipifera - Aesculus flava - (Fraxinus americana, Tilia americana var. heterophylla) / Actaea racemosa - Laportea canadensis* Forest (CEGL007710) and can sometimes resemble successional *Betula lenta* forest. This association is distinguished by its early successional status, often with an even-aged, single-species canopy, and lacking the suite of herbaceous species characteristic of CEGL007710. Occasionally types of this community can have a small component of *Pinus virginica, Pinus echinata,* or *Pinus strobus* which may create some additional confusion over photo-signature.

Global Classif Comments: This community differs from *Liriodendron tulipifera - Acer rubrum - Quercus* spp. Forest (CEGL007221) by its lack or relative lack of *Quercus* spp. It differs from other successional *Liriodendron tulipifera* types by the presence of *Robinia pseudocacia*.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled or observed on the Thunderhead Mountain, Smokemont, Cades Cove, and Mount Le Conte quadrangles and is likely in other areas of the park. On the Cades Cove quadrangle this community is found on low slopes around Cades Cove; on slopes along lower Green Branch Creek; slopes above Rowans Branch; north of Tater Ridge on low slopes above a creek; on low slopes northwest of Pine Ridge, and in the southeast portion of the quadrangle in the vicinity of Eagle Creek. Areas where it is known to occur on the Mount Le Conte quadrangle include Porters Flats, in the eastern portion of the quadrangle, and in the northern portion, on low slopes in the watershed of Rhododendron Creek, and a low cove south of Hills Creek. It is likely on other low slopes below 2000 feet elevation in the northern half of the Mount Le Conte quadrangle, particularly in areas that where once settled by humans. It has also been sampled in the Smokemont Quad along Newfound Gap Road in areas of former road construction and along Big Cove Road adjacent to the Cherokee Indian Reservation.

Global Range: This community occurs in upland areas of the Blue Ridge escarpment where there has been removal of the above-ground portion of canopy trees within the past ten years. It occurs in North Carolina, South Carolina, Georgia, and Tennessee, in the Blue Ridge Physiographic Province and is likely in the Cumberland Plateau and Ridge and Valley Province.

Nations: US
States/Provinces: GA:S?, KY:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 50:C, 51:C
USFS Ecoregions: 221Ha:CCC, 221He:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 2 **Identifier:** CEGL007219

REFERENCES (type in full citation below if reference is new): Allard 1990, Eyre 1980, Golden 1974, Govus 1982, Horn 1976, Horn 1980, McGee and Hooper 1970, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Phillips and Shure 1990, Schmalzer 1978, Thomas 1966, USFS 1988

Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina) Forest

White Oak - (Northern Red Oak, Rock Chestnut Oak) / Flame Azalea - Mountain Laurel - (Bear Huckleberry) Forest

Appalachian Montane Oak Hickory Forest (Typic Acidic Type)

Ecological Group (SCS;MCS): Appalachian Montane Oak-Hickory Forests (410-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: These forests occur in a wide elevation range (2000-4500 feet) in the Southern Blue Ridge and in the Blue Ridge/Piedmont transition, on protected sites, typically lower slopes, bottoms, and coves. Stands of this deciduous forest association are dominated or codominated by *Quercus alba*, occurring with other *Quercus* species (*Quercus rubra, Quercus prinus, Quercus coccinea*). Associated species are characteristically montane, and typical of acidic forests. This association lacks indicators of circumneutral soils and also lacks low elevation dry sites species such as *Pinus echinata, Quercus falcata, Quercus stellata*, and *Quercus marilandica*. Species other than oaks that can be important in the canopy include *Carya alba, Carya glabra, Liriodendron tulipifera, Acer rubrum*, and *Magnolia fraseri*. Common species in the subcanopy/sapling strata include *Cornus florida, Acer rubrum, Carya* spp., *Liriodendron tulipifera, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Pinus strobus*, and *Halesia tetraptera*. Shrub cover is sparse to very dense, and is often dominated by deciduous heaths. *Kalmia latifolia* and *Gaylussacia ursina* are usually present, but other shrub species can include *Euonymus americana, Rhododendron calendulaceum, Vaccinium stamineum, Vaccinium pallidum, Viburnum acerifolium, Calycanthus floridus, Pyrularia pubera, Ilex montana, Halesia tetraptera,* and *Hamamelis virginiana*. *Smilax glauca* and *Vitis rotundifolia* are common vines. The herbaceous stratum is sparse to moderate in coverage, but often rich in species, approaching the diversity but not the coverage of rich cove forests. Associated herbaceous species vary with elevation. Often there is a dominant fern stratum, with *Thelypteris noveboracensis* and *Polystichum acrostichoides* most typically dominant.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was sampled at low elevations (1120 to 2600 feet) in draws and on low to middle slopes with south and east aspects. At higher elevations (3800 to 4500 feet) this community occurred on middle to high slopes and summits, with north, west, and south aspects. This forest occurs on sites with well-developed soils.

Global Environment: These forests occur in a wide elevation range (2000-4500 feet) in the Southern Blue Ridge and in the Blue Ridge/Piedmont transition, on protected sites, typically lower slopes, bottoms, and coves.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy and subcanopy of this forest are dominated by *Quercus alba, Carya glabra*, and *Acer rubrum*. At low elevations (below 2600 feet), *Carya alba* shares canopy dominance, and at high elevations (greater than 3800 feet) *Quercus rubra* often codominates. Occasionally *Quercus falcata, Liriodendron tulipifera*, and *Halesia tetraptera var. monticola* may have high coverage in the canopy and subcanopy. Other typical species in the canopy and subcanopy include *Cornus florida, Nyssa sylvatica, Oxydendrum arboreum, Amelanchier laevis, Quercus prinus,* and *Quercus velutina*. The shrub stratum has sparse to moderate coverage often with no clear dominant but can also be sparse. In either case, it is usually more diverse than more acidic oak forests but contains less herbaceous biomass than cove forests that may border this association. Common shrubs include *Acer pensylvanicum, Castanea dentata, Gaylussacia ursina, Ilex opaca, Magnolia fraseri, Robinia pseudoacacia,* and *Sassafras albidum*. Herbaceous cover can be moderately dense and diverse with no clear dominant. Of the plots sampled *Amphicarpaea bracteata, Dennstaedtia punctilobula, Desmodium nudiflorum, Polystichum acrostichoides var. acrostichoides,* and *Thelypteris noveboracensis* most often have the highest coverage. Species with the greatest constancy include *Ageratina altissima (var. altissima* and *var. roanensis), Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex laxiflora var. laxiflora, Carex pensylvanica, Carex virescens), Chimaphila maculata, Collinsonia canadensis, Dichanthelium* spp. (e.g.,

Dichanthelium boscii, Dichanthelium commutatum, Dichanthelium dichotomum), Dioscorea quaternata, Galium spp. (e.g., *Galium circaezans, Galium latifolium, Galium triflorum), Goodyera pubescens, Houstonia purpurea var. purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Potentilla canadensis, Prenanthes* spp., *Solidago curtisii (= Solidago caesia var. curtisii), Thalictrum* spp. (e.g., *Thalictrum dioicum, Thalictrum thalictroides), Trillium* spp. (e.g., *Trillium catesbaei, Trillium undulatum), Uvularia* spp. (e.g., *Uvularia perfoliata, Uvularia puberula, Uvularia sessilifolia),* and *Viola* spp. (e.g., *Viola blanda, Viola canadensis, Viola cucullata, Viola hastata, Viola rotundifolia, Viola sororia, Viola tripartita*), although other species may occur. Common vines include *Smilax glauca, Smilax rotundifolia, Vitis aestivalis,* and *Vitis rotundifolia*.

Global Vegetation: The canopies of stands of this association are dominated or codominated by *Quercus alba*, occurring with other *Quercus* species (*Quercus rubra, Quercus prinus, Quercus coccinea*). Species other than oaks that can be important in the canopy include *Carya alba, Carya glabra, Liriodendron tulipifera, Acer rubrum,* and *Magnolia fraseri*. Stands lack indicators of circumneutral soils and also lack low elevation dry sites species such as *Pinus echinata, Quercus falcata, Quercus stellata,* and *Quercus marilandica*. Common species in the subcanopy/sapling strata include *Cornus florida, Acer rubrum, Carya* spp., *Liriodendron tulipifera, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Pinus strobus,* and *Halesia tetraptera*. Shrub cover is sparse to very dense, and is often dominated by deciduous heaths, including *Kalmia latifolia* and *Gaylussacia ursina*. Other shrub species can include *Euonymus americana, Rhododendron calendulaceum, Vaccinium stamineum, Vaccinium pallidum, Viburnum acerifolium, Calycanthus floridus, Pyrularia pubera, Ilex montana, Halesia tetraptera,* and *Hamamelis virginiana*. *Smilax glauca* and *Vitis rotundifolia* are common vines. The herbaceous stratum is sparse to moderate in coverage, but often rich in species, approaching that of rich cove forests (but with a different composition). Associated herbaceous species vary with elevation. Some of the more constant species include *Parthenocissus quinquefolia, Dioscorea quaternata, Dichanthelium* spp., *Carex pensylvanica, Chimaphila maculata, Desmodium nudiflorum, Goodyera pubescens, Maianthemum racemosum ssp. racemosum,* and *Trillium catesbaei*. Other species include *Dichanthelium laxiflorum, Oclemena acuminata (= Aster acuminatus), Eurybia divaricata (= Aster divaricatus), Galax urceolata, Galium latifolium, Lysimachia quadrifolia, Mitchella repens, Viola hastata* and *Melanthium parviflorum*. Often there is a dominant fern stratum, with *Thelypteris noveboracensis* and *Polystichum acrostichoides* most typically dominant. Other ferns include *Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula,* and *Dryopteris intermedia*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Carya alba, Carya glabra, Quercus alba, Quercus rubra*
TREE SUB-CANOPY	*Carya alba, Cornus florida, Halesia tetraptera var monticola*
FORB	*Amphicarpaea bracteata, Desmodium nudiflorum*
FERN	*Dennstaedtia punctilobula, Polystichum acrostichoides var acrostichoides, Thelypteris Noveboracensis*

Global

Stratum	Species
TREE CANOPY	*Carya alba, Carya glabra, Quercus alba, Quercus coccinea, Quercus prinus, Quercus rubra*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Carya alba, Carya glabra, Quercus alba*
TREE SUB-CANOPY	*Cornus florida*
SHRUB	*Rhododendron calendulaceum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida Forest (CEGL007267)--is drier and less diverse.

GRank & Reasons: G5 (98-04-30).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: The low-elevation (below 2000 feet) *Quercus alba*-dominated forests of the pilot quadrangles have some similarities with forests defined in the *Quercus alba - Quercus (falcata, stellata)* Forest Alliance (A.241), but overall are not dry enough to fit the concept of forests in this alliance. It is likely that *Quercus alba*-dominated vegetation in the park represents a subset of the Global concept of *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230). Samples from the park can be segregated into two distinct groups: *Quercus alba*-dominated forests below 2200 feet, distinguished by high coverage by *Carya alba, Cornus florida, Liriodendron tulipifera*, and *Polystichum acrostichoides var. acrostichoides*; and those over 4000 feet elevation that have greater coverage by *Quercus rubra, Amelanchier laevis, Magnolia acuminata, Ilex montana, Rhododendron calendulaceum*, and *Dennstaedtia punctilobula*. These higher elevation examples still have canopies with high coverage by *Quercus alba* and *Carya glabra*, but the overall composition begins to resemble CEGL007300, particularly along the Tennessee / North Carolina stateline on the Cades Cove quadrangle where *Quercus rubra* and *Quercus alba* dominance intergrade and may make delineation of this type difficult.

Global Classif Comments: This association is meant to cover the typical acidic, oak-hickory forests of the Southern Blue Ridge Mountains. It has a broad concept, and there is potential for subdividing this type by moisture, elevation, or undergrowth. It can be distinguished from *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267) by higher species diversity and the presence of a substantial amount of *Quercus alba*.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from the Cades Cove, Mount Le Conte, Calderwood, Gatlinburg, Bryson City, and Smokemont quadrangles. Historic samples of this community come from low elevations (1120 to 2600 feet) on the Calderwood quadrangle. On low elevations of the Cades Cove quadrangle this community was sampled north of the Cades Cove Loop Road, in the vicinity of Cave Ridge (low east-facing slope, 1791 feet) and west of Paw Paw Ridge at the head of a southwest-facing cove (2230 feet). In the southern portion of the quadrangle, at higher elevations, this community was sampled on the summits and convex high slopes of High Point; the southwest slopes below Gregory Bald; the southeastern high slopes below Moore Spring Camp; the summit ridge of Brier Lick Gap and the upper slopes south of Brier Lick Gap; the southwest middle slopes south of Doe Knob; the upper south slope of Greer Knob; on Twenty Mile Ridge south of Greer Knob; on the convex slopes north of Ekaneetlee Gap; on a south-facing side ridge of Bill Grill Ridge, south of Devils Tater Patch; and the convex west slopes of Mollies Ridge. This community was sampled from the northern portion of the Mount Le Conte quadrangle, on a low slope and low ridge in the vicinity of Copeland Creek (1590 and 1600 feet) and on a low slope above Dudley Creek (1680 feet). Variations of this community were also found just upslope from the Job Corps Center near Cherokee, NC, east of Beaugard Ridge on the Noland Divide Trail, upslope from Abram's Creek, and on the Laurel Fall's Trail. This community may occur in most every quadrangle of the park.

Global Range: This community is found in the Southern Blue Ridge and the Blue Ridge/Piedmont transition of the eastern United States.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 51:C, 52:P
USFS Ecoregions: 231Ag:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007230
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, Major et al. 1999, NatureServe Ecology - Southeast U.S. unpubl. data, Nelson 1986, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Quercus alba - Quercus rubra - Carya ovata / Cercis canadensis - Juniperus virginiana var. virginiana Forest

White Oak - Northern Red Oak - Shagbark Hickory / Redbud - Eastern Red-cedar Forest

Ridge-and-Valley Dry-Mesic White Oak - Hickory Forest

Ecological Group (SCS;MCS): Appalachian Highlands Dry-mesic Circumneutral Hardwood Forests and Woodlands (401-17; 2.5.3.z)
Appalachian Highlands Dry-mesic Oak Forests and Woodlands (401-13; 2.5.3.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This dry-mesic late-successional Appalachian forest occurs on slopes with southerly aspects and well-drained upland soils. The canopy is dominated by *Quercus alba, Quercus rubra, Carya ovata*, and *Carya alba*. Other *Quercus* species are common in the canopy (*Quercus falcata, Quercus stellata, Quercus coccinea, Quercus muehlenbergii*, and *Quercus velutina*). Other canopy species can include *Pinus virginiana, Pinus echinata, Juniperus virginiana var. virginiana, Quercus prinus, Liriodendron tulipifera*, and *Fraxinus americana*. A mixture of calciphilic and acidophilic trees are present in the subcanopy, including *Juniperus virginiana var. virginiana, Cercis canadensis var. canadensis, Acer leucoderme, Nyssa sylvatica, Cornus florida, Acer rubrum*, and *Oxydendrum arboreum*. *Acer saccharum, Acer nigrum*, or *Acer leucoderme* are sometimes present in the canopy and are often common in the lower strata (subcanopy, tall-shrub, and low-shrub). Other species in the shrub strata include *Cornus florida, Juniperus virginiana var. virginiana, Ulmus alata, Cercis canadensis var. canadensis, Vaccinium stamineum, Vaccinium arboreum, Viburnum rufidulum, Frangula caroliniana*, and *Ostrya virginiana*. The herbaceous layer can be moderately dense to somewhat sparse. Possible herbaceous species are *Polystichum acrostichoides, Hexastylis arifolia var. ruthii, Dioscorea quaternata, Galium circaezans, Maianthemum racemosum ssp. racemosum, Parthenocissus quinquefolia, Toxicodendron radicans, Zizia aptera, Chamaelirium luteum, Desmodium nudiflorum, Desmodium rotundifolium*, and other *Desmodium* species.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This dry-mesic association occurs only in areas of the park with very calcium-rich soils, such as the White Oak Sinks area in the Kinzel Springs quadrangle. The sites tend to be drier than adjacent cove and mesic white oak communities, and most examples are rocky.

Global Environment: This dry-mesic late-successional Appalachian forest occurs on slopes with southerly or westerly aspects and well-drained upland soils. This association is not (at this time) explicitly restricted to any particular geological substrates or soil types. This would be valuable information, as the flora seems to be at least somewhat oriented to a circumneutral substrate.

This forest is most often found on slopes with elevation ranging from 820-1000 feet with a westerly aspect. Topographical position ranges from low slope to high slope. Slopes range from gentle to very steep (0-40 degrees+). These stands are underlain by soils weathered from calcareous shale and calcareous sandstone of the Middle Ordivician. These soils are slightly to very acidic and well-drained. Soil series of this type are Dandridge (Lithic Ruptic-Alfic Eutrochrepts), Tellico (Typic Rhododults), and Steekee (Ruptic-Ultic Dystrochrepts). These soils are slightly to very acidic and well drained to very well drained. Average depth of solum ranges from 17 inches (Dandridge series) to 58 inches (Tellico series). The combination of environmental factors and well-drained soils results in dry-mesic site conditions.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy of this community is usually dominated by *Quercus alba*, but with a wide variety of codominants including *Quercus stellata, Quercus falcata, Quercus velutina, Carya* spp., *Pinus rigida, Pinus virginiana*, and even *Liriodendron tulipifera*. The subcanopy is dominated by *Cercis canadensis* but also contains *Nyssa sylvatica, Cornus florida, Acer nigrum, Ostrya virginiana, Juniperus virginiana*, and *Acer saccharum*. The herbaceous layer is moderate to dense and very diverse, especially considering the slightly dry nature of the community. *Solidago sphacelata* seems to be a consistent indicator within examples of this community in the Smokies, but other species include *Zizia aptera, Bromus pubescens, Symphyotrichum undulatum (= Aster undulatus),*

Doellingeria umbellata, Hepatica nobilis var. obtusa (= Hepatica americana), Packera obovata, and others.

Global Vegetation: The canopy is generally closed (>75% cover) with gaps resulting from natural disturbance (i.e., mudslides, fire) and is dominated by *Quercus alba, Quercus rubra, Carya ovata*, and *Carya alba*. Other *Quercus* species are common in the canopy (*Quercus falcata, Quercus stellata, Quercus coccinea, Quercus muehlenbergii*, and *Quercus velutina*). Other canopy species can include *Pinus virginiana, Pinus echinata, Juniperus virginiana var. virginiana, Quercus prinus, Liriodendron tulipifera*, and *Fraxinus americana*. A mixture of calciphilic and acidophilic trees are present in the subcanopy, including *Juniperus virginiana var. virginiana, Cercis canadensis var. canadensis, Acer leucoderme, Nyssa sylvatica, Cornus florida, Acer rubrum*, and *Oxydendrum arboreum*. *Acer saccharum, Acer nigrum*, or *Acer leucoderme* are sometimes present in the canopy and are often common in the lower strata (subcanopy, tall-shrub, and low-shrub). Other species in the shrub strata include *Cornus florida, Juniperus virginiana var. virginiana, Ulmus alata, Cercis canadensis var. canadensis, Vaccinium stamineum, Vaccinium arboreum, Viburnum rufidulum, Frangula caroliniana*, and *Ostrya virginiana*. The herbaceous layer can be moderately dense to somewhat sparse. Possible herbaceous species are *Polystichum acrostichoides, Hexastylis arifolia var. ruthii, Dioscorea quaternata, Galium circaezans, Maianthemum racemosum ssp. racemosum, Parthenocissus quinquefolia, Toxicodendron radicans, Zizia aptera, Chamaelirium luteum, Desmodium nudiflorum, Desmodium rotundifolium*, and other *Desmodium* species.

Global Dynamics: Infrequent fires due to the dry conditions were the only observed disturbances effecting this community type in the Tellico study area.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus rigida, Quercus alba, Quercus stellata*
TREE SUB-CANOPY	*Cercis canadensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE SUB-CANOPY	*Cercis canadensis*
FORB	*Solidago sphacelata*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
CANOPY	*Carya* spp. also dominate the tree canopy.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus alba - Carya (ovata, alba, glabra) - Pinus virginiana Forest (CEGL007231)
- Quercus alba - (Quercus rubra, Acer saccharum, Fagus grandifolia) / Aesculus flava Forest (CEGL007233)
- Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis Forest (CEGL002070)--is an apparently related type, but with chinquapin oak.

GRank & Reasons: G4 (00-01-14). This is not an inherently rare forest type. It is at least moderately widespread, and it is presumed to be relatively common throughout its range, although its full range is not known. It occurs on a variety of aspects and elevations, and it is not restricted to any highly specific geologic substrates. It is poorly documented through EOs, and not much data are available on the specific condition of examples of this type. Some stands have been impacted by removal of more valuable timber species and loss of herbaceous species diversity from the disturbance effects of logging. The Grank was formerly G3G5. Changing this to G4 helps to clarify its status and indicates that it is not a rare type.

CLASSIFICATION COMMENTS

Global Classif Comments: Described from Tellico Pilot Project (Ridge and Valley of Tennessee, northeastern Monroe County; 50 stands sampled) (Andreu and Tukman 1995). *Juniperus virginiana var. virginiana* is included in the name to indicate the relative xeric nature of this forest, until more information is available to define understory indicator species. This association is related to *Quercus alba - (Quercus rubra, Acer saccharum, Fagus grandifolia) / Aesculus flava* Forest (CEGL007233), a more mesic type described from

the Tellico Pilot Project. May be similar to some limestone forests in Virginia's Ridge and Valley (G. Fleming pers. comm. 1997).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: Due to its restriction to calcium-rich soils only found in a few places within park boundaries, this community is most likely limited to the Kinzel Springs quadrangle of the Smokies. Occurrences exist near the White Oak Sinks area.

Global Range: This association is at least a moderately widespread type, probably present throughout the Ridge and Valley from Alabama to Tennessee and possibly to Virginia, as well as adjacent Southern Blue Ridge. A comprehensive review of related types has not been completed.

Nations: US
States/Provinces: AL?, GA:S?, KY?, TN:S?, VA?
TNC Ecoregions: 50:C, 51:C
USFS Ecoregions: 221Jb:CCC, 222E:??, 231Cc:CCC, 231Da:CCC, 231Dc:CCC, M221Dd:CCC
Federal Lands: DOE (Oak Ridge); NPS (Great Smoky Mountains); TVA (Tellico); USFS (Chattahoochee, Cherokee, Daniel Boone?)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: M. Andreu and M. Tukman, SCS **Confidence:** 2 **Identifier:** CEGL007240
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, Andreu and Tukman 1995, Eyre 1980, Fleming pers. comm., NatureServe Ecology - Southeast U.S. unpubl. data, Oberholster 1993, Pyne 1994

Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata Forest

White Oak - Northern Red Oak - Rock Chestnut Oak / Richweed - May-apple - Hog-peanut Forest

Appalachian Montane Oak - Hickory Forest (Rich Type)

Ecological Group (SCS;MCS): Appalachian Montane Oak-Hickory Forests (410-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes forests dominated by *Quercus alba*, occurring over circumneutral soils in the Southern Blue Ridge and adjacent inner Piedmont. Other species that can be important in the canopy include *Quercus rubra, Quercus coccinea, Quercus prinus, Quercus velutina, Carya glabra*, and *Carya alba*. On some sites, species more typical of 'cove forests,' such as *Fraxinus americana* or *Magnolia acuminata*, may form a very minor component. *Oxydendrum arboreum* and *Cornus florida* are common in the subcanopy. Heath species (*Rhododendron maximum* or *Kalmia latifolia*) are absent or very minor in the shrub stratum. On very high-base status soils, *Philadelphus hirsutus* or *Lindera benzoin* may be in the shrub stratum. The herbaceous stratum can be quite diverse and is characterized by mesic herbs and species associated with circumneutral soils, such as *Podophyllum peltatum, Arisaema triphyllum, Amphicarpaea bracteata, Adiantum pedatum, Collinsonia canadensis, Asplenium platyneuron, Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Sanguinaria canadensis, Tradescantia subaspera, Euphorbia purpurea, Phegopteris hexagonoptera, Polystichum acrostichoides, Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula*, and *Dryopteris intermedia*. These forests can occur across a broad elevation range (2000-4500 feet), and can occur in exposed topographic settings (upper slopes), as well as on more protected sites (edges of coves). Presumed upper Piedmont examples may be at lower elevations (e.g., below 1000 feet).

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Same as global description.

Global Environment: This association includes forests dominated by *Quercus alba*, occurring over circumneutral soils in the Southern Blue Ridge and adjacent Piedmont. These forests can occur across a broad elevation range (2000-4500 feet), and can occur in exposed topographic settings (upper slopes), as well as on more protected sites (edges of coves). Presumed upper Piedmont examples may be at lower elevations (e.g., below 1000 feet).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global description.

Global Vegetation: This association includes forests dominated by *Quercus alba*. Other species that can be important in the canopy include *Quercus rubra, Quercus coccinea, Quercus prinus, Quercus velutina, Carya glabra*, and *Carya alba*. On some sites, species more typical of 'cove forests,' such as *Fraxinus americana* or *Magnolia acuminata*, may form a very minor component. *Oxydendrum arboreum* and *Cornus florida* are common in the subcanopy. Heath species (*Rhododendron maximum* or *Kalmia latifolia*) are absent or very minor in the shrub stratum. On very high-base status soils, *Philadelphus hirsutus* or *Lindera benzoin* may be in the shrub stratum. Other woody species may include *Cercis canadensis, Viburnum acerifolium*, and *Ulmus alata*. The herbaceous stratum can be quite diverse and is characterized by mesic herbs and species associated with circumneutral soils, such as *Podophyllum peltatum, Arisaema triphyllum, Amphicarpaea bracteata, Adiantum pedatum, Collinsonia canadensis, Asplenium platyneuron, Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Sanguinaria canadensis, Tradescantia subaspera, Euphorbia purpurea, Phegopteris hexagonoptera, Polystichum acrostichoides, Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula*, and *Dryopteris intermedia*. A stand included here from Chilhowee Mountain in the Cherokee National Forest also includes *Ageratina altissima var. altissima, Arabis canadensis, Aristolochia serpentaria, Asplenium platyneuron, Desmodium nudiflorum, Hepatica nobilis var. obtusa, Monarda fistulosa, Sanicula canadensis, Scutellaria elliptica, Silene stellata, Smallanthus uvedalius, Solidago curtisii, Solidago simplex var. spathulata (= Solidago spathulata), Spigelia marilandica, Tradescantia subaspera*, and *Uvularia perfoliata*.

Global Dynamics:

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Quercus alba*
FORB	*Actaea racemosa, Amphicarpaea bracteata, Arisaema triphyllum, Caulophyllum thalictroides, Collinsonia canadensis, Podophyllum peltatum, Sanguinaria canadensis*
FERN	*Adiantum pedatum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus rubra - Tilia americana var. heterophylla - Halesia tetraptera var. monticola / Collinsonia canadensis - Tradescantia subaspera Forest (CEGL007878)

GRank & Reasons: G3 (01-01-31). This montane oak-hickory forest is naturally limited to richer sites in the Southern Blue Ridge mountains and adjacent inner Piedmont. Later successional, unaltered occurrences are rare. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba*, other *Quercus* species) and the loss of herbaceous species diversity from the disturbance effects of logging.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Similar vegetation was sampled in the southern portion of the Cades Cove quadrangle, but it was dominated by *Quercus rubra* [see *Quercus rubra - Tilia americana var. heterophylla - Halesia tetraptera var. monticola / Collinsonia canadensis - Tradescantia subaspera* Forest (CEGL007878)].

Global Classif Comments: This association was originally defined based on occurrence information in the North Carolina Blue Ridge. More information is needed to better describe and define this association and its geographic distribution. Additional data on apparent occurrences have been collected in the Chattahoochee and Cherokee national forests.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was documented from low elevations on the North Carolina side of the park, on the Smokemont quadrangle and Bryson City quadrangle.

Global Range: This community occurs in the southern Blue Ridge of the Carolinas, Georgia, and Tennessee in the eastern United States.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 231Ad:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains?); USFS (Chattahoochee, Cherokee, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: M.P. Schafale, SCS **Confidence:** 2 **Identifier:** CEGL007692
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm.

Quercus rubra - Acer rubrum / Calycanthus floridus - Pyrularia pubera / Thelypteris noveboracensis Forest

Northern Red Oak - Red Maple / Sweet-shrub - Buffalo-nut / New York Fern Forest
Appalachian Montane Oak - Hickory Forest (Red Oak Type)
Ecological Group (SCS;MCS): Appalachian Montane Oak-Hickory Forests (410-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes *Quercus rubra* forests at intermediate elevations (mostly below 3500 feet, ranging from 2000-4000 feet) in the Southern Blue Ridge Escarpment, and may possibly range into adjacent areas of the Central Appalachians and Cumberland Plateau. These forests occur on mostly northern to eastern and southeastern, mid to upper, moderately steep slopes of intermediate exposure over acidic soils. The canopy is dominated by *Quercus rubra*, often with *Acer rubrum* and/or *Liriodendron tulipifera* codominating, and occasionally with a high component of *Quercus alba* in the canopy.. Other minor canopy species may include *Betula lenta, Carya alba, Carya glabra, Halesia tetraptera, Quercus prinus*, and *Magnolia fraseri*. The subcanopy and sapling strata include the canopy species, as well as *Halesia tetraptera, Betula lenta, Tsuga canadensis, Cornus florida, Acer pensylvanicum*, and *Oxydendrum arboreum*. The shrub stratum is typically sparse but may have local dominance by *Gaylussacia ursina* or *Rhododendron maximum*. Other typical species in the shrub stratum include *Castanea dentata, Calycanthus floridus, Pyrularia pubera, Rhododendron calendulaceum, Vaccinium corymbosum*, and *Viburnum acerifolium*. Herbaceous cover is sparse to moderate but can be species rich. Ferns can be locally dominant, typically *Thelypteris noveboracensis* and *Athyrium filix-femina ssp. asplenioides*. Other typical species include *Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex aestivalis, Carex debilis, Carex digitalis, Carex laxiflora var. laxiflora, Carex pensylvanica), Chimaphila maculata (= var. maculata), Desmodium nudiflorum, Dioscorea quaternata, Eupatorium purpureum, Galium latifolium, Galax urceolata, Goodyera pubescens, Houstonia purpurea var. purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Medeola virginiana, Polygonatum biflorum, Polystichum acrostichoides, Solidago curtisii (= Solidago caesia var. curtisii)*, and *Uvularia puberula*. Common vines are *Smilax rotundifolia, Smilax glauca*, and *Vitis aestivalis*. This forest is distinguished from High Elevation Red Oak forests [see associations in I.B.2.N.a *Quercus rubra* Montane Forest Alliance (A.272)] by lack of species such as *Betula alleghaniensis, Ilex montana, Vaccinium simulatum*, and by lacking abundant *Hamamelis virginiana*, as well as its occurrence at lower elevations. In the Southern Blue Ridge Escarpment region, these montane oak - hickory forests seem to occupy environments intermediate between more protected forests dominated by *Quercus alba* and drier, more exposed *Quercus prinus* forests.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This forest occurs at intermediate elevations, mostly on northern and western slopes of intermediate to protected exposure. Elevations averaged 2870 feet but ranged from 2170 to 4000 feet.

Global Environment: This association includes *Quercus rubra* forests at intermediate elevations (mostly below 3500 feet, ranging from 2000-4000 feet) in the Southern Blue Ridge Escarpment, and may possibly range into adjacent areas of the Central Appalachians and Cumberland Plateau. These forests occur on mostly northern to eastern and southeastern, mid to upper, moderately steep slopes of intermediate exposure over acidic soils.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This canopy is strongly dominated by *Quercus rubra* and *Acer rubrum*. Occasionally *Liriodendron tulipifera, Quercus prinus*, and *Robinia pseudoacacia* may have high canopy coverage. The subcanopy is dominated by *Acer rubrum, Halesia tetraptera var. monticola*, and *Oxydendrum arboreum*. Other species that may be present in the canopy and subcanopy, but have minor coverage, include *Carya alba, Cornus florida, Magnolia fraseri, Betula lenta*. Shrub coverage is moderate to high and dominated by deciduous species, most often *Gaylussacia ursina*. Other highly constant species in the shrub stratum include *Acer pensylvanicum, Castanea dentata, Calycanthus floridus, Cornus florida, Pyrularia pubera, Halesia tetraptera var. monticola, Magnolia acuminata, Magnolia*

fraseri, Nyssa sylvatica, Prunus serotina, Rhododendron calendulaceum, Rhododendron maximum, Sassafras albidum, Vaccinium corymbosum, and *Viburnum acerifolium*. *Tsuga canadensis* saplings often have moderate coverage in the shrub stratum. Herbaceous cover is sparse to moderate but species rich. Species with the highest coverage and constancy are *Galax urceolata* and *Thelypteris noveboracensis*. Other species with high constancy include *Eurybia divaricata (= Aster divaricatus), Carex* spp. (*Carex aestivalis, Carex debilis, Carex digitalis, Carex laxiflora var. laxiflora, Carex pensylvanica), Chimaphila maculata (= var. maculata), Dioscorea quaternata, Galax urceolata, Goodyera pubescens, Houstonia purpurea var. purpurea, Lysimachia quadrifolia, Medeola virginiana, Polygonatum biflorum, Polystichum acrostichoides, Solidago curtisii (= Solidago caesia var. curtisii), Thelypteris noveboracensis,* and *Uvularia puberula,* but other species may occur. Common vines are *Smilax rotundifolia, Smilax glauca,* and *Vitis aestivalis*.

Global Vegetation: The canopy is dominated by *Quercus rubra,* often with *Acer rubrum* and/or *Liriodendron tulipifera* codominating, and occasionally with a high component of *Quercus alba* in the canopy.. Other minor canopy species may include *Betula lenta, Carya alba, Carya glabra, Halesia tetraptera, Quercus prinus,* and *Magnolia fraseri*. The subcanopy and sapling strata include the canopy species, as well as *Halesia tetraptera, Betula lenta, Tsuga canadensis, Cornus florida, Acer pensylvanicum,* and *Oxydendrum arboreum*. The shrub stratum is typically sparse but may have local dominance by *Gaylussacia ursina* or *Rhododendron maximum*. Other typical species in the shrub stratum include *Castanea dentata, Calycanthus floridus, Pyrularia pubera, Rhododendron calendulaceum, Vaccinium corymbosum,* and *Viburnum acerifolium*. Herbaceous cover is sparse to moderate but can be species rich. Ferns can be locally dominant, typically *Thelypteris noveboracensis* and *Athyrium filix-femina ssp. asplenioides*. Other typical species include *Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex aestivalis, Carex debilis, Carex digitalis, Carex laxiflora var. laxiflora, Carex pensylvanica), Chimaphila maculata (= var. maculata), Desmodium nudiflorum, Dioscorea quaternata, Eupatorium purpureum, Galium latifolium, Galax urceolata, Goodyera pubescens, Houstonia purpurea var. purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Medeola virginiana, Polygonatum biflorum, Polystichum acrostichoides, Solidago curtisii (= Solidago caesia var. curtisii),* and *Uvularia puberula*. Common vines are *Smilax rotundifolia, Smilax glauca,* and *Vitis aestivalis*. This forest is distinguished from High Elevation Red Oak forests [see associations in I.B.2.N.a *Quercus rubra* Montane Forest Alliance (A.272)] by lack of species such as *Betula alleghaniensis, Ilex montana, Vaccinium simulatum,* and by lacking abundant *Hamamelis virginiana*, as well as its occurrence at lower elevations. In the Southern Blue Ridge Escarpment region, these montane oak - hickory forests seem to occupy environments intermediate between more protected forests dominated by *Quercus alba* and drier, more exposed *Quercus prinus* forests.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Quercus rubra*
TREE SUB-CANOPY	*Acer rubrum, Halesia tetraptera var monticola, Oxydendrum arboreum*
SHORT SHRUB	*Gaylussacia ursina*
FORB	*Galax urceolata*
FERN	*Thelypteris noveboracensis*

Global

Stratum	Species
TREE CANOPY	*Acer rubrum, Quercus rubra*
TREE SUB-CANOPY	*Acer rubrum, Calycanthus floridus, Halesia tetraptera var monticola, Oxydendrum arboreum, Pyrularia pubera*
SHORT SHRUB	*Gaylussacia ursina*
FORB	*Galax urceolata*
FERN	*Thelypteris noveboracensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus rubra*
SHRUB	*Acer pensylvanicum, Calycanthus floridus, Pyrularia pubera*

Global

Stratum	Species
TREE CANOPY	*Quercus rubra*
TALL SHRUB	Calycanthus floridus, Pyrularia pubera

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina) Forest (CEGL007230)--contains more than 50% *Quercus alba* in the canopy.
- Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis) Forest (CEGL007300)--is a high-elevation forest.

GRank & Reasons: G4? (00-01-03). This community is uncommon but secure within its range. It is often overlooked in surveys or not recognized as distinct, thus it is much more common than the number of documented occurrences suggests. Resolution of taxonomic issues that distinguish this community from similar associations may lead to a range extension.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Global Classif Comments: This association was originally defined from the Chattooga Basin Project (S. Simon pers. comm.) and later refined with information from the Great Smoky Mountains. Global name and concept may need revision as more information becomes available. This association may be a subset of the more broadly defined *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230) but is distinguished by the dominance of *Quercus rubra*, generally protected topographic setting, and may represent areas formerly dominated by *Quercus rubra* and *Castanea dentata*. This type replaced *Castanea dentata* in Virginia (G. Fleming pers. comm.).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove , Thunderhead Mountain, Bunches Bald, and Mount Le Conte quadrangles. Historic samples are from the Cades Cove quadrangle and Thunderhead Mountain quadrangles, but the community is likely in other areas of the Park. On the Cades Cove quadrangle, recent and historic samples representing this community come from elevations ranging from 2170 to 3820 feet. In the northern portion of the quadrangle, this community was sampled from the east- and west-facing low slopes and draws of Leadbetter Ridge and on low slopes in the vicinity of Boring Ridge and Rabbit Creek Road. In the central portion of the quadrangle, this community was also sampled on the low slopes north of Doe Ridge; above Forge Knob Branch; above Licklog Branch; and on northeast high slopes and ridges of Gregory Ridge. It was also sampled in the southeastern portion of the quadrangle on a west-facing draw above Eagle Creek. On the Mount Le Conte quadrangle this community was sampled from elevation ranging from 2295 to 3260 feet. In the western portion of the quadrangle it was sampled on the high, northwest slope of Piney Mountain and in the vicinity of the Baskins Creek trail. In the southeast, it was sampled on a low slope north of Porters Mountain, above Porter Creek.

Global Range: This association is found in the Southern Blue Ridge Escarpment and may possibly range into adjacent areas of the Central Appalachians and Cumberland Plateau.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?, VA?
TNC Ecoregions: 50:?, 51:C, 59:?
USFS Ecoregions: M221Dc:CCP, M221Dd:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Nantahala, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL006192
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, Nelson 1986, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990, Simon pers. comm.

Quercus rubra - Tilia americana var. heterophylla - Halesia tetraptera var. monticola / Collinsonia canadensis - Tradescantia subaspera Forest

Northern Red Oak - Appalachian Basswood - Mountain Silverbell / Richweed - Zigzag Spiderwort Forest

Southern Appalachian Red Oak Cove Forest

Ecological Group (SCS;MCS): Appalachian Montane Oak-Hickory Forests (410-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community is a *Quercus rubra*-dominated rich forest of protected steep, rocky slopes at intermediate elevations (3000-4000 feet) in the southern Appalachians. It has been described only from Great Smoky Mountains National Park and needs further review. This forest has a canopy dominated by *Quercus rubra* (50-95%) occurring with lesser amounts of *Tilia americana var. heterophylla, Halesia tetraptera var. monticola* or *Acer saccharum*. Occasionally *Liriodendron tulipifera* will have high canopy coverage. Other minor canopy and subcanopy trees include *Magnolia acuminata, Acer pensylvanicum, Acer rubrum, Aesculus flava,* and *Betula lenta*. The shrub stratum is open, made up of saplings from the canopy and subcanopy, with no clear dominant. Herbs are sparse to moderate in coverage, with relatively high species richness. Herbs with the highest coverages are *Thelypteris noveboracensis* and *Collinsonia canadensis*. Other typical herbs are *Actaea pachypoda, Ageratina altissima var. roanensis, Agrostis* spp., *Arisaema triphyllum, Athyrium filix-femina ssp. asplenioides, Caulophyllum thalictroides, Desmodium nudiflorum, Dioscorea quaternata, Galium lanceolatum, Laportea canadensis, Maianthemum racemosum, Phegopteris hexagonoptera, Polygonatum biflorum, Polystichum acrostichoides, Smilax herbacea, Solidago curtisii (= Solidago caesia var. curtisii), Tradescantia subaspera,* and *Viola cucullata*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was sampled from protected steep slopes, with most aspects, at elevations ranging from 3250 to 4000 feet. Sites are moist and often rocky.

Global Environment: This community is found on protected steep, rocky slopes at intermediate elevations (3000-4000 feet) in the southern Appalachians.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a canopy dominated by *Quercus rubra* (50-95%) occurring with lesser amounts of *Tilia americana var. heterophylla, Halesia tetraptera var. monticola*, or *Acer saccharum*. Occasionally *Liriodendron tulipifera* will have high canopy coverage. Other minor canopy and subcanopy trees include *Magnolia acuminata, Acer pensylvanicum, Acer rubrum, Aesculus flava,* and *Betula lenta*. The shrub stratum is open, made up of saplings from the canopy and subcanopy, with no clear dominant. Herbs are sparse to moderate in coverage, with relatively high species richness. Herbs with the highest coverages are *Thelypteris noveboracensis* and *Collinsonia canadensis*. Other typical herbs are *Actaea pachypoda, Ageratina altissima var. roanensis, Agrostis* spp., *Arisaema triphyllum, Athyrium filix-femina ssp. asplenioides, Caulophyllum thalictroides, Desmodium nudiflorum, Dioscorea quaternata, Galium lanceolatum, Laportea canadensis, Maianthemum racemosum, Phegopteris hexagonoptera, Polygonatum biflorum, Polystichum acrostichoides, Smilax herbacea, Solidago curtisii (= Solidago caesia var. curtisii), Tradescantia subaspera*, and *Viola cucullata*.

Global Vegetation: This forest has a canopy dominated by *Quercus rubra* (50-95%) occurring with lesser amounts of *Tilia americana var. heterophylla, Halesia tetraptera var. monticola* or *Acer saccharum*. Occasionally *Liriodendron tulipifera* will have high canopy coverage. Other minor canopy and subcanopy trees include *Magnolia acuminata, Acer pensylvanicum, Acer rubrum, Aesculus flava,* and *Betula lenta*. The shrub stratum is open, made up of saplings from the canopy and subcanopy, with no clear dominant. Herbs are sparse to moderate in coverage, with relatively high species richness. Herbs with the highest coverages are *Thelypteris noveboracensis* and *Collinsonia canadensis*. Other typical herbs are *Actaea pachypoda, Ageratina altissima var. roanensis, Agrostis* spp., *Arisaema triphyllum, Athyrium filix-femina ssp. asplenioides, Caulophyllum thalictroides, Desmodium nudiflorum, Dioscorea quaternata, Galium lanceolatum, Laportea canadensis, Maianthemum racemosum, Phegopteris hexagonoptera, Polygonatum*

biflorum, Polystichum acrostichoides, Smilax herbacea, Solidago curtisii (= Solidago caesia var. curtisii), Tradescantia subaspera, and *Viola cucullata*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus rubra, Tilia americana var heterophylla*
TREE SUB-CANOPY	*Halesia tetraptera var monticola*
FORB	*Collinsonia canadensis*
FERN	*Thelypteris noveboracensis*

Global

Stratum	Species
None	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Halesia tetraptera var monticola, Magnolia acuminata, Quercus rubra, Tilia americana var heterophylla*
FORB	*Caulophyllum thalictroides, Collinsonia canadensis, Disporum lanuginosum, Maianthemum racemosum, Sanguinaria canadensis, Tradescantia subaspera*
FERN	*Phegopteris hexagonoptera, Thelypteris noveboracensis*

Global

Stratum	Species
None	

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata Forest (CEGL007692)
- Liriodendron tulipifera - Aesculus flava - (Fraxinus americana, Tilia americana var. heterophylla) / Actaea racemosa - Laportea canadensis Forest (CEGL007710)
- Quercus rubra - Acer saccharum - Tilia americana var. heterophylla - Aesculus flava - (Cladrastis kentukea) Forest (CEGL007698)

GRank & Reasons: G3? (02-09-03). The conservation status of this community has not yet been fully assessed.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: Samples representing this association occur in AIS polygons 29 and 31 on the Cades Cove quadrangle.

Global Classif Comments: This association may represent a subset of *Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata* Forest (CEGL007692), Appalachian Montane Oak - Hickory Forest (Rich Type), or may be transitional between it and *Liriodendron tulipifera - Aesculus flava - (Fraxinus americana, Tilia americana var. heterophylla) / Actaea racemosa - Laportea canadensis* Forest (CEGL007710), Southern Appalachian Cove Forest (Typic Montane Type). More regional information is needed to assess the distinctiveness of this type. It is described from a small number of samples from Great Smoky Mountains National Park. Classification and alliance placement are provisional. A similar alliance is *Quercus rubra - (Acer saccharum)* Forest Alliance (A.251), but it is not defined for the Southern Blue Ridge.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from the Cades Cove and Bunches Bald quadrangles. On the Cades Cove quadrangle, it was sampled from a north-facing slope of Ledbetter Ridge; from a east-facing high slope of Big Abrams Gap; from west-facing upper slopes of Nuna Ridge; a protected draw east of Powell Knob above Ekaneetlah Creek; and a draw southeast of Doe Knob. On the Bunches Bald quadrangle it was sampled just off of the Hyatt Ridge Trail.

Global Range: This community is found in the southern Appalachians of Tennessee. Its complete distribution has not been determined.

Nations: US
States/Provinces: TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 3 **Identifier:** CEGL007878
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002

Quercus alba / Kalmia latifolia Forest

White Oak / Mountain Laurel Forest
Southern Blue Ridge High-Elevation White Oak Forest
Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Oak Forests (410-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: *Quercus alba*-dominated forests on exposed, rocky ridges and convex upper slopes at high elevations (>3000 feet). The shrub stratum is dominated by *Kalmia latifolia*, occurring as patches or with continuous cover (>25%). In some parts of this forest's range, *Gaylussacia ursina* is dominant in the often dense low-shrub stratum. Herbaceous cover is typical of xeric *Quercus*-and-*Carya*-dominated forests in the area, with *Carex pensylvanica, Chimaphila maculata, Euphorbia corollata, Galax urceolata, Galium latifolium, Goodyera pubescens, Hexastylis shuttleworthii, Iris verna var. smalliana, Medeola virginiana* typical. The shrub/sapling stratum often has a high coverage of *Castanea* stump sprouts and also includes *Castanea pumila, Sassafras albidum, Oxydendrum arboreum*, and *Nyssa sylvatica*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community exists in patches on dry, exposed ridgetops and upper slopes at elevations above 1200 m in the Smokies. The example documented with a plot faced southwest at an elevation of approximately 1500 m.

Global Environment: These *Quercus alba*-dominated forests occur on exposed, rocky ridges and convex upper slopes at high elevations (>3000 feet).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Within the park, this community exists as patches within a matrix of high-elevation *Quercus rubra*-dominated forests. It consists of a canopy of at least 50% *Quercus alba* with a solid shrub layer of *Kalmia latifolia*. In areas where the *Kalmia latifolia* is not thick, *Vaccinium pallidum* often covers the ground. Herbs are sparse, but include *Epigaea repens, Dennstaedtia punctilobula, Stenanthium gramineum*, and *Clintonia umbellulata*. Root sprouts of *Castanea dentata* are still common in this community.

Global Vegetation: These forests are dominated by *Quercus alba* in the canopy. The shrub stratum is dominated by *Kalmia latifolia*, occurring as patches or with continuous cover (>25%). In some parts of this forest's range, *Gaylussacia ursina* is dominant in the often dense low-shrub stratum. Herbaceous cover is typical of xeric *Quercus*-and-*Carya*-dominated forests in the area, with *Carex pensylvanica, Chimaphila maculata, Euphorbia corollata, Galax urceolata, Galium latifolium, Goodyera pubescens, Hexastylis shuttleworthii, Iris verna var. smalliana, Medeola virginiana* typical. The shrub/sapling stratum often has a high coverage of *Castanea* stump sprouts and also includes *Castanea pumila, Sassafras albidum, Oxydendrum arboreum*, and *Nyssa sylvatica*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus alba*
TREE SUB-CANOPY	*Acer rubrum*
SHRUB	*Kalmia latifolia*

Global

Stratum	Species
Same as local	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
SHRUB	*Castanea dentata, Kalmia latifolia*

Global

Stratum	Species
TREE CANOPY	*Quercus alba*
TALL SHRUB	*Castanea dentata, Castanea pumila, Kalmia latifolia*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata Forest (CEGL007299)
- Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis) Forest (CEGL007300)
- Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina) Forest (CEGL007230)

GRank & Reasons: G2Q (99-12-29). This forest is restricted geographically, and if considered distinct, it is naturally rare within its range. It is floristically related to other, more common associations and may be better considered a subassociation of one of these communities.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community is rare within the park; however, this community type is often seen as a component of both *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230) or this and *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299).

Global Classif Comments: These forests are related to oak - hickory forests and may be best considered as a variant of them. Similar associations include *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299), *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300), and *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230). On some sites these forests are transitional to *Quercus rubra*-dominated forests (High Elevation Red Oak Forest).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled in an area along the Cattaloochee Divide near the Purchase (Dellwood quadrangle) and most likely exists as small scattered patches on exposed slopes throughout high-elevation areas of the park.

Global Range: This community occurs in the Southern Blue Ridge of western North Carolina, eastern Tennessee, northwestern South Carolina, and northeastern Georgia.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains?); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007295
REFERENCES (type in full citation below if reference is new): Allard 1990, McCormick and Platt 1980, Newell and Peet 1995, Patterson 1994, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens) Forest

(Rock Chestnut Oak, Scarlet Oak) / Mountain Laurel / (Galax, Wintergreen) Forest
Chestnut Oak Forest (Xeric Ridge Type)
Ecological Group (SCS;MCS): Appalachian Highlands Xeric Oak Forests and Woodlands (401-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community includes xeric ridgetop forests in the Southern Blue Ridge, ranging south and east into the upper Piedmont and north into the Central Appalachians, and possibly west into the Ridge and Valley. This community occurs over shallow, rocky soils, primarily on south- to west-facing slopes and ridgetops. It includes forests with canopies strongly dominated by *Quercus prinus* and/or *Quercus coccinea*, with lesser amounts of *Quercus velutina, Quercus rubra, Quercus falcata, Oxydendrum arboreum, Nyssa sylvatica*, and *Acer rubrum var. rubrum*, occurring over a typically dense shrub stratum dominated by ericaceous species. The shrub layer may vary between evergreen and deciduous dominance. Typical shrub species include *Kalmia latifolia, Rhododendron maximum, Vaccinium stamineum, Vaccinium pallidum, Gaylussacia ursina, Gaylussacia baccata*, and *Leucothoe recurva*. *Castanea dentata* may occur abundantly as root sprouts. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* and *Gaultheria procumbens*. Other common species include *Chamaelirium luteum, Chimaphila maculata, Galax urceolata, Magnolia fraseri, Sassafras albidum, Symplocos tinctoria, Smilax rotundifolia*, and *Smilax glauca*. This community is distinguished by its overall floristic composition, with a high abundance of acid-loving ericaceous species, which are indicative of this community's extremely infertile, acid soils.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found on middle to upper convex slopes and ridges with mostly southern and western aspects. Soils can be deep and well-drained or shallow and rocky. This community typically occurs below 3500 feet elevation but was sampled as high at 3880 feet on a dry ridgeline that was once dominated by pine. At least some occurrences of this community are the result of hardwood succession following fire suppression or pine mortality from Southern pine beetle (*Dendroctonus frontalis*).

Global Environment: This community occurs over shallow, rocky soils, primarily on south- to west-facing slopes and ridgetops. This community includes xeric ridgetop forests in the Southern Blue Ridge, ranging south and east into the upper Piedmont and north into the Central Appalachians, and possibly west into the Ridge and Valley.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy of this forest is dominated by *Quercus prinus, Quercus coccinea*, and *Acer rubrum*, occurring either singly or in various combinations. Other species found in the canopy and subcanopy include *Carya glabra, Cornus florida, Nyssa sylvatica, Oxydendrum arboreum, Pinus rigida, Quercus rubra, Quercus velutina, Quercus falcata*, and *Robinia pseudoacacia*. The dense shrub layer is dominated by the evergreen shrub *Kalmia latifolia* and/or the deciduous shrub *Gaylussacia ursina*. Other common shrubs include *Rhododendron maximum, Castanea dentata, Vaccinium hirsutum, Vaccinium pallidum*, and *Vaccinium stamineum*. Stands with a heavy deciduous shrub layer tend to have greater herb density and diversity, but typically herbs are sparse. Common herbs include *Chimaphila maculata, Epigaea repens, Galax urceolata*, and *Goodyera pubescens.* The vines *Smilax rotundifolia* and *Smilax glauca* are common and abundant.

Global Vegetation: Stands of this association are forests with canopies strongly dominated by *Quercus prinus* and/or *Quercus coccinea*, with lesser amounts of *Quercus velutina, Quercus rubra, Quercus falcata, Oxydendrum arboreum, Nyssa sylvatica*, and *Acer rubrum var. rubrum*, occurring over a typically dense shrub stratum dominated by ericaceous species. The shrub layer may vary between evergreen and deciduous dominance. Typical shrub species include *Kalmia latifolia, Rhododendron maximum, Vaccinium stamineum, Vaccinium pallidum, Gaylussacia ursina, Gaylussacia baccata*, and *Leucothoe recurva*. *Castanea dentata* may occur abundantly as root sprouts. The herb layer is typically sparse and includes

subshrubs such as *Epigaea repens* and *Gaultheria procumbens*. Other common species include *Chamaelirium luteum, Chimaphila maculata, Galax urceolata, Magnolia fraseri, Sassafras albidum, Symplocos tinctoria, Smilax rotundifolia,* and *Smilax glauca*. This community is distinguished by its overall floristic composition, with a high abundance of acid-loving ericaceous species, which are indicative of this community's extremely infertile, acid soils. In the Great Smoky Mountains *Acer rubrum* is often dominant or codominant in these forests, presumably on former American Chestnut (*Castanea dentata*) sites. In the Blue Ridge-Piedmont transition, below 2800 feet elevation, where this community is often associated with *Pinus rigida* forests and woodlands, *Quercus falcata* may be a component of the canopy, and the shrub stratum is strongly dominated by *Vaccinium pallidum*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Quercus coccinea, Quercus prinus*
TREE SUB-CANOPY	*Acer rubrum, Nyssa sylvatica, Oxydendrum arboreum*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Gaylussacia ursina*
FORB	*Galax urceolata*
VINE/LIANA	*Smilax glauca, Smilax rotundifolia*

Global

Stratum	Species
TREE CANOPY	*Quercus coccinea, Quercus prinus*
TREE SUB-CANOPY	*Acer rubrum, Nyssa sylvatica, Oxydendrum arboreum*
TALL SHRUB	*Kalmia latifolia, Vaccinium stamineum*
SHORT SHRUB	*Vaccinium pallidum*
FORB	*Epigaea repens, Galax urceolata, Gaultheria procumbens*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Quercus coccinea, Quercus prinus*
TALL SHRUB	*Gaylussacia ursina, Kalmia latifolia*

Global

Stratum	Species
TREE CANOPY	*Quercus coccinea, Quercus prinus*
TREE SUB-CANOPY	*Acer rubrum, Nyssa sylvatica, Oxydendrum arboreum, Sassafras albidum*
TALL SHRUB	*Kalmia latifolia, Vaccinium stamineum*
SHRUB	*Castanea dentata, Castanea pumila, Gaylussacia baccata, Rhododendron periclymenoides*
SHORT SHRUB	*Vaccinium pallidum*
FORB	*Galax urceolata*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus prinus - Quercus (rubra, velutina) / Gaylussacia baccata Forest (CEGL006282)--defined for the Northern Piedmont, Central Appalachians; occurs on granite monadnocks.
- Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia) Forest (CEGL005023)--broadly defined type for the Appalachian Plateau and Interior Low Plateau.
- Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum Forest (CEGL008431)--defined for the southern Cumberland Plateau and western fringe of the southern Blue Ridge, with more diverse shrubs.
- Quercus prinus - Carya spp. - Quercus velutina / Vaccinium arboreum / Iris verna var. smalliana Forest (CEGL007261)--defined for the lower Piedmont of Alabama and has Coastal Plain affinities.
- Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata Forest (CEGL006286)--is more mesic and has a higher component of *Rhododendron maximum* and relatively little *Kalmia latifolia*.

GRank & Reasons: G5 (97-12-31).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Many examples of this community are on sites formerly dominated by *Pinus rigida* and *Pinus pungens* and may have these species remaining in the canopy and shrub layers. Other examples occur on sites not dry or rocky enough to support *Pinus*-dominated forests. The canopy and shrub dominants of this community can vary greatly from site to site.

This variation is most likely related to a combination of past disturbance regimes and site and soil factors. Stands strongly dominated by *Quercus coccinea* also tended to contain *Pinus rigida* and a dense *Kalmia latifolia* shrub layer. Stands lacking a dense *Kalmia latifolia* shrub layer but rather with a dense deciduous shrub layer also tended to contain high coverage of *Carya glabra* and more herbaceous cover. This community grades downslope into more mesic vegetation such as *Tsuga canadensis* streamside forests and submesic oak forests dominated by *Quercus prinus* and *Quercus rubra*. It grades upslope to more xeric *Pinus*-dominated communities.

Global Classif Comments: In the Great Smoky Mountains *Acer rubrum* is often dominant or codominant in these forests, presumably on former American chestnut (*Castanea dentata*) sites. In the Blue Ridge-Piedmont transition, below 2800 feet elevation, where this community is often associated with *Pinus rigida* forests and woodlands, *Quercus falcata* may be a component of the canopy, and the shrub stratum is strongly dominated by *Vaccinium pallidum*. A similar association defined for the southern Cumberland Plateau, *Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431), occurs over sandstone or other geologies not as acid as the Blue Ridge type and lacks species indicative of the Blue Ridge association, such as *Kalmia latifolia, Gaylussacia ursina, Gaylussacia baccata,* and *Gaultheria procumbens*.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was found on the Gatlinburg, Smokemont, Dellwood, Mount Le Conte, and Cades Cove quadrangles and is widely distributed elsewhere in the Park. On the Cades Cove quadrangle, recent and historic samples representing this community come from elevations ranging from 2240 to 3940 feet, from all areas of the quadrangle. In the northern portion, this community was sampled on the southern slopes of Arbutus Ridge (2240 and 2280 feet); the eastern slopes (3440 feet) and lower northwestern slopes (2840 feet) of Leadbetter Ridge; and north of Leadbetter Ridge on the north slopes above Anthony Creek. In the central portion of the quadrangle, on the low east and west slopes above Forge Creek, west of Mollies Butt (2657 and 2840 feet); the lower and middle west slopes of Doe Ridge (3000 and 3336 feet); northwest slopes below Powell Ridge, the southern upper slopes and ridges in the vicinity of Mollies Ridge and lower slopes west of Mollies Butt (3200 and 2940 feet); on middle slopes at the northern edge of Gregory's Ridge (2700 feet); and on the middle, southern slopes of Big Grill Ridge (3640 feet). In the southeastern part of Cade Cove quadrangle, this community was sampled from the southwest sideridge of Nuna Ridge (3880 feet) and from the southeast slope of Paw Paw Ridge (2620 feet). On the Mount Le Conte quadrangle, this community was sampled at elevations ranging from 1800 to 3250 feet. In the northern portion of the quadrangle, this community was sampled from low ridges and slopes north and east of Grapeyard Ridge (1800 to 2100 feet). In the western part of the quadrangle, it was sampled on the low west-facing slopes above Cherokee Orchard (2560 to 2720 feet) and the west slopes below Scratch Britches (3250 feet). In the east, this community was sampled on east-facing, low slopes above the Little Pigeon River (1880 feet).

Global Range: The center of distribution for this community is the Southern Blue Ridge of southwestern Virginia, western North Carolina, eastern Tennessee, northeastern Georgia and northwestern South Carolina. It ranges south and east into the upper Piedmont and north into the Central Appalachians, and could possibly extend west into the Ridge and Valley and the Cumberlands of Kentucky.

Nations: US
States/Provinces: GA:S?, KY:S?, NC:S?, SC:S?, TN:S?, VA:S?
TNC Ecoregions: 50:C, 51:C, 52:P, 59:C
USFS Ecoregions: 231Ag:CCC, M221Aa:CCC, M221Ab:CCC, M221Bd:CCC, M221Be:CCC, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL006271
REFERENCES (type in full citation below if reference is new): Allard 1990, CAP pers. comm. 1998, Evans 1991, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming et al. 2001, Golden 1974, Major et al. 1999, McLeod 1988, NatureServe Ecology - Southeast U.S. unpubl. data, Nelson 1986, Peet et.al. 2002, Pyne 1994, Rawinski et al. 1996, Schafale 1998b, Schafale and Weakley 1990, Whittaker 1956

Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida Forest

Rock Chestnut Oak - (Northern Red Oak) - Hickory species / Sourwood - Flowering Dogwood Forest

Appalachian Montane Oak Hickory Forest (Chestnut Oak Type)

Ecological Group (SCS;MCS): Appalachian Montane Oak-Hickory Forests (410-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community is known from low to intermediate elevations of the Southern Blue Ridge escarpment and Piedmont transition areas. It occurs on relatively exposed landforms below 3000 feet elevation (1200-2900 feet), on moderately steep to steep, convex, middle to upper slopes and ridges, with mostly northern to southwestern aspects. Canopies are dominated by *Quercus prinus*, with *Acer rubrum* often codominating. Other species that can have significant canopy coverage include *Carya glabra*, *Liriodendron tulipifera*, and *Quercus rubra*. The subcanopy is commonly dominated by *Cornus florida*. Additional canopy and subcanopy species can include *Quercus velutina, Carya alba, Halesia tetraptera var. monticola, Nyssa sylvatica, Robinia pseudoacacia, Magnolia fraseri*, and *Oxydendrum arboreum*. The shrub stratum is sparse with no clear dominant. Some typical shrub species include *Gaylussacia ursina, Hydrangea arborescens, Hydrangea radiata, Kalmia latifolia, Magnolia fraseri, Sassafras albidum*, and, *Vaccinium pallidum*. Common vines are *Smilax rotundifolia, Smilax glauca, Vitis aestivalis, Vitis rotundifolia*, and *Vitis vulpina*. Herb cover is sparse, but diversity and species composition vary among occurrences. Some of the more typical species include *Eurybia divaricata (= Aster divaricatus), Chimaphila maculata, Desmodium nudiflorum, Dichanthelium* spp. (e.g., *Dichanthelium boscii, Dichanthelium commutatum, Dichanthelium dichotomum), Dioscorea quaternata, Galium latifolium, Houstonia purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Polystichum acrostichoides, Prenanthes* spp., *Thalictrum thalictroides, Thelypteris noveboracensis, Uvularia perfoliata, Uvularia puberula, Uvularia sessilifolia*, and *Viola* spp. (e.g., *Viola blanda, Viola hastata, Viola X palmata, Viola tripartita*). Some occurrences may have areas of exposed rock.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This forest occurs at low elevations, on northern, western, and southwestern, middle to upper slopes. Elevations averaged 2084 feet but ranged from 1650 to 2600 feet.

Global Environment:

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy is dominated by *Quercus prinus* and *Acer rubrum*. Other species that can have significant canopy coverage include *Carya glabra* and *Liriodendron tulipifera*. The subcanopy is dominated by *Cornus florida*. Additional canopy and subcanopy species can include *Quercus rubra, Quercus velutina, Carya alba, Halesia tetraptera var. monticola, Nyssa sylvatica, Robinia pseudoacacia*, and *Oxydendrum arboreum*. The shrub stratum is sparse with no clear dominant. Some typical shrub species include *Gaylussacia ursina, Sassafras albidum, Nyssa sylvatica, Oxydendrum arboreum, Cornus florida*, and *Magnolia fraseri. Pinus strobus* and *Tsuga canadensis* saplings are commonly in the shrub stratum. Herbaceous cover is sparse to moderate but species rich. Species with the highest coverage and constancy are *Desmodium nudiflorum, Polystichum acrostichoides*, and *Thelypteris noveboracensis*. Other species with high constancy include *Eurybia divaricata (= Aster divaricatus), Chimaphila maculata, Dichanthelium* spp. (e.g., *Dichanthelium commutatum, Dichanthelium dichotomum), Dioscorea quaternata, Maianthemum racemosum ssp. racemosum, Prenanthes* spp., *Thalictrum thalictroides, Uvularia perfoliata, Uvularia puberula, Uvularia sessilifolia,* and *Viola* spp. (e.g., *Viola blanda, Viola hastata, Viola X palmata, Viola tripartita*), but other species may occur. Common vines are *Smilax rotundifolia, Smilax glauca, Vitis aestivalis*, and *Vitis vulpina*.

Global Vegetation: The canopies of stands of this type are dominated by *Quercus prinus*, with *Acer rubrum* often codominating. Other species that can have significant canopy coverage include *Carya glabra, Liriodendron tulipifera*, and *Quercus rubra*. The subcanopy is commonly dominated by *Cornus florida*. Additional

canopy and subcanopy species can include *Quercus velutina, Carya alba, Halesia tetraptera var. monticola, Nyssa sylvatica, Robinia pseudoacacia, Magnolia fraseri,* and *Oxydendrum arboreum*. The shrub stratum is sparse with no clear dominant. Some typical shrub species include *Gaylussacia ursina, Hydrangea arborescens, Hydrangea radiata, Kalmia latifolia, Magnolia fraseri, Sassafras albidum*, and, *Vaccinium pallidum*. Common vines are *Smilax rotundifolia, Smilax glauca, Vitis aestivalis, Vitis rotundifolia,* and *Vitis vulpina*. Herb cover is sparse, but diversity and species composition vary among occurrences. Some of the more typical species include *Eurybia divaricata (= Aster divaricatus), Chimaphila maculata, Desmodium nudiflorum, Dichanthelium* spp. (e.g., *Dichanthelium boscii, Dichanthelium commutatum, Dichanthelium dichotomum), Dioscorea quaternata, Galium latifolium, Houstonia purpurea, Lysimachia quadrifolia, Maianthemum racemosum ssp. racemosum, Polystichum acrostichoides, Prenanthes* spp., *Thalictrum thalictroides, Thelypteris noveboracensis, Uvularia perfoliata, Uvularia puberula, Uvularia sessilifolia,* and *Viola* spp. (e.g., *Viola blanda, Viola hastata, Viola X palmata, Viola tripartita*).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Carya glabra, Quercus prinus*
TREE SUB-CANOPY	*Cornus florida*
FORB	*Desmodium nudiflorum*
FERN	*Polystichum acrostichoides, Thelypteris noveboracensis*

Global

Stratum	Species
TREE CANOPY	*Quercus prinus, Quercus rubra*
TREE SUB-CANOPY	*Cornus florida, Oxydendrum arboreum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Carya glabra, Quercus prinus, Quercus velutina*
TREE SUB-CANOPY	*Cornus florida*
FORB	*Maianthemum racemosum ssp racemosum, Thalictrum thalictroides*

Global

Stratum	Species
TREE CANOPY	*Quercus prinus, Quercus rubra*
TREE SUB-CANOPY	*Cornus florida, Oxydendrum arboreum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus prinus - Quercus rubra - Carya (glabra, alba) / Gaylussacia baccata Forest (CEGL006057)

GRank & Reasons: G4G5 (97-08-15).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Global Classif Comments: This forest lacks the dense ericaceous shrub layer typical of other *Quercus prinus*-dominated forests in the Blue Ridge escarpment region and commonly has diverse herbaceous composition. It is distinguished from similar forests in the Ridge and Valley by lacking *Acer saccharum* and from Piedmont forests by the lack of *Quercus falcata* and *Quercus stellata*, and by the presence of species more typical of the southern Appalachians (*Magnolia fraseri, Halesia tetraptera*, and *Castanea dentata*). This association was originally defined from the Chattooga Basin Project (S. Simon pers. comm.) and later refined with information from the Great Smoky Mountains. The North Carolina Piedmont examples of this association are only montane transition areas, such as the Sauratown Mountains and Hanging Rock. It may become more widespread in the Piedmont of Virginia.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove, Mount Le Conte, and Bryson City quadrangles. Historic samples also exist for the Calderwood quadrangle, and the community is likely in other areas of the Park. On the Cades Cove quadrangle, recent and historic samples representing this community come from elevations ranging from 2000 to 2600 feet. In the northwestern

portion of the quadrangle, this community was sampled from the southern and western slopes Arbutus Ridge; the northwest slopes of Stony Ridge; a north-facing draw north of Coon Butt; and from a north-facing upper slope of Boring Ridge. It was also sampled from the northwest slopes above Licklog Creek, west of Mollies Butt. This community was sampled from the eastern half of the Mount Le Conte quadrangle, at elevations ranging from 1400 to 2200 feet. Samples representing this community come from the lower east slope of Potato Ridge; north-facing slopes above the lower Little Pigeon River, north of Grapeyard Ridge; and from the southwest-facing sideridge and upper slopes of Copeland Divide.

Global Range: This community occurs in the Southern Blue Ridge and Piedmont transition areas of western North Carolina, eastern Tennessee, northwestern South Carolina, and northeastern Georgia. It may possibly extend into Virginia.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?, VA?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 231Aa:PPP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007267
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, NatureServe Ecology - Southeast U.S. unpubl. data, Nelson 1986, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990, Simon pers. comm.

Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata Forest

Rock Chestnut Oak - Northern Red Oak / Great Rhododendron / Galax Forest
Chestnut Oak Forest (Mesic Slope Heath Type)
Ecological Group (SCS;MCS): Appalachian Montane Oak-Hickory Forests (410-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This montane deciduous forest is known from protected, steep north-facing slopes in the Southern Blue Ridge and ranges into adjacent areas of the upper Piedmont. It is dominated by *Quercus prinus*, usually with lesser amounts of *Quercus rubra* and/or *Acer rubrum*, and always occurring over a dense, very tall shrub stratum (2-6 m) of *Rhododendron maximum*. In some areas *Rhododendron minus* may dominate or *Tsuga canadensis* may have dense understory regeneration. Other common shrubs can include *Gaylussacia ursina* and *Kalmia latifolia*. Herbs are sparse. The ground cover is dominated by leaf litter, but *Galax urceolata* is in most occurrences. Other herb species than can be typical include *Chimaphila maculata, Goodyera pubescens*, and *Polystichum acrostichoides*. Some examples may have sparse (woodland-like) canopies and occur in association with rock outcroppings. This forest is found on moderate to very steep slopes with northerly exposures, on lower slope positions, typically at elevations between 2500 and 4000 feet. In the Great Smoky Mountains it was found consistently as a transitional band of vegetation, downslope from drier *Quercus prinus* ridgetop forests, *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271), and grading into acidic cove forests, *Tsuga canadensis - Liriodendron tulipifera - Betula lenta / Rhododendron maximum* Forest (CEGL007543) on the steep ravines below.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This association was sampled on a steep, north-facing slope at 1780 feet elevation. It occurs throughout the park in small patches on steep, upper, north-facing slopes up to the exposed ridgeline areas and may occur up to 3500 feet.

Global Environment: This is typically a mid-slope to lower slope type, but it can be found on upper slopes in a more sheltered position (M. Schafale pers. comm.).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest is dominated by *Quercus prinus*, with lesser amounts of *Acer rubrum*, occurring over a dense, tall-shrub stratum of *Rhododendron maximum*. Ground cover is dominated by leaf litter, and herbs are scattered about. Typical herbs include *Chimaphila maculata, Galax urceolata, Goodyera pubescens*, and *Polystichum acrostichoides*.

Global Vegetation: The canopy can contain *Betula alleghaniensis (= Betula lutea), Pinus strobus, Quercus alba, Nyssa sylvatica, Magnolia fraseri*, and *Oxydendrum arboreum*. It is intermediate between acidic cove forest and Chestnut Oak (*Quercus prinus*) forest (M. Schafale pers. comm.).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum, Quercus prinus*
TALL SHRUB	*Rhododendron maximum*

Global

Stratum	Species
TREE CANOPY	*Quercus prinus, Quercus rubra*
TALL SHRUB	*Rhododendron maximum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus prinus, Quercus rubra*
TALL SHRUB	*Rhododendron maximum*
FORB	*Galax urceolata*

Global

Stratum	Species
TREE CANOPY	*Quercus prinus, Quercus rubra*
TALL SHRUB	*Rhododendron maximum*
FORB	*Galax urceolata*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens) Forest (CEGL006271)
- Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata Forest (CEGL007299)
- Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida Forest (CEGL007267)

GRank & Reasons: G4 (99-12-21). This community is uncommon, but not rare, throughout most of its range. As currently defined, it is a regional endemic, found only in the Southern Blue Ridge. This community is often overlooked or not distinguished separately in inventories, thus it is more common than the number of documented occurrences suggests.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: This forest can occur downslope from *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271) and can continue downslope into steep ravines. It is unlikely that the signature of this association can be distinguished from other *Quercus prinus*-dominated forests.

Global Classif Comments: This association is more protected and more mesic than *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271). It occurs at lower elevations and on more protected topographic positions than *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299). It is much less diverse than *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267), lacking the diverse herbaceous and woody components found in that association.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association is uncommon and was sampled at only a single location in the northern portion of the Mount Le Conte quadrangle, above Hill Creek. It was observed on the Cades Cove quadrangle in the vicinity of Bunting Branch and in the Cataloochee Valley. It is possible at the appropriate exposure and elevation elsewhere in the park.

Global Range: This community occurs in the Southern Blue Ridge of northeastern Georgia, northwestern South Carolina, north through eastern Tennessee and western North Carolina. Its range extends into the upper Piedmont of North Carolina and possibly into Virginia's Blue Ridge.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?, VA?
TNC Ecoregions: 51:C, 52:C, 59:?
USFS Ecoregions: M221A:C?, M221B:C?, M221C:C?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL006286
REFERENCES (type in full citation below if reference is new): Allard 1990, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Simon pers. comm.

Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata Forest

Northern Red Oak / (Mountain Laurel, Great Rhododendron) / Galax Forest
High-Elevation Red Oak Forest (Evergreen Shrub Type)
Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Oak Forests (410-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This montane community of the southern Appalachians includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical shrub dominants include *Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron maximum*. The herbaceous stratum is not diverse and is typically very sparse with scattered forbs including *Galax urceolata, Solidago curtisii (= Solidago caesia var. curtisii), Epigaea repens, Dennstaedtia punctilobula, Conopholis americana, Thelypteris noveboracensis, Clintonia umbellulata, Eurybia divaricata (= Aster divaricatus), Dioscorea villosa*. This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on ridges and mid to upper slope positions, commonly with southern and southeastern exposures. On exposed sites this community commonly contains, as inclusions, acidic rock outcrop communities and montane shrublands, and may grade into forests dominated by *Tsuga caroliniana, Pinus rigida, Pinus pungens*, and *Quercus prinus*. At higher elevations this forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri*, or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava).*

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was sampled on a flat summit at 4400 feet elevation. The canopy had damage by insects.

Global Environment: This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on ridges and mid- to upper-slope positions, commonly with south and southeast exposures. DeLapp (1978) found that this community type occurs on most slope aspects but was most commonly found on southeast and south exposures. This community occurs over well-drained soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this forest with a mainly evergreen shrub understory are slightly more acidic than *Quercus rubra*-dominated forests with deciduous shrub understories (DeLapp 1978).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community has a rather open canopy dominated by *Quercus rubra*. Other species with minor canopy/subcanopy coverage include *Acer rubrum, Betula alleghaniensis, Hamamelis virginiana, Ilex montana, Oxydendrum arboreum*, and *Prunus serotina*. The tall-shrub stratum is extremely dense and dominated by *Rhododendron maximum* or sometimes *Kalmia latifolia*. Other shrubs include *Rubus canadensis* and *Leucothoe fontanesiana*. Typical species in the sparse herb stratum are *Dryopteris intermedia, Galax urceolata, Carex pensylvanica*, and *Dennstaedtia punctilobula*.

Global Vegetation: Stands of this montane community of the southern Appalachians are dominated by *Quercus rubra* which makes up at least 75% of the tree canopy. Stands typically have greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical shrub dominants include *Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron maximum*. The herbaceous stratum is not diverse and is typically very sparse with scattered forbs including *Galax urceolata, Solidago curtisii (= Solidago caesia var. curtisii), Epigaea repens, Dennstaedtia punctilobula, Conopholis americana, Thelypteris noveboracensis, Clintonia umbellulata, Eurybia divaricata (= Aster divaricatus),* and *Dioscorea villosa*.

Global Dynamics: The canopy is probably rarely removed completely by natural disturbance however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and

south and west facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival are optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum*, and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra*, which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus rubra*
TREE SUB-CANOPY	*Hamamelis virginiana, Ilex montana*
TALL SHRUB	*Rhododendron maximum*
FERN	*Dryopteris intermedia*

Global

Stratum	Species
TREE CANOPY	*Quercus rubra*
TREE SUB-CANOPY	*Acer rubrum, Hamamelis virginiana*
TALL SHRUB	*Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum*
FORB	*Galax urceolata*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus rubra*
TREE SUB-CANOPY	*Hamamelis virginiana, Ilex montana*
TALL SHRUB	*Rhododendron maximum*
FORB	*Galax urceolata*

Global

Stratum	Species
TREE CANOPY	*Quercus rubra*
TREE SUB-CANOPY	*Acer rubrum, Hamamelis virginiana*
TALL SHRUB	*Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum*
SHRUB	*Ilex montana*
FORB	*Galax urceolata*

OTHER NOTEWORTHY SPECIES

Global

Stratum	Species
TREE CANOPY	*Abies fraseri, Aesculus flava*
SHRUB	*Clethra acuminata, Leucothoe recurva, Vaccinium erythrocarpum*
FORB	*Ageratina altissima var roanensis, Euphorbia purpurea, Silene ovata, Solidago curtisii*
FERN	*Botrychium lanceolatum var angustisegmentum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis) Forest (CEGL007300)--has greater than 20% shrub cover but with more than 50% of the shrub cover composed of deciduous species.
- Quercus rubra / Carex pensylvanica - Ageratina altissima var. roanensis Forest (CEGL007298)--has less than 20% shrub cover and a herb stratum dominated by ferns, tall forbs, and sedges.
- Quercus rubra / Rhododendron catawbiense - Rhododendron arborescens Woodland (CEGL004503)--occurs at higher elevations, in more extreme environments, sometimes adjacent to CEGL007299.

GRank & Reasons: G4 (00-01-04). This community is uncommon but not rare. It is secure within its range.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This forest occurs adjacent to north slope forests dominated by *Betula alleghaniensis* and *Fagus grandifolia* . It is unlikely that the signature of this community can be distinguished from other forests in this alliance. In addition, many of the occurrences of this community type are mixtures of three community types: *Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299), *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286), and *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271).

Global Classif Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover. More than 50% of the total shrub cover is evergreen, although deciduous shrubs may be present. Typical evergreen shrub species in this community include *Kalmia latifolia, Rhododendron catawbiense,* and *Rhododendron maximum*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not distinguish *Quercus rubra* at the varietal level, it is likely, given the elevation range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

Similar *Quercus rubra*-dominated forests occur in the southern Appalachian Mountains. Forests with less than 75% *Quercus rubra* in the canopy are classified in other forest alliances. In Georgia this type occurs on the north side of Rabun Bald, where it grades into *Quercus rubra / Rhododendron catawbiense - Rhododendron arborescens* Woodland (CEGL004503) in more extreme areas.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled in the central portion of the Cades Cove quadrangle, on the northeast summit of McCampbell Knob (4400 feet elevation). In addition, it was sampled in the Bunches Bald (off of Balsam Mountain Road) and Dellwood (Cattaloochee Divide) quadrangles in 2002. Occurrences of this type intergrade readily with other high-elevation oak community types.

Global Range: This community occurs on most of the major mountain ranges of the southern Appalachians in North Carolina, Tennessee, and Georgia. This community could possibly range into South Carolina.

Nations: US
States/Provinces: GA:S?, NC:S?, SC?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL007299
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Eyre 1980, Fernald 1950, Golden 1974, Kartesz 1999, McDougal and Parks 1984, McNab and Browning 1993, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Pittillo and Smathers 1979, Pyne 1994, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Stephenson and Adams 1989, USFS 1988, Weakley 1997, Whigham 1969, Whittaker 1956

Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis) Forest

Northern Red Oak / (Mountain Highbush Blueberry, Flame Azalea) / (Hay-scented Fern, New York Fern) Forest

High-Elevation Red Oak Forest (Deciduous Shrub Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Oak Forests (410-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover, which may be continuous to patchy. More than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical shrub dominants include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta*, and *Lyonia ligustrina*. The herbaceous stratum is diverse and is predominantly a mix of sedges, ferns, and tall herbs (*Ageratina altissima var. roanensis, Eurybia divaricata (= Aster divaricatus), Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina ssp. asplenioides, Clintonia umbellulata, Collinsonia canadensis, Conopholis americana, Dennstaedtia punctilobula, Dioscorea villosa, Laportea canadensis, Lysimachia quadrifolia, Medeola virginiana, Monarda fistulosa, Potentilla canadensis, Prenanthes roanensis, Silene stellata, Solidago curtisii (= Solidago caesia var. curtisii), Thelypteris noveboracensis*). Herbaceous dominance varies within and between occurrences. This community occurs on most of the major mountain ranges of the southern Appalachians at elevations of 1070-1525 m (3500-5000 feet) on broad ridges and mid to upper slope positions, commonly with southeastern and southern exposures. At higher elevations this forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri*, or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava).* In some areas, this community is found adjacent to montane shrublands and grasslands. At low elevations, on dry sites, this community may grade into forests dominated by mixed *Quercus* species.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was sampled at elevations from 3500 to 5000 feet, on high slopes, ridges, and summits with northern to southwestern aspects. Most examples showed evidence of disturbance by wind, ice, and Chestnut Blight.

Global Environment: This community occurs at elevations of 1070-1525 m (3500-5000 feet) on broad ridges and mid- to upper-slope positions. DeLapp (1978) found that this community occurs on most slope aspects but was most commonly found on southeast and south exposures. This community occurs over well-drained soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this forest with a mainly deciduous shrub understory are slightly less acidic than *Quercus rubra*-dominated forests with evergreen shrub understories (DeLapp 1978).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy of this forest is strongly dominated by *Quercus rubra*, often gnarled and stunted, particularly on sites affected by wind and ice. Other minor canopy trees include *Quercus alba* and *Acer rubrum*. The subcanopy can be absent or have moderate coverage and commonly includes *Acer rubrum* and *Amelanchier laevis*. The shrub strata are moderate to dense and dominated by deciduous species, commonly *Ilex montana, Rhododendron calendulaceum, Castanea dentata, Rubus canadensis, Vaccinium erythrocarpum*, and *Vaccinium corymbosum*. The well-developed herbaceous stratum is quite diverse and can approach 100% coverage. Fern species (*Dennstaedtia punctilobula, Thelypteris noveboracensis*) are often dominant, but many other species can occur. Some of the other herbaceous species found in this forest include *Ageratina altissima var. roanensis, Agrostis perennans, Agrostis stolonifera, Eurybia divaricata (= Aster divaricatus), Eurybia macrophylla (= Aster macrophyllus), Carex pensylvanica, Clintonia umbellulata, Collinsonia canadensis, Dichanthelium* spp., *Dioscorea quaternata, Eupatorium maculatum, Galium latifolium, Gentianella quinquefolia ssp. quinquefolia, Hieracium paniculatum, Houstonia purpurea var. purpurea, Houstonia serpyllifolia,*

Lysimachia quadrifolia, Maianthemum racemosum, Medeola virginiana, Monarda clinopodia, Prenanthes spp., *Silene stellata, Smilax herbacea, Solidago curtisii (= Solidago caesia var. curtisii),* and *Stenanthium gramineum.*

Global Vegetation: This forest is dominated by *Quercus rubra* with other species making up less than 25% of the canopy cover. Other canopy and subcanopy trees may include *Acer rubrum, Betula alleghaniensis, Betula lenta, Castanea dentata* (root sprouts), *Hamamelis virginiana, Fagus grandifolia, Ilex montana, Acer pensylvanicum, Halesia tetraptera,* and on more exposed sites, *Quercus prinus*. At higher elevations, this community may contain *Picea rubens*. The shrub layer may be continuous to patchy but has at least 20% cover and more than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical shrub dominants include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta,* and *Lyonia ligustrina*. Other shrubs occur with low frequency and may include *Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum*. *Rubus allegheniensis* occurs in disturbed openings and in seeps. The herbaceous stratum is diverse and is predominantly a mix of sedges, ferns, and tall herbs. Herbaceous dominance varies within and among occurrences. Typical herbaceous species include *Ageratina altissima var. roanensis, Eurybia divaricata (= Aster divaricatus), Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina ssp. asplenioides, Clintonia umbellulata, Collinsonia canadensis, Conopholis americana, Dennstaedtia punctilobula, Dioscorea villosa, Laportea canadensis, Lysimachia quadrifolia, Medeola virginiana, Monarda fistulosa, Potentilla canadensis, Prenanthes roanensis, Silene stellata, Solidago curtisii (= Solidago caesia var. curtisii),* and *Thelypteris noveboracensis.*

Global Dynamics: The canopy is probably rarely removed completely by natural disturbance however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival are optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum,* and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra,* which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus rubra*
TREE SUB-CANOPY	*Acer rubrum, Amelanchier laevis*
TALL SHRUB	*Castanea dentata, Ilex montana, Rhododendron calendulaceum, Vaccinium corymbosum*
FERN	*Dennstaedtia punctilobula, Thelypteris noveboracensis*

Global

Stratum	Species
TREE CANOPY	*Quercus rubra*
TREE SUB-CANOPY	*Acer rubrum, Hamamelis virginiana, Ilex montana*
TALL SHRUB	*Rhododendron calendulaceum, Vaccinium simulatum*
SHORT SHRUB	*Rubus canadensis, Vaccinium erythrocarpum, Vaccinium pallidum*
GRAMINOID	*Carex pensylvanica*
FORB	*Ageratina altissima var roanensis*
FERN	*Dennstaedtia punctilobula, Thelypteris noveboracensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus rubra*
SHRUB	*Hamamelis virginiana, Ilex montana, Rhododendron calendulaceum, Vaccinium erythrocarpum*
GRAMINOID	*Carex pensylvanica*
FORB	*Ageratina altissima var roanensis*
FERN	*Dennstaedtia punctilobula, Thelypteris noveboracensis*

Global

Stratum	Species
TREE CANOPY	*Quercus rubra*
TREE SUB-CANOPY	*Acer rubrum, Hamamelis virginiana, Ilex montana*
TALL SHRUB	*Rhododendron calendulaceum, Vaccinium simulatum*
SHORT SHRUB	*Rubus canadensis, Vaccinium erythrocarpum, Vaccinium pallidum*
GRAMINOID	*Carex pensylvanica*
FORB	*Ageratina altissima var roanensis*
FERN	*Dennstaedtia punctilobula, Thelypteris noveboracensis*

OTHER NOTEWORTHY SPECIES

Global

Stratum	Species
TREE CANOPY	*Abies fraseri, Aesculus flava*
SHRUB	*Clethra acuminata, Leucothoe recurva, Rhododendron catawbiense*
FORB	*Euphorbia purpurea, Silene ovata, Solidago curtisii*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata Forest (CEGL007299)--has greater than 20% shrub cover but with more than 50% of the shrub cover composed of evergreen species.
- Quercus rubra / Carex pensylvanica - Ageratina altissima var. roanensis Forest (CEGL007298)--has less than 20% shrub cover and an herb stratum dominated by ferns, tall forbs, and sedges.

GRank & Reasons: G4 (97-12-31). This community is uncommon but not rare. It is secure within its range.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Particularly along the Tennessee / North Carolina stateline on the Cades Cove quadrangle, *Quercus rubra* and *Quercus alba* dominance intergrades and may make delineation of this type difficult. Lower elevation occurrences (below 4500 feet elevation) begin to resemble Typic Acidic Montane Oak - Hickory Forest (*Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina*) Forest (CEGL007230)) in composition, with an increase in coverage of species such as *Acer rubrum, Quercus alba, Cornus florida, Magnolia fraseri, Oxydendrum arboreum, Robinia pseudoacacia, Carya* spp., *Gaylussacia ursina*, and *Vaccinium hirsutum*, and the presence of herbs more indicative of lower elevation forests. It is unlikely that the signature of this community can be distinguished from other forests in the *Quercus rubra* Montane Forest Alliance (A.272).

Global Classif Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with greater than 20% shrub cover. More than 50% of the total shrub cover is deciduous, although evergreen shrubs may be present. Typical deciduous shrub species in this community include *Rhododendron calendulaceum, Vaccinium simulatum, Vaccinium erythrocarpum, Ilex montana, Gaylussacia ursina, Rubus canadensis, Corylus cornuta*, and *Lyonia ligustrina*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations

suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not distinguish *Quercus rubra* at the varietal level, it is likely, given the elevational range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

Similar vegetation may occur in the Cumberland Mountains (Black Mountain, Cumberland Mountain, Kentucky); for more information see Braun 1950 book and Black Mountain paper (Braun 1940). Kentucky occurrences lack *Gaylussacia ursina, Corylus cornuta, Prenanthes roanensis,* and occur at 3500-3800 feet (M. Evans pers. comm.).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove and Bunches Bald quadrangles. On the Cades Cove quadrangle, recent and historic samples representing this community come from elevations ranging from just over 4000 feet to 5000 feet, in the southern portion of the quadrangle. This community was sampled from the summits and convex high slopes Gregory Ridge; the southwest slopes below Gregory Bald; the southeastern high slopes below Moore Spring Camp; the western summit of Pond Knob; and the convex west slopes of Mollies Ridge. In the Bunches Bald area, this community was sampled along Balsam Mountain Road from 3500 to 5000 feet in elevation.

Global Range: This community occurs on most of the major mountain ranges of the southern Appalachians in North Carolina, Tennessee, and Georgia. It may possibly range into Kentucky's Cumberland Mountains and into Virginia and West Virginia.

Nations: US
States/Provinces: GA:S?, KY?, NC:S?, TN:S?, VA?, WV?
TNC Ecoregions: 51:C, 59:?
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL007300
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, Braun 1940, Braun 1950, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Evans, Evans 1991, Evans, M., pers. comm., Eyre 1980, Fernald 1950, Golden 1974, Kartesz 1999, M., McDougal and Parks 1984, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Pyne 1994, Rawinski 1992, Rohrer 1983, Schafale 1998b, Schafale and Weakley 1990, Stephenson and Adams 1989, USFS 1988, Weakley 1997, Whigham 1969, Whittaker 1956, pers. comm.

Quercus rubra / Carex pensylvanica - Ageratina altissima var. roanensis Forest

Northern Red Oak / Pennsylvania Sedge - Appalachian White Snakeroot Forest
High-Elevation Red Oak Forest (Tall Herb Type)
Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Oak Forests (410-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community includes forest vegetation, with a closed to very open canopy, where *Quercus rubra* makes up at least 75% of the tree canopy and with less than 20% shrub cover. Canopy trees may be gnarled and stunted, especially on ridge crests. Other canopy species may include *Acer rubrum, Crataegus punctata, Crataegus flabellata, Betula alleghaniensis, Betula lenta,* and, at high elevations, *Picea rubens.* An open subcanopy contains canopy species plus *Hamamelis virginiana, Amelanchier arborea, Acer pensylvanicum, Halesia tetraptera,* and *Ilex montana*. Herbaceous cover is dense and diverse, composed of sedges, ferns, and tall herbs, with dominance varying within and between occurrences. Typical herbaceous dominants include *Carex pensylvanica, Ageratina altissima var. roanensis, Thelypteris noveboracensis, Dennstaedtia punctilobula, Eurybia chlorolepis (= Aster chlorolepis), Oclemena acuminata (= Aster acuminatus),* and *Laportea canadensis*. This type occurs on most of the major mountain ranges of the southern Appalachians in North Carolina and Tennessee, at elevations over 1400 m (4500 feet) on broad ridges, and on steep rocky slopes at the heads of coves, often with northern or southeastern aspects. This forest often occurs adjacent to or grades into forests dominated by *Picea rubens, Abies fraseri,* or northern hardwood species (*Betula alleghaniensis, Fagus grandifolia, Aesculus flava)*. In some areas, this community is found adjacent to montane shrublands and grasslands. This community is often referred to as a 'Subalpine Oak Orchard Forest.'

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This type was sampled on a steep, south-facing, high slope at an elevation of 4640 feet. The site showed evidence of Chestnut Blight.

Global Environment: This community occurs at elevations over 1400 m (4500 feet) on broad ridges and on steep rocky slopes at the heads of coves, often with north or southeast aspects. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance. This community occurs over well-drained, loamy soils underlain by Precambrian gneisses, schists, and granites. These soils are classified as Typic, Umbric, or Lithic Dystrochrepts, and Typic Haplumbrepts (Golden 1974). Soils supporting this community tend to have relatively high base status.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy of this short-statured forest is strongly dominated by *Quercus rubra*. Other trees that may form a minor portion of the canopy and subcanopy include *Acer rubrum, Halesia tetraptera var. monticola,* and *Prunus serotina*. The shrub stratum is open with scattered shrubs, mostly *Halesia tetraptera var. monticola* and *Ilex montana*. Other species in the shrub stratum include *Acer pensylvanicum, Acer saccharum, Kalmia latifolia, Magnolia fraseri, Prunus serotina, Rubus canadensis, Vaccinium corymbosum,* and *Vaccinium erythrocarpum.* The herbaceous stratum is strongly dominated by *Carex pensylvanica*, which forms a dense carpet. Other herbaceous species include *Angelica triquinata, Eurybia chlorolepis (= Aster chlorolepis), Clintonia umbellulata, Cuscuta rostrata, Dioscorea quaternata, Dryopteris intermedia, Gentianella quinquefolia ssp. quinquefolia, Lilium superbum, Maianthemum racemosum, Medeola virginiana, Mitchella repens, Prenanthes altissima, Smilax herbacea, Solidago curtisii (= Solidago caesia var. curtisii),* and *Thelypteris noveboracensis*.

Global Vegetation: This community includes forest vegetation, with a closed to very open canopy, where *Quercus rubra* makes up at least 75% of the tree canopy and with less than 20% shrub cover. Canopy trees may be gnarled and stunted, especially on ridge crests. Other canopy species may include *Acer rubrum, Crataegus punctata, Crataegus flabellata, Betula alleghaniensis, Betula lenta,* and, at high elevations, *Picea rubens*. An open subcanopy contains canopy species plus *Hamamelis virginiana, Amelanchier arborea, Acer pensylvanicum, Halesia tetraptera,* and *Ilex montana*. Herbaceous cover is dense and diverse, composed of

sedges, ferns, and tall herbs, with dominance varying within and among occurrences. Typical herbaceous dominants include *Carex pensylvanica, Ageratina altissima var. roanensis, Thelypteris noveboracensis, Dennstaedtia punctilobula, Eurybia chlorolepis (= Aster chlorolepis), Oclemena acuminata (= Aster acuminatus)*, and *Laportea canadensis*.

Global Dynamics: The canopy is probably rarely removed completely by natural disturbance; however, small canopy gaps are caused by individual tree death. Occurrences of this community on exposed slopes and south- and west-facing ridges are subject to lightening-caused fires and damage by ice and wind. Damage by ice storms is probably the most common form of natural disturbance.

Quercus rubra reproduction and survival is optimal in canopy gaps with little regeneration under the forest canopy, hence these forests will eventually succeed to forests with mixed canopy composition of *Quercus rubra, Betula alleghaniensis, Acer rubrum*, and *Fagus grandifolia*. Many *Quercus rubra*-dominated stands of today were, prior to the chestnut blight in the 1930s, dominated or codominated by *Castanea dentata* with scattered *Quercus rubra* and *Acer rubrum* in the canopy (Golden 1974). The fungus *Endothia parasitica* eliminated *Castanea dentata* in the upper canopy, subsequently releasing the subcanopy *Quercus rubra*, which eventually resulted in a nearly pure upper canopy of large *Quercus rubra*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus rubra*
TREE SUB-CANOPY	*Acer rubrum*
TALL SHRUB	*Halesia tetraptera var monticola, Ilex montana*
SHORT SHRUB	*Rubus canadensis*
GRAMINOID	*Carex pensylvanica*

Global

Stratum	Species
TREE CANOPY	*Quercus rubra*
GRAMINOID	*Carex pensylvanica*
FORB	*Ageratina altissima var roanensis*
FERN	*Dennstaedtia punctilobula, Thelypteris noveboracensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Quercus rubra*
GRAMINOID	*Carex pensylvanica*
FORB	*Ageratina altissima var roanensis*

Global

Stratum	Species
TREE CANOPY	*Quercus rubra*
GRAMINOID	*Carex pensylvanica*
FORB	*Ageratina altissima var roanensis*
FERN	*Dennstaedtia punctilobula, Thelypteris noveboracensis*

OTHER NOTEWORTHY SPECIES

Global

Stratum	Species
TREE CANOPY	*Abies fraseri, Aesculus flava*
SHRUB	*Clethra acuminata, Leucothoe recurva, Rhododendron catawbiense, Vaccinium erythrocarpum*
FORB	*Euphorbia purpurea, Silene ovata, Solidago curtisii*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus rubra / (Kalmia latifolia, Rhododendron maximum) / Galax urceolata Forest (CEGL007299)--has greater than 20% shrub cover but with more than 50% of the shrub cover composed of evergreen species.
- Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis) Forest (CEGL007300)--has greater than 20% shrub cover but with more than 50% of the shrub cover composed of deciduous species.

GRank & Reasons: G2 (98-04-30). This community is relatively secure within its range, but has a naturally restricted habitat. Red oak decline is affecting occurrences of this community; fire may be needed for stand establishment.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: While one of the samples of this community seems to represent the assigned association, the vegetation on some of the overall ridgelines may be more appropriately mapped as *Quercus rubra / (Vaccinium simulatum, Rhododendron calendulaceum) / (Dennstaedtia punctilobula, Thelypteris noveboracensis)* Forest (CEGL007300) or even as *Quercus rubra* Montane Forest Alliance (A.272), as it is unlikely that the various associations in this alliance will have distinguishable signatures.

Global Classif Comments: This community includes forest vegetation with *Quercus rubra* making up at least 75% of the tree canopy and with less than 20% shrub cover. Herbaceous stratum dominance varies within and between occurrences but is composed of sedges, ferns, and tall herbs. Typical herbaceous dominants include *Carex pensylvanica, Ageratina altissima var. roanensis, Thelypteris novaborensis, Dennstaedtia punctilobula, Eurybia chlorolepis, Oclemena acuminata,* and *Laportea canadensis*.

Two varieties of *Quercus rubra* occur within the range of this community, *Quercus rubra var. ambigua* and *Quercus rubra var. rubra* (Kartesz 1999). Although the two varieties are known to occur together (Rohrer 1983), *Quercus rubra var. ambigua* occurs mostly at elevations greater than 1000 m (3300 feet), while *Quercus rubra var. rubra* occurs at elevations less than 1000 m (3300 feet) (Weakley 1997). The two varieties are based upon morphological differences in the leaves and acorns (Fernald 1950, Coker and Totten 1945); however, studies of foliar flavonoid composition in different *Quercus rubra* populations suggest that varietal distinction may not be warranted (McDougal and Parks 1984). Even though most studies of *Quercus rubra*-dominated vegetation do not distinguish *Quercus rubra* at the varietal level, it is likely, given the elevational range of this community, that the dominant species in this forest is *Quercus rubra var. ambigua*.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from two locations, one in the southwestern portion of the Mount Le Conte quadrangle, on the western ridge of Balsam Point (4640 feet elevation) and the other just off of Balsam Mountain Road (Bunches Bald quadrangle) on the North Carolina side of the park. The community most likely occurs in other areas of the park at the appropriate elevation range.

Global Range:

Nations: US
States/Provinces: NC:S?, TN:S?, VA:S?
TNC Ecoregions: 50:P, 51:C, 59:?
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee?, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, SCS **Confidence:** 1 **Identifier:** CEGL007298
REFERENCES (type in full citation below if reference is new): Allard 1990, CAP pers. comm. 1998, Coker and Totten 1945, DeLapp 1978, Eyre 1980, Fernald 1950, Fleming et al. 2001, Golden 1974, Kartesz 1999, McDougal and Parks 1984, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Pyne 1994, Rohrer 1983, Schafale 1998b, Schafale and Weakley 1990, USFS 1988, Weakley 1980, Weakley 1997, Whittaker 1956

Quercus alba - Quercus coccinea - Quercus falcata / Kalmia latifolia - Vaccinium pallidum Forest

White Oak - Scarlet Oak - Southern Red Oak / Mountain Laurel - Hillside Blueberry Forest
Appalachian Montane Oak - Hickory Forest (Low-Elevation Xeric Type)
Ecological Group (SCS;MCS): Appalachian Montane Oak-Hickory Forests (410-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes dry, deciduous forests of low elevations (below 3000 feet) in the Southern Blue Ridge, associated with sandy, dry soils derived from granitic gneiss and other acid substrates. These forests have canopies dominated by *Quercus alba, Quercus coccinea, Quercus falcata*, and sometimes *Quercus prinus*, although other species can be present, including *Pinus rigida*. This forest is characterized by having associated species more typical of lower, non-montane areas, such as *Quercus falcata, Schizachyrium scoparium, Silphium compositum, Baptisia tinctoria, Piptochaetium avenaceum*, and by the absence of species more typical in mesic, montane oak forests (*Medeola virginiana, Maianthemum racemosum, Thelypteris noveboracensis, Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula, Dryopteris intermedia)*. The shrub stratum can be quite open, with *Rhododendron calendulaceum* typical. *Kalmia latifolia* and *Vaccinium pallidum* are usually present in moderate abundance. *Solidago odora var. odora* and *Pteridium aquilinum var. latiusculum* are typical herb components. This association is known as a matrix forest type in the area of Brevard, North Carolina, where it occurs on open slopes and broad ridges, in a landscape of a low, rolling plateau. It may extend south into South Carolina.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Within the park, this community occurs on the North Carolina side on xeric south- and southwest-facing slopes below 2500 feet.

Global Environment: This association includes dry, deciduous forests of low elevations (below 3000 feet) in the Southern Blue Ridge, associated with sandy, dry soils derived from granitic gneiss. This association is known as a matrix forest type in the area of Brevard, North Carolina, where it occurs on open slopes and broad ridges, in a landscape of a low, rolling plateau.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Canopies are often dominated by a combination of *Quercus alba, Quercus falcata, Quercus rubra*, and *Quercus prinus*, but also sometimes contain high proportions of *Pinus rigida* and *Pinus virginiana* where they may eventually transition to more pine-dominated xeric associations. The herb layer is similar to the global description though *Pteridium aquilinum* is not always present in examples in the Great Smokies.

Global Vegetation: These forests have canopies dominated by *Quercus alba* and *Quercus coccinea* and sometimes *Quercus prinus*, although other species can be present, including *Quercus falcata* and *Pinus rigida*. This forest is characterized by having associated species more typical of lower, non-montane areas, such as *Quercus falcata, Schizachyrium scoparium, Silphium compositum, Baptisia tinctoria, Piptochaetium avenaceum*, and by the absence of species more typical in mesic, montane oak forests (*Medeola virginiana, Maianthemum racemosum, Thelypteris noveboracensis, Athyrium filix-femina ssp. asplenioides, Dennstaedtia punctilobula, Dryopteris intermedia*). The shrub stratum can be quite open, with *Rhododendron calendulaceum* typical. *Solidago odora var. odora* and *Pteridium aquilinum var. latiusculum* are typical herb components.

GRank & Reasons: G2G3 (98-04-30).

CLASSIFICATION COMMENTS

Global Classif Comments: This association was defined based on North Carolina occurrences. More information is needed to better describe this association and define its geographic distribution.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: Examples of this community occur on dry south-facing ridges on the North Carolina side of the park. They are especially common in the vicinity of the Goldmine Loop Trail upslope from Lake Fontana.

Global Range: This association is known as a matrix forest type in the area of Brevard, North Carolina. It may extend south into South Carolina.

Nations: US
States/Provinces: NC:S?, SC?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Nantahala)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007691
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale 1998b

Platanus occidentalis - Fraxinus pennsylvanica - Quercus imbricaria Forest

Sycamore - Green Ash - Shingle Oak Forest

Montane Alluvial Forest (Cades Cove/Oconaluftee)

Ecological Group (SCS;MCS): Appalachian Highlands Montane Riverine Forests and Shrublands (422-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association was described from Cades Cove, a limestone window at 1700 feet elevation in Great Smoky Mountains National Park. The description may need substantial revision with additional information. Similar vegetation could be in Kentucky, Indiana, Illinois, or Missouri. This community occurs on broad flats along streams, within a landscape of pastures and fields. It is impacted by cattle grazing. The forest has a closed canopy dominated by *Platanus occidentalis, Acer negundo var. negundo, Acer rubrum var. trilobum, Liriodendron tulipifera*, and *Quercus imbricaria*. In some areas the canopy is dominated by *Quercus imbricaria* and *Prunus serotina*, and in other areas it may be dominated by *Juglans nigra* or *Juglans cinerea*. The subcanopy stratum is sparse and primarily composed of canopy species. The shrub stratum is sparse. The herb layer includes *Boehmeria cylindrica, Impatiens pallida, Verbesina alternifolia, Phacelia purshii, Packera aurea (= Senecio aureus), Carex intumescens, Iris* spp., and *Carex* spp. This alluvial forest can contain seasonally wet inclusions dominated by *Juncus effusus, Panicum* sp., and *Festuca* sp.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Temporarily Flooded

Great Smoky Mountains National Park Environment: This community occurs on broad flats along streams and may be associated with calcareous geology. It is within a landscape of pastures and fields and was impacted by cattle grazing.

Global Environment: This community occurs on broad flats along streams, within a landscape of pastures and fields. It is impacted by cattle grazing.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a closed canopy dominated by *Platanus occidentalis, Acer negundo var. negundo, Acer rubrum var. trilobum, Liriodendron tulipifera*, and *Quercus imbricaria*. In some areas the canopy is dominated by *Quercus imbricaria* and *Prunus serotina*. The subcanopy stratum is sparse and primarily composed of canopy species. The shrub stratum is sparse. The herb layer includes *Boehmeria cylindrica, Verbesina alternifolia, Phacelia purshii, Packera aurea (= Senecio aureus), Carex intumescens, Iris* spp., and *Carex* spp. This alluvial forest can contain seasonally wet inclusions dominated by *Juncus effusus, Panicum* sp., and *Festuca* sp.

Global Vegetation: The forest has a closed canopy dominated by *Platanus occidentalis, Acer negundo var. negundo, Acer rubrum var. trilobum, Liriodendron tulipifera*, and *Quercus imbricaria*. In some areas the canopy is dominated by *Quercus imbricaria* and *Prunus serotina*. The subcanopy stratum is sparse and primarily composed of canopy species. The shrub stratum is sparse. The herb layer includes *Boehmeria cylindrica, Verbesina alternifolia, Phacelia purshii, Packera aurea (= Senecio aureus), Carex intumescens, Iris* spp., and *Carex* spp. This alluvial forest can contain seasonally wet inclusions dominated by *Juncus effusus, Panicum* sp., and *Festuca* sp.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Platanus occidentalis*
SHRUB	*Lindera benzoin*
FORB	*Hydrophyllum canadense, Impatiens pallida*

Global

Stratum	Species
TREE CANOPY	*Platanus occidentalis*
SHRUB	*Lindera benzoin*
FORB	*Hydrophyllum canadense, Impatiens pallida*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer negundo var negundo, Acer rubrum var trilobum, Platanus occidentalis, Prunus serotina, Quercus imbricaria*
FORB	*Boehmeria cylindrica, Verbesina alternifolia*

Global

Stratum	Species
TREE CANOPY	*Quercus imbricaria*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Juglans cinerea*

GRank & Reasons: G2Q (02-10-24). This community occurs on broad flats along streams, within a landscape of pastures and fields. It has been described from a protected example in Great Smoky Mountains National Park at Cades Cove, a limestone window at 1700 feet elevation and from another protected but impacted example near Cherokee, NC. It is impacted by cattle grazing. It is distinct from montane alluvial forests found at higher elevations and on acid substrates in the Blue Ridge, but may be similar to alluvial vegetation in the Ridge and Valley and farther west. The "Q" on the Grank indicates that there are issues about the taxonomic distinctiveness of this type, and that its merger with another type would make it less rare. Grank was changed from G3G4 to G2G3 to indicate that this community may be more restricted than originally thought. It may be a distinct type restricted to the Southern Blue Ridge region, or it may be sufficiently related to other associations to be merged with more common and widespread types. More information is needed on it and its relationship to similar types.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community is meant to cover some streamside forests within the open fields of Cades Cove and along sections of the Oconaluftee River.

Global Classif Comments: This association was described from Cades Cove, a limestone window at 1700 feet elevation in Great Smoky Mountains National Park. It was also found at the opposite end of the park adjacent to the Oconaluftee River near the Qualla Boundary. This type is distinct from montane alluvial forests found at higher elevations and on acid substrates in the Blue Ridge, but may be similar to alluvial vegetation in the Ridge and Valley and farther west. Presently (2000-12) not attributed to the Ridge and Valley (ECO50).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled along a stretch of Abrams Creek on the Tennessee side of the park (Cades Cove quad) and along a short stretch of the Oconaluftee River (Smokemont quad) on the North Carolina side of the park. These are most likely the only two occurrences of this community known inside the park (and the only two occurrences of this community known at this time in the U.S.).

Global Range: This association may be restricted to the Southern Blue Ridge, but its full range is not known and its relationship to other types is under review.

Nations: US
States/Provinces: KY?, NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 3 **Identifier:** CEGL007339
REFERENCES (type in full citation below if reference is new): Allard 1990, NatureServe Ecology - Southeast U.S. unpubl. Data

Liquidambar styraciflua - Liriodendron tulipifera - (Platanus occidentalis) / Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata Forest

Sweetgum - Tuliptree - (Sycamore) / Ironwood - Mountain Silverbell / Hog-peanut Forest

Montane Sweetgum Alluvial Flat

Ecological Group (SCS;MCS): Appalachian Highlands Montane Riverine Forests and Shrublands (422-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This is a low-elevation montane or submontane alluvial forest which is found on large alluvial flats and high terraces along large rivers (e.g., Little Pigeon River) or on small, disturbed flats along medium-sized perennial streams. It is found at lower elevations in the southern fringes of the Southern Blue Ridge Province, or in the adjacent Piedmont and Southern Ridge and Valley. It often occurs on sites that were formerly cleared for farming or settlement. Soils are typically deep, loamy silts but can have large rocks and cobbles. In the Great Smoky Mountains, the mean elevation of samples is 1680 feet, ranging from 1480-1900 feet. It would be possibly expected at lower elevations as well, especially in the adjacent ecoregions. This forest has an open to closed canopy dominated by *Liquidambar styraciflua* and *Liriodendron tulipifera*, often with *Platanus occidentalis*. It is distinguished from other kinds of Montane Alluvial Forests by the dominance or relatively higher importance of *Liquidambar styraciflua* in its stands, and by its habitat on larger, lower-elevation, riverine situations. *Platanus* is characteristic, but not necessarily dominant in stands of this association. Other minor species that are variably present in the canopy include *Acer rubrum, Aesculus flava, Fraxinus americana, Juglans cinerea, Juglans nigra, Pinus virginiana, Prunus serotina, Robinia pseudoacacia, Tilia americana var. heterophylla,* and *Ulmus americana*. In habitats with a more calcareous influence in the substrate, *Juglans nigra* may have a higher relative importance or even be codominant. The subcanopy is absent to well-developed. Typical dominants are *Carpinus caroliniana, Cornus florida,* and *Acer rubrum*. Other species that can be present in the subcanopy include *Betula alleghaniensis, Betula lenta, Aesculus flava, Tsuga canadensis, Juglans cinerea, Halesia tetraptera (var. monticola, var. tetraptera), Acer pensylvanicum, Acer saccharum, Amelanchier laevis, Oxydendrum arboreum,* and *Prunus serotina*. The shrub stratum is absent to moderately dense. *Rhododendron maximum* and *Tsuga canadensis* are the most common shrubs, although other species can be present, including *Alnus serrulata, Hamamelis virginiana,* and *Lindera benzoin*. Vines can include *Campsis radicans, Menispermum canadense, Parthenocissus quinquefolia, Smilax bona-nox,* and *Toxicodendron radicans*. Herbaceous cover is often absent or sparse, with ground cover dominated by litter and duff. On smaller streams, near open fields or where animal grazing is evident, herbaceous cover can approach 100% cover. Species often present with high coverage include *Amphicarpaea bracteata, Ageratina altissima var. altissima, Dichanthelium boscii, Thelypteris noveboracensis,* and *Toxicodendron radicans ssp. radicans*. Stands found on small, disturbed flats along medium-sized perennial streams may contain patches of *Xanthorhiza simplicissima*. Other common species include *Arisaema triphyllum, Asplenium platyneuron, Eurybia divaricata (= Aster divaricatus), Rudbeckia laciniata, Carex* spp. (e.g., *Carex digitalis, Carex intumescens, Carex laxiflora var. laxiflora, Carex plantaginea, Carex platyphylla, Carex retroflexa, Carex swanii, Carex torta), Dichanthelium* spp. (e.g., *Dichanthelium commutatum, Dichanthelium dichotomum, Dichanthelium sphaerocarpon), Collinsonia canadensis, Elymus virginicus, Houstonia serpyllifolia, Laportea canadensis, Lobelia cardinalis, Mertensia virginica, Mitchella repens, Polystichum acrostichoides, Prenanthes* spp., *Rudbeckia laciniata, Sanicula canadensis, Smallanthus uvedalius, Viola cucullata, Viola sororia,* and *Verbesina alternifolia*. The exotic grass *Microstegium vimineum* may have high cover in some stands.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This forest is found on large alluvial flats and high terraces along large rivers (e.g., Little Pigeon River) or on small, disturbed flats along medium-sized perennial streams. This community often occurs on sites that were formerly cleared for farming or settlement. Soils are typically deep, loamy silts but can have large rocks and cobbles. The mean elevation of samples is 1680 feet, ranging from 1480 to 1900 feet.

Global Environment: This forest was defined from Great Smoky Mountains National Park, Tennessee, where it is found on large alluvial flats and high terraces along large rivers (e.g., Little Pigeon River) or on small,

disturbed flats along medium-sized perennial streams. It often occurs on sites that were formerly cleared for farming or settlement. Soils are typically deep, loamy silts but can have large rocks and cobbles. The mean elevation of samples is 1680 feet, ranging from 1480-1900 feet.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has an open to closed canopy dominated by *Liquidambar styraciflua* and *Liriodendron tulipifera,* often with *Platanus occidentalis*. Other minor species that are variably present in the canopy include *Acer rubrum, Fraxinus americana, Juglans nigra, Pinus virginiana, Prunus serotina, Robinia pseudoacacia, Tilia americana var. heterophylla,* and *Ulmus americana*. The subcanopy is absent to well-developed. Typical dominants are *Carpinus caroliniana, Cornus florida,* and *Acer rubrum.* Other species that can be present in the subcanopy include *Betula alleghaniensis, Betula lenta, Tsuga canadensis, Juglans cinerea, Halesia tetraptera var. monticola, Acer pensylvanicum, Acer saccharum, Amelanchier laevis, Oxydendrum arboreum,* and *Prunus serotina*. The shrub stratum is absent to moderately dense. *Rhododendron maximum* and *Tsuga canadensis* are the most common shrubs, although other species can be present. Herbaceous cover is often absent or sparse, with ground cover dominated by litter and duff. On smaller streams, near open fields or where animal grazing is evident, herbaceous cover can approach 100% cover. Species often present with high coverage include *Amphicarpaea bracteata, Dichanthelium boscii, Microstegium vimineum, Thelypteris noveboracensis,* and *Toxicodendron radicans ssp. radicans*. Other common species include *Arisaema triphyllum, Asplenium platyneuron, Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex digitalis, Carex intumescens, Carex laxiflora var. laxiflora, Carex plantaginea, Carex platyphylla, Carex retroflexa, Carex swanii, Carex torta), Dichanthelium* spp. (e.g., *Dichanthelium commutatum, Dichanthelium dichotomum, Dichanthelium sphaerocarpon), Houstonia serpyllifolia, Laportea canadensis, Mitchella repens, Parthenocissus quinquefolia, Polystichum acrostichoides, Prenanthes* spp., *Sanicula canadensis*, and *Verbesina alternifolia*.

Global Vegetation: This forest has an open to closed canopy dominated by *Liquidambar styraciflua* and *Liriodendron tulipifera,* often with *Platanus occidentalis*. Other minor species that are variably present in the canopy include *Acer rubrum, Fraxinus americana, Juglans nigra, Pinus virginiana, Prunus serotina, Robinia pseudoacacia, Tilia americana var. heterophylla,* and *Ulmus americana*. In habitats with a more calcareous influence in the substrate, *Juglans nigra* may have a higher relative importance or even be codominant. The subcanopy is absent to well-developed. Typical dominants are *Carpinus caroliniana, Cornus florida,* and *Acer rubrum.* Other species that can be present in the subcanopy include *Betula alleghaniensis, Betula lenta, Tsuga canadensis, Juglans cinerea, Halesia tetraptera var. monticola, Acer pensylvanicum, Acer saccharum, Amelanchier laevis, Oxydendrum arboreum,* and *Prunus serotina*. The shrub stratum is absent to moderately dense. *Rhododendron maximum* and *Tsuga canadensis* are the most common shrubs, although other species can be present. Herbaceous cover is often absent or sparse, with ground cover dominated by litter and duff. On smaller streams, near open fields or where animal grazing is evident, herbaceous cover can approach 100% cover. Species often present with high coverage include *Amphicarpaea bracteata, Dichanthelium boscii, Microstegium vimineum, Thelypteris noveboracensis,* and *Toxicodendron radicans ssp. radicans*. Other common species include *Arisaema triphyllum, Asplenium platyneuron, Eurybia divaricata (= Aster divaricatus), Carex* spp. (e.g., *Carex digitalis, Carex intumescens, Carex laxiflora var. laxiflora, Carex plantaginea, Carex platyphylla, Carex retroflexa, Carex swanii, Carex torta), Dichanthelium* spp. (e.g., *Dichanthelium commutatum, Dichanthelium dichotomum, Dichanthelium sphaerocarpon), Houstonia serpyllifolia, Laportea canadensis, Mitchella repens, Parthenocissus quinquefolia, Polystichum acrostichoides, Prenanthes* spp., *Sanicula canadensis*, and *Verbesina alternifolia*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*
TREE SUB-CANOPY	*Carpinus caroliniana, Cornus florida*

Global

Stratum	Species
Same as local	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*
TREE SUB-CANOPY	*Carpinus caroliniana, Cornus florida, Halesia tetraptera var monticola, Juglans cinerea, Tsuga canadensis*
TALL SHRUB	*Ilex opaca, Rhododendron maximum*
GRAMINOID	*Microstegium vimineum*
FORB	*Amphicarpaea bracteata*
VINE/LIANA	*Toxicodendron radicans ssp radicans*

Global

Stratum	Species
Similar to global	

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana Forest (CEGL004691)

GRank & Reasons: G? (99-03-22). The conservation status of this community has not yet been assessed.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Given the taxonomic uncertainty of this association, consideration should be given to mapping this vegetation at the Alliance level.

Global Classif Comments: This type is distinguished from other kinds of Montane Alluvial Forests by the dominance or relatively higher importance of *Liquidambar styraciflua* in its stands, and by its habitat on larger, lower elevation, riverine situations. Natural forests strongly dominated by *Liquidambar styraciflua* are uncommon in Southern Blue Ridge landscapes, thus this forest may represent a community that is more common at lower elevations in the southern fringes of the Southern Blue Ridge Province, or in the adjacent Piedmont and Southern Ridge and Valley. Information from a larger geographic range is needed to fully distinguish this association from related types. A similar alliance is the I.B.2.N.d *Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum)* Temporarily Flooded Forest Alliance (A.287), but it is currently not defined for the Southern Blue Ridge. In Great Smoky Mountains National Park, Tennessee, this vegetation is found on the Little Pigeon River. A stand in Linville Gorge, now placed here (Newell and Peet 1997) is referred to as a "large high alluvial flat" in which *Liquidambar styraciflua* shares dominance. This association was initially defined from disturbed floodplains in Great Smoky Mountains National Park and is related to the more broadly defined *Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691), Montane Alluvial Forest.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: Sweetgum-dominated alluvial forests were sampled from the Cades Cove, Gatlinburg, and Mount Le Conte quadrangles and are likely in other areas of the Park. They were sampled from the northern portion of the Mount Le Conte quadrangle, on the floodplain of the Little Pigeon River, northeast of the Greenbrier Campground and also near the confluence with Ted's Branch; on the Lower Little Pigeon River, near the northern Park boundary; and on the broad floodplain of Dud's Branch, near Dudley Creek. On the Cades Cove quadrangle this community was sampled in the northern half of the quadrangle, off the Cades Cove Loop Road, in the vicinity of Mills Creek and Abrams Creek and along Rowans Branch; and just south of the Loop Road, in the vicinity of Mill Creek and Forge Creek Road.

Global Range: This community was defined from the western fringe of the Southern Blue Ridge, but is also found at lower elevations in the southern fringes of the Southern Blue Ridge Province, and probably in the adjacent Piedmont and Southern Ridge and Valley.

Nations: US
States/Provinces: GA:S?, NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 3 **Identifier:** CEGL007880
REFERENCES (type in full citation below if reference is new): Allard 1990, NatureServe Ecology - Southeast U.S. unpubl. data, Newell and Peet 1995, Patterson et al. 1999, Peet et al. 2002

Platanus occidentalis - Liriodendron tulipifera - Betula (alleghaniensis, lenta) / Alnus serrulata - Leucothoe fontanesiana Forest

Sycamore - Tuliptree - (Yellow Birch, Sweet Birch) / Smooth Alder - Mountain Doghobble Forest

Appalachian Montane Alluvial Forest

Ecological Group (SCS;MCS): Appalachian Highlands Montane Riverine Forests and Shrublands (422-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association covers alluvial forests of Southern Blue Ridge and nearby portions of the inner Piedmont. This type is associated with narrow, rocky floodplains and islands in medium-sized rivers, typically at elevations below 3000 feet. It is more frequent below 2000 feet. Canopy composition of stands is variable but typical dominants are *Platanus occidentalis, Liriodendron tulipifera, Fraxinus americana, Betula alleghaniensis*, and *Betula lenta*. *Platanus* is characteristic, but not necessarily dominant in stands of this association. Other canopy/subcanopy trees can include *Carpinus caroliniana, Betula nigra, Acer rubrum, Pinus virginiana, Pinus strobus*, and *Tsuga canadensis*. In contrast to montane alluvial forests on the margins of the Southern Blue Ridge or on larger rivers, *Liquidambar styraciflua* is rare to absent in this type. The shrub stratum can be dense, often with local dominance by *Leucothoe fontanesiana* or *Rhododendron maximum*. Other characteristic shrubs include *Alnus serrulata, Xanthorhiza simplicissima, Corylus americana, Cornus amomum, Hamamelis virginiana, Euonymus americana,* and *Hydrangea arborescens*. Vines can be prominent including *Aristolochia macrophylla, Parthenocissus quinquefolia, Smilax glauca, Smilax rotundifolia,* and *Vitis aestivalis*. Herbaceous species composition varies from site to site, and herbaceous strata can be quite patchy on the rocky substrate. Characteristic species known from these forests include *Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Anemone quinquefolia, Athyrium filix-femina, Claytonia virginica, Erythronium americanum, Medeola virginiana, Packera aurea, Stellaria pubera, Tiarella cordifolia,* and *Viola blanda*. *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex digitalis, Carex plantaginea, Carex swanii, Carex torta*). Examples are known from the Nantahala Gorge, Slickrock Creek, the South Toe River, and the Black and Craggy Mountains.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Great Smoky Mountains National Park Environment: This community type is common along medium to large streams, especially sections of streams that are flat or only gently sloping. Although the global description constrains the community to "medium-sized rivers," this community may occur in medium and large high-energy streams as they spill down towards larger rivers.

Global Environment: This association covers alluvial forests of Southern Blue Ridge and nearby portions of the inner Piedmont. This type is associated with narrow, rocky floodplains and islands in medium-sized rivers, typically at elevations below 3000 feet. It is more frequent below 2000 feet. Examples are known from the Nantahala Gorge, Slickrock Creek (Newell et al. 1997), Great Smoky Mountains, the South Toe River, the Black and Craggy Mountains (McLeod and Ulrey unpubl. data), and the Chattahoochee National Forest of Georgia.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Stands within the Smokies typically contain *Platanus occidentalis,* but not usually as the dominant. Often, dominance is shared between *Liriodendron tulipifera, Betula lenta, Betula alleghaniensis, Platanus occidentalis,* and *Tsuga canadensis*. The shrub stratum is usually dominated by either a monoculture of *Rhododendron maximum* or *Leucothoe fontanesiana* or a combination of various medium and low shrubs including the ones just mentioned and *Xanthorhiza simplicissima* and even sometimes *Kalmia latifolia*. The herb layer is only developed in patches of no shrubs.

Global Vegetation: Canopy composition of stands is variable but typical dominants are *Platanus occidentalis, Liriodendron tulipifera, Fraxinus americana, Betula alleghaniensis*, and *Betula lenta*. *Platanus* is characteristic, but not necessarily dominant in stands of this association. Other canopy/subcanopy trees can

include *Carpinus caroliniana, Betula nigra, Acer rubrum, Pinus virginiana, Pinus strobus,* and *Tsuga canadensis*. In contrast to montane alluvial forests on the margins of the Southern Blue Ridge or on larger rivers, *Liquidambar styraciflua* is rare to absent in this type. The shrub stratum can be dense, often with local dominance by *Leucothoe fontanesiana* or *Rhododendron maximum*. Other characteristic shrubs include *Alnus serrulata, Xanthorhiza simplicissima, Corylus americana, Cornus amomum, Hamamelis virginiana, Euonymus americana*, and *Hydrangea arborescens*. Vines can be prominent including *Aristolochia macrophylla, Parthenocissus quinquefolia, Smilax glauca, Smilax rotundifolia,* and *Vitis aestivalis*. Herbaceous species composition varies from site to site, and herbaceous strata can be quite patchy on the rocky substrate. Characteristic species known from these forests include *Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Anemone quinquefolia, Athyrium filix-femina, Claytonia virginica, Erythronium americanum, Medeola virginiana, Packera aurea, Stellaria pubera, Tiarella cordifolia,* and *Viola blanda*. In addition, *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex digitalis, Carex plantaginea, Carex swanii, Carex torta*).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Liriodendron tulipifera*
SHRUB	*Rhododendron maximum, Xanthorhiza simplicissima*

Global

Stratum	Species
Same as local	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Platanus occidentalis*
SHRUB	*Leucothoe fontanesiana*

Global

Stratum	Species
TREE CANOPY	*Betula alleghaniensis, Betula lenta, Fraxinus americana, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*
TREE SUB-CANOPY	*Betula nigra, Carpinus caroliniana, Tsuga canadensis*
SHRUB	*Alnus serrulata, Leucothoe fontanesiana, Rhododendron maximum, Xanthorhiza simplicissima*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Liquidambar styraciflua - Liriodendron tulipifera - (Platanus occidentalis) / Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata Forest (CEGL007880)--with at least partial dominance by *Liquidambar styraciflua*.

GRank & Reasons: G2? (99-02-23). This community is naturally uncommon in the Southern Blue Ridge. Well-developed examples are rare due to clearing for agriculture and development. This community is threatened by road building and other disturbances causing hydrologic alteration.

CLASSIFICATION COMMENTS

Global Classif Comments: This alluvial forest type is less common in the Southern Blue Ridge than alluvial forests dominated by *Tsuga canadensis*, which are found in areas with better-developed soils and less frequent flooding than the I.A.8.N.e *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest Alliance (A.171).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove, Bryson City, and Smokemont quadrangles and likely exists along large stream corridors throughout th epark.

Global Range: This community is found in the Southern Blue Ridge of western North Carolina, northern South Carolina, and eastern Tennessee. It likely extends into Georgia.

Nations: US

States/Provinces: GA?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains?); USFS (Chattahoochee?, Cherokee?, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004691
REFERENCES (type in full citation below if reference is new): Allard 1990, McLeod 1988, NatureServe Ecology - Southeast U.S. unpubl. data, Newell and Peet 1995, Newell et al. 1997, Peet et al. 2002, Pittillo and Smathers 1979, Schafale 1998a, Schafale and Weakley 1990

Acer rubrum var. trilobum - Fraxinus pennsylvanica / Carex crinita - Peltandra virginica Forest

Carolina Red Maple - Green Ash / Fringed Sedge - Green Arrow-arum Forest
Montane Floodplain Slough Forest
Ecological Group (SCS;MCS): Appalachian Highlands Montane Riverine Forests and Shrublands (422-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs in floodplain depressions in the Blue Ridge of North Carolina. Some characteristic and often dominant canopy and subcanopy species include *Acer rubrum var. trilobum* and *Fraxinus pennsylvanica*. *Peltandra virginica* is prominent in the herbaceous layer. Other herbaceous species include *Carex crinita var. brevicrinis, Sparganium americanum, Leersia oryzoides, Cornus amomum (= ssp. amomum), Carex lupulina, Juncus effusus, Onoclea sensibilis,* and the aliens *Murdannia keisak* and *Microstegium vimineum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Great Smoky Mountains National Park Environment: The example of this community within the park was most likely an old farm field at one time that has now reverted to an early version of what it once may have been. The area is relatively flat but does contain numerous depressions and areas of higher land that create opportunities for both wetland species and upland species to be present.

Global Environment: This community occurs in floodplain depressions in the Blue Ridge of North Carolina.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Within the park, there is most likely only one occurrence of this community. The canopy trees are *Acer rubrum var. trilobum* and *Fraxinus* spp. with scattered individuals of *Liriodendron tulipifera, Pinus rigida,* and *Pinus strobus*. There is no shrub layer. The herb layer is dominated by *Microstegium vimineum*, but also contains a large amount of *Boehmeria cylindrica, Carex crinita, Carex squarrosa, Gratiola* spp., and other forest wetland species.

Global Vegetation: Some characteristic and often dominant canopy and subcanopy species include *Acer rubrum var. trilobum* and *Fraxinus pennsylvanica*. *Peltandra virginica* is prominent in the herbaceous layer. Other herbaceous species include *Carex crinita var. brevicrinis, Sparganium americanum, Leersia oryzoides, Cornus amomum (= ssp. amomum), Carex lupulina, Juncus effusus, Onoclea sensibilis,* and the aliens *Murdannia keisak* and *Microstegium vimineum*.

GRank & Reasons: G1 (01-01-31). This floodplain depression forest occurs in very limited sites in the floodplains of Blue Ridge rivers. It is naturally very limited in extent. Many examples have been destroyed by alteration of floodplains, and all remaining examples have been altered by timber harvest, hydrologic alteration, and exotic species.

CLASSIFICATION COMMENTS

Global Classif Comments: Known from alluvial depressions along the Little Tennessee River, probably more widespread (though certainly not common). Data are available from the North Carolina Vegetation Survey.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community type is most likely only represented in one location within the park, an area within the floodplain of Abrams Creek in the Cades Cove quadrangle.

Global Range: This community occurs in the Blue Ridge of North Carolina.

Nations: US

States/Provinces: NC:S?

TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Authors: SCS **Confidence:** 2 **Identifier:** CEGL004420

REFERENCES (type in full citation below if reference is new): Allard 1990, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale 1998a, Schafale and Weakley 1990

Liquidambar styraciflua - Acer rubrum / Carex spp. - Sphagnum spp. Forest

Sweetgum - Red Maple / Sedge species - Peatmoss species Forest

Upland Sweetgum - Red Maple Pond

Ecological Group (SCS;MCS): Appalachian Highlands Wooded Depression Ponds (458-15; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association is designed to accommodate a variety of isolated, poorly understood seasonally flooded forests of upland depressions in the Southern Blue Ridge and the adjacent and submontane Piedmont. This includes an example in Cades Cove in the Great Smokies National Park, an example in the Piedmont portion of the Chattahoochee National Forest (Georgia), the Bankhead National Forest (Alabama), and possibly the Uwharrie National Forest (North Carolina). Stands assigned to this concept are dominated by some combination of *Liquidambar styraciflua* and/or *Acer rubrum*, possibly with *Nyssa sylvatica* and/or *Liriodendron tulipifera*. Some shrubs that may be found include *Cornus amomum, Cornus foemina*, and *Alnus serrulata*. Some woody vines which are possible components include *Berchemia scandens, Decumaria barbara*, and *Smilax laurifolia*. Herbs (which may be abundant to sparse) include *Carex intumescens, Carex* spp., *Chasmanthium sessiliflorum, Dichanthelium dichotomum var. dichotomum, Dichanthelium* spp., *Leersia* spp., *Rhynchospora capitellata, Mitchella repens*, and *Arisaema triphyllum*. Some sites may have ground layers dominated by vascular plants (especially graminoids), others dominated by *Sphagnum* spp. One of the *Sphagnum* species associated with these forests may be a disjunct Coastal Plain species, *Sphagnum cuspidatum var. floridanum*. The variable composition of stands assigned here and the lack of understanding of the dynamics of this type (successional trends, disturbance, hydrology) mean that the type is somewhat poorly defined. More information is needed.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Great Smoky Mountains National Park Environment: This is a palustrine, seasonally flooded forest in an upland depression. Water is ponded about one meter deep during the wettest part of the year and below the surface in the summer months. The vegetation is heavily browsed by deer.

Global Environment: Stands assigned to this association occur in a variety of upland depressions in the Southern Blue Ridge and Piedmont.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy (15-35 m) is strongly dominated by *Liquidambar styraciflua* but with occasional *Acer rubrum var. trilobum* and *Nyssa sylvatica*. There is essentially no shrub cover, but *Rhododendron maximum* is present. During the summer, when the pond is dry, ground cover is dominated by leaf litter, and herb cover is restricted to fallen logs and tip-up mounds. Herb density and composition probably vary from year to year. Herb species include *Chasmanthium laxum, Dennstaedtia punctilobula, Microstegium vimineum*, and *Juncus effusus*. Scattered mosses include *Sphagnum* spp., *Polytrichum commune, Atrichum* spp., *Hypnum* spp., and *Thuidium* spp.

Global Vegetation: Stands assigned to this concept are dominated by some combination of *Liquidambar styraciflua* and/or *Acer rubrum*, possibly with *Nyssa sylvatica* and/or *Liriodendron tulipifera*. Some shrubs that may be found include *Cornus amomum, Cornus foemina*, and *Alnus serrulata*. Some woody vines which are possible components include *Berchemia scandens, Decumaria barbara*, and *Smilax laurifolia*. Herbs (which may be abundant to sparse) include *Carex intumescens, Carex* spp., *Chasmanthium sessiliflorum, Dichanthelium dichotomum var. dichotomum, Dichanthelium* spp., *Leersia* spp., *Rhynchospora capitellata, Mitchella repens*, and *Arisaema triphyllum*. Some sites may have ground layers dominated by vascular plants (especially graminoids), others dominated by *Sphagnum* spp. One of the *Sphagnum* species associated with these forests may be a disjunct Coastal Plain species, *Sphagnum cuspidatum var. floridanum*.

Global Dynamics: The variable composition of stands assigned here, and the lack of understanding of the dynamics of this type (successional trends, disturbance, hydrology) mean that the type is somewhat poorly defined. More information is needed.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Liquidambar styraciflua*
GRAMINOID	*Chasmanthium laxum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer rubrum var trilobum, Liquidambar styraciflua*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
GROUND	*Sphagnum* spp. are dominant and diagnostic.

GRank & Reasons: G2Q (01-03-29). There is an incomplete understanding of the ecological limits and acceptable variability of this association concept. It was originally based on only one site, but additional stands from several states have been assigned here. The variable composition of stands assigned here and the lack of understanding of the dynamics of this type (successional trends, disturbance, hydrology) mean that the type is somewhat poorly defined. More information is needed.

CLASSIFICATION COMMENTS

Global Classif Comments: This association concept was originally based on one site in Cades Cove (Gum Swamp) at 1750 feet elevation. The area is heavily browsed by deer. A similar site upslope has *Acer rubrum (var. trilobum?)* occurring with *Liquidambar styraciflua*. One of the *Sphagnum* species associated with these forests may be a disjunct Coastal Plain species, *Sphagnum cuspidatum var. floridanum* (B. Dellinger pers. comm.). Examples may also occur at Uwharrie National Forest and in Duke Forest (both North Carolina Piedmont). The naturalness of vegetation at these Piedmont locations is unclear (M. Schafale pers. comm. 2001); this may represent a degraded form of *Quercus phellos / Carex (albolutescens, intumescens, joorii) - Chasmanthium sessiliflorum / Sphagnum lescurii* Forest (CEGL007403). This association (with an expanded and generalized concept) is being utilized for a sample from the Chattahoochee National Forest (Georgia Piedmont). Data are also available from the Bankhead National Forest (Work Center Gum Pond).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from Gum Swamp, along the Cades Cove Loop Road, on the Codes Cove quadrangle and is most likely the only occurrence of this type within the park.

Global Range: The full range of this association is unknown, but it is thought to occur in the Piedmont, Southern Blue Ridge, and Cumberland Plateau of Alabama, Georgia, North Carolina, and Tennessee.

Nations: US
States/Provinces: AL:S?, GA:S?, NC:S?, TN:S?
TNC Ecoregions: 50:C, 51:C, 52:C
USFS Ecoregions: 231Ad:CCC, 231Af:CCC, 231Cd:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Bankhead, Chattahoochee, Uwharrie)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: M. Pyne, SCS **Confidence:** 3 **Identifier:** CEGL007388
REFERENCES (type in full citation below if reference is new): Dellinger pers. comm., NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002

Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense) Forest

Red Spruce - (Yellow Birch, Yellow Buckeye) / (Great Rhododendron, Catawba Rhododendron) Forest

Red Spruce - Northern Hardwood Forest (Shrub Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Spruce-Fir Forests (410-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association occurs in the broad elevational transition zone between spruce-fir and northern hardwoods in the Southern Blue Ridge (approx. 4600-5100 feet). Sites are steep to very steep, slopes often associated with cliff faces, rock outcroppings, or bouldery situations, and subject to disturbance by wind, ice, and landslides. The canopy is comprised of *Picea rubens* codominating with deciduous species *Betula alleghaniensis, Fagus grandifolia*, and *Aesculus flava*, occurring singly or in combination. At higher elevations, *Abies fraseri* may be a minor canopy component. The shrub layer is well-developed and dominated by *Rhododendron maximum* or *Rhododendron catawbiense*. In the Great Smoky Mountains, *Leucothoe fontanesiana* can be the dominant shrub. Other minor shrubs include *Ilex montana, Viburnum lantanoides, Vaccinium erythrocarpum*, and *Rubus allegheniensis*. The thick, evergreen shrub layer precludes the establishment of seedlings or herbaceous plants and creates a heavy, slowly decomposing litter layer. Bryophyte cover can be high (over 50%), and the ground is covered with downed and decaying logs.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This forest was found on steep to very steep, slightly concave slopes at 5350 feet and 4850 feet elevation, often associated with cliff faces, rock outcroppings, and bouldery situations. Soils are peaty and rocky. This community is subject to disturbance by wind, ice, and landslides.

Global Environment: This forest was found on steep to very steep, slightly concave slopes at 5350 feet and 4850 feet elevation, often associated with cliff faces, rock outcroppings, and bouldery situations. Soils are peaty and rocky. This community is subject to disturbance by wind, ice, and landslides.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The tree canopy is dominated by *Picea rubens* and *Betula alleghaniensis*. Other trees that can occur with minor coverage in the canopy and subcanopy include *Acer rubrum, Prunus serotina*, and *Tsuga canadensis*. Shrub cover is dense and dominated by *Leucothoe fontanesiana*. Other shrubs include *Ilex montana, Viburnum lantanoides, Vaccinium erythrocarpum, Rhododendron catawbiense*, and *Rubus allegheniensis*. Herbaceous cover is absent or sparse and consists of scattered ferns and other forbs such as *Dryopteris intermedia, Dennstaedtia punctilobula, Oxalis montana, Rugelia nudicaulis, Circaea alpina, Arisaema triphyllum*, and *Trillium undulatum*. Bryophyte cover can be high (over 50%), and the ground is covered with downed and decaying logs.

Global Vegetation: : The tree canopy is dominated by *Picea rubens* and *Betula alleghaniensis*. Other trees that can occur with minor coverage in the canopy and subcanopy include *Acer rubrum, Prunus serotina*, and *Tsuga canadensis*. Shrub cover is dense and dominated by *Leucothoe fontanesiana*. Other shrubs include *Ilex montana, Viburnum lantanoides, Vaccinium erythrocarpum, Rhododendron catawbiense*, and *Rubus allegheniensis*. Herbaceous cover is absent or sparse and consists of scattered ferns and other forbs such as *Dryopteris intermedia, Dennstaedtia punctilobula, Oxalis montana, Rugelia nudicaulis, Circaea alpina, Arisaema triphyllum*, and *Trillium undulatum*. Bryophyte cover can be high (over 50%), and the ground is covered with downed and decaying logs.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis, Picea rubens*

TALL SHRUB	*Ilex montana, Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

Global

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis, Fagus grandifolia, Picea rubens*
TALL SHRUB	*Rhododendron catawbiense, Rhododendron maximum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis, Picea rubens*
SHORT SHRUB	*Leucothoe fontanesiana*

Global

Stratum	Species
TREE CANOPY	*Betula alleghaniensis, Picea rubens*
TALL SHRUB	*Rhododendron maximum*

GRank & Reasons: G1? (98-04-30). The community is geographically and environmentally restricted to the highest elevations of the Southern Blue Ridge. Very few occurrences are known to exist, and it has only been described from the Great Smoky Mountains.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: Examples of this community on more exposed, rocky sites may transition to heath shrublands. At high elevations, this community grades into *Picea rubens*-dominated forests.

Global Classif Comments: This association is known from the Great Smoky Mountains of Tennessee but may possibly occur in the Blue Ridge of North Carolina and Virginia. This association should be compared with other vegetation farther north in the Appalachians. Examples of this community on more exposed, rocky sites may transition to heath shrublands. At high elevations, this community grades into *Picea rubens*-dominated forests.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte quadrangle and the Bunches Bald quadrangle and was not found on the Cades Cove quadrangle. It was sampled in the vicinity of Alum Cave on steep slopes at 4850 and 5350 feet elevation and along Balsam Road at an elevation of approximately 4500 feet. It should be sought in other high-elevation areas of the park, between 4500 and 5300 feet elevation.

Global Range:

Nations: US
States/Provinces: NC?, TN:S?, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah?)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004983
REFERENCES (type in full citation below if reference is new): Golden 1974, Golden 1981, Livingston and Mitchell 1976, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002

Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata Forest

Red Spruce - (Yellow Birch, Yellow Buckeye) / Hobblebush / Common Wood Sorrel - Skunk Goldenrod Forest

Red Spruce - Northern Hardwood Forest (Herb Type)

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Spruce-Fir Forests (410-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association occurs in the broad elevational transition zone between spruce - fir and northern hardwoods in the Southern Blue Ridge (approx. 4600-5100 feet). The canopy is comprised of *Picea rubens* codominating with the deciduous species *Betula alleghaniensis, Fagus grandifolia*, and *Aesculus flava*, occurring singly or in combination. At higher elevations, *Abies fraseri* may be a minor canopy component. The shrub stratum is open to absent. *Viburnum lantanoides* is a common shrub, and *Acer pensylvanicum* and *Amelanchier laevis* often occur as small trees. The herbaceous stratum is lush and diverse. Typical herbs include *Oclemena acuminata (= Aster acuminatus), Carex pensylvanica, Dryopteris campyloptera, Dryopteris intermedia, Maianthemum canadense, Oxalis montana, Solidago glomerata*, and *Rugelia nudicaulis* (in the Great Smoky Mountains). This association occurs on steep slopes and protected ridges, over shallow, stony soils.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found on steep, north- and south-facing, middle and upper slopes, at elevations over 5000 feet. Landforms were often slightly convex to concave, broad slopes with boulders and rock outcroppings. Soils are stony to gravelly and have high organic content. Major disturbance factors affecting this forest include ice, wind, and feral hogs. Examples on the Mount Le Conte quadrangle include old-growth forest.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The forest canopy and subcanopy is codominated by large *Picea rubens* and *Betula alleghaniensis*. In some occurrences, *Picea rubens* can overtop *Betula alleghaniensis*. Other subcanopy trees include *Abies fraseri, Aesculus flava*, and *Prunus pensylvanica*. Shrub cover can be sparse to moderate (20-90%) but is always dominated by deciduous species. The tall- and short-shrub strata share many species. The most constant shrubs are *Abies fraseri, Acer spicatum, Vaccinium erythrocarpum, Viburnum lantanoides, Sorbus americana*, and *Rubus canadensis*. Other shrubs include *Acer pensylvanicum, Ilex montana, Lonicera canadensis, Ribes cynosbati, Ribes glandulosum, Hydrangea arborescens, Rubus allegheniensis, Betula alleghaniensis, Sambucus racemosa var. racemosa (= var. pubens), Viburnum nudum var. cassinoides, Cornus alternifolia, Menziesia pilosa, Rhododendron maximum*, and *Rhododendron catawbiense*. Herbaceous cover is moderate to dense (30-100%) and is dominated by ferns and other forbs. Herbaceous dominance may vary from site to site, but the most constant herb species are *Dryopteris campyloptera, Oxalis montana, Solidago glomerata, Clintonia borealis*, and *Rugelia nudicaulis*. Other herbaceous species include *Ageratina altissima var. roanensis, Asplenium montanum, Oclemena acuminata (= Aster acuminatus), Eurybia chlorolepis (= Aster chlorolepis), Athyrium filix-femina, Chelone lyonii, Actaea podocarpa (= Cimicifuga americana), Cinna latifolia, Circaea alpina, Dryopteris intermedia, Huperzia lucidula, Impatiens pallida, Melanthium parviflorum, Monotropa uniflora, Polypodium appalachianum, Tiarella cordifolia*, and *Trillium undulatum*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis, Picea rubens*
TREE SUB-CANOPY	*Betula alleghaniensis*
TALL SHRUB	*Acer spicatum, Viburnum lantanoides*
SHORT SHRUB	*Vaccinium erythrocarpum*
FORB	*Solidago glomerata*

FERN	*Dryopteris campyloptera*

Global

Stratum	Species
TREE CANOPY	*Aesculus flava, Betula alleghaniensis, Fagus grandifolia, Picea rubens*
TALL SHRUB	*Viburnum lantanoides*
FORB	*Oxalis montana, Solidago glomerata*
FERN	*Dryopteris campyloptera, Dryopteris intermedia*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis, Picea rubens*
SHRUB	*Viburnum lantanoides*
FORB	*Solidago glomerata*
FERN	*Dryopteris campyloptera*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri, Aesculus flava, Betula alleghaniensis, Fagus grandifolia, Picea rubens*
TALL SHRUB	*Viburnum lantanoides*
FORB	*Solidago glomerata*
FERN	*Dryopteris campyloptera*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense) Forest (CEGL004983)

GRank & Reasons: G2 (00-01-04). The community is geographically and environmentally restricted to the highest elevations of the Southern Blue Ridge. Very few occurrences are known to exist.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: On Mount Le Conte and Newfound Gap this community grades into forests dominated by *Picea rubens* or by *Picea rubens* and *Abies fraseri* at higher elevations, and to Northern Hardwood and Cove forests at lower elevations.

Global Classif Comments: Original type was split into two forest associations [see also *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense)* Forest (CEGL004983)].

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte and Clingmans Dome quadrangles. In the Mount Le Conte quadrangle, t was sampled in the vicinity of Mount Kephart, on the broad, steep slopes on the northern and southern flanks of Mount Le Conte, and in the vicinity of Balsam point, at elevations ranging from 5000 to 5880 feet. It should be sought in other high-elevation (>4500 feet) areas of the park. In the Clingmans Dome quadrangle, it was sampled near Newfound Gap.

Global Range: This community is restricted to the southern Blue Ridge of North Carolina and Tennessee. It may occur at high elevations (above 4000 feet) in Virginia and Georgia.

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221A:CP, M221B:CP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee?, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL006256

REFERENCES (type in full citation below if reference is new): Allard 1990, Golden 1974, Golden 1981, Livingston and Mitchell 1976, McLeod pers. comm., NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale and Weakley 1990

Pinus echinata - Quercus (prinus, falcata) / Oxydendrum arboreum / Vaccinium pallidum Forest

Shortleaf Pine - (Rock Chestnut Oak, Southern Red Oak) / Sourwood / Hillside Blueberry Forest
Southern Blue Ridge Escarpment Shortleaf Pine - Oak Forest
Ecological Group (SCS;MCS): Appalachian Highlands Xeric Shortleaf Pine Woodlands and Forests (401-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes crests of low-elevation slopes and ridges on the fringes of the Southern Blue Ridge, extending into the southern Ridge and Valley and Cumberland Plateau, where *Pinus echinata* and dry-site oaks characteristic of lower elevations codominate in association with other Appalachian flora. This forest is known from the southern Blue Ridge Escarpment region of North Carolina, South Carolina, and Georgia, particularly in the Blue Ridge/Piedmont transition, where it occurs on exposed, rocky ridges and upper, convex slopes, at elevations at or below 2200 feet. It also extends into the southern Ridge and Valley and Cumberland Plateau, but more information is needed to characterize the variation in that part of the range. Canopies are codominated by *Pinus echinata* and combinations of dry-site oaks that may include *Quercus falcata, Quercus coccinea, Quercus prinus, Quercus stellata*, and *Quercus velutina*. On rocky sites, canopies may be slightly stunted. Mid-canopy trees can be scattered or form a well-developed subcanopy. Common subcanopy trees can include *Oxydendrum arboreum, Ilex opaca var. opaca, Cornus florida, Quercus marilandica, Quercus stellata,* and *Carya pallida*. The shrub stratum varies in composition and density but is typically dominated by *Vaccinium pallidum*. Other shrubs may include *Vaccinium stamineum, Gaylussacia ursina, Gaylussacia baccata, Rhododendron calendulaceum, Rhododendron minus, Castanea pumila,* and *Kalmia latifolia*. On some sites *Symplocos tinctoria* can be important. *Vitis rotundifolia* and *Smilax glauca* are common vines. The herb stratum is poorly developed with scattered species such as *Chimaphila maculata, Iris verna, Pteridium aquilinum var. latiusculum, Goodyera pubescens, Hexastylis arifolia, Coreopsis major (= var. rigida), Tipularia discolor, Schizachyrium scoparium, Pityopsis graminifolia var. latifolia, Tephrosia virginiana, Silphium compositum, Dichanthelium* spp., and *Galax urceolata*.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Pinus echinata - Quercus alba / Vaccinium pallidum / Hexastylis arifolia - Chimaphila maculata Forest (CEGL008427)
- Pinus echinata - Quercus stellata - Quercus prinus - Carya glabra / (Danthonia spicata, Piptochaetium avenaceum) Forest (CEGL007500)--a more open, grassy variant.
- Pinus echinata - Quercus prinus / Rhododendron minus / Vaccinium pallidum Forest (CEGL007496)

GRank & Reasons: G3G4 (00-01-12). This community occurs within a restricted geographic range and is uncommon within this range. Because this community is poorly known and essentially uninventoried throughout its range, there remain questions regarding its taxonomic distinctiveness and geographic extent. Further inventory and more detailed field information may expand the current range and concept of this type.

CLASSIFICATION COMMENTS

Global Classif Comments: These communities are distinguished by canopies codominated by *Pinus echinata* and combinations of dry-site oaks that may include *Quercus falcata, Quercus coccinea, Quercus prinus, Quercus stellata*, and *Quercus velutina*. These communities are not well known. In North Carolina they are apparently largely confined to Cherokee County. Examples are also known from the southern portion of the Chattooga River Basin watershed in South Carolina and Georgia. This forest is probably fire-dependent to some extent, and fire (prescribed or natural) will stimulate regeneration of *Pinus echinata*. Many occurrences of this community are highly disturbed and contain exotic species such as *Ligustrum japonicum, Dioscorea oppositifolia*, and *Lonicera japonica*. *Pinus echinata*, in many occurrences, has been attacked by the Southern Pine Bark Beetle, which will eventually kill the trees. The concepts of the former associations *Pinus echinata - Quercus falcata / Vaccinium pallidum* Forest (CEGL007494) and *Pinus echinata - Quercus prinus / Oxydendrum arboreum / Vaccinium pallidum* Forest (CEGL007495) were merged into this association and should be considered variants of this community. *Pinus echinata - Quercus alba / Vaccinium pallidum / Hexastylis arifolia - Chimaphila maculata* Forest (CEGL008427)

includes shortleaf pine - mesic oak forests of the non-coastal plain, non-Ozark/Ouachita portion of the *Pinus echinata* range, with an overall more mesophytic species composition than the association described here.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: No plot was documented for the park, but this community most likely does exist on an exposed ridge at a low elevation within the park, possibly in the Bryson City or Calderwood quadrangles.

Global Range: This association occurs in the southern fringes of the Southern Blue Ridge, extending into the southern Ridge and Valley and Cumberland Plateau. It could possibly range into the upper Piedmont.

Nations: US
States/Provinces: GA:S?, KY:S?, NC:S?, SC:S?, TN?
TNC Ecoregions: 50:C, 51:C, 52:?
USFS Ecoregions: 231Ag:CCC, 231Dc:CCC, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee?, Daniel Boone, Nantahala, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007493
REFERENCES (type in full citation below if reference is new): Allard 1990, Evans 1991, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale 1998b

Pinus strobus - Quercus alba - (Carya alba) / Gaylussacia ursina Forest

Eastern White Pine - White Oak - (Mockernut Hickory) / Bear Huckleberry Forest
Appalachian White Pine - Mesic Oak Forest
Ecological Group (SCS;MCS): Appalachian Highlands Upland White Pine Forests (401-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association covers mesic pine-oak-hickory in the Southern Blue Ridge Escarpment and in the Piedmont transition, found below 2900 feet elevation, on protected ridges, mid to upper slopes, and in disturbed bottoms. Canopies are dominated by variable mixtures of *Pinus strobus, Quercus alba, Quercus velutina, Carya alba*, and *Acer rubrum*. Other canopy species may include *Liriodendron tulipifera, Tsuga canadensis, Quercus rubra, Quercus falcata, Quercus prinus*, and *Magnolia fraseri*. Subcanopy and saplings include canopy species and *Cornus florida, Halesia tetraptera, Oxydendrum arboreum*, and *Nyssa sylvatica*. Shrub layers are moderate to dense, with *Gaylussacia ursina* and *Kalmia latifolia* most commonly dominating. Other shrubs include *Rhododendron minus, Rhododendron maximum, Symplocos tinctoria, Arundinaria gigantea, Castanea dentata, Sassafras albidum, Amelanchier arborea, Pyrularia pubera*, and *Hydrangea radiata*. The herb stratum is sparse, although ferns (*Thelypteris noveboracensis, Dennstaedtia punctilobula* and *Polystichum acrostichoides*) may occasionally dominate. Common herbs include *Chimaphila maculata, Viola hastata, Goodyera pubescens, Maianthemum racemosum, Polygonatum biflorum, Monotropa uniflora, Trillium catesbaei, Desmodium nudiflorum, Eupatorium purpureum, Galium circaezans, Galium latifolium, Galax urceolata, Hexastylis shuttleworthii, Medeola virginiana, Mitchella repens*, and *Houstonia purpurea*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment:

Global Environment: Stands of this association are found below 2900 feet elevation, on protected ridges, mid to upper slopes, and in disturbed bottoms in the Southern Blue Ridge Escarpment and in the Piedmont transition region.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation:

Global Vegetation: Canopies are dominated by variable mixtures of *Pinus strobus, Quercus alba, Carya alba*, and *Acer rubrum*. Other canopy species may include *Liriodendron tulipifera, Tsuga canadensis, Quercus rubra, Quercus prinus*, and *Magnolia fraseri*. Subcanopy and saplings include canopy species and *Cornus florida, Halesia tetraptera, Oxydendrum arboreum*, and *Nyssa sylvatica*. Shrub layers are moderate to dense, with *Gaylussacia ursina* and *Kalmia latifolia* most commonly dominating. Other shrubs include *Rhododendron minus, Rhododendron maximum, Symplocos tinctoria, Arundinaria gigantea, Castanea dentata, Sassafras albidum, Amelanchier arborea, Pyrularia pubera*, and *Hydrangea radiata*. The herb stratum is sparse, although ferns (*Thelypteris noveboracensis, Dennstaedtia punctilobula*, and *Polystichum acrostichoides*) may occasionally dominate. Common herbs include *Chimaphila maculata, Viola hastata, Goodyera pubescens, Maianthemum racemosum, Polygonatum biflorum, Monotropa uniflora, Trillium catesbaei, Desmodium nudiflorum, Eupatorium purpureum, Galium circaezans, Galium latifolium, Galax urceolata, Hexastylis shuttleworthii, Medeola virginiana, Mitchella repens*, and *Houstonia purpurea*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Acer rubrum, Carya alba, Pinus strobus, Quercus alba*
TREE SUB-CANOPY	*Cornus florida, Halesia tetraptera, Nyssa sylvatica, Oxydendrum arboreum*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Gaylussacia ursina*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Carya alba, Liriodendron tulipifera, Magnolia fraseri, Pinus strobus, Quercus alba*
FORB	*Goodyera pubescens, Medeola virginiana, Mitchella repens*
FERN	*Polystichum acrostichoides, Thelypteris noveboracensis*

GRank & Reasons: G2G3 (00-01-04). This community is geographically restricted and uncommon within its range.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: In some occurrences, *Pinus strobus* may overtop the deciduous canopy component, resulting in a signature similar to other *Pinus strobus*-dominated vegetation (i.e., *Pinus strobus / Kalmia latifolia - (Vaccinium stamineum, Gaylussacia ursina)* Forest (CEGL007100), *Pinus strobus - Quercus (coccinea, prinus) / (Gaylussacia ursina, Vaccinium stamineum)* Forest (CEGL007519), *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102)).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was not observed or sampled but is likely in low-elevation, disturbed areas in some parts of the park.

Global Range: This community is known from the escarpment region of the Southern Blue Ridge.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains?); USFS (Chattahoochee, Cherokee?, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007517
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, NatureServe Ecology - Southeast U.S. unpubl. data, Schafale 1998b, Schafale and Weakley 1990

Pinus strobus - Quercus (coccinea, prinus) / (Gaylussacia ursina, Vaccinium stamineum) Forest

Eastern White Pine - (Scarlet Oak, Rock Chestnut Oak) / (Bear Huckleberry, Deerberry Forest
Appalachian White Pine - Xeric Oak Forest
Ecological Group (SCS;MCS): Appalachian Highlands Upland White Pine Forests (401-40; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association represents mixed forests of the southern Appalachian Mountains with *Pinus strobus, Quercus prinus,* and *Quercus coccinea,* occurring singly or in combination, each contributing 25-75% of the total canopy coverage. Open subcanopies are composed of *Oxydendrum arboreum, Acer rubrum var. rubrum, Nyssa sylvatica,* and *Cornus florida*. The shrub stratum is dominated by deciduous heath species, typically *Gaylussacia ursina* or *Vaccinium stamineum*. Other species in the shrub/sapling stratum may include *Vaccinium pallidum, Leucothoe recurva, Kalmia latifolia, Castanea dentata,* or *Acer rubrum var. rubrum*. On rocky sites, *Deschampsia flexuosa* may be common. This community occurs on exposed upper slopes and ridgetops at elevations below 920 m (3000 feet) in the southern Appalachian Mountains.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found mostly below 2000 feet elevation (ranging from 1560-2400 feet) on convex slopes and low ridges. Many stands showed evidence of past logging, and most examples are in early to middle stages of succession.

Global Environment: This community occurs on exposed upper slopes and ridgetops at elevations below 920 m (3000 feet) in the southern Appalachian Mountains.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: These are forests with a well-developed canopy and subcanopy dominated by *Pinus strobus,* codominating with *Quercus prinus* and *Acer rubrum*. Other species that can have high coverage in the canopy or subcanopy include *Quercus coccinea, Pinus rigida, Nyssa sylvatica, Oxydendrum arboreum,* and *Pinus virginiana*. Other trees the can be present include *Pinus echinata, Quercus alba, Quercus rubra, Amelanchier laevis, Carya glabra,* and *Tsuga canadensis*. The tall-shrub stratum can be moderate to very dense and typically is dominated by *Kalmia latifolia, Acer rubrum,* or *Rhododendron maximum*. The short-shrub stratum is dense and dominated by *Gaylussacia ursina* or *Vaccinium pallidum*. Other species that can be in the shrub strata include saplings of canopy and subcanopy species and *Vaccinium hirsutum, Vaccinium stamineum, Calycanthus floridus, Castanea dentata, Cornus florida, Ilex opaca, Magnolia fraseri, Pyrularia pubera, Robinia pseudoacacia,* and *Sassafras albidum*. The herb stratum is sparse, and the ground is often dominated by leaf litter. Typical herb species include *Chimaphila maculata, Dioscorea quaternata, Epigaea repens, Galax urceolata, Gaultheria procumbens, Goodyera pubescens, Lysimachia quadrifolia, Pteridium aquilinum, Uvularia puberula,* and *Viola hastata*. *Smilax rotundifolia* and *Smilax glauca* are common vines.

Global Vegetation: Stands of this forest association typically contain *Pinus strobus* (contributing 25-75% of the canopy coverage) and *Quercus prinus* and/or *Quercus coccinea* (occurring singly or in combination) as 25-75% of the canopy coverage. Open subcanopies are composed of *Oxydendrum arboreum, Acer rubrum var. rubrum, Nyssa sylvatica*, and *Cornus florida*. The shrub stratum is dominated by deciduous heath species, typically *Gaylussacia ursina* or *Vaccinium stamineum*. Other species in the shrub/sapling stratum may include *Vaccinium pallidum, Leucothoe recurva, Kalmia latifolia, Castanea dentata,* or *Acer rubrum var. rubrum*. On rocky sites, *Deschampsia flexuosa* may be common.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus strobus, Quercus prinus*
TREE SUB-CANOPY	*Acer rubrum*
TALL SHRUB	*Kalmia latifolia, Rhododendron maximum*

SHORT SHRUB *Gaylussacia ursina, Vaccinium pallidum*

Global

Stratum	Species
TREE CANOPY	*Pinus strobus, Quercus coccinea, Quercus prinus*
TREE SUB-CANOPY	*Acer rubrum var rubrum, Oxydendrum arboreum*
SHORT SHRUB	*Gaylussacia ursina, Vaccinium stamineum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus strobus, Quercus coccinea, Quercus prinus*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Gaylussacia ursina*

Global

Stratum	Species
TREE CANOPY	*Pinus strobus, Quercus coccinea, Quercus prinus*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Gaylussacia ursina, Vaccinium stamineum*

GRank & Reasons: G3 (00-01-04). This community has a restricted range and is uncommon. It is not threatened or particularly vulnerable.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove quadrangle but was not found on the Mount Le Conte quadrangle. It is likely in other areas of the park. On the Cades Cove quadrangle, it was sampled or observed north of the Cades Cove Loop Road, along the ridgeline of Tater Ridge (2500 feet); on the steep north-facing slopes off Crooked Arm Ridge (2400 feet); and on the north-facing slopes above Laurel Creek (2100 feet). It was also sampled southwest of the Cades Cove Loop Road, on low ridges (2000 feet) north and south of Abrams Creek, and on gentle, southwest slopes, east of Forge Creek Road (2000 feet).

Global Range: This community is known from the escarpment region of the Southern Blue Ridge and may extend into Virginia.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?, VA?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 221Hb:CCC, 221He:CCC, 222Eo:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee?, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL007519
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, Patterson 1994, Peet et al. 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990

Pinus virginiana - Quercus prinus - Quercus rubra / Vaccinium pallidum - Kalmia latifolia Forest

Virginia Pine - Rock Chestnut Oak - Northern Red Oak / Hillside Blueberry - Mountain Laurel Forest

Blue Ridge Acid Shale Forest

Ecological Group (SCS;MCS): Appalachian Shale Glades and Barrens (440-40; 2.3.4.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: This xeric slope forest is found on steep shale substrates in the southern Appalachians. It has a 10- to 25-m, closed (to slightly open) canopy dominated by *Pinus virginiana, Quercus prinus*, and *Quercus rubra*. Understory species include *Acer rubrum var. rubrum* and *Oxydendrum arboreum*. The moderate to dense shrub layer consists of *Vaccinium pallidum* and *Kalmia latifolia*, with less frequent *Vaccinium stamineum* and *Philadelphus hirsutus*. The herb stratum is poorly developed, usually consisting of scattered individuals of *Campanula divaricata, Dichanthelium* spp., *Hieracium venosum, Danthonia spicata, Houstonia longifolia (= Houstonia tenuifolia),* and others. This community is known to occur over somewhat calcareous shales in the Hot Springs Window, in the Blue Ridge of North Carolina and Tennessee. It is also reported from the Chauga Basin, South Carolina, and from Chilhowee Mountain, Tennessee. It is apparently a long-lived community, maintained by harsh edaphic conditions of steep slopes and shifting shale substrate.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Same as global description

Global Environment: This xeric slope forest is found on steep shale substrates in the southern Appalachians. It is apparently a long-lived community, maintained by harsh edaphic conditions of steep slopes and shifting shale substrate.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global description

Global Vegetation: The canopy of stands is dominated by *Pinus virginiana, Quercus prinus*, and *Quercus rubra*. Understory species include *Acer rubrum var. rubrum* and *Oxydendrum arboreum*. The moderate to dense shrub layer consists of *Vaccinium pallidum* and *Kalmia latifolia*, with less frequent *Vaccinium stamineum* and *Philadelphus hirsutus*. The herb stratum is poorly developed, usually consisting of scattered individuals of *Campanula divaricata, Dichanthelium* spp., *Hieracium venosum, Danthonia spicata, Houstonia longifolia (= Houstonia tenuifolia),* and others.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TREE CANOPY	*Pinus virginiana, Quercus prinus, Quercus rubra*
SHORT SHRUB	*Vaccinium pallidum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Pinus virginiana / Schizachyrium scoparium - Carex pensylvanica Woodland (CEGL003624)--a related woodland also from the Hot Springs Window, in the Blue Ridge Mountains.

GRank & Reasons: G2? (98-06-23).

CLASSIFICATION COMMENTS

Global Classif Comments: L.L. Gaddy reports this association from the Chauga Basin, South Carolina. Known from Chilhowee Mountain, Tennessee.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community is uncommon but may occur in the park where shale outcrops occur on steep slopes. One occurrence is known from the Calderwood quadrangle, on Chilhowee Mountain.

Global Range: This forest is found in the southern Appalachians of the Carolinas and Tennessee. It is reported from somewhat calcareous shales in the Hot Springs Window, in the Blue Ridge of North Carolina and Tennessee, from the Chauga Basin, South Carolina, and from Chilhowee Mountain, Tennessee.

Nations: US
States/Provinces: NC:S?, SC?, TN:S?
TNC Ecoregions: 50:P, 51:C
USFS Ecoregions: 221Jb:PPP, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains?); USFS (Cherokee, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007539
REFERENCES (type in full citation below if reference is new): Allard 1990, Gaddy pers. comm.

Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana Forest

Yellow Birch - (Eastern Hemlock) / Great Rhododendron / Mountain Doghobble Forest

Blue Ridge Hemlock - Northern Hardwood Forest

Ecological Group (SCS;MCS): Appalachian Highlands High Elevation Northern Hardwood Forests (410-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association was described from high elevations in Great Smoky Mountains National Park and needs further regional and national assessment. It is likely that is also occurs in the high mountain areas of western North Carolina. This mixed forest type has an open to closed canopy dominated by *Betula alleghaniensis* and/or *Tsuga canadensis*, although either of these species may be locally dominant at a small scale. Other minor canopy and subcanopy species may include *Aesculus flava, Halesia tetraptera var. monticola, Picea rubens, Prunus pensylvanica, Betula lenta,* and *Tilia americana var. heterophylla*. The tall-shrub stratum is over 2 m in height, very dense (50-100% coverage) and dominated by *Rhododendron maximum*. The dense low-shrub stratum is dominated by *Leucothoe fontanesiana* if gaps exist in the *Rhododendron maximum* shrub layer.. Other minor shrubs can include *Acer pensylvanicum, Ilex montana, Kalmia latifolia, Rubus allegheniensis, Sambucus racemosa var. racemosa (= Sambucus racemosa var. pubens), Tsuga canadensis*, and *Vaccinium erythrocarpum*. The ground layer is dominated by leaf litter, fallen trees, and rocks. Herbaceous cover is sparse (0-5%) and is composed of scattered plants typical of middle to high elevation acid forests. Some of the more characteristic species include *Dryopteris intermedia, Medeola virginiana, Mitchella repens, Tiarella cordifolia, Oxalis montana, Polypodium appalachianum*, and *Smilax rotundifolia*. Additional herb species found in this community include *Arisaema dracontium, Arisaema triphyllum, Aristolochia macrophylla, Oclemena acuminata (= Aster acuminatus), Eurybia divaricata (= Aster divaricatus), Circaea alpina, Goodyera pubescens, Goodyera repens, Huperzia lucidula, Laportea canadensis, Monotropa uniflora, Polygonatum pubescens, Prenanthes altissima*, and *Viola blanda*. This community was found on steep, mostly north-facing slopes, and on slopes and flats along and above streams. These forests occur on middle slope or toe slope positions, protected by higher landforms. The elevations of samples ranged from as low as 3400 feet elevation to around 4400 feet, but the community can probably occur as high as 5000 feet or until *Picea rubens* begins to dominate. Sites are rocky, often with many large boulders and talus. Soils are stony with heavy litter layers. This forest is affected by occasional disturbance by ice, wind, and landslides. It grades into forests dominated by *Picea rubens* or *Tsuga canadensis* at higher elevations.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was found on steep, mostly north-facing slopes, and on slopes and flats along and above streams. These forests occur on middle slope or toeslope positions, protected by higher landforms. The elevations of samples ranged from as low as 3400 feet elevation to around 4400 feet, but the community can probably occur as high as 5000 feet or until *Picea rubens* begins to dominate. Sites are rocky, often with many large boulders and talus. Soils are stony with heavy litter layers. These forests are affected by occasional disturbance by ice, wind, and landslides.

Global Environment: This community occurs on steep, mostly north-facing mesic slopes, and on toeslopes and flats along streams. It typically occupies middle- to lower-slope and valley-bottom topographic positions that are well protected by higher landforms. In the Great Smoky Mountains, plot-sampled stands range from as low as 1030 m (3400 feet) to around 1350 m (4400 feet) elevation. Lower elevation stands may intergrade with *Betula lenta*-dominated forest types. The elevation range in Virginia is from about 900 m (3000 feet) on Allegheny Mountain to 1450 m (4800 feet) in the Southern Blue Ridge. Sites are often rocky, with many large boulders and stones. Soils, weathered from sandstone, acidic shale, or metamorphic igneous rocks, have dense, root-rich duff layers. Samples collected from plots are extremely acidic (mean pH = 3.7) with low base status and moderately high organic matter content (mean = 20%). On stream-bottom sites, local areas of seepage are not uncommon and habitats may be somewhat transitional to a saturated hydrologic regime. Sites occupied by this forest are affected by occasional ice, wind, and landslide disturbances.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This mixed forest type has an open to closed canopy dominated by *Betula alleghaniensis* with some stands codominated by *Tsuga canadensis*. Other minor canopy and subcanopy species may include *Aesculus flava, Picea rubens, Prunus pensylvanica, Betula lenta, Tilia americana var. heterophylla*, and at lower elevations, *Magnolia fraseri, Acer rubrum, Liriodendron tulipifera*, and *Halesia tetraptera var. monticola*. The tall-shrub stratum is over 2 m in height, very dense (50-100% coverage) and dominated by *Rhododendron maximum*. The dense low-shrub stratum is dominated by *Leucothoe fontanesiana*. Other minor shrubs can include *Acer pensylvanicum, Ilex montana, Kalmia latifolia, Rubus allegheniensis, Sambucus racemosa var. racemosa (= var. pubens), Tsuga canadensis*, and *Vaccinium erythrocarpum*. The ground layer is dominated by leaf litter, fallen trees, and rocks. Herbaceous cover is sparse (0-5%) and is composed of scattered plants typical of middle to high elevation acid forests. Some of the more characteristic species include *Dryopteris intermedia, Medeola virginiana, Mitchella repens, Tiarella cordifolia, Oxalis montana*, and *Polypodium appalachianum*. Additional herb species found in this community include *Arisaema dracontium, Arisaema triphyllum, Aristolochia macrophylla, Oclemena acuminata (= Aster acuminatus), Eurybia divaricata (= Aster divaricatus), Circaea alpina, Goodyera pubescens, Goodyera repens, Huperzia lucidula, Laportea canadensis, Monotropa uniflora, Polygonatum pubescens, Prenanthes altissima*, and *Viola blanda*.

Global Vegetation: This mixed forest community has an open to closed canopy codominated by *Betula alleghaniensis* and/or *Tsuga canadensis*, although either of these species may be solely dominant over small areas. Minor canopy and subcanopy species may include *Aesculus flava, Picea rubens, Prunus pensylvanica, Betula lenta, Magnolia acuminata, Magnolia fraseri, Fagus grandifolia*, and *Tilia americana var. heterophylla*. *Picea rubens* is present in a majority of Virginia sites and is a codominant canopy tree in several. The community has a very dense (50-100% cover), evergreen tall-shrub stratum (>2 m tall) dominated by *Rhododendron maximum*. In the Great Smoky Mountains, a dense low-shrub stratum dominated by *Leucothoe fontanesiana* is typical, but this species is absent from Virginia examples of the type. Minor understory species can include *Acer pensylvanicum, Ilex montana, Kalmia latifolia, Rubus allegheniensis, Sambucus racemosa (= Sambucus pubens)*, and *Vaccinium erythrocarpum*. Herbaceous cover is sparse (0-5%) and is composed of scattered plants typical of middle- to high-elevation acidic forests. Some of the more characteristic species include *Dryopteris intermedia, Medeola virginiana, Mitchella repens, Tiarella cordifolia, Oxalis montana*, and *Polypodium appalachianum*. Additional herbaceous species found in this community include *Arisaema dracontium, Arisaema triphyllum, Oclemena acuminata (= Aster acuminatus), Eurybia divaricata (= Aster divaricatus), Circaea alpina, Goodyera pubescens, Goodyera repens, Huperzia lucidula, Laportea canadensis, Maianthemum canadense, Monotropa uniflora, Polygonatum pubescens, Prenanthes altissima, Viola blanda*, and *Viola rotundifolia*. Species richness of plot-sampled stands ranges from 10 to 38 taxa per 400 m2 (mean = 24).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis*
TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*
FERN	*Dryopteris intermedia*

Global

Stratum	Species
Same as local	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula alleghaniensis, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*
SHORT SHRUB	*Leucothoe fontanesiana*

Global

Stratum	Species
TREE CANOPY	*Betula alleghaniensis, Magnolia fraseri, Picea rubens, Prunus pensylvanica, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*

FORB	*Viola rotundifolia*
FERN	*Botrychium oneidense*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Tsuga canadensis - Betula alleghaniensis Lower New England / Northern Piedmont Forest (CEGL006109)
- Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum Forest (CEGL006206)
- Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum Forest (CEGL007543)

GRank & Reasons: G3G4Q (99-01-28). This community type is naturally uncommon within its range due to specific requirements for protected, mesic sites at high elevations. Most remaining examples of this community have been affected by past logging and are currently threatened with the loss of their *Tsuga canadensis* component due to ongoing or potential infestations by the exotic pest hemlock woolly adelgid (*Adelges tsugae*). This community type has a restricted but locally extensive distribution in the highest mountains of southwestern and west-central Virginia. This association was originally described from Great Smoky Mountains National Park. It needs to be compared with other associations in this alliance to determine its taxonomy, range, and conservation status.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: On aerial photography, this community may appear similar to other Hemlock-Hardwood communities (i.e., *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543) and *Tsuga canadensis - Halesia tetraptera - (Fagus grandifolia, Magnolia fraseri) / Rhododendron maximum / Dryopteris intermedia* Forest (CEGL007693)) but should be distinguishable by its higher elevation and topographic position. These forests grade into forests dominated by *Picea rubens* or *Tsuga canadensis* at higher elevations and may grade into *Betula lenta*-dominated forests such as acid cove forests at lower elevations.

Global Classif Comments: This association was originally described from Great Smoky Mountains National Park. It should be compared with and distinguished from other associations in this alliance, such as *Tsuga canadensis - Betula alleghaniensis* Lower New England / Northern Piedmont Forest (CEGL006109), *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206), and *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543), as well as other vegetation in the Southern Blue Ridge.

The relationship between this community and CEGL006206 is unclear and needs resolution. Although CEGL006206 is alleged to be the characteristic acidic cove forest of the Allegheny Mountains and higher Ridge and Valley sites, Virginia stands do not have *Prunus serotina* as a prominent component and clearly have much affinity to the Great Smoky Mountains stands that originally formed the basis of the type described here. However, information concerning the environments, composition, and distribution of CEGL006206 is sparse. At present, the distinction between the two types seems dubious, but more information and analysis is needed.

Forests of high-elevation coves at Salt Pond Mountain in Giles County (e.g., War Spur Branch), where *Picea rubens* is codominant with or subordinate to *Tsuga canadensis* and *Betula alleghaniensis*, are tentatively placed here. Some of these stands, however, may be better classified as wetlands and require additional investigation.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Clingmans Dome, Luftee Knob, Bunches Bald, and Mount Le Conte quadrangles and is possible on other quadrangles. On the Mount Le Conte quadrangle, samples of this type ranged from 3400-4400 feet elevation and were found on lower slopes on the northern flanks of Mount Le Conte, the steep south-facing slopes southwest of Balsam Point, as well as on the north-facing slopes above the West Prong of the Pigeon River and its tributaries, Walker Camp Prong and Trout Branch, and the steep slopes above and lower slopes and flats along Alum Cave Creek.

Global Range: This community has been documented in the Great Smoky Mountains of North Carolina and Tennessee; in the Mount Rogers - Whitetop Mountain area of the Virginia Blue Ridge (Grayson, Smyth and Washington counties); on Salt Pond Mountain in the Ridge and Valley of west-central Virginia (Giles County); and on Allegheny Mountain in Highland County, Virginia and adjacent Pocahontas County, West Virginia. Most likely, this vegetation type is locally distributed throughout higher elevations of the Southern and Central Appalachians.

Nations: US
States/Provinces: NC?, TN:S?, VA:S?
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Aa:CCC, M221Ba:CCC, M221Bd:CC?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, George Washington, Jefferson)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: G. Fleming and P. Coulling, SCS **Confidence:** 2 **Identifier:** CEGL007861
REFERENCES (type in full citation below if reference is new): Adams and Stephenson 1991, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Livingston and Mitchell 1976, NatureServe Ecology - Southeast U.S. unpubl. data, Newell 1997, Newell et al. 1997, Peet et al. 2002

Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum Forest Tuliptree - Sweet Birch - Eastern Hemlock / Great Rhododendron Forest

Southern Appalachian Acid Cove Forest (Typic Type)

Ecological Group (SCS;MCS): Appalachian Highlands Hemlock-Hardwood Forests (420-25; 2.5.3.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes hemlock-hardwood forests of lower to intermediate elevations in the Southern Blue Ridge and upper Piedmont, ranging from southwestern Virginia, south and west to northwestern Georgia. These communities occur at low to middle elevations (1300-3500 feet) in the mountains and foothills, generally in coves, gorges, or sheltered slopes, over acid soils. The canopy is usually dominated by a combination of *Tsuga canadensis, Liriodendron tulipifera, Betula lenta,* and *Acer rubrum*, but can be dominated by any one of these trees in some instances. Other deciduous species more typical of 'rich' coves may occur as scattered individuals; *Tilia americana var. heterophylla, Fraxinus americana,* and *Fagus grandifolia*. Other canopy/subcanopy species often include *Quercus alba, Quercus rubra, Magnolia fraseri, Ilex opaca var. opaca, Calycanthus floridus, Halesia tetraptera var. tetraptera,* and *Pinus strobus. Rhododendron maximum* is scattered to dominant in the shrub stratum. Other typical shrubs include *Kalmia latifolia* and *Leucothoe fontanesiana*. Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Typical herbs include *Polystichum acrostichoides, Dennstaedtia punctilobula, Goodyera pubescens, Mitchella repens, Thelypteris noveboracensis, Galax urceolata, Viola rotundifolia, Hexastylis* sp., and *Tiarella cordifolia*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community was sampled on low slopes and flats, but also occurred on moderate to steep protected slopes in many instances. This forest is often associated with streams but is not a wetland. This community is best developed at the bottom of well-protected coves in areas with especially acidic soils, but it can range well up the slope in protected mesic situations. The forest ranges up to 3500 feet and can occasionally range to higher elevations.

Global Environment: Over its full geographic range, this association is typically found at lower to intermediate elevations (400-1060 m or 1300-3500 feet) in the southern Appalachians and adjacent foothills. Habitats are located on gentle to steep, lower slopes, middle slopes that are protected, and in coves or gorges with acidic soils. The type often occurs in linear patches along stream bottoms and in steep ravines. Although frequently associated with streams, it is not a wetland. Habitats in the Virginia part of the range are similar and are mostly situated below 900 m (3000 feet) elevation. Soils collected from plots are extremely acidic (mean pH = 3.9) and infertile, with high iron and aluminum levels and very low total base saturation.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The canopy of this forests can be dominated by *Tsuga canadensis, Liriodendron tulipifera, Betula lenta, Acer rubrum,* or a combination of them all. Other deciduous species that will occasionally have high coverage in the canopy or subcanopy include *Betula alleghaniensis, Tilia americana var. heterophylla,* and *Fagus grandifolia*. Other canopy/subcanopy species can include *Magnolia fraseri, Ilex opaca, Cornus florida, Halesia tetraptera, Oxydendrum arboreum,* and *Pinus strobus*. *Rhododendron maximum* is scattered to dominant in the shrub stratum and is the most consistent character separating this from other communities. Other typical shrubs include *Euonymus americana, Ilex opaca,* and *Leucothoe fontanesiana*. Herbaceous cover is sparse. Typical herbs include *Mitchella repens* and *Polystichum acrostichoides*.

In some cases at the upper elevations of this community, the example may contain only *Betula alleghaniensis* and *Betula lenta* in the canopy. These cases are distinct enough to warrant mention but probably are not distinct enough to allow for a new association.

Global Vegetation: This association encompasses hemlock - hardwood forests with canopies dominated by mixtures of *Tsuga canadensis* with deciduous trees such as *Liriodendron tulipifera, Betula lenta,* and *Acer rubrum*. Other deciduous species more typical of fertile coves, including *Tilia americana var. heterophylla, Fraxinus americana,* and *Fagus grandifolia,* may occur as scattered individuals. Minor overstory and understory species include *Quercus alba, Quercus rubra, Magnolia fraseri, Ilex opaca, Calycanthus*

floridus, Halesia tetraptera, and *Pinus strobus*. *Rhododendron maximum* is scattered to dominant in the shrub stratum. Other typical shrubs include *Kalmia latifolia* and *Leucothoe fontanesiana*. Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Typical herbs include *Polystichum acrostichoides, Goodyera pubescens, Mitchella repens, Thelypteris noveboracensis, Galax urceolata, Hexastylis* spp., and *Tiarella cordifolia*.

Virginia examples of this association are similar to those further south but generally lack *Ilex opaca, Calycanthus floridus, Halesia tetraptera*, and *Leucothoe fontanesiana*. Presumably because of past logging, *Tsuga canadensis* is absent or confined to the understory in some stands, which have mixed canopies of *Liriodendron tulipifera, Betula lenta, Acer rubrum, Magnolia acuminata, Quercus rubra*, and/or *Nyssa sylvatica*. *Hamamelis virginiana* and *Acer pensylvanicum* are additional, frequent understory species. The shrub layers of Virginia occurrences are consistently dominated by dense (usually >50% cover), often nearly impenetrable colonies of *Rhododendron maximum*. Frequent low-cover species of sparse herb layers include *Galax urceolata, Chimaphila maculata, Eurybia divaricata (= Aster divaricatus), Arisaema triphyllum, Monotropa uniflora, Mitchella repens*, and *Medeola virginiana*. The spectacular sedge *Cymophyllus fraserianus* is often associated with this forest.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula lenta, Liriodendron tulipifera, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*

Global

Stratum	Species
TREE CANOPY	*Betula lenta, Liriodendron tulipifera, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Betula lenta, Liriodendron tulipifera, Tsuga canadensis*
SHORT SHRUB	*Leucothoe fontanesiana*
FORB	*Tiarella cordifolia*

Global

Stratum	Species
TREE CANOPY	*Betula lenta, Liriodendron tulipifera, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*
SHRUB	*Leucothoe fontanesiana*
GRAMINOID	*Luzula echinata*
FORB	*Galax urceolata, Tiarella cordifolia, Waldsteinia fragarioides*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana Forest (CEGL007861)
- Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala Forest (CEGL008407)

SYNONYMY [OtherName (short citation) relationship. Note]:

- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (Fleming and Coulling 2001)
- IA5b. Southern Appalachian Hemlock Cove Forest (Allard 1990) B. in part
- Cove Forest (Patterson et al. 1994) B. in part
- Type 5 (Newell and Peet 1995)
- Mixed Mesophytic Coves (Gettman 1974)
- Yellow-poplar - Eastern Hemlock: 58 (Eyre 1980) B. in part
- Acidic Cove Forest (Typic Subtype) (Schafale 1998b)
- (Allard 1990) N90ALL01ICEC
- (Eyre 1980) B80EYR01ICEC
- (Fleming and Coulling 2001) N01FLE01ICEC

- (Fleming et al. 2001) G01FLE01ICEC
- (Gettman 1974) N74GET01ICEC
- (NatureServe Ecology - Southeast U.S. unpubl. data) UNDNAT01ICEC
- (Newell and Peet 1995) N95NEW01ICEC
- (Patterson 1994) N94PAT01ICEC
- (Patterson et al. 1994) A94PAT01ICEC
- (Peet et al. 2002) U02PEE01ICEC
- (Schafale 1998b) N98SCH02ICEC
- (Schafale and Weakley 1990) G90SCH01ICEC

GRank & Reasons: G5 (97-12-01). Within its range, this community type occurs extensively in suitable mesic habitats. Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of Tsuga canadensis.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community can include areas where *Betula lenta* and *Liriodendron tulipifera* dominate over dense *Rhododendron maximum* without a canopy of *Tsuga canadensis*. This situation was found throughout the park. One example was on the Cades Cove quadrangle at the confluence of Big Tommy Branch and Ekaneetlee Creek. On aerial photography, this community may appear similar to other Hemlock-Hardwood communities (i.e., *Tsuga canadensis - Halesia tetraptera - (Fagus grandifolia, Magnolia fraseri) / Rhododendron maximum / Dryopteris intermedia* Forest (CEGL007693) and *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861)). Some occurrences, where *Tsuga canadensis* overtops the deciduous trees, may have signatures similar to Hemlock and Hemlock-White Pine Forests (i.e., *Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana)* Forest (CEGL007136) and *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102)).

This community crosses over numerous mapping units. *Betula* spp.-dominated versions of this community may be mapped differently than the typical version with *Tsuga canadensis*. In addition, many communities labeled Montane alluvial may actually be this community. The two types intergrade quite a bit and cannot be distinguished easily from aerial photography.

Global Classif Comments: Deciduous trees more typical of 'rich' coves, such as *Aesculus flava, Tilia americana var. heterophylla*, and *Acer saccharum*, are present in this forest only as minor components, if at all. Likewise, rich-site herbs, such as *Actaea racemosa (= Cimicifuga racemosa), Caulophyllum thalictroides, Actaea pachypoda*, and *Adiantum pedatum*, are absent or nearly so. This forest is distinguished from "northern hardwood forests" by the lack of or near absence of *Fagus grandifolia, Betula alleghaniensis, Aesculus flava*, and the presence of low-elevation species, such as *Betula lenta* and *Liriodendron tulipifera*, and generally by a more depauperate herb layer. An interesting example from the Piedmont/Blue Ridge transition of Georgia (Cedar Creek Canyon, Chattahoochee National Forest) has high coverage of *Rhododendron minus* and other foothills/Piedmont species such as *Liquidambar styraciflua* and *Aesculus sylvatica*.

This community type is grossly under-represented by plot data considering its extensive distribution in southwestern Virginia. In the 900-1060 m (3000-3500 feet) elevation range, the type becomes transitional to *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861), which lacks lower-elevation species such as *Liriodendron tulipifera* and *Galax urceolata*, and contains many species characteristic of higher elevations and northern latitudes.

Similar vegetation has been observed in coves of the Cumberland Mountains of southwestern Virginia (e.g., Clinch Ranger District: Dark Hollow, Roaring Branch, Pick Breeches and Flannery Ridges,) but comprehensive data are needed to determine whether these stands are part of this forest types or transitional to *Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407). The latter unit apparently has an extensive distribution in the Cumberland Plateau of Kentucky and Tennessee, the Southern Ridge and Valley of Tennessee, and the Central Appalachians of West Virginia and southwestern Pennsylvania.

Internal Comments: RW 11-02: Plots 407, 513, 543, and 553 attributed to this community type (NatureServe Ecology South unpubl. data 2002). REE 10-02: There are apparently Carolina Vegetation Survey plots attributable to this type (Peet et al. 2002). MP 2002-03-07: CHER.59, Big Frog Mt, Sept 2001, M221Dd308. mjr 3-02: Also related concept *Tsuga canadensis - Liriodendron/Thelypteris* Forest (reference unknown). RW 11-27-2001: Plot #14 from Carl Sandburg Home National Historic Site

(NatureServe SE Ecology 2001 Unpublished Data). RW 09-19-2001: Plots 305, 405, and 409 from the Great Smoky Mountains National Park were used in this classification. KP 06-26-2001: Sample plots CHAT.16, CHAT114, and CHAT.67 (Piedmont). 12/98 CAP Not used, This type is in WV but not in CAP, see new type CEGLICnew1

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from quadrangles throughout the park. It is one of the most wide-ranging communities in the park, occurring in virtually every drainage of the park as it heads down the mountains into the 1840- to 3020-foot range.

Global Range: This community occurs in the Southern Blue Ridge and peripherally in the upper Piedmont, ranging from southwestern Virginia, south and west to northwestern Georgia.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?, VA:S?, WV:S?
TNC Ecoregions: 50:P, 51:C, 52:C, 59:C
USFS Ecoregions: 231Aa:CCC, M221Aa:CCC, M221Ab:CCC, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CC?, M221Db:CCC, M221Dc:CCC, M221Dd:CCC, M231Ad:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: K.D. Patterson, mod. G. Fleming and P. Coulling, SCS **Confidence:** 1 **Identifier:** CEGL007543
REFERENCES (type in full citation below if reference is new): Allard 1990, Eyre 1980, Fleming and Coulling 2001, Fleming et al. 2001, Gettman 1974, NatureServe Ecology - Southeast U.S. unpubl. data, Newell and Peet 1995, Patterson 1994, Patterson et al. 1994, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Tsuga canadensis - Halesia tetraptera - (Fagus grandifolia, Magnolia fraseri) / Rhododendron maximum / Dryopteris intermedia Forest

Eastern Hemlock - Mountain Silverbell - (American Beech, Fraser Magnolia) / Great Rhododendron / Fancy Fern Forest

Southern Appalachian Acid Cove Forest (Silverbell Type)

Ecological Group (SCS;MCS): Appalachian Highlands Hemlock-Hardwood Forests (420-25; 2.5.3.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes forests dominated by *Tsuga canadensis* and *Halesia tetraptera var. monticola*, occurring in restricted montane areas of western North Carolina and eastern Tennessee. This forest is found on protected, lower slopes and coves at elevations of 2800-4600 feet. The most important canopy trees are *Tsuga canadensis* and *Halesia tetraptera var. monticola*, although *Magnolia fraseri* or *Fagus grandifolia* can have high canopy coverage in some examples. Some occurrences have dense, tall-shrub strata dominated by *Rhododendron maximum*, while other occurrences have a more open shrub stratum with greater herbaceous cover, often dominated by *Dryopteris intermedia*. Other subcanopy/shrub species may include *Acer pensylvanicum, Acer saccharum, Acer rubrum, Amelanchier laevis, Betula alleghaniensis, Betula lenta,* and *Prunus pensylvanica*. Other common herbaceous species include *Mitchella repens, Medeola virginiana, Polystichum acrostichoides, Solidago curtisii (= Solidago caesia var. curtisii), Viola blanda,* and *Viola hastata*. *Rubus canadensis* is also common. This community is distinguished from *Tsuga canadensis - Liriodendron tulipifera - Betula lenta / Rhododendron maximum* Forest (CEGL007543) by not having *Liriodendron tulipifera* as an important component and by generally occurring at higher elevations (over 3000 feet). This community is distinguished from *Tsuga canadensis - Betula alleghaniensis / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861) by occurring on more protected sites and having more diverse tree and herb strata.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community is found on moderately steep, protected slopes and coves with western to northeastern aspects. Samples had a mean elevation of 3475 feet, ranging from 2600 to 4600 feet.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This forest has a canopy dominated by *Tsuga canadensis* and *Halesia tetraptera var. monticola*. Other species that can have high coverage in the canopy or subcanopy include *Acer saccharum, Fagus grandifolia, Magnolia fraseri, Betula alleghaniensis,* and *Acer rubrum*. *Prunus serotina* can also be present in the subcanopy. Some occurrences have dense tall-shrub strata dominated by *Rhododendron maximum*, but more typically the shrub stratum is open, with coverage by saplings of the canopy species. *Acer pensylvanicum* is also a typical shrub. The herb stratum has sparse to moderate coverage. Common species include *Eurybia divaricata (= Aster divaricatus), Dryopteris intermedia, Huperzia lucidula, Medeola virginiana, Mitchella repens, Oxalis montana, Solidago curtisii (= Solidago caesia var. curtisii), Tiarella cordifolia,* and *Viola* spp. (e.g., *Viola blanda, Viola canadensis, Viola hastata, Viola rotundifolia*).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Halesia tetraptera var monticola, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*
FERN	*Dryopteris intermedia*

Global

Stratum	Species
TREE CANOPY	*Halesia tetraptera var monticola, Tsuga canadensis*
TALL SHRUB	*Rhododendron maximum*
FERN	*Dryopteris intermedia*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Acer saccharum, Halesia tetraptera var monticola, Tsuga canadensis*
FORB	*Mitchella repens*
FERN	*Dryopteris intermedia*

Global

Stratum	Species
TREE CANOPY	*Halesia tetraptera var monticola, Tsuga canadensis*
TREE SUB-CANOPY	*Acer saccharum*
FORB	*Mitchella repens*
FERN	*Dryopteris intermedia*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum Forest (CEGL007543)
- Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / Leucothoe fontanesiana Forest (CEGL007861)

GRank & Reasons: G2 (00-01-04). This community is uncommon and geographically restricted to the Great Smoky Mountains, Tennessee, and to Joyce Kilmer Wilderness in western North Carolina. Occurrences are threatened by the Hemlock Woolly Adelgid (*Adelges tsugae*), an exotic insect pest.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community is distinguished from *Tsuga canadensis - Liriodendron tulipifera - Betula lenta / Rhododendron maximum* Forest (CEGL007543) by not having *Liriodendron tulipifera* as an important component and by generally occurring at higher elevations (over 3000 feet). This community is distinguished from *Tsuga canadensis - Betula alleghaniensis / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861) by occurring on more protected sites and having more diverse tree and herb strata. On aerial photography, this community may appear similar to other Hemlock-Hardwood communities (i.e., *Tsuga canadensis - Liriodendron tulipifera - Betula lenta / Rhododendron maximum* Forest (CEGL007543) and *Tsuga canadensis - Betula alleghaniensis / Rhododendron maximum / Leucothoe fontanesiana* Forest (CEGL007861)). In some occurrences *Tsuga canadensis* dominates beneath the deciduous upper canopy and may not be evident on air photos. Some occurrences, where *Tsuga canadensis* overtops the deciduous trees, may have signatures similar to Hemlock and Hemlock-White Pine Forests (i.e., *Tsuga canadensis / Rhododendron maximum - (Clethra acuminata, Leucothoe fontanesiana)* Forest (CEGL007136) and *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102)).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from the Cades Cove, Mount Le Conte, and Mount Guyot quadrangles. Historic samples come from the Thunderhead Mountain quadrangle (3420-4600 feet elevation). Samples of this community from the Cades Cove quadrangle ranged in elevation from 2720-3900 feet. Recent and historic samples from the Cades Cove quadrangle come from low slopes above the Left Prong of Anthony Creek; from protected slopes and coves north of McCampbell Knob; and in the vicinity of Forge Creek. Samples from the Mount Le Conte quadrangle ranged from 2602-4120 feet elevation and included samples from the western portion of the quadrangle near the Cherokee Orchard-Rainbow Falls trailhead and from coves east of Piney Mountain above Rocky Spur Branch. In the eastern portion of the Mount Le Conte quadrangle this community was sampled from low slopes above Horseshoe Branch and from Upper Porter's Creek on the far southwestern part of Mount Guyot quadrangle.

Global Range: This association occurs in restricted montane areas of western North Carolina and eastern Tennessee.

Nations: US

States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL007693
REFERENCES (type in full citation below if reference is new): Golden 1974, Newell et al. 1997, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm.

Pinus echinata / Schizachyrium scoparium Appalachian Woodland

Shortleaf Pine / Little Bluestem Appalachian Woodland
Shortleaf Pine / Little Bluestem Appalachian Woodland
Ecological Group (SCS;MCS): Appalachian Highlands Xeric Shortleaf Pine Woodlands and Forests (401-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: These fire-maintained, shortleaf pine woodlands occurred historically in the Appalachian regions of Alabama, north through Georgia, Tennessee, Kentucky, and possibly Virginia, on dry ridges and slopes or rock outcrops. Almost no intact examples are known to persist, although restoration efforts are underway in the Daniel Boone National Forest, Kentucky, the Chattahoochee National Forest, Georgia, and in Great Smoky Mountains National Park, Tennessee. Stands of these woodlands are dominated by *Pinus echinata*, with less than 25% cover by *Quercus* spp. They may contain an admixture of *Pinus virginiana* or *Pinus rigida*. The canopy can range from an open forest to woodland structure. The understory is open and dominated by graminoids and forbs. This community was historically habitat for montane populations of Red-cockaded Woodpecker (*Picoides borealis*). More information is needed to characterize and distinguish this community.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment:

Global Environment: One stand attributed to this type from the Cherokee National Forest in Monroe County, Tennessee, is a frequently burned woodland occurring on a steep slope underlain by phyllite (NatureServe unpubl. data).

VEGETATION DESCRIPTION

Global Vegetation: An example of this community undergoing restoration in the western edge of the Blue Ridge, in Fannin County, Georgia, has a canopy dominated by *Pinus echinata*, but with significant coverage by *Quercus coccinea* and *Quercus alba*. Other woody species in the canopy and subcanopy include *Pinus taeda, Pinus strobus, Nyssa sylvatica, Acer rubrum, Quercus prinus*, and *Oxydendrum arboreum*. The shrub stratum is open, but patchy, dominated by ericaceous shrubs such as *Vaccinium pallidum, Vaccinium stamineum, Vaccinium hirsutum, Vaccinium arboreum, Rhododendron alabamense, Kalmia latifolia*, and *Lyonia ligustrina*. Other shrubs and vines include *Smilax glauca, Hypericum hypericoides ssp. multicaule*, and *Diospyros virginiana*. The herbaceous stratum is closed, but has variable local dominance. Visual dominants at this site were *Schizachyrium scoparium, Pityopsis graminifolia, Pteridium aquilinum, Baptisia tinctoria*, and *Epigaea repens*. Other herbaceous species are *Iris cristata, Coreopsis major, Solidago odora, Dichanthelium commutatum, Antennaria plantaginifolia, Galax urceolata, Symphyotrichum dumosum (= Aster dumosus), Tephrosia virginiana*, and *Ageratina aromatica*. A sample from the upper Piedmont of Georgia (Chattahoochee National Forest) which is placed here is dominated by *Pinus echinata* in the canopy. The subcanopy includes *Juniperus virginiana var. virginiana, Quercus marilandica, Quercus stellata, Nyssa sylvatica*, and *Liquidambar styraciflua*. Shrubs are *Vaccinium arboreum, Chionanthus virginicus, Smilax glauca*, and *Crataegus uniflora*. Herbs include *Danthonia sericea, Coreopsis major, Schizachyrium scoparium, Andropogon gyrans*, and *Liatris microcephala*. This example is adjacent to a "glade." An additional sample from the Cherokee National Forest in Monroe County, Tennessee, is a frequently burned woodland occurring on a steep slope underlain by phyllite. The canopy is dominated by *Pinus echinata* (10-25% cover). Other canopy components include *Pinus rigida, Pinus virginiana*, and *Quercus alba*. The open subcanopy is characterized by *Quercus marilandica, Quercus alba*, and *Quercus stellata*. The open shrub layer includes *Calycanthus floridus* and *Ceanothus americanus*. Some of the more prominent members of the dense and diverse herbaceous layer include *Schizachyrium scoparium, Sorghastrum nutans, Pityopsis graminifolia, Tephrosia virginiana, Liatris scariosa, Antennaria plantaginifolia, Symphyotrichum undulatum (= Aster undulatus), Helianthus divaricatus*, and *Galactia volubilis.*

Global Dynamics: Nearby stands on similar topographic positions often have a very different composition and lack the open woodland character. In Georgia, these adjacent stands are often densely dominated by *Pinus virginiana*. Young *Pinus strobus* seedlings are becoming established underneath the canopy and are

anticipated to move into the gaps caused by the dying and declining canopy species. The dense shaded environment of these stands suppresses fine fuels provided by herbaceous species and are consequently difficult to burn.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Pinus echinata - Quercus stellata - Quercus marilandica / Vaccinium pallidum Woodland (CEGL003765)--a related mixed woodland.
- Pinus echinata - Quercus prinus - Quercus stellata / Vaccinium pallidum / Pityopsis graminifolia var. latifolia Woodland (CEGL004445)--a mixed woodland.

GRank & Reasons: G2 (99-02-15). This community is naturally rare in the Appalachians, where shortleaf pine communities are uncommon. It is a fire-maintained community, and most remaining acreage is fire-suppressed with little compositional similarity to historic vegetation. Shortleaf pine (*Pinus echinata*) populations seem to have undergone rangewide declines in vigor and extent. This phenomenon is primarily due to changes in fire regime and to depredations of the Southern Pine Beetle (*Dendroctonus frontalis*). Stands are threatened by the effects of continued fire suppression, which would inhibit the reproduction of *Pinus echinata*.

CLASSIFICATION COMMENTS

Global Classif Comments: This community occurs outside the range of *Pinus palustris*. In Great Smoky Mountains National Park, this community is being restored through the reintroduction of fire (B. Dellinger pers. comm.). There are no true remnants of this community left in Kentucky; all have *Quercus* spp. understory and shrubs and belong in a *Pinus echinata - Quercus* spp. woodland alliance (J. Campbell pers. comm.). On the very western edge of the Blue Ridge province in northern Georgia (the Cohutta Foothills), this community is being restored with the reintroduction of fire (K. Wooster pers. comm.). The current presence of related vegetation in the Cumberlands and/or the Interior Low Plateau of Kentucky and Tennessee is more speculative; in those regions, this type was probably more common historically than it is at present.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community may exist on the Calderwood qudarangle. Forests dominated by *Pinus echinata* occur within the park boundary, and efforts are being made to restore this association through reintroduction of fire to the landscape.

Global Range: This association occurred historically in the Appalachian regions of Alabama, north through Georgia, Tennessee, Kentucky, and possibly Virginia. Restoration efforts are underway in Georgia, Tennessee, and Kentucky.

Nations: US
States/Provinces: AL?, GA:S?, KY:S?, TN?, VA?
TNC Ecoregions: 44:C, 50:C, 51:C, 52:C
USFS Ecoregions: 221:C, 222Ab:C??, 222Af:C??, 222E:CC, 231Ad:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: USFS (Chattahoochee, Cherokee)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 3 **Identifier:** CEGL003560
REFERENCES (type in full citation below if reference is new): Campbell pers. comm., Dellinger pers. comm., NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Wooster pers. comm.

Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum Woodland

Table Mountain Pine - Pitch Pine - (Rock Chestnut Oak) / Mountain Laurel - Hillside Blueberry Woodland

Blue Ridge Table Mountain Pine - Pitch Pine Woodland (Typic Type)

Ecological Group (SCS;MCS): Appalachian Highlands Pitch and Table Mountain Pine Woodlands (401-80; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes mostly evergreen woodlands dominated by *Pinus pungens* and/or *Pinus rigida*, occurring over a dense ericaceous shrub stratum, on sharp ridges, mostly above 2000 feet elevation in the Southern Blue Ridge. This type is also found in limited areas of the inner Piedmont. This woodland occurs across a wide elevational range (1600-4000 feet), on exposed ridges and upper slopes with southerly and westerly exposures, over thin, excessively drained, nutrient-poor soils, and can be associated with rock outcroppings. Canopy coverage can often approach that of a forest, especially in areas where fire has been excluded and deciduous species have significant coverage. Deciduous species that can be important, particularly in the subcanopy, include *Quercus prinus, Quercus coccinea, Quercus stellata, Nyssa sylvatica, Acer rubrum*, and *Oxydendrum arboreum*. *Pinus virginiana* and *Pinus strobus* can have high coverage and even codominate on some sites. The shrub stratum is dominated by ericaceous species, typically *Kalmia latifolia* and *Leucothoe recurva* in the tall-shrub stratum and *Vaccinium pallidum* as a low shrub. Other shrub species vary with location, but include *Vaccinium stamineum, Vaccinium simulatum, Vaccinium pallidum, Vaccinium hirsutum, Vaccinium corymbosum, Rhododendron maximum, Rhododendron minus, Gaylussacia ursina, Gaylussacia baccata, Buckleya distichophylla, Pyrularia pubera*, and *Fothergilla major*. Species commonly found in the sparse herb stratum include *Chimaphila maculata, Galax urceolata, Pteridium aquilinum var. latiusculum, Xerophyllum asphodeloides, Chamaelirium luteum, Comptonia peregrina, Leiophyllum buxifolium, Gaultheria procumbens, Iris verna, Dichanthelium* spp., and *Epigaea repens*, although herbaceous species composition will vary within the range of this community. *Smilax glauca* is a common vine. Without periodic fire, this community will gradually succeed into forests dominated by *Quercus prinus* and *Quercus coccinea*, except on the most extreme sites, where this vegetation is self-perpetuating. It is thought that woodlands dominated by *Pinus pungens* are associated with more xeric conditions than woodlands dominated by *Pinus pungens* in combination with other tree species.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community is found on the Cades Cove quadrangle at elevations from 2300-3800 feet, on exposed ridgetops and on middle to upper slopes with west to southeast aspects. On the Mount Le Conte quadrangle it is found on similar sites, with south and southwest aspects, but reaches elevations over 4000 feet and as low as 1850 feet. Landforms are steep, flat to convex slopes and ridges. Soils are thin, rocky or sandy, and litter layers are thick. Almost all stands sampled showed evidence of Southern Pine Beetle (*Dendroctonus frontalis*) with dead or dying *Pinus pungens*. It is found in other quadrangles (especially Calderwood), but additional samples were not needed elsewhere.

Global Environment: This association is typically found on sharp ridges mostly above 2000 feet elevation in the Southern Blue Ridge. This woodland occurs across a wide elevation range (1600-4000 feet) in the southern Appalachians, on exposed ridges and upper slopes with southerly and westerly exposures, over thin, excessively drained, nutrient-poor soils, and can be associated with rock outcroppings. It is thought that woodlands dominated by *Pinus pungens* are associated with more xeric conditions than woodlands dominated by *Pinus pungens* in combination with other tree species (Barden 1977, Zobel 1969).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community has a woodland to forest canopy dominated by *Pinus pungens* and/or *Pinus rigida*, which often overtop all other trees species. The canopy can include many standing dead and dying *Pinus* species. Some occurrences may have significant canopy coverage by *Quercus prinus* or *Quercus coccinea*. A tree subcanopy may be absent or well-developed, with as much as 80% coverage and composed of small-diameter trees, typically *Acer rubrum, Oxydendrum arboreum*, and

Nyssa sylvatica. Other tree species that can occur in the canopy and subcanopy include *Amelanchier laevis, Castanea dentata, Magnolia fraseri, Pinus virginiana, Quercus rubra, Robinia pseudoacacia, Carya alba, Pinus strobus*, and *Tsuga canadensis*. A tall-shrub stratum varies from sparse and patchy to dense and continuous, often dominated by *Kalmia latifolia* and/or *Vaccinium stamineum*. Occurrences at high elevations (over 4000 feet) have *Pieris floribunda* as a dominant shrub. The short-shrub stratum ranges in coverage from 0-80% and is often dominated by *Gaylussacia ursina*. Other shrubs that may dominant this stratum include *Vaccinium hirsutum, Vaccinium pallidum*, and *Gaylussacia baccata*. Additional shrub species that are found in this community include species from the canopy and subcanopy, as well as *Acer pensylvanicum, Ilex montana, Pyrularia pubera, Quercus velutina, Rhododendron carolinianum, Rhododendron calendulaceum, Rhododendron maximum*, and *Sassafras albidum*. The herbaceous stratum can be sparse to moderate in coverage and is composed of various sub-shrubs and dry site forbs. *Epigaea repens, Galax urceolata*, and *Gaultheria procumbens* typically have the most coverage. Other species in the herbaceous stratum can include *Chimaphila maculata, Cleistes divaricata, Coreopsis major, Cypripedium acaule, Dichanthelium commutatum, Goodyera pubescens, Melampyrum lineare, Pteridium aquilinum, Schizachyrium scoparium*, and *Tephrosia virginiana*. The litter layer is thick and often makes up greater than 50% of the ground cover. *Smilax rotundifolia* is a common vine.

Global Vegetation: These mostly evergreen woodlands are characteristically dominated by *Pinus pungens* and/or *Pinus rigida*, occurring over a dense ericaceous shrub stratum. Deciduous species that can be important, particularly in the subcanopy, include *Quercus prinus, Quercus coccinea, Quercus stellata* (in lower elevation occurrences), *Nyssa sylvatica, Acer rubrum*, and *Oxydendrum arboreum. Pinus virginiana* and *Pinus strobus* can have high coverage and even codominate on some sites. The shrub stratum is dominated by ericaceous species, typically *Kalmia latifolia* and *Leucothoe recurva* in the tall-shrub stratum and *Vaccinium pallidum* as a low shrub. Other shrub species vary with location, but include *Vaccinium stamineum, Vaccinium simulatum, Vaccinium pallidum, Vaccinium hirsutum, Vaccinium corymbosum, Rhododendron maximum, Rhododendron minus, Gaylussacia ursina, Gaylussacia baccata, Buckleya distichophylla, Pyrularia pubera, Castanea dentata, Castanea pumila*, and *Fothergilla major*. Species commonly found in the sparse herb stratum include *Chimaphila maculata, Galax urceolata, Pteridium aquilinum var. latiusculum, Xerophyllum asphodeloides, Chamaelirium luteum, Comptonia peregrina, Leiophyllum buxifolium, Gaultheria procumbens, Iris verna, Melampyrum lineare, Dichanthelium* spp., and *Epigaea repens*, although herbaceous species composition will vary within the range of this community. *Smilax glauca* is a common vine.

Global Dynamics: Canopy coverage in stands of this association can often approach that of a forest, especially in areas where fire has been excluded and deciduous species have significant coverage. Without periodic fire, this community will gradually succeed into forests dominated by *Quercus prinus* and *Quercus coccinea*, except on the most extreme sites, where this vegetation is self-perpetuating. However, recent regional pine beetle kills throughout large areas of the Southeast have accelerated the rate of succession in most of these stands. This acceleration of succession may lead to conversion of these forests to hardwoods in the long term (Mike Jenkins, personal communication)

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus pungens, Pinus rigida*
TREE SUB-CANOPY	*Acer rubrum, Nyssa sylvatica*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Gaylussacia ursina, Vaccinium pallidum*
FORB	*Epigaea repens, Galax urceolata, Gaultheria procumbens*
VINE/LIANA	*Smilax rotundifolia*

Global

Stratum	Species
TREE CANOPY	*Pinus pungens, Pinus rigida*
TREE SUB-CANOPY	*Acer rubrum, Nyssa sylvatica, Oxydendrum arboreum, Quercus prinus*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Vaccinium pallidum*
FORB	*Galax urceolata*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Pinus pungens, Pinus rigida*
TALL SHRUB	*Kalmia latifolia*
SHORT SHRUB	*Gaylussacia ursina*
FORB	*Epigaea repens, Galax urceolata, Gaultheria procumbens, Melampyrum lineare*
FERN	*Pteridium aquilinum*

Global

Stratum	Species
TREE CANOPY	*Pinus pungens*
TALL SHRUB	*Fothergilla major*
SHORT SHRUB	*Comptonia peregrina, Leiophyllum buxifolium*
FORB	*Epigaea repens, Galax urceolata, Gaultheria procumbens, Xerophyllum asphodeloides*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
None at the moment.	

Global

Stratum	Species
SHRUB	*Pieris floribunda*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Pinus (pungens, rigida) / Quercus ilicifolia / Gaylussacia baccata Woodland (CEGL004996)

GRank & Reasons: G3 (98-04-30). This community is endemic to the southern Appalachian Mountains where it is maintained by periodic fire or extreme site conditions. Recent studies show that acreage of this community has decreased due to fire suppression (Turrill and Buckner 1995) and that many remaining examples have substantial hardwood invasion. Lightning-set and high-intensity controlled burns are necessary to maintain and re-establish this community type. In addition, recent pine beetle outbreaks have killed off large areas of this community type in the past five years (1998-2003) in the Southeast. Due to this, the global rank may soon need to be adjusted to G2.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Examples at the lowest elevations (below 2300 feet) on the Mount Le Conte quadrangle lacked *Pinus pungens* and *Pinus virginiana* and were dominated by *Pinus rigida* and *Quercus coccinea*. Many former examples of this community now exist as chestnut oak forests (CEGL006271) due to fire suppression and pine mortality due to Pine Bark Beetle. This community often grades into *Quercus prinus*-dominated forests (CEGL006271) on the ridgelines above. Other adjacent communities can include heath shrublands or oak - hickory forests on less exposed sites.

Global Classif Comments: Other communities with *Pinus pungens* occur in central Pennsylvania and in Virginia. These northern types are thought to have a different species composition and geology than the forests described here. Species associated with *Pinus pungens* in the northern part of its range that do not occur in this community include *Quercus ilicifolia, Viburnum acerifolium,* and *Vaccinium angustifolium*. [See *Pinus (pungens, rigida) / Quercus ilicifolia / Gaylussacia baccata* Woodland (CEGL004996).]

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled heavily on the Cades Cove and Mount Le Conte quadrangles and occurs in other areas of the park. On the Cade Cove quadrangle it was found at elevations from 2300-3800 feet. Areas sampled include Cobb Butt and Cobb Ridge, on south slopes and along the southern ridgeline from 3500-3800 feet elevation; an area north of the Cades Cove Loop Road, north of Tater Ridge, on a southwest sideridge of Cave Ridge at 2840 feet; and just southeast of the Cades Cove Loop Road, on northwest, steep, middle slopes above Anthony Creek at 2400 feet. Historic samples that may represent this community on the Cades Cove quadrangle were taken from the

broad ridges and upper, west- to southeast-facing slopes north of Parsons Branch Road, above Rabbit Creek (2460-2500 feet elevation); the upper east slopes of Leadbetter Ridge (2300 feet elevation); the eastern, middle slopes of Gregory Ridge (3040-3440 feet elevation); and the middle and upper south slopes of Mollies Ridge / Butt from 2840-3500 feet elevation. This community seems to be less common on the Mount Le Conte quadrangle and was found at elevations from 1850-4200 feet. It was sampled in the southwestern portion of the quadrangle, on the southeast slopes of Bullhead (4200 feet); in the central portion of the quadrangle on the lower western slopes of Mt. Winnesoka above Roaring Fork (2700 feet); north of Brushy Mountain, on the southeast slopes below Turkey Ridge (3700 feet); on the southern part of Potato Ridge; and on a northeast-running sideridge of Mt. Winnesoka, above Injun Creek (2180 feet). In the northeastern portion of the quadrangle, this community was found north of Copeland Creek, on the southwest high slopes over Copeland Creek (1850 feet).

Global Range: This community ranges throughout the Southern Blue Ridge, from southwestern Virginia, south through western North Carolina and eastern Tennessee, into northeastern Georgia and northwestern South Carolina.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?, VA?
TNC Ecoregions: 51:C, 52:C, 59:?
USFS Ecoregions: M221Aa:CCP, M221Ab:CCP, M221Ac:CCC, M221Da:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL007097
REFERENCES (type in full citation below if reference is new): Allard 1990, Barden 1977, Golden 1974, Golden 1981, Hedlin et al. 1981, McLeod 1988, NatureServe Ecology - Southeast U.S. unpubl. data, Nelson 1986, Newell and Peet 1995, Peet et al. 2002, Pyne 1994, Racine 1966, Schafale 1998b, Schafale and Weakley 1990, Turrill and Buckner 1995, Wharton 1978, Whittaker 1956, Williams 1991, Williams and Johnson 1990, Williams and Johnson 1992, Williams et al. 1990a, Zobel 1969

Carya glabra - Fraxinus americana - Quercus prinus / Ostrya virginiana / Philadelphus hirsutus Woodland

Pignut Hickory - White Ash - Rock Chestnut Oak / Eastern Hop-hornbeam / Hairy Mock-orange Woodland

Blue Ridge Calcareous Shale Slope Woodland (Shrubby Type)

Ecological Group (SCS;MCS): Appalachian Shale Glades and Barrens (440-40; 2.3.4.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: These deciduous or mostly deciduous edaphically maintained woodlands are known from the Southern Blue Ridge of Tennessee and Virginia, possibly ranging into the Ridge and Valley. These woodlands occur as small openings on steep slopes, below 3000 feet elevation, on outcrops with mixtures of calcareous shales, siltstones, and sandstones. These xeric woodlands have canopies typically dominated by *Carya glabra, Fraxinus americana,* and *Quercus prinus*. In addition, *Ulmus alata, Carya carolinae-septentrionalis, Quercus rubra* and *Juniperus virginiana var. virginiana* may also be present in the canopy. Shrub cover can be sparse to moderately dense. Typical shrubs include *Philadelphus hirsutus* and *Ostrya virginiana*. Other shrubs and small trees may include *Acer leucoderme, Cornus florida, Celtis tenuifolia, Staphylea trifolia, Cercis canadensis, Chionanthus virginicus, Ulmus rubra, Ptelea trifoliata,* and *Symphoricarpos orbiculatus*. The ground cover is sparse, with large areas of bare substrate common. Coverage by mosses and lichens can be substantial. Characteristic herbaceous species include *Dichanthelium boscii, Muhlenbergia tenuifolia, Packera obovata (= Senecio obovatus), Asclepias quadrifolia, Erigeron pulchellus, Polygala paucifolia, Arabis laevigata, Campanula divaricata*, and *Aristolochia serpentaria*. Additional herbs from a stand assigned here from the Ocoee River Gorge (Tennessee) include *Chasmanthium latifolium, Solidago sphacelata, Carex purpurifera*, and *Symphyotrichum oblongifolium (= Aster oblongifolius)* (these dominant to frequent), as well as *Asplenium platyneuron, Carex laxiflora, Carex pensylvanica, Cheilanthes lanosa, Dichanthelium* sp., *Euphorbia corollata, Geum* sp., *Heuchera* sp., *Oxalis grandis, Rudbeckia triloba, Sedum nevii, Senna marilandica, Tradescantia* sp., *Verbesina occidentalis,* and *Verbesina virginica*. The exotic grass *Microstegium vimineum* may also be present in stands of this association.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Within the park, these communities occur on steep slopes with calcareous outcrops. Since there is very little of this geology in the park, this type is extremely rare and may only occur in one location in the park.

Global Environment: These woodlands occur as small openings on steep slopes, below 3000 feet elevation, on outcrops with mixtures of calcareous shales, siltstones, and sandstones.

The site in Virginia is a steep (25 degrees), convex, south-facing sideslope along Whitetop Laurel Creek. Bedrock is mapped as the Unicoi Formation, which here consists of conglomeratic sandstone and phyllite, with minor interbedded basalt. Numerous shaley-appearing outcrops and loose boulders cover about 50% of the slope where this community type occurs. About 30% of the remaining surface substrate consists of exposed, dark-colored, clay-loam mineral soil with substantial coverage by mosses and lichens. Although no chemistry data are available, it presumed that this soil has at least moderately high base status, based on the abundance of several nutrient-demanding species (e.g., *Philadelphus hirsutus, Fraxinus americana, Ostrya virginiana,* etc.). The soil moisture regime was assessed as xeric.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The vegetation of this community may approach a forest with the influence of adjacent *Quercus prinus* matrix communities. However, examples of this community possess short *Carya glabra, Fraxinus americana, Ulmus americana,* and *Quercus prinus* over a sparse to moderate shrub layer of *Philadelphus hirsutus*. The herbaceous layer in the example of this community sampled was very diverse, with plants ranging from *Arnoglossum atriplicifolium (= Cacalia atriplicifolia)* and *Pilea pumila* that occur in more mesic habitats to *Polystichum acrostichoides* and *Asplenium platyneuron,* plants generally associated with drier and more acidic soils.

Global Vegetation: These xeric woodlands have canopies typically dominated by *Carya glabra, Fraxinus americana*, and *Quercus prinus*. In addition, *Ulmus alata, Carya carolinae-septentrionalis, Quercus rubra, Pinus virginiana*, and *Juniperus virginiana var. virginiana* may also be present in the canopy. Shrub cover can be sparse to moderately dense. Typical shrubs include *Philadelphus hirsutus* and *Ostrya virginiana*. Other shrubs and small trees may include *Acer leucoderme, Cornus florida, Celtis tenuifolia, Staphylea trifolia, Cercis canadensis, Chionanthus virginicus, Ulmus rubra, Ptelea trifoliata*, and *Symphoricarpos orbiculatus*. The ground cover is sparse, with large areas of bare substrate common. Coverage by mosses and lichens can be substantial. Characteristic herbaceous species include *Dichanthelium boscii, Muhlenbergia tenuifolia, Packera obovata (= Senecio obovatus), Asclepias quadrifolia, Erigeron pulchellus, Polygala paucifolia, Arabis laevigata, Campanula divaricata*, and *Aristolochia serpentaria*. Additional herbs from a stand assigned here from the Ocoee River Gorge (Tennessee) include *Chasmanthium latifolium, Solidago sphacelata, Carex purpurifera*, and *Symphyotrichum oblongifolium (= Aster oblongifolius)* (these dominant to frequent), as well as *Asplenium platyneuron, Carex laxiflora, Carex pensylvanica, Cheilanthes lanosa, Dichanthelium* sp., *Euphorbia corollata, Geum* sp., *Heuchera* sp., *Oxalis grandis, Rudbeckia triloba, Sedum nevii, Senna marilandica, Tradescantia* sp., *Verbesina occidentalis*, and *Verbesina virginica*. The exotic grass *Microstegium vimineum* may also be present in stands of this association.

The stand in Virginia is a deciduous, apparently edaphically maintained woodland dominated by stunted (6-10 m tall) *Carya glabra, Fraxinus americana*, and *Quercus prinus*. Minor canopy trees include *Carya ovata, Quercus rubra*, and *Acer saccharum*. Shrub cover varies from moderately to very dense and is dominated by thickets of *Philadelphus hirsutus*. Associated small trees and shrubs include *Ostrya virginiana* and *Amelanchier arborea*. The sparse herb layer contains *Dichanthelium boscii, Muhlenbergia tenuifolia, Packera obovata (= Senecio obovatus), Asclepias quadrifolia, Erigeron pulchellus, Polygala paucifolia, Arabis laevigata, Campanula divaricata, Solidago caesia, Potentilla canadensis*, and *Aristolochia serpentaria*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Carya glabra, Fraxinus americana, Ostrya virginiana, Quercus prinus, Ulmus americana*
SHRUB	*Philadelphus hirsutus*

Global

Stratum	Species
TREE CANOPY	*Carya glabra, Fraxinus americana, Quercus prinus*
SHRUB	*Philadelphus hirsutus*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Carya glabra, Ulmus americana*
SHRUB	*Philadelphus hirsutus*

Global

Stratum	Species
SHRUB	*Philadelphus hirsutus*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Quercus prinus - Juniperus virginiana - (Pinus virginiana) / Philadelphus hirsutus - Celtis occidentalis Woodland (CEGL007720)--a related "grassy type."

GRank & Reasons: G2 (98-04-07). This community is limited to regionally uncommon and small exposures of moderately nutrient-rich rock in the Southern Blue Ridge (and possibly the Ridge and Valley). It is presently only known from a single site in the southern Virginia Blue Ridge and at a related site in Tennessee. Additional occurrences in the Blue Ridge, Ridge and Valley, or Cumberland Mountains of Virginia, North Carolina, Tennessee, and Kentucky are possible. The total acreage of this community may be less than 1000 acres. Threats are few, although logging in adjacent areas can cause unnatural disturbance or downslope erosion, along with alteration of light levels.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community may deserve its own community type, but based on the one location that we have documented within the park boundary we could not find sufficient justification to create the new type yet. We should continue to look for other examples of this community type to document and to use for later elaboration of this type into two.

Global Classif Comments: Known from calcareous shale at Whitetop Laurel Slopes, Virginia, and from the Ocoee River Gorge, Tennessee.

The single Virginia plot representing this community type was analyzed with many other plots representing similar basic or calcareous woodlands and forests, but consistently performed as an outlier in multivariate analyses of compositional data. Additional occurrences of this vegetation should be sought within the range of *Philadelphus hirsutus*, a species which barely enters Virginia from the southwest.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community most likely does not occur in the park. However, the community may exist and is included in here just in case it is spotted in an area with shale slopes within the park.

Global Range: This community is known from a single site in the southern Virginia Blue Ridge and at a related site in Tennessee. Additional occurrences in the Blue Ridge, Ridge and Valley, or Cumberland Mountains of Virginia, North Carolina, Tennessee, and Kentucky are possible.

Nations: US
States/Provinces: TN:S?, VA:S?
TNC Ecoregions: 51:C, 59:?
USFS Ecoregions: M221Ce:C??, M221Db:CCC, M221Dc:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:

Authors: G. Fleming and A.S. Weakley, mod. G. Fleming and P. Coulling, SCS **Confidence:** 2 **Identifier:** CEGL004995

REFERENCES (type in full citation below if reference is new): Fleming and Coulling 2001, Fleming et al. 2001, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale 1998b

Pinus virginiana / Schizachyrium scoparium - Carex pensylvanica Woodland

Virginia Pine / Little Bluestem - Pennsylvania Sedge Woodland
Blue Ridge Acid Shale Woodland
Ecological Group (SCS;MCS): Appalachian Shale Glades and Barrens (440-40; 2.3.4.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs on steep, shaley slopes in the southern Appalachians and has an open stunted canopy and sparse herb and shrub strata characterized by species able to grow in loose shale fragments. It is known from the Hot Springs Window, in the Blue Ridge Mountains, and occurs elsewhere in the southern Appalachians, as well. The stunted open canopy (5-8 m tall, 25-75% cover) is dominated by *Pinus virginiana*, with scattered individuals of *Quercus prinus* and *Quercus rubra* sometimes present. The shrub layer is very sparse, and may include scattered individuals of *Kalmia latifolia, Vaccinium stamineum*, and *Vaccinium pallidum*. The herb layer is very sparse to patchy, and is dominated by *Schizachyrium scoparium, Carex pensylvanica, Danthonia spicata, Dichanthelium linearifolium*, with scattered individuals of *Coreopsis major, Houstonia longifolia (= Houstonia tenuifolia), Hieracium venosum*, and *Euphorbia corollata*. Lichens are frequent, particularly on in-place outcrops, and include *Cladina rangiferina* and *Cladonia* spp. Loose shale fragments cover 80-90% of the ground surface.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Same as global description.

Global Environment: This community occurs on steep, shaley slopes in the southern Appalachians and has an open, stunted canopy and sparse herb and shrub strata characterized by species able to grow in loose shale fragments. Loose shale fragments cover 80-90% of the ground surface.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global description.

Global Vegetation: The stunted open canopy (5-8 m tall, 25-75% cover) of stands of this type is dominated by *Pinus virginiana*, with scattered individuals of *Quercus prinus* and *Quercus rubra* sometimes present. The shrub layer is very sparse, and may include scattered individuals of *Kalmia latifolia, Vaccinium stamineum*, and *Vaccinium pallidum*. The herb layer is very sparse to patchy, and is dominated by *Schizachyrium scoparium, Carex pensylvanica, Danthonia spicata, Dichanthelium linearifolium*, with scattered individuals of *Coreopsis major, Houstonia longifolia (= Houstonia tenuifolia), Hieracium venosum*, and *Euphorbia corollata*. Lichens are frequent, particularly on in-place outcrops, and include *Cladina rangiferina* and *Cladonia* spp.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Pinus virginiana - Quercus prinus - Quercus rubra / Vaccinium pallidum - Kalmia latifolia Forest (CEGL007539)--a related "forest" from the same area.

GRank & Reasons: G2? (98-12-11). As defined, this community is limited to the rare outcrops of shale in the Blue Ridge and in the transition between the Blue Ridge and Ridge and Valley physiographic provinces in extreme western North Carolina and eastern Tennessee. There is some possibility that this may be found to be somewhat more widespread in the Ridge and Valley of Tennessee, southwestern Virginia, and northern Alabama. It is distinguished from the various shale barren types of western Virginia, eastern West Virginia, western Maryland, and south-central Pennsylvania by the complete absence of the distinctive endemic flora of that region. Most examples are not highly threatened because of their steep slope and poor timber.

CLASSIFICATION COMMENTS

Global Classif Comments: This type is distinguished from the various shale barren types of western Virginia, eastern West Virginia, western Maryland, and south-central Pennsylvania by the complete absence of the distinctive endemic flora of that region.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was found in the Calderwood quadrangle off of the Little Bottoms Trail. It is extremely rare within the park and may only occur in this one location.

Global Range: This community is known from the Hot Springs Window, in the Blue Ridge Mountains, and occurs elsewhere in the southern Appalachians as well.

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: USFS (Cherokee, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL003624
REFERENCES (type in full citation below if reference is new): Allard 1990, Peet et al. 2002, Schafale 1998b

Kalmia latifolia - Rhododendron catawbiense - (Gaylussacia baccata, Pieris floribunda, Vaccinium corymbosum) Shrubland

Mountain Laurel - Catawba Rhododendron - (Black Huckleberry, Mountain Fetterbush, Highbush Blueberry) Shrubland

Southern Appalachian Mountain Laurel Bald

Ecological Group (SCS;MCS): Appalachian Highlands Shrub Balds (436-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs in the mountains of Georgia, North Carolina, and Tennessee, on ridges, and steep, rocky slopes at intermediate elevations (4000-5000 feet). It is a mostly evergreen shrubland, although deciduous shrubs may be present and even locally dominant. Shrubs form a dense, sometimes impenetrable thicket, 1-4 m tall. The most typical shrub dominants are *Kalmia latifolia* and *Rhododendron catawbiense*, although *Gaylussacia baccata, Leiophyllum buxifolium, Pieris floribunda, Rhododendron carolinianum, Rhododendron maximum*, and *Vaccinium corymbosum* are dominant or have high coverage in some occurrences. Other shrubs include *Photinia melanocarpa (= Aronia melanocarpa), Clethra acuminata, Ilex montana, Vaccinium stamineum, Leucothoe recurva*, and *Viburnum nudum var. cassinoides*. Small openings in the shrub canopy are dominated by lichens, bare rock or herbs, with some occurrences having up to 60% exposed rock. Herb cover beneath the shrub canopy is absent or very sparse (<5%) and may include *Galax urceolata, Gaultheria procumbens, Goodyera pubescens, Melampyrum lineare, Mitchella repens*, and *Pteridium aquilinum*. *Smilax rotundifolia* is a common vine. Small, scattered trees are possible (*Acer rubrum, Amelanchier laevis, Betula alleghaniensis, Ilex montana, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Prunus pensylvanica, Quercus rubra*) and may be more typical of shrublands resulting from intense fires on less exposed sites. Windfall, landslides, and small, localized, lightning-caused fires are important in the establishment and maintenance of these shrublands. This community can result from secondary succession after fire or logging or can occur as a topo-edaphic climax on steep or exposed sites.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community occurs on southerly exposed ridges and steep slopes below 5000 feet elevation. Samples range from 4190 to 4900 feet elevation. One example is in a gap, on a convex slope, and may be a fire scar. Another is on a steep northwest-facing slope.

Global Environment: This community occurs in the mountains of Georgia, North Carolina, and Tennessee, on ridges, and steep, rocky slopes at intermediate elevations (4000-5000 feet).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community is a mostly evergreen shrubland, although deciduous shrubs may be present and even locally dominant. Shrubs form a dense, sometimes impenetrable thicket, 1-4 m tall. The most typical shrub dominants are *Kalmia latifolia* and *Rhododendron catawbiense*, although *Gaylussacia baccata, Leiophyllum buxifolium, Pieris floribunda, Rhododendron carolinianum, Rhododendron maximum*, and *Vaccinium corymbosum* are dominant or have high coverage in some occurrences. Other shrubs include *Photinia melanocarpa (= Aronia melanocarpa), Clethra acuminata, Vaccinium stamineum*, and *Viburnum nudum var. cassinoides*. Small openings in the shrub canopy are dominated by rock or herbs, with some occurrences having up to 60% exposed rock. However, herb cover beneath the shrub canopy is absent or very sparse (<5%) and may include *Galax urceolata, Gaultheria procumbens, Goodyera pubescens, Melampyrum lineare, Mitchella repens*, and *Pteridium aquilinum*. *Smilax rotundifolia* is a common vine. Small, scattered trees are possible (*Acer rubrum, Amelanchier laevis, Betula alleghaniensis, Ilex montana, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Picea rubens*, and *Prunus pensylvanica*) and may be more typical of shrublands resulting from intense fires on less exposed sites.

Global Vegetation: This association typically manifests as a mostly evergreen shrubland, although deciduous shrubs may be present and even locally dominant. These shrubs form a dense, sometimes impenetrable thicket, 1-4 m tall. The most typical shrub dominants are *Kalmia latifolia* and *Rhododendron catawbiense*, although *Gaylussacia baccata, Leiophyllum buxifolium, Pieris floribunda, Rhododendron carolinianum,*

Rhododendron maximum, and *Vaccinium corymbosum* are dominant or have high coverage in some occurrences. Other shrubs include *Photinia melanocarpa (= Aronia melanocarpa), Clethra acuminata, Ilex montana, Vaccinium simulatum, Vaccinium stamineum, Leucothoe recurva*, and *Viburnum nudum var. cassinoides*. Small openings in the shrub canopy are dominated by lichens, bare rock or herbs, with some occurrences having up to 60% exposed rock. Herb cover beneath the shrub canopy is absent or very sparse (<5%) and may include *Galax urceolata, Gaultheria procumbens, Goodyera pubescens, Melampyrum lineare, Mitchella repens*, and *Pteridium aquilinum*. *Smilax rotundifolia* is a common vine. Small, scattered trees are possible (*Acer rubrum, Amelanchier laevis, Betula alleghaniensis, Ilex montana, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Prunus pensylvanica, Picea rubens*, and *Quercus rubra*) and may be more typical of shrublands resulting from intense fires on less exposed sites.

Global Dynamics: Windfall, landslides, and small, localized, lightning-caused fires are important in the establishment and maintenance of these shrublands. This community can result from secondary succession after fire or logging or can occur as a topo-edaphic climax on steep or exposed sites.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TALL SHRUB	*Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum*
SHORT SHRUB	*Leiophyllum buxifolium, Rhododendron catawbiense*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TALL SHRUB	*Gaylussacia baccata, Kalmia latifolia, Pieris floribunda, Rhododendron catawbiense, Vaccinium corymbosum*
FORB	*Galax urceolata, Gaultheria procumbens*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium Shrubland (CEGL007876)

GRank & Reasons: G2G3 (99-02-15). This is a locally common heath bald type in parts of the Southern Blue Ridge. Some occurrences represent a topo-edaphic climax, while other areas require fire to maintain the physiognomy. Fire-maintained occurrences are threatened by general fire prevention in the mountains.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community typically occurs below the elevation of spruce - fir forests and adjacent to forests dominated by Table Mountain pine, northern red oak, or *Fagus grandifolia* ("Beech Gaps"). Occurrences at high elevations may be transitional to *Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium* Shrubland (CEGL007876), and it may be difficult to distinguish the two heath bald signatures. The alliance may serve as a better mapping unit for these communities.

Global Classif Comments: These shrublands possibly have a broader distribution and typically occur at lower elevations than other montane shrublands in the *Rhododendron (catawbiense, carolinianum) - Kalmia latifolia* Shrubland Alliance (A.744). In the Southern Blue Ridge, this shrubland generally occurs at elevations over 1200 meters (4000 feet) and grades into forests dominated by *Quercus coccinea, Pinus rigida, Pinus pungens*, and/or *Quercus rubra*. High-elevation occurrences may be compositionally similar to another heath bald community, *Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium* Shrubland (CEGL007876).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Mount Le Conte and Bunches Bald quadrangles and not on the Cades Cove quadrangle, although it is possible there. This community is uncommon in the landscape but possible in other areas of the park. On the Mount Le Conte quadrangle it was sampled on Brushy Mountain, ridges along the Alum Cave Trail south of Mount Le Conte (4600 and 4900 feet), and in the southwestern portion of the quadrangle on the western ridge of Balsam Point, the vicinity of Chimney Tops, and east of Bullhead. It was also sampled on Spruce Mountain in 2002 and can be easily seen along sections of the Newfound Gap Road on both the Tennessee and North Carolina sides.

Global Range: This community is found in the Blue Ridge Mountains of Georgia, North Carolina, and Tennessee. Examples in the Cumberlands of Kentucky are rare and of limited extent.

Nations: US
States/Provinces: GA:S?, KY:S?, NC:S?, TN:S?
TNC Ecoregions: 50:C, 51:C, 59:C
USFS Ecoregions: M221Aa:CPP, M221Be:CPP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL003814
REFERENCES (type in full citation below if reference is new): Allard 1990, Ambrose 1990a, CAP pers. comm. 1998, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Pyne 1994, Risk 1993, Schafale 1998b, Schafale and Weakley 1990

Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium Shrubland

Carolina Rhododendron - Catawba Rhododendron - Sand-myrtle Shrubland
Southern Appalachian Heath Bald
Ecological Group (SCS;MCS): Appalachian Highlands Shrub Balds (436-20; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This high-elevation shrubland occurs in the Great Smoky Mountains of eastern Tennessee, on steep ridges, rock outcroppings, and landslides at elevations over 5500 feet, in the Spruce-Fir zone. It has 25-100% shrub cover and may occur as a dense shrubland, 2-4 m tall, or as a shorter, more open shrubland with areas of exposed rock, scattered mats of prostrate vegetation, and isolated clumps of herbaceous species. The most common shrubs are *Rhododendron carolinianum, Rhododendron catawbiense*, and *Leiophyllum buxifolium*, locally dominant in patches and forming a mosaic. Shrubs are less than 1 m tall on the steepest, rockiest, most exposed sites, and taller on gentle, more protected sites with greater soil development. Other associated shrubs with minor coverage may include *Abies fraseri, Photinia pyrifolia (= Aronia arbutifolia), Photinia melanocarpa (= Aronia melanocarpa), Diervilla sessilifolia, Ilex montana, Menziesia pilosa, Pieris floribunda, Prunus pensylvanica, Vaccinium corymbosum, Vaccinium erythrocarpum*, and *Viburnum nudum var. cassinoides*. Under tall, dense shrubs there is little herb cover, but in more open shrublands, on steep cliffs with seepage, herbaceous species may grow in dense patches on ledges and crevices. Herbaceous species such as *Calamagrostis cainii, Carex misera, Geum radiatum, Saxifraga michauxii, Solidago glomerata*, and *Trichophorum caespitosum (= Scirpus cespitosus)* are associated with this community on the summits of Mount LeConte. Thick hummocks of lichens and mosses can occur on flatter sites, and scattered wind-sheared trees of *Picea rubens* or *Abies fraseri* are possible in some examples. High solar irradiation and desiccating winds, in combination with the shallow, nutrient-poor soils, are key environmental factors influencing this community. Locally, vegetation is influenced by seepage areas on steep cliffs and ledges. It is known from areas of exposed slate on the steep ridges of Mount LeConte (Ramseur 1958).

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community occurs on steep ridges, rock outcroppings, and landslides at elevations over 5500 feet, in the spruce-fir zone. High solar irradiation and desiccating winds, in combination with the shallow, nutrient-poor soils, are key environmental factors influencing this community. Locally vegetation is influenced by seepage areas on steep cliffs and ledges (e.g., southwest portion of the Mount Le Conte summit). This community is known from areas of exposed slate on the steep ridges of Mount Le Conte (Ramseur 1958). Perhaps the best examples of this community exist on Charlies Bunion.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community has 25-100% shrub cover and may occur as a dense shrubland, 2-4 m tall, or as a shorter, more open shrubland with areas of exposed rock, scattered mats of prostrate vegetation, and isolated clumps of herbaceous species. The most common shrubs are *Rhododendron carolinianum, Rhododendron catawbiense*, and *Leiophyllum buxifolium*, locally dominant in patches and forming a mosaic. Shrubs are less than 1 m tall on the steepest, rockiest, most exposed sites, and taller on gentle, more protected sites with greater soil development. Other associated shrubs with minor coverage may include *Abies fraseri, Photinia pyrifolia (= Aronia arbutifolia), Photinia melanocarpa (= Aronia melanocarpa), Diervilla sessilifolia, Ilex montana, Menziesia pilosa, Pieris floribunda, Prunus pensylvanica, Vaccinium corymbosum, Vaccinium erythrocarpum*, and *Viburnum nudum var. cassinoides*. Under tall dense shrubs there is little herb cover, but in more open shrublands, on steep cliffs with seepage, herbaceous species may grow in dense patches on ledges and crevices. Herbaceous species such as *Calamagrostis cainii, Carex misera, Geum radiatum, Saxifraga michauxii, Solidago glomerata, Trichophorum caespitosum (= Scirpus cespitosus)* are associated with this community on the summits of Mount Le Conte. Thick hummocks of lichens and mosses can occur on flatter sites. Scattered wind-sheared trees of *Picea rubens* or *Abies fraseri* are possible in some examples.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TALL SHRUB	*Rhododendron catawbiense*
SHORT SHRUB	*Leiophyllum buxifolium, Rhododendron carolinianum*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TALL SHRUB	*Abies fraseri, Picea rubens, Rhododendron catawbiense*
SHORT SHRUB	*Diervilla sessilifolia, Leiophyllum buxifolium, Menziesia pilosa, Rhododendron carolinianum*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Rhododendron carolinianum Shrubland (CEGL003816)

GRank & Reasons: G1 (99-02-16). This community is limited in extent, occurring as scattered pockets in the southern Appalachian Mountains, possibly limited to the Great Smoky Mountains. This fragile community is threatened by heavy recreational use.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This shrubland grades into vegetation dominated by *Picea rubens* and/or *Abies fraseri*. Particularly on the summit and high slopes of Mount Le Conte, the taxonomic distinction between *Rhododendron minus* and *Rhododendron carolinianum* is uncertain. Some of what is treated here as *Rhododendron carolinianum* may prove to be *Rhododendron minus*. It may be difficult to distinguish the signature of this heath bald type from that of *Kalmia latifolia - Rhododendron catawbiense - (Gaylussacia baccata, Pieris floribunda, Vaccinium corymbosum*) Shrubland (CEGL003814), especially at transitional elevations. The alliance may serve as a better mapping unit for these communities.

Global Classif Comments: The taxonomic distinctions between *Rhododendron minus* and *Rhododendron carolinianum* are currently uncertain. Some of what is treated here as *Rhododendron carolinianum* may prove to be *Rhododendron minus*. This association contains a portion of the former concept of *Rhododendron carolinianum* Shrubland (CEGL003816), which occurs at lower elevations in areas of quartzite and meta-arkose geology.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from the highest elevations of the Mount Le Conte quadrangle and neighboring quadrangles. It may occur in other high-elevation areas of the park. On the Mount Le Conte quadrangle this community was sampled from Rocky Spur north of Mount Le Conte; from Clifftop west of the Mount Le Conte summit; and from the Jumpoff, in the vicinity of Mount Kephart. In addition, it was sampled from Charlie's Bunion off of the Appalachian Trail.

Global Range: This high-elevation shrubland occurs in the Great Smoky Mountains of eastern Tennessee.

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007876
REFERENCES (type in full citation below if reference is new): Allard 1990, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Ramseur 1958, Risk 1993, Schafale and Weakley 1990, Whittaker 1979

Arundinaria gigantea ssp. gigantea Shrubland

Giant Cane Shrubland

Floodplain Canebrake

Ecological Group (SCS;MCS): Interior Highlands Riverfront and Levee Forests and Shrublands (426-45; 1.6.3.6)
Southeastern Coastal Plain Floodplain Shrublands (385-25; 1.6.4.5)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association is characterized by dense, often monospecific thickets of the bamboo shrub *Arundinaria gigantea* occupying large areas referred to as canebrakes. The canebrake shrubland type was historically widespread, but is now rare and occupies very little of its former acreage. It was best developed in streamside flats and alluvial floodplains on ridges and terraces where it was protected from prolonged inundation. Historically, this community covered large areas of many floodplains and streamsides in the Coastal Plain from North Carolina to Texas, Mississippi River Alluvial Plain, Interior Highlands, Interior Low Plateau, Southern Blue Ridge and possibly the Central Appalachians of the southeastern United States. Stands occur on alluvial and loess soils and are often associated with bottomland hardwood forest vegetation. This association is successional and is thought to be maintained by periodic fires. It may have originated following abandonment of aboriginal agricultural fields or other natural and anthropogenic disturbances such as blow-downs and catastrophic floods. Historical accounts report cane as abundant along the Wabash and Ohio drainage systems, as well as common along larger rivers (Buffalo, White, Norfork) in the Ozarks and Ouachitas. It was also reported as common along the Red and Mississippi rivers in Louisiana, Coastal Prairie rivers in Texas, and the Black, Washita, Arkansas, Sabine, Pearl, Tombigbee, Yazoo, Savannah, and St. Mary's rivers. Large, extant canebrakes still exist and have been documented from the Ocmulgee Basin, south of Macon, Georgia. In the Central Appalachians various wetlands, including those on alluvial or loess substrates (streamside flats, bottomlands), were dominated by *Arundinaria*, without an overstory, or with widely scattered trees.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Great Smoky Mountains National Park Environment: This vegetation occurs in association with an oxbow pond.

Global Environment: Stands of this association occur on alluvial and loess soils often affiliated with bottomland hardwood forest vegetation. Historically, it was best developed in streamside flats and alluvial floodplains on ridges and terraces where it was protected from prolonged inundation.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The single example of this community observed on the Cades Cove quadrangle covers approximately 750 square meters. It is a dense, monospecific stand of *Arundinaria gigantea*.

Global Vegetation: The vegetation is dominated by *Arundinaria gigantea*. Little else is known about its vegetational characteristics. However, information on its historic patterns of distribution provides some clues as to its ecology. General Land Office surveys and other historical accounts indicate that canebrakes were present in southern Illinois, southern Indiana, Kentucky, Missouri, Arkansas, eastern Texas, Louisiana, Tennessee, Mississippi, Alabama, Georgia, and South Carolina. Historical accounts refer to both "pure" stands of cane without an overstory of trees (cane shrublands) and areas with variable overstory closure (woodlands or forests) but with a dense understory dominated by cane as "canebrakes." As currently described, this association refers only to the former, cane shrublands. Cane was abundant along the Wabash and Ohio drainage systems (B. McClain pers. comm. 2000). In Missouri, these canebrakes were also thought to be common in the Ozark Highlands, particularly in southward-draining rivers and streams with finer-textured, more developed soils on upper floodplain terraces (T. Nigh pers. comm. 2000). Stands may be found along larger rivers (Buffalo, White, Norfork) in the Arkansas Ozarks in addition to the Ouachitas. In the Central Appalachians various wetlands, including those on alluvial or loess substrates (streamside flats, bottomlands), were dominated by *Arundinaria*, without an overstory, or with widely scattered trees (Central Appalachian Forest Ecoregional Team pers. comm. 1998). Historic accounts describe large expanses (one area was described as 75 miles long by 1-3 miles wide) of an "ocean of cane"

in bottomlands of the Coastal Prairie of Texas (Smeins et al. 1992). No extant occurrences of this vegetation are known from this area today.

Global Dynamics: A canebrake is an early successional community. It is suggested that Native Americans maintained canebrakes with the use of periodic fire, to provide a ready source of cane for a myriad of uses. Canebrakes may have expanded greatly in cover following the abandonment of aboriginal agricultural lands after the collapse of Native American populations due to exotic diseases (Platt and Brantley 1997).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TALL SHRUB	*Arundinaria gigantea*

Global

Stratum	Species
Same as local	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Arundinaria gigantea*

Global

Stratum	Species
Same as local	

GRank & Reasons: G2? (99-02-15). Stands of this vegetation type were historically widespread, but now are rare or occupy very little acreage. It is thought to be maintained by frequent fire and may have historically resulted from aboriginal agriculture and burning. Dense, monospecific stands of *Arundinaria gigantea ssp. gigantea* were historically found in bottomland sites throughout the southeastern United States. Today, this vegetation exists as small remnants, and high-quality examples are extremely rare.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: On the Cades Cove quadrangle this vegetation occurs adjacent to a shrub swamp and abandoned agricultural fields.

Global Classif Comments: This is a general placeholder, covering a broad geographic range, and several associations may ultimately be recognized. Dense, monospecific stands of *Arundinaria gigantea ssp. gigantea* were historically found in bottomland sites in the southeastern United States. Today, high-quality examples are extremely rare, if not absent. Historical accounts refer to both "pure" stands of cane without an overstory of trees (cane shrublands) and areas with variable overstory closure (woodlands or forests) but with a dense understory dominated by cane as "canebrakes." As currently described, this association refers only to the former, cane shrublands.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from one location on the Cade Cove quadrangle. It could occur in other areas of the park, particularly along larger rivers. This community was sampled from the western end of the Cades Cove Loop Road, along Abrams Creek.

Global Range: This association was widespread historically but now occupies very little acreage. It may be found along rivers and streamsides in Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and possibly Virginia (?).

Nations: US

States/Provinces: AL:S?, AR:S?, FL?, GA:S?, IL:S?, IN:S?, KY:S?, LA:S?, MO:S?, MS:S?, NC:S?, OK:S?, SC:S?, TN:S?, TX:S?, VA?

TNC Ecoregions: 31:P, 32:P, 38:C, 39:C, 40:C, 41:P, 42:C, 43:P, 44:C, 50:C, 51:C, 52:P, 53:P, 56:C, 57:P, 59:C

USFS Ecoregions: 221Ha:CC?, 221Hc:CCP, 221Hd:CCP, 221He:CC?, 221Ja:CCC, 221Jb:CCP, 221Jc:CCP, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Ca:CCP, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Ch:CCP, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP,

222De:CCP, 222Dg:CCP, 222Di:CCP, 222Dj:CCP, 222Ea:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ef:CCP, 222Eg:CCP, 222Eh:CCC, 222Ei:CCP, 222Ej:CC?, 222Ek:CCP, 222El:CCP, 222Em:CCP, 222En:CC?, 222Eo:CC?, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Ff:CC?, 231Aa:CCP, 231Ab:CC?, 231Ac:CCP, 231Ad:CCP, 231Ae:CCP, 231Af:CCP, 231Ag:CC?, 231Ah:CC?, 231Ai:CCP, 231Am:CC?, 231An:CC?, 231Ao:CCP, 231Ba:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCP, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Db:CCP, 231Dc:CCP, 231Dd:CCP, 231De:CCP, 231Ea:CCP, 231Eb:CCP, 231Ec:CCC, 231Ed:CCC, 231Ee:CCP, 231Ej:CCP, 231Ek:CCP, 231Em:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Aa:CCC, 234Ab:CC?, 234Ac:CCP, 234Ad:CCP, 234Ae:CCC, 234Af:CCP, 234Ag:CCC, 234Ah:CC?, 234Ai:CCC, 234Aj:CC?, 234Ak:CC?, 234Al:CCP, 234Am:CCC, 234An:CCC, 255Da:PPP, 255Db:PPP, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: NPS (Buffalo, Great Smoky Mountains); USFS (Cherokee?, Mark Twain, Ouachita?, Ozark, St. Francis); USFWS (Little River, San Bernard?)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:

Authors: K.D. Patterson, mod. D. Faber-Langendoen, mod. J. Teague, SCS **Confidence:** 2 **Identifier:** CEGL003836

REFERENCES (type in full citation below if reference is new): Blair 1938, Campbell 1980, Campbell 1989b, Davidson 1950, Flores 1984, Foti et al. 1994, Heineke 1987, Hoagland 1997, Hoagland 1998c, Hoagland 2000, Hughes 1966, McClain pers. comm., McInteer 1952, Meanley 1972, Mohr 1901, Nigh pers. comm., Nuttall 1821, Peet et al. 2002, Platt and Brantley 1992, Platt and Brantley 1997, Schafale 1998b, Smeins et al. 1992, West 1934

Vitis aestivalis Vine-Shrubland

Summer Grape Vine-Shrubland
Montane Grape Opening
Ecological Group (SCS;MCS): Semi-natural Wooded Uplands (900-40; 8.0.0.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community is strongly dominated by the vine *Vitis aestivalis*. Vines, extremely thick in patches and covering nearly every tree as well as the ground, have 50-100% coverage. Trees in the canopy and subcanopy have 0-50% coverage and vary from site to site. The shrub layer is sparse. The herb layer is sparse to moderate, decreasing with vine coverage. Herbaceous composition varies from site to site. Beneath the vine canopy, coarse woody debris and tip-up mounds are typical. The dynamics of this community are poorly understood. It apparently originates from disturbance, such as an ice or wind storm; and can persist for decades. This community can range in size from less than a hectare to ten hectares. In Great Smoky Mountains National Park, this community occurs on steep to very steep, northerly, middle to upper slopes at intermediate elevations between 600 and 1000 m (2000-3500 feet). All areas sampled showed evidence of disturbance by wind, ice, or logging.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community occurs on steep to very steep, northerly, middle to upper slopes at intermediate elevations (between 2000 and 3500 feet). All areas sampled showed evidence of disturbance by wind, ice, or logging.

Global Environment: In Great Smoky Mountains National Park, this community occurs on steep to very steep, northerly, middle to upper slopes at intermediate elevations between 600 and 1000 m (2000-3500 feet) (MacKenzie 1993).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Communities within the Smokies are also strongly dominated by *Vitis aestivalis* and contain a wide range of canopy tree species. In addition to the usual species such as *Acer rubrum, Acer saccharum, Halesia tetraptera var. monticola,* and *Liriodendron tulipifera*, this community may also contain examples of more calciphilic species such as *Carya cordiformis* and *Juglans cinerea*.

Global Vegetation: This community is strongly dominated by the vine *Vitis aestivalis*. Vines, extremely thick in patches and covering nearly every tree as well as the ground, have 50-100% coverage. Trees in the canopy and subcanopy have 0-50% coverage and vary from site to site, but typical species include *Acer rubrum, Acer saccharum, Halesia tetraptera var. monticola,* and *Liriodendron tulipifera*. The shrub layer is sparse. The herb layer is sparse to moderate, decreasing with vine coverage. Herbaceous composition varies from site to site but is typical of mesic forests in the area. Some of the more common species from the sampled areas in Great Smoky Mountains National Park are *Ageratina altissima var. altissima, Amphicarpaea bracteata, Arisaema triphyllum ssp. triphyllum, Polystichum acrostichoides, Sanguinaria canadensis,* and *Viola* spp. Beneath the vine canopy, coarse woody debris and tip-up mounds are typical.

Global Dynamics: The dynamics of this community are poorly understood. It apparently originates from disturbance, such as an ice or wind storm; and can persist for decades. This community can range in size from less than a hectare to ten hectares. All areas sampled showed evidence of disturbance by wind, ice, or logging.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
VINE/LIANA	*Vitis aestivalis*

Global

Stratum	Species
VINE/LIANA	*Vitis aestivalis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
VINE/LIANA	*Aristolochia macrophylla, Vitis aestivalis*

Global

Stratum	Species
VINE/LIANA	*Vitis aestivalis*

GRank & Reasons: G2G3 (97-08-11). This is an uncommon community. It is restricted within its range and could be limited by specific disturbance regimes.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Forests previously occupying sites that support this community are mesic forest types, such as cove forests or mesic forest dominated by chestnut oak and red oak. Forests on steep mesic sites may be more susceptible to treefall and gap formation.

Global Classif Comments: This community is important for wildlife, especially bears. In the Great Smoky Mountains, forests previously occupying sites that support this community are mesic forest types, such as cove forests or mesic forest dominated by chestnut oak and red oak. Forests on steep, mesic sites may be more susceptible to treefall and gap formation.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove, Mount Le Conte, Thunderhead Mountain, and Wear Cove quadrangles. It was sampled in the central and eastern portion of the Mount Le Conte quadrangle, on steep slopes north of Potato Ridge and north of Mt. Winnesoka. On the Cades Cove quadrangle it was sampled or observed on the north slopes of Allnight Ridge, in the northern portion of the quadrangle, and on steep slopes over Rowans Branch and steep slopes south of Pond Knob, in the eastern portion of the quadrangle. A plot also exists upslope from the West Prong. It has been seen but not sampled on the North Carolina side.

Global Range: This community is known from the Great Smoky Mountains of Tennessee and may possibly occur in montane areas of Arkansas, Kentucky, North Carolina, and Oklahoma.

Nations: US
States/Provinces: AR?, KY?, NC:S?, OK?, TN:S?
TNC Ecoregions: 38:P, 39:P, 50:P, 51:C
USFS Ecoregions: M221Dd:CCC, M222Ab:PPP, M231A:PP
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Ozark?)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL003890
REFERENCES (type in full citation below if reference is new): MacKenzie 1993, Peet et al. 2002, Schafale 1998b

Rubus canadensis - (Rubus idaeus ssp. strigosus) / Athyrium filix-femina - Solidago glomerata Shrubland

Smooth Blackberry - (Red Raspberry) / Lady Fern - Skunk Goldenrod Shrubland

High-Elevation Blackberry Thicket

Ecological Group (SCS;MCS): Appalachian Highlands Rocky Summits (436-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This vegetation occurs at high elevations in the southern Appalachian Mountains of North Carolina and Tennessee. It is successional vegetation resulting from severe disturbance of spruce-fir forests (including Balsam Woolly Adelgid-affected stands and stands which were severely burned after logging), as well as exposed sites with other frequent, natural disturbance (such as shrub invasion of grazed fire meadows). It occurs on exposed summits and high slopes, typically at elevations over 6000 feet. This community includes high-elevation Appalachian *Rubus* thickets and differs from *Rubus* thickets on grassy balds by predominance of forbs rather than sedges and by frequent presence of *Rubus idaeus*. Vegetation is variously dominated by dense *Rubus canadensis* or by dense *Athyrium filix-femina ssp. asplenioides* and *Solidago glomerata* (on more protected sites). Standing dead *Abies fraseri* often tower above the shrubs and herbs, and there is usually much downed woody debris. Other species present include *Agrostis perennans, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex brunnescens, Carex crinita, Carex intumescens, Carex debilis, Cinna latifolia, Clintonia borealis, Danthonia compressa, Diervilla sessilifolia, Oxalis montana, Prunus pensylvanica, Sorbus americana,* and *Rugelia nudicaulis*. Scattered living *Picea rubens, Betula alleghaniensis,* and *Amelanchier laevis* may occur. The long-term future of this community is uncertain, but it appears to be fairly stable over periods of several decades. A variation of this community occurs in areas such as Shining Rock Wilderness and parts of the Great Smoky Mountains where fires were started after logging had taken place and the intensity of the fires due to the accumulated slash burned down nearly to mineral soil. These areas do not have as much coarse woody debris from downed spruce or fir and often have a canopy approaching that of a woodland with sparse coverage of *Sorbus americana* and *Prunus pensylvanica*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This vegetation results from severe disturbance of spruce - fir forests (i.e., Balsam Woolly Adelgid-affected stands), past logging followed by severe fire, as well as exposed sites with other frequent natural disturbance. It occurs on exposed summits and high slopes, typically at elevations over 6000 feet.

Global Environment: This vegetation occurs at high elevations in the southern Appalachian Mountains of North Carolina and Tennessee. It is successional vegetation resulting from severe disturbance of spruce-fir forests (including Balsam Woolly Adelgid-affected stands and stands which were severely burned after logging), as well as exposed sites with other frequent, natural disturbance (such as shrub invasion of grazed fire meadows). It occurs on exposed summits and high slopes, typically at elevations over 6000 feet.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This is successional vegetation on the summit of Mount Le Conte and Clingman's Dome resulting from the death of *Abies fraseri*. Vegetation is variously dominated by *Rubus canadensis* and *Diervilla sessilifolia* (on the most exposed sites), by dense *Rubus canadensis*, or by dense *Athyrium filix-femina ssp. asplenioides* and *Solidago glomerata* (on more protected sites). Standing dead trees tower above the shrubs and herbs, and there is much downed woody debris. Other species present include *Abies fraseri, Agrostis perennans, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex brunnescens, Carex crinita, Carex intumescens, Carex debilis, Cinna latifolia, Clintonia borealis, Danthonia compressa, Oxalis montana, Picea rubens, Prunus pensylvanica, Rugelia nudicaulis,* and *Sorbus americana*. A variant of this type that originated from logging followed by severe fire tends to have a 10-40% canopy cover of *Prunus pensylvanica* and *Sorbus americana*, but a similar herbaceous/shrub layer.

Global Vegetation: Vegetation is variously dominated by dense *Rubus canadensis* or by dense *Athyrium filix-femina ssp. asplenioides* and *Solidago glomerata* (on more protected sites). Standing dead *Abies fraseri*

tower above the shrubs and herbs, and there is much downed woody debris. Other species present include *Agrostis perennans, Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex brunnescens, Carex crinita, Carex intumescens, Carex debilis, Cinna latifolia, Clintonia borealis, Danthonia compressa, Diervilla sessilifolia, Oxalis montana, Prunus pensylvanica, Sorbus americana,* and *Rugelia nudicaulis*. Scattered living *Picea rubens, Betula alleghaniensis*, and *Amelanchier laevis* may occur. A variation of this community occurs in areas such as Shining Rock Wilderness and parts of the Great Smoky Mountains where fires were started after logging had taken place and the intensity of the fires due to the accumulated slash burned down nearly to mineral soil. These areas do not have as much coarse woody debris from downed spruce or fir and often have a canopy approaching that of a woodland with sparse coverage of *Sorbus americana* and *Prunus pensylvanica*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Abies fraseri*
TALL SHRUB	*Diervilla sessilifolia, Rubus canadensis*
FORB	*Solidago glomerata*
FERN	*Athyrium filix-femina ssp asplenioides*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri*
TALL SHRUB	*Rubus canadensis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
SHRUB	*Diervilla sessilifolia, Rubus canadensis*
FORB	*Solidago glomerata*
FERN	*Athyrium filix-femina ssp asplenioides*

Global

Stratum	Species
TALL SHRUB	*Diervilla sessilifolia, Rubus canadensis*
FORB	*Solidago glomerata*
FERN	*Athyrium filix-femina ssp asplenioides*

GRank & Reasons: GM (97-08-11). This community represents an altered vegetation type, modified by the effects of an alien pest species and/or the effects of past land use. Examples of this vegetation once represented what is now a globally rare and critically imperiled community that has an uncertain future. This modified vegetation is now a natural part of high-elevation landscapes in the Southern Blue Ridge and an important part of the functioning landscape, providing habitat for many southern Appalachian species. For conservation planning purposes, examples of this community may be best considered low-quality occurrences of forests in the *Abies fraseri - Picea rubens* Forest Alliance (A.136).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community grades into *Abies fraseri / Viburnum lantanoides / Dryopteris campyloptera - Oxalis montana / Hylocomium splendens* Forest (CEGL006049).

Global Classif Comments: This community differs from *Rubus* thickets on grassy balds by predominance of forbs rather than sedges and by frequent presence of *Rubus idaeus*.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the summit of Mount Le Conte on the Mount Le Conte quadrangle and on Clingmans Dome quadrangle. It was not sampled, nor is it expected, on the Cades Cove quadrangle, although it may occur in other areas of the park. It occurs in most areas of the park that reach an elevation of 6000 feet or more and have spruce-fir forest.

Global Range: This vegetation occurs at high elevations in the southern Appalachians of North Carolina and Tennessee.

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Bd:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Blue Ridge Parkway, Great Smoky Mountains); USFS (Cherokee, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL003893
REFERENCES (type in full citation below if reference is new): CAP pers. comm. 1998, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002

Alnus serrulata - Xanthorhiza simplicissima Shrubland

Smooth Alder - Yellowroot Shrubland

Rocky Bar and Shore (Alder - Yellowroot Type)

Ecological Group (SCS;MCS): Appalachian Highlands Riverscour Vegetation (457-40; 2.2.3.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes shrublands on rocky or gravelly substrates along narrow river margins in the southeastern Blue Ridge Escarpment gorges, ranging into the Cumberland Plateau. Vegetation composition, density, and height vary with frequency of flooding, substrate, and soil depth. The nominal shrubs are common and characteristic but not always dominant. Other shrubs may include *Arundinaria gigantea, Diervilla sessilifolia, Salix nigra, Salix sericea, Rhododendron arborescens, Rhododendron viscosum, Rhododendron maximum, Rhododendron periclymenoides, Kalmia latifolia, Leucothoe fontanesiana, Cornus foemina, Cornus amomum, Itea virginica*, and *Viburnum nudum var. cassinoides*. Arborescent species that occur as tall shrubs (or as occasional trees, less than 10% cover) include *Acer rubrum, Carpinus caroliniana, Diospyros virginiana, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*, and *Tsuga canadensis*. Open areas dominated by grasses and forbs include species such as *Agrostis perennans, Boykinia aconitifolia, Carex torta, Holcus lanatus* (exotic), *Lycopus virginicus, Trautvetteria caroliniensis, Houstonia serpyllifolia, Impatiens capensis, Hypericum mutilum, Viola X primulifolia*, and *Eupatorium fistulosum*. Adjacent alluvial forests in the Blue Ridge are dominated by *Tsuga canadensis, Liriodendron tulipifera, Betula lenta*, and, at lower elevations, below 600 m (2000 feet), *Platanus occidentalis* and *Liquidambar styraciflua*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Great Smoky Mountains National Park Environment: In the Smokies, this community only occurs at low elevations (below 2000 feet) along the largest creeks and rivers. The community exists in very narrow bands along the river, often so small as to be unsamplable.

Global Environment: This association includes shrublands on rocky or gravelly substrates along narrow river margins in the southeastern Blue Ridge Escarpment gorges, ranging into the Cumberland Plateau. Vegetation composition, density, and height vary with frequency of flooding, substrate, and soil depth. The occurrences can be in very narrow bands of 1-2 meters or wider bars of up to 10-20 meters wide adjacent to large creeks and small rivers.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The vegetation of this association within the park is dominated by the shrub *Alnus serrulata* at 0.5-2 m tall and the shrub *Xanthorhiza simplicissima* at below 0.5 m in height. Other shrub and small tree species such as *Toxicodendron radicans* can also be quite common. The community usually has an overarching canopy of *Carpinus caroliniana* and various upland species from the adjacent higher ground and a fairly well-developed herbaceous stratum, especially in patches where shrub cover is low.

Global Vegetation: The nominal shrubs are common and characteristic but not always dominant. Other shrubs may include *Arundinaria gigantea, Diervilla sessilifolia, Salix nigra, Salix sericea, Rhododendron arborescens, Rhododendron viscosum, Rhododendron maximum, Rhododendron periclymenoides, Kalmia latifolia, Leucothoe fontanesiana, Cornus foemina, Cornus amomum, Itea virginica*, and *Viburnum nudum var. cassinoides*. Arborescent species that occur as tall shrubs (or as occasional trees, less than 10% cover) include *Acer rubrum, Carpinus caroliniana, Diospyros virginiana, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis*, and *Tsuga canadensis*. Open areas dominated by grasses and forbs include species such as *Agrostis perennans, Boykinia aconitifolia, Carex torta, Holcus lanatus* (exotic), *Lycopus virginicus, Trautvetteria caroliniensis, Houstonia serpyllifolia, Impatiens capensis, Hypericum mutilum, Viola X primulifolia*, and *Eupatorium fistulosum*. Adjacent alluvial forests in the Blue Ridge are dominated by *Tsuga canadensis, Liriodendron tulipifera, Betula lenta*, and, at lower elevations, below 600 m (2000 feet), *Platanus occidentalis* and *Liquidambar styraciflua*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TALL SHRUB	*Alnus serrulata*
SHORT SHRUB	*Xanthorhiza simplicissima*

Global

Stratum	Species
TALL SHRUB	*Alnus serrulata*
SHORT SHRUB	*Xanthorhiza simplicissima*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
Same as global	

Global

Stratum	Species
TALL SHRUB	*Alnus serrulata, Carpinus caroliniana, Diospyros virginiana, Leucothoe fontanesiana, Liquidambar styraciflua, Liriodendron tulipifera, Platanus occidentalis, Tsuga canadensis, Xanthorhiza simplicissima*

GRank & Reasons: G3G4 (99-12-17). This community is naturally restricted in terms of geography and habitat, thus could be vulnerable to elimination. However, this community is often overlooked in inventories or not separately distinguished, and is likely much more common than the number of documented occurrences suggests. Threats to this community include alteration of the natural flooding regime due to damming of rivers and invasion by exotic species carried on river courses.

CLASSIFICATION COMMENTS

Global Classif Comments: This association is known from the Bankhead National Forest, but further inventory is needed to fully describe the variation of this type on the Bankhead and elsewhere in the Cumberland Plateau.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This association was only sampled on one small section of Abrams Creek in the Calderwood quadrangle. It most likely exists along other stretches of Abrams and the Little Pigeon Rivers on the Tennessee side of the park.

Global Range: This association is found along montane rivers in the southeastern Blue Ridge Escarpment gorges and in the Cumberland Plateau of Kentucky south to Alabama.

Nations: US
States/Provinces: AL:S?, GA:S?, KY:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 50:C, 51:C, 52:P
USFS Ecoregions: 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 231Cd:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Bankhead, Chattahoochee, Daniel Boone, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: R. White, SCS **Confidence:** 2 **Identifier:** CEGL003895
REFERENCES (type in full citation below if reference is new): Allard 1990, NatureServe Ecology - Southeast U.S. unpubl. data, Nelson 1986, Newell and Peet 1995, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Alnus serrulata - Lindera benzoin / Scutellaria lateriflora - Thelypteris noveboracensis Shrubland

Smooth Alder - Northern Spicebush / Mad-dog Skullcap - New York Fern Shrubland
Montane Low-Elevation Seep

ELEMENT CONCEPT

GLOBAL SUMMARY: This low-elevation seep is known from low elevations in the Southern Blue Ridge of North Carolina, but is likely more widespread. The type may need substantial revision as more information is collected. This community occurs in stream headwaters and on the edges of small stream floodplains, where groundwater seepage emerges and provides a relatively constant flow and saturated conditions. A small streamlet (less than 1 m wide) flows through the community, and saturated and upland conditions form a mosaic through the remainder of the community. Physiognomy is variable, and may include herbaceous-dominated patches, shrubby areas, and areas with an open canopy of trees. The open to scattered canopy includes species such as *Betula lenta, Magnolia tripetala, Acer rubrum var. trilobum,* and *Nyssa sylvatica*. The shrub stratum is open to dense, and is dominated by *Alnus serrulata, Lyonia ligustrina, Kalmia latifolia, Lindera benzoin var. benzoin,* and *Vaccinium fuscatum*. Typical herbaceous species include *Scutellaria lateriflora, Thelypteris noveboracensis, Mimulus ringens, Osmunda cinnamomea, Ludwigia palustris, Apios americana, Oxypolis rigidior, Leersia virginica, Galium obtusum, Viola cucullata, Lycopus virginicus, Vernonia noveboracensis, Boehmeria cylindrica, Solidago altissima, Impatiens capensis, Scirpus georgianus, Hypericum mutilum, Rhexia virginica, Ludwigia alternifolia, Solidago patula var. patula, Rudbeckia laciniata var. laciniata, Carex gynandra,* and *Juncus gymnocarpus*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: Same as global.

Global Environment: This community occurs in stream headwaters and on the edges of small stream floodplains, where groundwater seepage emerges and provides a relatively constant flow and saturated conditions. A small streamlet (less than 1 m wide) flows through the community, and saturated and upland conditions form a mosaic through the remainder of the community.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global.

Global Vegetation: Physiognomy is variable, and may include herbaceous-dominated patches, shrubby areas, and areas with an open canopy of trees. The open to scattered canopy includes species such as *Betula lenta, Magnolia tripetala, Acer rubrum var. trilobum,* and *Nyssa sylvatica*. The shrub stratum is open to dense, and is dominated by *Alnus serrulata, Lyonia ligustrina, Kalmia latifolia, Lindera benzoin var. benzoin,* and *Vaccinium fuscatum*. Typical herbaceous species include *Scutellaria lateriflora, Thelypteris noveboracensis, Mimulus ringens, Osmunda cinnamomea, Ludwigia palustris, Apios americana, Oxypolis rigidior, Leersia virginica, Galium obtusum, Viola cucullata, Lycopus virginicus, Vernonia noveboracensis, Boehmeria cylindrica, Solidago altissima, Impatiens capensis, Scirpus georgianus, Hypericum mutilum, Rhexia virginica, Ludwigia alternifolia, Solidago patula var. patula, Rudbeckia laciniata var. laciniata, Carex gynandra,* and *Juncus gymnocarpus*.

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Juncus gymnocarpus*

GRank & Reasons: G2? (02-11-01).

CLASSIFICATION COMMENTS

Global Classif Comments: More information is needed in order to fully understand the composition and distribution of this type.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was found in the Bryson City quadrangle, along the Gold Mine Loop Trail, in the area north of Lake Fontana.

Global Range: This low-elevation seep is found in the Southern Appalachians at low elevations. It has been documented from North Carolina, and is likely to occur in adjacent states (South Carolina, Tennessee, Georgia).

Nations: US
States/Provinces: GA?, KY?, NC:S?, SC?, TN?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: A.S. Weakley, SCS **Confidence:** 2 **Identifier:** CEGL003909
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. Data

Lolium (arundinaceum, pratense) Herbaceous Vegetation

(Tall Fescue, Meadow Fescue) Herbaceous Vegetation

Cultivated Meadow

Ecological Group (SCS;MCS): Exotic Species-Dominated Herbaceous Upland Vegetation (900-60; 8.0.0.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. The dominant species in this type are the European 'tall or meadow fescues,' of uncertain and controversial generic placement. These communities are sometimes nearly monospecific but can also be very diverse and contain many native species of grasses, sedges, and forbs. This vegetation is currently defined for the southern Appalachians, Ozarks, Ouachita Mountains, and parts of the Piedmont and Interior Low Plateau, but it is possible throughout much of the eastern United States and southern Canada.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This association includes most low-elevation cultivated fields within the park.

Global Environment: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The open fields in and around Cades Cove appear to be quite variable in composition. Some areas are dominated by *Festuca* spp. and *Andropogon glomeratus*. More information is needed to better describe compositional variation in this community. This is a broad community type and so encompasses most of the variations seen in various areas of the park.

Global Vegetation: The dominant species in this alliance are the European 'tall or meadow fescues,' of uncertain and controversial generic placement. Although traditionally treated as *Festuca pratensis (= Festuca elatior)* and *Festuca arundinacea*, these two closely related species are now usually treated as either *Lolium pratense* and *Lolium arundinaceum* (Kartesz 1999), or as *Schedonorus pratensis* and *Schedonorus arundinaceus*. These communities are sometimes nearly monospecific but can also be very diverse and contain many native species of grasses, sedges, and forbs.

Global Dynamics: This association varies greatly depending upon the past land-use history and the recent history of the site. Some examples that have been recently farmed may be monocultures of *Lolium*, whereas other fields that were traditionally lightly grazed may have much higher diversity.

GRank & Reasons: GW (00-01-05). This vegetation is dominated by an exotic species, is of anthropogenic origin, and is thus not a conservation priority.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Park scientists are attempting the restoration of native grasses in some parts of Cade Cove.

Global Classif Comments: *Lolium pratense* and *Lolium arundinaceum* are two closely related species which were traditionally treated as *Festuca pratensis (= Festuca elatior)* and *Festuca arundinacea*, and could alternately be treated as *Schedonorus pratensis* and *Schedonorus arundinaceus*. Conversion to Kartesz (1999) standard has necessitated the shift of this to the *Lolium* names from *Festuca*.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community occurs in the open fields of Cades Cove, Cataloochee Valley, parts of the area along the Oconaluftee River, and other scattered low-elevation areas that are mowed yearly.

Global Range: This association is possible throughout much of the eastern United States and southern Canada.

Nations: CA? US
States/Provinces: AR:S?, GA:S?, MO:S?, NB?, NC:S?, NS?, OK:S?, ON?, QC?, SC:S?, TN:S?, VA:S?
TNC Ecoregions: 38:C, 39:C, 50:C, 51:C, 52:C, 57:C, 59:C
USFS Ecoregions: 221:C, 222:C, 231Ae:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC, M231A:CC
Federal Lands: NPS (Blue Ridge Parkway, Buffalo, Carl Sandburg Home, Great Smoky Mountains, Guilford Courthouse, Ninety Six, Shenandoah); USFS (Cherokee, Ouachita, Ozark)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004048
REFERENCES (type in full citation below if reference is new): Heath et al. 1973, Hoagland 2000, Kartesz 1999

Danthonia compressa - (Sibbaldiopsis tridentata) Herbaceous Vegetation

Mountain Oatgrass - (Mountain-cinquefoil) Herbaceous Vegetation
Grassy Bald (Southern Grass Type)
Ecological Group (SCS;MCS): Appalachian Highlands Grassy Balds (436-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community consists of graminoid-dominated vegetation with scattered shrubs, occurring on moderate to high elevation peaks and saddles in the Southern Blue Ridge. Characteristically, this vegetation is strongly dominated by *Danthonia compressa*, or in some areas codominated by the subshrub *Sibbaldiopsis tridentata (= Potentilla tridentata).* Other characteristic herbaceous species are *Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex pensylvanica, Carex debilis, Carex intumescens, Carex brunnescens, Deschampsia flexuosa, Erythronium umbilicatum ssp. monostolum, Gentiana austromontana, Gentianella quinquefolia, Houstonia serpyllifolia, Ionactis linariifolius (= Aster linariifolius), Lysimachia quadrifolia, Potentilla canadensis, Prenanthes roanensis, Smilax herbacea, Solidago bicolor, Solidago glomerata, Stachys clingmanii, Trautvetteria caroliniensis var. caroliniensis.* The floristic composition is a mixture of widespread species, northern disjunct species (such as *Agrostis mertensii, Carex siccata (= Carex aenea), Minuartia groenlandica, Packera schweinitziana (= Senecio schweinitzianus), Sibbaldiopsis tridentata*), and Southern Appalachian endemics (such as *Erythronium umbilicatum ssp. monostolum, Geum geniculatum, Geum radiatum, Houstonia serpyllifolia, Lilium grayi, Prenanthes roanensis, Solidago glomerata, Stachys clingmanii*). Typical shrubs (which may occur as scattered individuals or as patches) are *Rhododendron calendulaceum, Rhododendron catawbiense, Menziesia pilosa, Vaccinium corymbosum,* and *Rubus canadensis*. Species indicative of past grazing include *Phleum pratense, Agrostis gigantea, Hieracium scabrum, Rumex acetosella, Prunella vulgaris*. This community occurs on high-elevation (usually above 1350 m or 4500 feet), often south- to southwest-facing domes, ridgetops, and gentle slopes. Strong winds, high rainfall, frequent fog, shallow rocky soils, and extremes of temperature and moisture are characteristic of these environments. It is known from the highest elevations of the southern Appalachian Mountains. It is typically surrounded by dwarfed forests dominated by *Fagus grandifolia* or *Quercus rubra*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Examples of this community sampled were on gentle ridges at between 4320 feet and approximately 5300 feet. Invasion by woody species is occurring in all examples to various extents, and trails by humans have heavily impacted examples near Clingman's Dome.

Global Environment: This community occurs on high-elevation (usually above 1350 m or 4500 feet), often south- to southwest-facing domes, ridgetops, and gentle slopes. Strong winds, high rainfall, frequent fog, shallow rocky soils, and extremes of temperature and moisture are characteristic of these environments. In North Carolina and Tennessee, this grassland vegetation is typically surrounded by dwarfed forests dominated by *Fagus grandifolia* or *Quercus rubra*. On Whitetop Mountain, Virginia, the type occurs at elevations from 1525-1655 m (5000-5430 feet), adjacent to both well-developed *Picea rubens*-dominated forests and stunted northern hardwoods. Soils are extremely acidic (pH = 3.8), with low (5%) base saturation, high aluminum levels (1600 ppm), and relatively high (27%) organic matter content.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community includes open vegetation dominated by graminoid species, sometimes with large patches dominated by deciduous ericads. *Danthonia compressa* is the aspect dominant herb, although other herbaceous species with high coverage include *Arnoglossum muehlenbergii, Cinna latifolia, Danthonia spicata, Phleum pratense, Poa compressa, Potentilla canadensis,* and *Rumex acetosella*. Other species present in the herbaceous stratum include *Achillea millefolium, Ageratina altissima var. roanensis, Arrhenatherum elatius, Symphyotrichum dumosum (= Aster dumosus), Sericocarpus asteroides (= Aster paternus), Carex siccata (= Carex aenea), Carex leavenworthii, Dichanthelium laxiflorum, Galium pilosum, Houstonia purpurea var. purpurea, Houstonia serpyllifolia, Hypericum punctatum, Juncus effusus, Juncus marginatus, Luzula acuminata, Lysimachia quadrifolia, Malaxis unifolia, Melampyrum lineare, Potentilla simplex, Prenanthes altissima, Prunella vulgaris, Rubus canadensis, Rudbeckia hirta, Rumex acetosella, Packera anonyma (= Senecio anonymus),*

Solanum carolinense, and *Viola X primulifolia (= var. villosa)*. Alien species present that may indicate past grazing include *Agrostis stolonifera, Carduus acanthoides, Cerastium nutans, Holcus lanatus, Leucanthemum vulgare, Phleum pratense, Trifolium pratense*, and *Veronica serpyllifolia*. On Gregory Bald, the shrubs *Rhododendron calendulaceum* and *Vaccinium corymbosum* are locally dominant. Other scattered woody plants in this community include *Amelanchier laevis, Kalmia latifolia, Magnolia acuminata*, and *Prunus serotina*.

Global Vegetation: This vegetation is graminoid-dominated with scattered shrubs. Most occurrences are strongly dominated by *Danthonia compressa*, but some sites are codominated by the subshrub *Sibbaldiopsis tridentata (= Potentilla tridentata)*. Other characteristic herbaceous species are *Angelica triquinata, Oclemena acuminata (= Aster acuminatus), Carex pensylvanica, Carex debilis var. rudgei, Carex intumescens, Carex brunnescens ssp. sphaerostachya, Deschampsia flexuosa, Erythronium umbilicatum ssp. monostolum, Gentiana austromontana, Gentianella quinquefolia, Houstonia serpyllifolia, Ionactis linariifolius (= Aster linariifolius), Lysimachia quadrifolia, Potentilla canadensis, Prenanthes roanensis, Smilax herbacea, Solidago bicolor, Solidago glomerata, Stachys clingmanii*, and *Trautvetteria caroliniensis var. caroliniensis*. The floristic composition is a mixture of widespread species, northern disjunct species such as *Sibbaldiopsis tridentata*; and Southern Appalachian endemics such as *Houstonia serpyllifolia, Lilium grayi*, and *Prenanthes roanensis*. Typical shrubs, which may occur as scattered individuals or patches are *Rhododendron calendulaceum, Rhododendron catawbiense, Menziesia pilosa, Vaccinium corymbosum*, and *Rubus canadensis*. Invasive, introduced species indicative of past grazing include *Phleum pratense, Agrostis gigantea, Hieracium caespitosum, Rumex acetosella*, and *Prunella vulgaris*.

In the least disturbed, most natural areas, the most abundant or characteristic herbaceous associates are *Carex brunnescens ssp. sphaerostachya, Carex debilis var. rudgei, Lysimachia quadrifolia, Dennstaedtia punctilobula, Carex pensylvanica, Potentilla canadensis, Prenanthes roanensis, Solidago rugosa, Ageratina altissima var. roanensis*, and *Hypericum mitchellianum*. Despite the exposed topography, atmospheric conditions create a very moist microclimate, as evidenced by large populations of species often associated with wetlands, including *Helenium autumnale, Packera aurea, Houstonia serpyllifolia, Solidago patula*, and *Carex intumescens*.

Global Dynamics: The origin and ecological dynamics of this vegetation type are not clear. Several disturbance mechanisms, both natural and anthropogenic, have been hypothesized, including fire, grazing, trampling, clearing, climatic change, windthrow, or some combination of these influences. The importance of megaherbivores in long-term bald maintenance has recently been proposed (Weigl and Knowles 1999). It appears that new occurrences of this community are not being created, and that many existing ones are being encroached by shrub and tree species. The presence of northern disjunct species requiring open habitat suggests that some of these areas have been open since the Pleistocene. This is the case at Whitetop Mountain, Virginia, although there is little question that the original openings were greatly expanded during a long history of grazing and the development of a 19th century resort. A. Weakley (pers. comm. 2001) suggests that the balds of Roan Mountain, Tennessee, are primarily natural, whereas those farther north are of anthropogenic origin.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
SHORT SHRUB	*Rhododendron calendulaceum, Vaccinium corymbosum*
GRAMINOID	*Danthonia compressa*

Global

Stratum	Species
SHORT SHRUB	*Rhododendron calendulaceum, Rubus allegheniensis*
GRAMINOID	*Agrostis perennans, Carex brunnescens, Carex debilis, Carex pensylvanica, Danthonia compressa, Deschampsia flexuosa*
FORB	*Potentilla canadensis, Sibbaldiopsis tridentata*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Danthonia compressa*

Global

Stratum	Species
GRAMINOID	*Agrostis stolonifera, Carex brunnescens ssp sphaerostachya, Carex debilis var rudgei, Carex normalis, Danthonia compressa, Danthonia spicata, Deschampsia flexuosa*
FORB	*Houstonia serpyllifolia, Hypericum mitchellianum, Lysimachia quadrifolia, Prenanthes roanensis, Senecio schweinitzianus, Sibbaldiopsis tridentata, Solidago roanensis*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
Various	

Global

Stratum	Species
TREE CANOPY	*Alnus viridis ssp crispa*
SHRUB	*Rhododendron cumberlandense*
GRAMINOID	*Agrostis mertensii, Calamagrostis canadensis, Carex aenea, Carex cristatella, Phleum pratense, Poa compressa, Poa palustris, Trisetum spicatum*
FORB	*Ageratina altissima var roanensis, Cuscuta rostrata, Lilium philadelphicum, Minuartia groenlandica, Monarda media, Phlox subulata, Platanthera grandiflora, Prunella vulgaris, Spiranthes ochroleuca*
FERN	*Botrychium multifidum, Huperzia appalachiana, Huperzia selago, Lycopodium dendroideum, Lycopodium hickeyi*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

GRank & Reasons: G1 (98-12-14). This community has small range, few occurrences, and is rapidly disappearing due to vegetational succession. This community is threatened by high levels of recreational use and the introduction of exotic plant and animal species, as well as by successional trends of uncertain cause.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: Gregory Bald and Andrews Bald are currently maintained by manual woody species removal.

Global Classif Comments: Notable examples include various peaks of the Roan Mountain complex, Long Hope Valley, Shining Rock Wilderness, and Great Smoky Mountains National Park. The origin of this community is not clear, and in fact, several mechanisms, both natural and anthropogenic, have been proposed including fire, grazing, trampling, clearing, climatic change, windthrow, or some combination of these influences. The presence of northern disjunct species requiring open habitat may suggest that some of these areas have been open since the Ice Age. A. Weakley (pers. comm.) suggests that the balds of Roan Mountain, Tennessee, are primarily natural, whereas those farther north are of anthropogenic origin. It appears that new occurrences of this community are not being created, and those that exist are being encroached by shrub and tree species. Lindsay (1976) reported that examples of this community in Great Smoky Mountains National Park will have disappeared by the end of the century if management is not undertaken to halt invasion by woody plants. However, these balds are among those most likely to be of anthropogenic origin.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from Russell Field Bald, Gregory Bald, Spence Fields, and Andrews Bald.

Global Range: This montane sparse dwarf-shrubland is found in the high mountain areas of the Southern Appalachians. While the majority of examples occur in North Carolina, this community is also known from Tennessee and Virginia.

Nations: US
States/Provinces: NC:S?, TN:S?, VA:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Db:CC?, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson, Pisgah)

ELEMENT SOURCES

Authors: K.D. Patterson, SCS **Confidence:** 2 **Identifier:** CEGL004242

REFERENCES (type in full citation below if reference is new): Allard 1990, Allard et al. 1990, Billings and Mark 1957, Bratton 1975, Cain 1931, DeSelm and Murdock 1993, Fleming and Coulling 2001, Fleming et al. 2001, Gersmehl 1969, Gersmehl 1971, Gersmehl 1973, Lindsay 1976, Lindsay 1977, Lindsay 1978, Lindsay and Bratton 1979a, Lindsay and Bratton 1979b, Lindsay and Bratton 1980, Mark 1958, Mark 1959, NCNHP 1993, NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Pyne 1994, Schafale 1998b, Schafale and Weakley 1990, Stratton and White 1982, Weakley pers. comm., Wiegl and Knowles 1999

Carex torta Herbaceous Vegetation

Twisted Sedge Herbaceous Vegetation
Rocky Bar and Shore (Twisted Sedge Type)
Ecological Group (SCS;MCS): Rocky Riverbeds (457-30; 2.2.3.1)
Appalachian Highlands Riverscour Vegetation (457-40; 2.2.3.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: *Carex torta*-dominated alluvial wetlands on sand, gravel, and rock bars along riverbanks in valleys and gorges in southern Appalachians, west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians and Allegheny Mountains. This association is characterized by light-requiring, tough-rooted herbaceous perennials tolerant of frequent inundation and flood-scouring. *Carex torta* often forms dense, extensive colonies. Associated species vary with geography but can include *Verbena hastata, Doellingeria umbellata (= Aster umbellatus), Dichanthelium clandestinum, Solidago rugosa ssp. aspera, Juncus effusus, Scirpus expansus, Scirpus cyperinus, Equisetum arvense, Onoclea sensibilis, Vernonia noveboracensis, Lycopus virginicus, Scutellaria lateriflora, Lobelia cardinalis, Symphyotrichum dumosum (= Aster dumosus), Lycopus virginicus, Osmunda regalis, Hypericum mutilum, Eupatorium fistulosum, Solidago patula*, and *Salix sericea*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: This community occurs on river margins, rocky non-forested islands, and small shaded overflow outlets.

Global Environment: This association occupies boulder and gravel bars on the frequently flooded, active channel shelves of high-gradient rivers and large streams. Along Laurel Fork, flooding duration is probably similar to that documented along Passage Creek in Shenandoah County, Virginia, by Hupp (1982). In that drainage, the channel shelf was inundated approximately 15% of the time. Periodic large or severe floods transport and deposit large numbers of cobbles, stones, and even boulders in characteristic bars both within the channel (islands) and along its edges (streambanks). These bars provide a matrix for deposition of finer alluvium and habitats for the establishment of tough, adaptable herbaceous plants, which in turn stabilize the bars with massive networks of perennial rootstocks. Regular flood-scouring batters or removes woody plants which take root in these habitats, maintaining open-canopy conditions. These habitats are highly dynamic, with conditions more or less constantly shifting in response to an irregular but powerful disturbance regime. While some of the bar habitats may be damaged or removed by severe floods, others may accrete or be newly deposited during the same events.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This association is characterized by light-demanding, tough-rooted herbaceous perennials tolerant of frequent inundation and flood-scouring. *Carex torta* forms dense, extensive colonies. There is often bare substrate of boulders, cobbles, gravel or sand.

Global Vegetation: Vegetation is characterized by light-demanding, tough-rooted herbaceous perennials tolerant of frequent inundation and flood-scouring. *Carex torta* is the dominant species and typically forms dense, extensive colonies. Associated species vary with geography but can include *Verbena hastata, Doellingeria umbellata (= Aster umbellatus), Dichanthelium clandestinum, Solidago rugosa ssp. aspera, Juncus effusus var. solutus, Scirpus expansus, Scirpus cyperinus, Equisetum arvense, Onoclea sensibilis, Vernonia noveboracensis, Lycopus virginicus, Scutellaria lateriflora, Lobelia cardinalis, Symphyotrichum dumosum (= Aster dumosus), Osmunda regalis var. spectabilis, Eupatorium fistulosum, Solidago patula*, and *Hypericum mutilum*. Small specimens of *Salix sericea* and other woody plants are also frequent.

Global Dynamics: Periodic large or severe floods transport and deposit large numbers of cobbles, stones, and even boulders in characteristic bars both within the channel (islands) and along its edges (streambanks). These bars provide a matrix for deposition of finer alluvium and habitats for the establishment of tough, adaptable herbaceous plants, which in turn stabilize the bars with massive networks of perennial rootstocks. Regular flood-scouring batters or removes woody plants which take root in these habitats, maintaining open-canopy conditions. These habitats are highly dynamic, with conditions more or less constantly shifting in response to an irregular but powerful disturbance regime. While some of the bar habitats may be damaged or

removed by severe floods, others may accrete or be newly deposited during the same events (Hupp 1982). Successionally, this unit can be considered a pioneering type on new, coarse alluvial land, but it is also more or less permanently maintained by natural disturbances.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Carex torta*

Global

Stratum	Species
GRAMINOID	*Carex torta*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Carex torta*

Global

Stratum	Species
GRAMINOID	*Carex torta*

GRank & Reasons: G3G4 (00-01-21). This community is found as linear occurrences along waterways in the Southern Appalachians, west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians and Allegheny Mountains. Although this community has a moderately large geographic range, it is uncommon within its range and occurrences are small. This community is more common than the number of documented occurrences would suggest, since it is often overlooked in inventories.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community occurs adjacent to alluvial forests of *Liquidambar styraciflua* and *Platanus occidentalis*, surrounded by floodplain forests (i.e., Poplar-Gum-Hemlock). The Little Pigeon River has many seasonally dry forks that support this community. It may be visible on air photography.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from the northeast portion of the Mount Le Conte quadrangle, along the Little Pigeon and Greenbrier rivers. It was not sampled on the Cades Cove quadrangle. It should occur in other areas of the park, in association with larger rivers.

Global Range: This community is found as linear occurrences along waterways in the Southern Appalachians, west into the Cumberland Plateau and the Interior Low Plateau, and north into the Central Appalachians and Allegheny Mountains.

Nations: US
States/Provinces: AL:S?, GA:S?, KY:S?, NC:S?, SC:S?, TN:S?, VA:S?, WV:S?
TNC Ecoregions: 44:C, 50:C, 51:C, 58:C, 59:C
USFS Ecoregions: 221Ba:CCC, 221Ha:CC?, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Eg:CCC, 222En:CCC, 222Eo:CCC, 231Cd:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCP, M221Ba:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Cd:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: G. Fleming and P. Coulling, SCS **Confidence:** 1 **Identifier:** CEGL004103
REFERENCES (type in full citation below if reference is new): Allard 1990, CAP pers. comm. 1998, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Hupp 1982, NatureServe Ecology - Southeast U.S. unpubl. data, Palmer-Ball et al. 1988, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm.

Juncus effusus - Chelone glabra - Scirpus spp. Southern Blue Ridge Beaver Pond Herbaceous Vegetation

Soft Rush - White Turtlehead - Bulrush species Southern Blue Ridge Beaver Pond Herbaceous Vegetation

Southern Blue Ridge Beaver Pond Marsh

Ecological Group (SCS;MCS): Appalachian and Interior Highlands Herbaceous Depression Ponds and Pondshores (475-30; 1.5.4.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs in beaver-impounded sites along mountain streams in the Southern Blue Ridge and Ridge and Valley physiographic provinces. Vegetative composition is highly variable, but *Juncus effusus* is a characteristic dominant. The physiognomy of the type is also extremely variable. Examples of this community range from 0% shrub cover to much higher levels of cover depending upon the amount of time since inundation and the fluctuation of the water level over time.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: Same as global

Global Environment: This association is known from moderately high elevations (2000-3000 feet) in the southern terminus of the Blue Ridge and Ridge and Valley physiographic provinces.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global

Global Vegetation: Composition is highly variable from place to place and time to time. *Juncus effusus* dominates. Other species may include *Chelone glabra, Scirpus atrovirens, Scirpus hattorianus, Hypericum mutilum, Carex gynandra, Oxypolis rigidior, Ludwigia palustris, Mimulus ringens, Eleocharis* spp., *Thelypteris noveboracensis, Leersia virginica, Carex lurida*, and *Carex echinata*.

Global Dynamics: These are very dynamic communities, changing as a result of alteration of water levels by beaver activity and dam washouts or abandonment. They undergo major successional transformations.

GRank & Reasons: G4? (00-06-12).

CLASSIFICATION COMMENTS

Global Classif Comments: As the beaver pond ages, the vegetation may quickly succeed into a shrubby version of this association, eventually becoming an *Alnus*- or *Salix*-dominated association. The variable communities of beaver marshes and meadows are poorly understood. This type may need substantial revision and clarification.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: The only documented occurrence of this community was off of US 441 in the Smokemont quadrangle.

Global Range: The distribution of this type is poorly understood, since its circumscription is as yet unclear. It was originally defined from the southern terminus of the Blue Ridge and Ridge and Valley physiographic provinces.

Nations: US
States/Provinces: AL?, GA:S?, NC:S?, TN?
TNC Ecoregions: 50:C, 51:P
USFS Ecoregions: 231D:CC, M221Dd:CCP
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 3 **Identifier:** CEGL008433

REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data, Schafale and Weakley 1990

Juncus effusus Seasonally Flooded Herbaceous Vegetation

Soft Rush Seasonally Flooded Herbaceous Vegetation
Rush Marsh
Ecological Group (SCS;MCS): Eastern Emergent Marshes (480-20; 1.4.1.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This broadly defined type represents freshwater marsh vegetation dominated by *Juncus effusus*. Additional types may be developed as more information becomes available. This vegetation may occur in natural or artificial ponds, including beaver-enhanced ones. In various parts of its broad range as currently defined, associated species may include *Andropogon glomeratus, Cyperus* spp., *Typha latifolia, Scirpus cyperinus, Triadenum walteri, Apios americana,* and *Galium aparine*. This type includes seasonally to temporarily flooded vegetation dominated or codominated by *Juncus effusus* in the central and southern Appalachians.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: This community is seasonally to temporally flooded and occurs along artificial waterways and disturbed, wet fields.

Global Environment: This is a seasonally (to temporarily) flooded marsh vegetation type; it may occur in natural or artificial ponds, including beaver-enhanced ones.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This type includes artificial and natural wetlands dominated by *Juncus effusus*, sometimes codominating with *Andropogon glomeratus*. Other wetland shrubs and herbs may be present, for example, *Alnus serrulata, Boehmeria cylindrica, Carex lurida, Cinna arundinacea, Eleocharis* spp., *Polygonum spp., Rhexia mariana var. mariana, Rhynchospora capitellata, and Scirpus* spp.

Global Vegetation: This type is currently broadly and literally defined, based on dominance by *Juncus effusus*. In various parts of its broad range as currently defined, associated species may include *Andropogon glomeratus, Cyperus* spp., *Typha latifolia, Scirpus cyperinus, Triadenum walteri, Apios americana,* and *Galium aparine*. In Georgia, Wharton (1978) cites *Carex rostrata, Carex stipata, Schoenoplectus pungens (= Scirpus americanus),* and *Sagittaria latifolia* as associates of beaver pond vegetation containing *Juncus effusus*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Juncus effusus*

Global

Stratum	Species
GRAMINOID	*Juncus effusus*

GRank & Reasons: G5 (01-03-28). This is a broadly defined, widely distributed, and reasonably secure vegetation type.

CLASSIFICATION COMMENTS

Global Classif Comments: Though this association was not seen at the Bankhead National Forest, it is expected to occur there.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This wetland occurs in wet ditches and wet fields within Cades Cove, on the Cades Cove quadrangle. It has not been found in other areas of the park but is likely to exist elsewhere within the boundary.

Global Range: The range of this broadly defined association has not been fully described. It is confirmed as occurring in the Central Appalachians and is thought to occur in the Interior Low Plateau, Cumberland

Plateau, Southern Ridge and Valley, Southern Blue Ridge, Piedmont, Chesapeake Bay Lowlands, and the Coastal Plain from the Mid-Atlantic to the Upper East Gulf Coastal Plain.

Nations: US
States/Provinces: AL:S?, AR:S?, FL:S?, GA:S?, KY:S?, LA:S?, MS:S?, NC:S?, OK:S?, SC:S?, TN:S?, TX:S?, VA:S?
TNC Ecoregions: 43:C, 44:C, 50:P, 51:C, 52:P, 53:P, 56:P, 57:P, 58:P, 59:C
USFS Ecoregions: 222Eb:CCC, 231Ca:CPP, 231Cd:CPP, 231Db:CCC, M221Ab:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: DOD (Arnold, Fort Benning); NPS (Carl Sandburg Home, Great Smoky Mountains); USFS (Bankhead, Cherokee?, Oconee?, Talladega)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004112
REFERENCES (type in full citation below if reference is new): Allard 1990, Fleming et al. 2001, Hoagland 1998c, Hoagland 2000, Peet et al. 2002, TNC 1998a, Wharton 1978

Calamagrostis cainii - Carex ruthii - Parnassia asarifolia / Sphagnum spp. Herbaceous Vegetation

Cain's Reedgrass - Ruth's Sedge - Kidneyleaf Grass-of-Parnassus / Peatmoss species Herbaceous Vegetation

Blue Ridge High-Elevation Seep (Mt. Le Conte Type)

Ecological Group (SCS;MCS): Appalachian Highlands Acid Seeps (475-12; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This is a herbaceous-dominated seepage slope, 1-2 acres in size. It is known from a single location on Mount Le Conte, in the Great Smoky Mountains of Tennessee. The vegetation is open with little or no shading by the surrounding forest. Graminoid species have almost continuous coverage, growing within large mats of *Sphagnum*. It is strongly dominated by *Calamagrostis cainii*. Other species with moderate coverage include *Carex ruthii, Carex misera, Gentiana linearis*, and *Dennstaedtia punctilobula*. Additional herbaceous species include *Carex debilis, Glyceria nubigena, Hypericum graveolens, Krigia montana, Parnassia asarifolia,* and *Solidago glomerata*. Shrubs and small trees may be scattered within the seep but are more prominent around the perimeter. Woody species include *Abies fraseri, Picea rubens, Prunus pensylvanica, Rhododendron catawbiense, Rubus canadensis*, and *Vaccinium erythrocarpum*. This community occurs on a steep, south-facing, exposed slope, at 6000 feet elevation. The site is thought to be a former landslide scar. It is a perennial seep, with small rock outcroppings. This community occurs in the spruce - fir zone and is adjacent to forests affected by Balsam Woolly Adelgid (*Adelges piceae*).

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: This community occurs on a steep, south-facing, exposed slope, at 6000 feet elevation. The site is thought to be a former landslide scar (Feldcamp 1984). It is a perennial seep, with small rock outcroppings. This community occurs in the spruce - fir zone and is adjacent to forests affected by Balsam Woolly Adelgid (*Adelges piceae*).

Global Environment: This is a herbaceous-dominated seepage slope, 1-2 acres in size. It is known from a single location on Mount Le Conte, in the Great Smoky Mountains of Tennessee. This community occurs on a steep, south-facing, exposed slope, at 6000 feet elevation. The site is thought to be a former landslide scar (Feldcamp 1984). It is a perennial seep, with small rock outcroppings. This community occurs in the spruce - fir zone and is adjacent to forests affected by Balsam Woolly Adelgid (*Adelges piceae*).

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This is a herbaceous-dominated seepage slope, one to two acres in size. The vegetation is open with little or no shading by the surrounding forest. Graminoid species have almost continuous coverage, growing within large mats of *Sphagnum*. It is strongly dominated by *Calamagrostis cainii*. Other species with moderate coverage include *Carex ruthii, Carex misera, Gentiana linearis*, and *Dennstaedtia punctilobula*. Additional herbaceous species include *Carex debilis, Glyceria nubigena, Hypericum graveolens, Krigia montana, Parnassia asarifolia,* and *Solidago glomerata*. Shrubs and small trees may be scattered within the seep but are more prominent around the perimeter. Woody species include *Abies fraseri, Picea rubens, Prunus pensylvanica, Rhododendron catawbiense, Rubus canadensis*, and *Vaccinium erythrocarpum*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Calamagrostis cainii*

Global

Stratum	Species
GRAMINOID	*Calamagrostis cainii*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Calamagrostis cainii*
FORB	*Gentiana linearis, Parnassia asarifolia, Solidago glomerata*

Global

Stratum	Species
GRAMINOID	*Calamagrostis cainii*
FORB	*Gentiana linearis, Parnassia asarifolia, Solidago glomerata*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Carex gynandra - Platanthera clavellata - Drosera rotundifolia - Carex ruthii - Carex atlantica / Sphagnum spp. Herbaceous Vegetation (CEGL007697)

GRank & Reasons: G1Q (99-02-23). This is a highly restricted, naturally rare community and known from only a single location. The dominant species *Calamagrostis cainii* is only known from the summits of Mt. Le Conte and in the Blacks and Craggy mountains. Its current taxonomy is uncertain; it may be better classified as a very local expression of Blue Ridge High Elevation Seep (Sedge Type), *Carex gynandra - Platanthera clavellata - Drosera rotundifolia - Carex ruthii - Carex atlantica / Sphagnum* spp. Herbaceous Vegetation (CEGL007697), a G2 community.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: *Calamagrostis cainii* may be locally dominant in seepage inclusions of other communities on Mount Le Conte, such as cliffs, heath shrublands, and steep landslide scars. The site which supports this community is a former landslide scar directly downslope from Cliff Tops, where there is a large concentration of *Calamagrostis cainii* growing in stable ledges and seeps. These stable substrates provide propagule sources for revegetating landslide scars, thus there is a tight spatial autocorrelation for species composition between scars and nearby ledges and cliffs (J. Boetsch pers. comm.). This community may be better classified as a very local expression of Blue Ridge High Elevation Seep (Sedge Type) (CEGL007697).

Global Classif Comments: *Calamagrostis cainii* may be locally dominant in seepage inclusions of other communities on Mount Le Conte, such as cliffs, heath shrublands, and steep landslide scars. The site which supports this community is a former landslide scar directly downslope from Cliff Tops, where there is a large concentration of *Calamagrostis cainii*, growing in stable ledge and seeps. These stable substrates provide propagule sources for revegetating landslide scars, thus there is a tight spatial autocorrelation for species composition between scars and nearby ledges and cliffs (J. Boetsch pers. comm.). This community may be better classified as a local expression of Blue Ridge High Elevation Seep (Sedge Type), *Carex gynandra - Platanthera clavellata - Drosera rotundifolia - Carex ruthii - Carex atlantica / Sphagnum* spp. Herbaceous Vegetation (CEGL007697).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community is known from Mount Le Conte in the Great Smoky Mountains of Tennessee. It is currently known from only a single location.

Global Range: This association is known from a single location on Mount Le Conte, in the Great Smoky Mountains.

Nations: US
States/Provinces: TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 3 **Identifier:** CEGL007877
REFERENCES (type in full citation below if reference is new): Boetsch 1998, Feldcamp 1984, Peet et al. 2002

Carex gynandra - Platanthera clavellata - Drosera rotundifolia - Carex ruthii - Carex atlantica / Sphagnum spp. Herbaceous Vegetation

Mountain Fringed Sedge - Small Green Wood Orchid - Roundleaf Sundew - Ruth's Sedge - Prickly Bog Sedge / Peatmoss species Herbaceous Vegetation

Blue Ridge High-Elevation Seep (Sedge Type)

Ecological Group (SCS;MCS): Appalachian Highlands Acid Seeps (475-12; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: Sedge-dominated, seepage slopes scattered throughout the high elevations (>5000 feet) of the Southern Blue Ridge. This non-alluvial wetland is generally graminoid-dominated but may have significant coverage by trees or shrubs, especially around the edges. Particularly small examples may be completely shaded by trees in the community and in the adjacent forests. Typically this community has well-developed *Sphagnum* mats. Characteristic species include *Carex gynandra, Carex ruthii, Carex atlantica, Carex debilis var. rudgei (= Carex flexuosa), Glyceria striata, Glyceria melicaria, Hypericum graveolens, Hypericum mitchellianum, Hypericum mutilum, Chelone lyonii, Platanthera clavellata*, and *Drosera rotundifolia*. Occurrences of this community are surrounded by or were formerly surrounded by forests dominated by *Abies fraseri* and *Picea rubens* or by the highest northern hardwood forests (forests dominated by *Fagus grandifolia, Betula alleghaniensis,* and *Aesculus flava*). They are influenced by the high rainfall and low evaporation rates in these high mountain landscapes.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: This community was sampled from a flat area around Ice Water Springs, at 5900 feet elevation, and a gently sloping area just downslope from the peak of Andrews Bald. They were both relatively open, sunny seeps with standing water and a mucky substrate.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community is a spring-associated seep dominated by patches of forbs, sedges, and peatmoss. The aspect dominants are *Ageratina altissima var. roanensis* and *Chelone obliqua*; however, *Carex ruthii, Viola* spp., *Sphagnum* spp., and *Carex gynandra* also have high coverage. Other species include *Aconitum uncinatum ssp. muticum, Agrostis perennans, Angelica triquinata, Oclemena acuminata (= Aster acuminatus var. acuminatus), Cinna latifolia, Dennstaedtia punctilobula, Diervilla sessilifolia, Glyceria nubigena, Hypericum* spp., *Oxalis montana, Solidago glomerata,* and *Solidago patula var. patula*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Carex ruthii*
FORB	*Ageratina altissima*

Global

Stratum	Species
GRAMINOID	*Carex crinita, Carex gynandra, Carex ruthii*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
GRAMINOID	*Carex gynandra, Carex ruthii, Glyceria nubigena*
FORB	*Solidago glomerata*

Global

Stratum	Species
GRAMINOID	*Carex atlantica, Carex debilis var rudgei, Carex gynandra, Carex ruthii, Glyceria melicaria, Glyceria striata*
FORB	*Chelone lyonii, Drosera rotundifolia, Hypericum graveolens, Hypericum mitchellianum, Hypericum mutilum, Platanthera clavellata*

OTHER NOTEWORTHY SPECIES

Great Smoky Mountains National Park

Stratum	Species
GROUND	*Sphagnum* spp. are diagnostic and dominant nonvasculars. *Carex spp. are dominant graminoids and Hypericum* spp. are dominant forbs.

Global

Stratum	Species
GRAMINOID	*Carex oklahomensis*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis Herbaceous Vegetation (CEGL004293)
- Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis Herbaceous Vegetation (CEGL004296)

GRank & Reasons: G2 (98-12-14). This community occurs in a limited portion of high-elevation areas of the Southern Blue Ridge. Occurrences are small and embedded in forests or sometimes high-elevation grassy balds or heath balds. Many examples are in protected areas. Those which are not are vulnerable to logging and alteration of hydrology.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: This community is surrounded by forests dominated by *Picea rubens*, *Betula alleghaniensis*, and *Abies fraseri*.

Global Classif Comments: This community is distinguished from other high-elevation seeps in the Blue Ridge, such as *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293) and *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296), by being graminoid-dominated and having *Sphagnum* present. Examples of this association generally lack *Rudbeckia laciniata, Laportea canadensis, Monarda didyma,* and *Diphylleia cymosa*. It is distinguished from Southern Blue Ridge bog communities by floristic differences and by occurring on a pronounced slope at high elevations.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled from two locations, one in the vicinity of Ice Water Springs and the other on Andrews Bald. It may be found in other high-elevation areas in the park, but is most likely very rare on the landscape.

Global Range:

Nations: US
States/Provinces: NC:S?, TN:S?, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL007697
REFERENCES (type in full citation below if reference is new): Newell and Peet 1996a, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Glyceria striata - Carex gynandra - Chelone glabra - Symphyotrichum puniceum / Sphagnum spp. Herbaceous Vegetation

Fowl Mannagrass - Mountain Fringed Sedge - White Turtlehead - Purple-stem Aster / Peatmoss species Herbaceous Vegetation

Southern Appalachian Wet Seepage Meadow

Ecological Group (SCS;MCS): Appalachian Highlands Bogs (475-10; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This acidic seep occurs in small-scale patch communities along streams in the Southern Appalachians. Occurrences are nearly always less than 0.4 hectare (1 acre) in size. Hydrology is seepage-fed, and these sites may also receive short-term flooding from adjacent streams. Characteristic species include *Glyceria striata, Glyceria melicaria, Osmunda cinnamomea, Carex gynandra, Symphyotrichum puniceum (= Aster puniceus), Solidago patula var. patula, Chelone glabra,* and *Sphagnum recurvum*. Most occurrences are herbaceous-dominated, though scattered shrubs and trees may occur, and trees rooted outside the community sometimes provide substantial shade.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Great Smoky Mountains National Park Environment: Same as global.

Global Environment: This acidic seep occurs in small-scale patch communities along streams in the Southern Appalachians. Occurrences are nearly always less than 0.4 hectare (1 acre) in size. Hydrology is seepage-fed, and these sites may also receive short-term flooding from adjacent streams.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global.

Global Vegetation: The physiognomic structure of this community type is variable. Most occurrences are herbaceous-dominated, though scattered shrubs and trees may occur, and trees rooted outside the community sometimes provide substantial shade. The most characteristic species include *Glyceria striata, Glyceria melicaria, Osmunda cinnamomea, Carex gynandra, Symphyotrichum puniceum (= Aster puniceus), Solidago patula var. patula, Chelone glabra,* and *Sphagnum recurvum*. Other species reported from some occurrences include *Betula lenta, Liriodendron tulipifera, Pinus strobus, Acer rubrum, Kalmia latifolia, Lyonia ligustrina var. ligustrina, Vaccinium fuscatum, Oxypolis rigidior, Athyrium filix-femina ssp. asplenioides, Salix nigra, Salix sericea,* and *Laportea canadensis*.

Global Dynamics: These communities appear to be relatively stable. They can be affected by beaver activity.

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Carex gynandra - Scirpus cyperinus - Eriophorum virginicum - Osmunda cinnamomea Herbaceous Vegetation (CEGL007771)--is associated with smaller streams in the Cumberland Plateau from Virginia south possibly to Tennessee.

GRank & Reasons: G2G3 (01-06-26). This community is rather widespread but always occurs in very small patches.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Global Classif Comments: These communities are sometimes regarded as "poorly-developed bogs." This type needs additional study and reconciliation against communities in North Carolina currently treated as forests ("Swamp Forest - Bog Complexes").

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was found in both the Smokemont and Bryson City quadrangles.

Global Range: This community was defined from the western fringe of the Southern Blue Ridge in northern Georgia, eastern Tennessee, and western North Carolina, but likely extends into adjacent areas of Alabama, Kentucky, and South Carolina.

Nations: US
States/Provinces: AL?, GA:S?, NC:S?, SC?, TN:S?
TNC Ecoregions: 50:P, 51:C
USFS Ecoregions: 231Dc:CCC, 231De:CCP, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala?)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: A.S. Weakley, SCS **Confidence:** 2 **Identifier:** CEGL008438
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data, Schafale and Weakley 1990

Saxifraga michauxii - Carex misera - Calamagrostis cainii Herbaceous Vegetation

Cliff Saxifrage - Wretched Sedge - Cain's Reedgrass Herbaceous Vegetation
Southern Appalachian High-Elevation Rocky Summit (Anakeesta Type)
Ecological Group (SCS;MCS): Appalachian Highlands Rocky Summits (436-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community is known from the Great Smoky Mountains of Tennessee, where it occurs on high-elevation landslide scars, cliffs, rock outcrops, and summits. Slopes can be extremely steep (landslide scars and cliffs) or relatively flat (summits and ledges). This community occurs mostly above 6000 feet elevation but can occur as low as 4500 feet. It is most often associated with exposed outcrops of Anakeesta slate and has very sparse to moderate vegetative cover, made up of grasses, forbs and shrubs rooted in rock fissures. These extreme habitats may have up to 80% exposed bedrock and talus, and often have seepage inclusions. Occurrences can range in size from 25 square m to 2.5 ha (one acre). Composition and vegetative coverage vary from site to site, but common dominants include the herbs *Calamagrostis cainii*, *Carex debilis*, *Carex misera*, and *Saxifraga michauxii*, and the shrubs *Diervilla sessilifolia*, *Rhododendron carolinianum*, and *Rubus canadensis*. Other typical species include *Ageratina altissima var. roanensis*, *Oclemena acuminata (= Aster acuminatus)*, *Athyrium filix-femina*, *Danthonia compressa*, *Dennstaedtia punctilobula*, *Gentiana linearis*, *Rugelia nudicaulis*, *Saxifraga michauxii*, and *Solidago glomerata*. Other woody species found in this community include *Abies fraseri*, *Betula alleghaniensis*, *Picea rubens*, *Leiophyllum buxifolium*, *Menziesia pilosa*, *Prunus pensylvanica*, *Rhododendron catawbiense*, *Sorbus americana*, and *Vaccinium erythrocarpum*. This community occurs in a matrix of *Picea rubens - Abies fraseri* forest.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community occurs on high-elevation landslide scars, cliffs, rock outcrops, and summits. Slopes can be extremely steep (landslide scars and cliffs) or relatively flat (summits and ledges). This community occurs mostly above 6000 feet elevation but can occur as low as 4500 feet. This community is most often associated with exposed outcrops of Anakeesta slate in the Great Smoky Mountains.

Global Environment: This community is known from the Great Smoky Mountains of Tennessee, where it occurs on high-elevation landslide scars, cliffs, rock outcrops, and summits. Slopes can be extremely steep (landslide scars and cliffs) or relatively flat (summits and ledges). This community occurs mostly above 6000 feet elevation but can occur as low as 4500 feet. It is most often associated with exposed outcrops of Anakeesta slate and has very sparse to moderate vegetative cover, made up of grasses, forbs and shrubs rooted in rock fissures. These extreme habitats may have up to 80% exposed bedrock and talus, and often have seepage inclusions.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community has very sparse to moderate vegetative cover made up of grasses, forbs and shrubs rooted in rock fissures. These extreme habitats may have up to 80% exposed bedrock and talus and often have seepage inclusions. Occurrences can range in size from 25 square meters to over an acre. Composition and vegetative coverage vary from site to site, but common dominants include the herbs *Calamagrostis cainii*, *Carex debilis*, *Carex misera*, and *Saxifraga michauxii*, and the shrubs *Diervilla sessilifolia*, *Rhododendron carolinianum*, and *Rubus canadensis*. Other typical species include *Ageratina altissima var. roanensis*, *Oclemena acuminata (= Aster acuminatus)*, *Athyrium filix-femina*, *Danthonia compressa*, *Dryopteris campyloptera*, *Gentiana linearis*, *Rugelia nudicaulis*, *Saxifraga michauxii*, and *Solidago glomerata*. Other woody species found in this community include *Abies fraseri*, *Betula alleghaniensis*, *Picea rubens*, *Leiophyllum buxifolium*, *Menziesia pilosa*, *Prunus pensylvanica*, *Rhododendron catawbiense*, *Sorbus americana*, and *Vaccinium erythrocarpum*. This community occurs in a matrix with *Picea rubens - Abies fraseri* Forest.

Global Vegetation: The composition and vegetative coverage of stands varies from site to site, but common dominants include the herbs *Calamagrostis cainii*, *Carex debilis*, *Carex misera*, and *Saxifraga michauxii*, and the shrubs *Diervilla sessilifolia*, *Rhododendron carolinianum*, and *Rubus canadensis*. Other typical

species include *Ageratina altissima var. roanensis, Oclemena acuminata (= Aster acuminatus), Athyrium filix-femina, Danthonia compressa, Dennstaedtia punctilobula, Gentiana linearis, Rugelia nudicaulis, Saxifraga michauxii*, and *Solidago glomerata*. Other woody species found in this community include *Abies fraseri, Betula alleghaniensis, Picea rubens, Leiophyllum buxifolium, Menziesia pilosa, Prunus pensylvanica, Rhododendron catawbiense, Sorbus americana*, and *Vaccinium erythrocarpum*.

Global Dynamics: In some areas this community may occur as a mosaic with *Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium* Shrubland (CEGL007876). The vegetation of landslide scars on Mount LeConte is included in this association, along with vegetation of more stable cliffs, ledges and seeps. The vegetation on the stable rocky substrates serves as a source pool for the more ephemeral scars, which revegetate slowly in a rather chaotic, stepwise succession, thus the different habitats are not compositionally distinct (J. Boetsch pers. comm.).

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
SHORT SHRUB	*Diervilla sessilifolia, Rhododendron carolinianum, Rubus canadensis*
GRAMINOID	*Carex debilis, Carex misera*
FORB	*Saxifraga michauxii*

Global

Stratum	Species
SHORT SHRUB	*Diervilla sessilifolia, Rhododendron carolinianum, Rubus canadensis*
GRAMINOID	*Carex debilis, Carex misera*
FORB	*Saxifraga michauxii*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Abies fraseri*
SHRUB	*Rhododendron carolinianum, Vaccinium erythrocarpum*
SHORT SHRUB	*Diervilla sessilifolia, Leiophyllum buxifolium*
GRAMINOID	*Calamagrostis cainii, Carex misera*
FORB	*Aster acuminatus, Saxifraga michauxii, Solidago glomerata*

Global

Stratum	Species
TREE CANOPY	*Abies fraseri*
SHRUB	*Leiophyllum buxifolium, Vaccinium erythrocarpum*
SHORT SHRUB	*Diervilla sessilifolia, Rhododendron carolinianum*
GRAMINOID	*Calamagrostis cainii*
FORB	*Aster acuminatus, Saxifraga michauxii, Solidago glomerata*

GRank & Reasons: G1 (99-02-15). This rock outcrop community is known only from outcrops of Anakeesta slate in the Great Smoky Mountains of Tennessee. This community is naturally rare, representing a tiny fraction of the high-mountain landscape. It is known from only a few occurrences. Atmospheric deposition of air pollutants may have an adverse effect on these high-elevation communities. It is a fragile community and can be damaged by trampling in areas of high recreational use.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: In some areas this community may occur as a mosaic with *Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium* Shrubland (CEGL007876). The vegetation of landslide scars on Mount Le Conte is included in this association, along with vegetation of more stable cliffs, ledges and seeps. The vegetation on the stable rocky substrates serves as a source pool for the more ephemeral scars, which revegetate slowly in a rather chaotic, stepwise succession, thus the different habitats are not compositionally distinct (J. Boetsch pers. comm.).

Global Classif Comments: In some areas this community may occur as a mosaic with *Rhododendron carolinianum - Rhododendron catawbiense - Leiophyllum buxifolium* Shrubland (CEGL007876). The vegetation of landslide scars on Mount LeConte is included in this association, along with vegetation of more stable cliffs, ledges and seeps. The vegetation on the stable rocky substrates serves as a source pool

for the more ephemeral scars, which revegetate slowly in a rather chaotic, stepwise succession, thus the different habitats are not compositionally distinct (J. Boetsch pers. comm.).

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled or observed on the Mount Le Conte quadrangle on the high slopes and summits of Mount Le Conte and in the vicinity of Mount Kephart and has not been seen in any other part of the park as part of this project..

Global Range: This community is known from the Great Smoky Mountains of Tennessee.

Nations: US
States/Provinces: TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL004278
REFERENCES (type in full citation below if reference is new): Allard 1990, Boetsch pers. comm., Feldcamp 1984, Peet et al. 2002, Wiser 1993, Wiser et al. 1996

Saxifraga michauxii - Carex misera - Oclemena acuminata - Solidago glomerata Herbaceous Vegetation

Cliff Saxifrage - Wretched Sedge - Whorled Wood Aster - Skunk Goldenrod Herbaceous Vegetation

Southern Appalachian High-Elevation Rocky Summit (High Peak Type)

Ecological Group (SCS;MCS): Appalachian Highlands Rocky Summits (436-30; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association covers high-elevation (greater than 1980 m) vegetated rock outcrops of highly fractured felsic to mafic bedrock. The vegetative cover is sparse with grasses, forbs and shrubs rooted in rock fissures. Typical species in stands of this type are *Carex misera, Abies fraseri, Menziesia pilosa, Heuchera villosa, Rhododendron catawbiense, Saxifraga michauxii, Sorbus americana, Oclemena acuminata (= Aster acuminatus)*, and *Solidago glomerata*. This community occurs in a matrix of *Picea rubens - Abies fraseri* forest. Other characteristic species are *Minuartia glabra* and *Polypodium appalachianum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: Same as global

Global Environment: This association covers high-elevation (greater than 1980 m) on rock outcrops of highly fractured felsic to mafic bedrock. This community occurs in a matrix of *Picea rubens - Abies fraseri* forest.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global

Global Vegetation: Typical species in stands of this type are *Carex misera, Abies fraseri, Menziesia pilosa, Heuchera villosa, Rhododendron catawbiense, Saxifraga michauxii, Sorbus americana, Oclemena acuminata (= Aster acuminatus)*, and *Solidago glomerata*. Other characteristic species are *Minuartia glabra* and *Polypodium appalachianum*.

GRank & Reasons: G1 (95-01-15). This community is naturally rare, representing a tiny fraction of the high-mountain landscape. It is known from scattered, small acreage occurrences. Heavy recreational use in these fragile communities has damaged, and continues to threaten, many examples. Additionally, atmospheric deposition of air pollutants may have an adverse effect on these high-elevation communities.

CLASSIFICATION COMMENTS

Global Classif Comments: Occurs on the highest summits of Grandfather Mountain, Mount Craig, Roan High Bluff, Mount Buckley (Great Smoky Mountains National Park), Craggy Pinnacle.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was not documented in this project. However, historical records indicate that this community is/was found on Mount Buckley. It most likely occurs in other high elevation areas of the park.

Global Range:

Nations: US
States/Provinces: NC:S?, TN:S?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 1 **Identifier:** CEGL004277

REFERENCES (type in full citation below if reference is new): Allard 1990, Schafale 1998b, Schafale and Weakley 1990, Wiser 1993, Wiser et al. 1996

(Diospyros virginiana, Platanus occidentalis) / Eupatorium serotinum - Diodia virginiana Herbaceous Vegetation

(Eastern Persimmon, Sycamore) / Late Thoroughwort - Virginia Buttonweed Herbaceous Vegetation

Artificial Lake Drawdown Zone

ELEMENT CONCEPT

GLOBAL SUMMARY: This association consists of drawdown zones around artificial impoundments in the Southern Appalachians and likely adjacent provinces. Physiognomy and composition are highly variable. A scattering to sometimes well-developed stratum of woody trees and saplings is sometime present, and often includes species such as *Diospyros virginiana, Betula nigra*, and *Platanus occidentalis*. Characteristic herbs are weedy colonizers, such as *Eupatorium serotinum, Diodia virginiana, Juncus effusus, Ambrosia artemisiifolia, Juncus tenuis, Scirpus cyperinus, Lobelia inflata, Lobelia cardinalis, Apocynum cannabinum, Polygonum hydropiperoides, Acalypha virginica, Andropogon virginicus, Panicum* spp., *Hypericum mutilum, Hypericum punctatum, Plantago* spp., *Pseudognaphalium* spp., and others.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Temporarily Flooded

Great Smoky Mountains National Park Environment: This community is found along the shores of Lake Fontana. It occupies significant area.

Global Environment: This community occurs along shores of artificial impoundments.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Same as global.

Global Vegetation: Physiognomy and composition are highly variable. A scattering to sometimes well-developed stratum of woody trees and saplings is sometime present, and often includes species such as *Diospyros virginiana, Betula nigra*, and *Platanus occidentalis*. Characteristic herbs are weedy colonizers, such as *Eupatorium serotinum, Diodia virginiana, Juncus effusus, Ambrosia artemisiifolia, Juncus tenuis, Scirpus cyperinus, Lobelia inflata, Lobelia cardinalis, Apocynum cannabinum, Polygonum hydropiperoides, Acalypha virginica, Andropogon virginicus, Panicum* spp., *Hypericum mutilum, Hypericum punctatum, Plantago* spp., *Pseudognaphalium* spp., and others.

Global Dynamics: This community is highly variable in space and time, due to differences in substrate, flooding regime, length of time since flooding, etc.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
TREE CANOPY	*Diospyros virginiana, Platanus occidentalis*
SHRUB	*Diospyros virginiana, Platanus occidentalis*
FORB	*Diodia virginiana, Eupatorium serotinum*

Global

Stratum	Species
None	

GRank & Reasons: GW (02-11-01).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: Documented from Great Smoky Mountains National Park Plot #556, from north shore of Lake Fontana.

Global Classif Comments: This type will need substantial additional documentation, likely leading to classification and nomenclatural changes.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the shores of Lake Fontana (Lake Fontana quadrangle).

Global Range: This community is found at low elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, northern Georgia, and probably northwestern South Carolina.

Nations: US
States/Provinces: GA:S?, NC:S?, SC?, TN:S?, VA?
TNC Ecoregions: 51:C
USFS Ecoregions: M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Nantahala)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: A.S. Weakley, SCS **Confidence:** 2 **Identifier:** CEGL003910
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data

Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis Herbaceous Vegetation

Umbrella-leaf - Branch-lettuce - Wood Nettle Herbaceous Vegetation

Rich Montane Seep (Cove Type)

Ecological Group (SCS;MCS): Appalachian Highlands Acid Seeps (475-12; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: A characteristic association of shaded seeps of the southern Appalachian Mountains, usually with overhanging canopies though trees not rooted in the seep itself. Often not large enough to be readily mappable, but a distinctive habitat for many plants, invertebrate and vertebrate animals. Other characteristic species include *Cardamine clematitis, Chelone lyonii, Chelone glabra, Chrysosplenium americanum, Boykinia aconitifolia, Cicuta maculata, Houstonia serpyllifolia, Viola cucullata, Viola macloskeyi ssp. pallens, Lilium grayi, Oxypolis rigidior, Parnassia asarifolia, Tiarella cordifolia, Thalictrum clavatum, Trautvetteria caroliniensis, Stellaria corei,* and *Geum geniculatum.* Occurrences associated with more acidic soil conditions often contain *Juncus gymnocarpus* (G. Kauffman pers. comm.). This association often occurs in cove forests.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: This community is found at low to intermediate elevations (samples ranged from 1960-4100 feet), on steep, rocky slopes. Substrates range from boulders and rocks to saturated, gravelly muck. These are small wetlands that occur as inclusions in an otherwise forested landscape.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community includes forested seeps in cove forests dominated by *Aesculus flava, Tilia americana var. heterophylla*, and *Betula alleghaniensis*. The seeps are open herbaceous vegetation, but canopy trees hang over the seep and can have up to 70% coverage. Shrubs are absent to sparse. Herbs have 50-100% coverage. Species with the highest coverages are *Diphylleia cymosa, Saxifraga micranthidifolia, Actaea podocarpa (= Cimicifuga americana), Laportea canadensis, Tiarella cordifolia,* and *Impatiens pallida*. Other common herbs include *Ageratina altissima var. roanensis, Eurybia divaricata (= Aster divaricatus), Chrysosplenium americanum, Euonymus obovata,* and *Monarda didyma*. Bryophytes, other than *Sphagnum*, can have substantial cover on rocks.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
FORB	*Diphylleia cymosa, Saxifraga micranthidifolia*

Global

Stratum	Species
FORB	*Diphylleia cymosa, Saxifraga micranthidifolia*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
FORB	*Diphylleia cymosa, Saxifraga micranthidifolia*

Global

Stratum	Species
FORB	*Diphylleia cymosa, Saxifraga micranthidifolia*

1.1.1.1.1

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis Herbaceous Vegetation (CEGL004293)

GRank & Reasons: G3 (98-12-14). This community occurs at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina. It occurs as a small patch community, embedded in a variety of regional forest types. While restricted in range and of small size, the community is relatively frequent within its range, many examples are protected, and threats are relatively few and minor.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community is too small to map and often occurs under a forested canopy.

Global Classif Comments: The nominal species *Diphylleia cymosa*, is a conspicuous component of this association, but may also be found in seeps of varying canopy closure at middle and high elevations. The associated nominal species, *Saxifraga micranthidifolia* and *Laportea canadensis*, are indicative of shaded seeps (G. Kauffman pers. comm.). Another high-elevation herbaceous seep association known from the southern Appalachians, *Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis* Herbaceous Vegetation (CEGL004293), often occurs on boulder fields or in northern hardwood forests, at higher elevations than the association defined here.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on both the Cades Cove and Mount Le Conte quadrangles and observed in most other areas of the park with mesic slopes. On the Cades Cove quadrangle this community was sampled in the southern portion of the quadrangle on a high slope north of Rich Gap and in the eastern portion of the quadrangle along Pole Knob Branch. On the Mount Le Conte quadrangle, this community was sampled north of Cherokee Orchard, above Baskins Creek; and in the vicinity of Rainbow Falls, along Le Conte Creek.

Global Range: This community is found at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina.

Nations: US
States/Provinces: GA:S?, NC:S?, SC?, TN:S?, VA:S?
TNC Ecoregions: 51:C, 59:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Jefferson, Nantahala, Pisgah, Sumter?)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004296
REFERENCES (type in full citation below if reference is new): Allard 1990, Fleming et al. 2001, Kauffman pers. comm., Nelson 1986, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis Herbaceous Vegetation

(Orange Jewelweed, Yellow Jewelweed) - Beebalm - Appalachian Black-eyed-Susan Herbaceous Vegetation

Rich Montane Seep (High-Elevation Type)

Ecological Group (SCS;MCS): Appalachian Highlands Acid Seeps (475-12; n/a)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association covers forb-dominated palustrine vegetation occurring as small wetlands at high elevations (greater than 1200 m or 4000 feet), on upper slopes and ridgetops in the Southern Blue Ridge ecoregion. These areas lack extensive *Sphagnum* and are typically open, without shading from a forest canopy. Typical dominant species include *Impatiens capensis, Impatiens pallida, Monarda didyma*, and *Rudbeckia laciniata var. humilis*. Other characteristic species include *Aconitum reclinatum, Cardamine clematitis, Carex leptonervia, Carex debilis var. rudgei (= Carex flexuosa), Carex ruthii, Chelone lyonii, Cicuta maculata, Claytonia caroliniana, Conioselinum chinense, Euonymus obovata, Geum geniculatum, Helenium autumnale, Houstonia serpyllifolia, Lilium superbum, Lilium grayi, Packera aurea (= Senecio aureus), Solidago patula, Thalictrum clavatum, Trautvetteria caroliniensis, Veratrum viride, Viola cucullata*, and *Viola macloskeyi ssp. pallens*. This vegetation is often associated with boulder fields or other northern hardwood forests [see I.B.2.N.a *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)].

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: Stands of this association occur both in open areas without an overstory and along high-elevation forested and semi-forested streams, especially in northern hardwood forests. Although usually very small in size (often less than 10 meters across), this community can occasionally occur as a larger patch in areas where a high-elevation stream runs through a flat stretch of land.

Global Environment: Stands of this association are forb-dominated palustrine vegetation occurring as small wetlands at high elevations (greater than 1200 m or 4000 feet), on upper slopes and ridgetops in the Southern Blue Ridge ecoregion. These areas lack extensive *Sphagnum* and are typically open, without shading from a forest canopy. This vegetation is often associated with boulder fields or other northern hardwood forests.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Typical dominant species in the Great Smoky Mountains include *Rudbeckia laciniata var. humilis, Symphyotrichum puniceum, Monarda didyma, Carex lurida*, and other *Carex* species. In some patches *Angelica triquinata, Stachys latidens, Impatiens* sp., and *Juncus effusus* were dominant. This community is best picked out from the matrix in late July when the *Rudbeckia laciniata* and *Monarda didyma* are both in full bloom.

Global Vegetation: Typical dominant species include *Impatiens capensis, Impatiens pallida, Monarda didyma*, and *Rudbeckia laciniata var. humilis*. Other characteristic species include *Aconitum reclinatum, Cardamine clematitis, Carex leptonervia, Carex debilis var. rudgei (= Carex flexuosa), Carex ruthii, Chelone lyonii, Cicuta maculata, Claytonia caroliniana, Conioselinum chinense, Euonymus obovata, Geum geniculatum, Helenium autumnale, Houstonia serpyllifolia, Lilium superbum, Lilium grayi, Packera aurea (= Senecio aureus), Solidago patula, Thalictrum clavatum, Trautvetteria caroliniensis, Veratrum viride, Viola cucullata*, and *Viola macloskeyi ssp. pallens*. These stands lack extensive cover by *Sphagnum* spp., and are typically open, without shading from a forest canopy.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
FORB	*Monarda didyma, Rudbeckia laciniata var humilis*

Global

Stratum	Species
FORB	*Impatiens capensis, Impatiens pallida, Monarda didyma, Rudbeckia laciniata var humilis*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
FORB	*Monarda didyma, Rudbeckia laciniata var humilis*

Global

Stratum	Species
FORB	*Impatiens capensis, Impatiens pallida, Monarda didyma, Rudbeckia laciniata var humilis*

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:

- Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis Herbaceous Vegetation (CEGL004296)—typically occurs at lower elevations and is associated with cove forests.

GRank & Reasons: G3 (98-12-14). This community occurs at moderate to high elevations of the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and probably northwestern South Carolina. It occurs as a small patch community, embedded in a variety of regional forest types. While restricted in range and of small size, the community is relatively frequent within its range, many examples are protected, and threats are relatively few and minor.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: This community is usually too small to map and often occurs under a forested canopy.

Global Classif Comments: Another high-elevation herbaceous seep association known from the southern Appalachians, *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296), typically occurs at lower elevations and is associated with cove forests.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Bunches Bald quadrangle along the Flat Creek Trail and near the Heintooga Spur. It probably occurs in other mid-high elevation areas of the park.

Global Range: This community occurs at moderate to high elevations in the southern Blue Ridge Mountains of western North Carolina, eastern Tennessee, southwestern Virginia, northern Georgia, and northwestern South Carolina.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?, VA:S?, WV?
TNC Ecoregions: 51:C, 59:P
USFS Ecoregions: M221Ba:CCC, M221Bb:CCP, M221Bc:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Cherokee, Jefferson, Nantahala, Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: A.S. Weakley, SCS **Confidence:** 2 **Identifier:** CEGL004293
REFERENCES (type in full citation below if reference is new): Allard 1990, CAP pers. comm. 1998, Fleming et al. 2001, NatureServe Ecology - Southeast U.S. unpubl. data, Nelson 1986, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Vittaria appalachiana - Heuchera parviflora var. parviflora - Houstonia serpyllifolia / Plagiochila spp. Herbaceous Vegetation

Appalachian Shoestring Fern - Cave Alumroot - Appalachian Bluet / Liverwort species Herbaceous Vegetation

Southern Blue Ridge Spray Cliff

Ecological Group (SCS;MCS): Eastern Moist Acid Cliffs (430-45; 2.4.3.4)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community includes herbaceous vegetation on rock substrates associated with the spray of cascades and waterfalls in the Southern Blue Ridge and adjacent portions of the Piedmont. It is found in southwestern North Carolina, northwestern South Carolina, and northeastern Georgia, in the escarpment gorges of the Southern Blue Ridge and west of the escarpment in eastern Tennessee. It occurs on saturated rock outcrops, on nearly vertical rock surfaces and ledges, slopes, and crevices with shallow soils which are constantly saturated. Vegetative coverage is sparse to moderate with 50-75% unvegetated surface (bedrock) possible. Vegetation grows in cracks and on organic accumulations on ledges. It is characterized by a variable but unique assemblage of vascular herbs, algae, and bryophytes, many of which are endemic to this community. Composition of this community varies from location to location, in part due to its insular nature. Characteristic species include liverworts (*Bazzania denudata, Conocephalum conicum, Oxalis montana, Pellia epiphylla, Pellia neesiana, Plagiochila austini, Plagiochila caduciloba, Plagiochila sharpii ssp. sharpii, Plagiochila* spp., *Plagiochila sullivantii, Riccardia multifida*); mosses (*Bryocrumia vivicolor, Dichodontium pellucidum, Fissidens osmundioides, Hyophila involuta, Mnium marginatum, Oncophorus raui, Plagiomnium affine, Plagiomnium carolinianum, Pseudotaxiphyllum distichaceum, Sphagnum girgensohnii, Sphagnum quinquefarium, Thalictrum* spp., *Thamnobryum alleghaniense*); ferns (*Adiantum pedatum, Asplenium monanthes, Asplenium montanum, Asplenium trichomanes ssp. trichomanes, Cystopteris protrusa, Grammitis nimbata (= Micropolypodium nimbatum), Hymenophyllum tayloriae, Polypodium virginianum, Trichomanes boschianum, Trichomanes intricatum, Vittaria appalachiana*); and other vascular species (*Galax urceolata, Heuchera parviflora var. parviflora, Houstonia serpyllifolia, Huperzia porophila, Hydrocotyle americana, Impatiens capensis, Phegopteris connectilis, Saxifraga careyana, Saxifraga caroliniana, Carex biltmoreana*). This community varies in composition with no consistent dominant species. Nominal species are either constant or regional endemics. South and west of the Blue Ridge Escarpment, this association is less diverse than those occurrences in the central portion of the range.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: This community occurs on saturated rock outcrops associated with the spray of cascades and waterfalls. This community is found on nearly vertical rock surfaces and ledges, slopes, and crevices with shallow soils which are constantly saturated. It is not a mappable unit as it is vertical and tends to be very small in size.

Global Environment: The hydrology of this community is supplied by constant spray from waterfalls. The community consists of nearly vertical rock surfaces and ledges, slopes, and crevices with shallow soils which are constantly saturated by spray from adjacent waterfalls. Freezing occurs very rarely, and flooding damage very seldom or never. Small pockets or mats of mineral or organic matter are interspersed with bare rock, and may or may not have seepage as well.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community includes herbaceous vegetation on rock substrates associated with waterfalls. Vegetative coverage is sparse to moderate with 50-75% unvegetated surface (bedrock) possible. Vegetation grows in cracks and on organic accumulations on ledges. It is characterized by a variable but unique assemblage of vascular herbs, algae, and bryophytes, many of which are endemic to this community. Composition of this community varies from location to location, in part due to its insular nature (Zartman and Pittillo 1998). Characteristic species include liverworts (*Bazzania denudata, Conocephalum conicum, Pellia epiphylla, Pellia neesiana, Plagiochila austini, Plagiochila caduciloba, Plagiochila sharpii ssp. sharpii, Plagiochila* spp., *Plagiochila sullivantii, Riccardia multifida*),

mosses (*Bryocrumia vivicolor, Dichodontium pellucidum, Fissidens osmundioides, Hyophila involuta, Mnium marginatum, Oncophorus raui, Plagiomnium affine, Plagiomnium carolinianum, Pseudotaxiphyllum distichaceum, Sphagnum girgensohnii, Sphagnum quinquefarium, Thalictrum* spp., *Thamnobryum alleghaniense*), ferns (*Adiantum pedatum, Asplenium monanthes, Asplenium montanum, Asplenium trichomanes ssp. trichomanes, Cystopteris protrusa, Grammitis nimbata (= Micropolypodium nimbatum), Hymenophyllum tayloriae, Phegopteris connectilis, Polypodium virginianum, Trichomanes intricatum, Vittaria appalachiana*), and other vascular species (*Galax urceolata, Heuchera parviflora var. parviflora, Houstonia serpyllifolia, Huperzia porophila, Hydrocotyle americana, Impatiens capensis, Oxalis montana, Saxifraga careyana,* and *Saxifraga caroliniana*).

Global Vegetation: This association consists of a variable collection of mosses, liverworts, algae, vascular herbs, and occasional shrubs (generally less than 10%), most of them requiring constantly moist substrate and very high relative humidity. Many of the typical species of this community are bryophytes and ferns disjunct from tropical regions, endemic bryophytes, and ferns disjunct from boreal regions. Shrubs include *Rhododendron maximum* and *Kalmia latifolia*. Herb species include *Huperzia porophila, Asplenium montanum, Asplenium trichomanes, Asplenium rhizophyllum, Asplenium monanthes, Cystopteris protrusa, Polypodium appalachianum, Trichomanes boschianum, Grammitis nimbata, Vittaria appalachiana, Hymenophyllum tayloriae, Trichomanes intricatum, Phegopteris connectilis, Adiantum pedatum, Saxifraga careyana, Saxifraga caroliniana, Heuchera parviflora var. parviflora, Circaea alpina ssp. alpina, Impatiens capensis, Houstonia serpyllifolia, Hydrocotyle americana, Thalictrum* spp., *Oxalis montana, Carex biltmoreana*, and *Galax urceolata*. Bryophyte species, many of them nearly or entirely limited to this community, include *Sphagnum quinquefarium, Sphagnum girgensohnii, Plagiomnium carolinianum, Mnium affine, Mnium marginatum, Isopterygium distichaceum, Bryocrumia vivicolor, Flakea papillosa, Hookeria acutifolia, Thamnobryum alleghaniense, Oncophorus raui, Hyophila involuta, Dichodontium pellucidum, Radula* spp., *Plagiochila sharpii, Plagiochila caduciloba, Plagiochila sullivantii, Plagiochila austinii, Fissidens osmundioides, Bazzania denudata, Conocephalum conicum, Pellia epiphylla, Pellia neesiana*, and *Riccardia multifida*.

Global Dynamics: These communities occur in unusually stable and equitable environments. The humidity is high and moisture supply is essentially constant. Temperatures are moderated by water, rock, and sheltering from sun and wind, resulting in only rare freezes or high temperatures. Potential disturbances include extreme droughts or freezes that may result in some die-off of sensitive species. Floods or rock falls may damage some parts, but in general this community is well sheltered from physical disturbance.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
Similar to global	

Global

Stratum	Species
FORB	*Circaea alpina ssp alpina, Heuchera parviflora var parviflora, Houstonia serpyllifolia, Thalictrum clavatum*
FERN	*Vittaria appalachiana*
NON-VASCULAR	*Hookeria acutifolia*

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
FORB	*Houstonia serpyllifolia*
FERN	*Vittaria appalachiana*

Global

Stratum	Species
GRAMINOID	*Carex biltmoreana*
FORB	*Circaea alpina ssp alpina, Galax urceolata, Houstonia serpyllifolia, Hydrocotyle americana, Impatiens capensis, Oxalis montana, Saxifraga careyana, Saxifraga caroliniana*
FERN	*Adiantum pedatum, Asplenium monanthes, Asplenium montanum, Asplenium rhizophyllum, Asplenium trichomanes ssp trichomanes, Cystopteris protrusa, Grammitis nimbata, Huperzia porophila,*

Hymenophyllum tayloriae, Phegopteris connectilis, Polypodium virginianum, Trichomanes boschianum, Trichomanes intricatum, Vittaria appalachiana

NON-VASCULAR *Bazzania denudata, Bryocrumia vivicolor, Conocephalum conicum, Dichodontium pellucidum, Fissidens osmundioides, Hookeria acutifolia, Hyophila involuta, Mnium marginatum, Oncophorus raui, Pellia epiphylla, Pellia neesiana, Plagiochila austinii, Plagiochila caduciloba, Plagiochila sharpii, Plagiochila sullivantii, Plagiomnium carolinianum, Riccardia multifida, Sphagnum girgensohnii, Sphagnum quinquefarium, Thamnobryum alleghaniense*

GRank & Reasons: G2 (98-04-30). This community is very limited, known only from a few dozen occurrences, most of which are less than one acre in size; the largest are only about two acres in size. Most examples are in rugged montane areas and have escaped direct disturbance, though many may have been affected by logging or development on surrounding lands. Water-quality declines may have detrimental impacts on this very delicate and easily impacted community. Even limited human visitation has degraded some occurrences.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park Other Comments: This community occurs adjacent to deciduous and hemlock cove forests

Global Classif Comments: Zartman and Pittillo (1998) found *Thuidium delicatulum, Atrichum oerstedianum, Houstonia serpyllifolia,* and *Plagiomnium ciliare* to be the most constant species in spray cliff communities sampled from the Chattooga River Watershed, in northern Georgia, western North Carolina, and northwestern South Carolina.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled only from the Mount Le Conte quadrangle. On Mount Le Conte, it was sampled at Rainbow Falls, Grotto Falls, and Thousand Drips. It is most common on the Tennessee side but may also occur at some waterfalls on the North Carolina side.

Global Range: It is found in southwestern North Carolina, northwestern South Carolina, and northeastern Georgia, in the escarpment gorges of the Southern Blue Ridge and west of the escarpment in eastern Tennessee.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004302
REFERENCES (type in full citation below if reference is new): Allard 1990, Anderson et al. 1990, Dellinger 1992, Farrar 1998, Nelson 1986, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990, Stotler and Crandall-Stotler 1977, Weakley 1993, Weakley and Schafale 1994, Wharton 1978, Zartman and Pittillo 1998

Polygonum (hydropiperoides, punctatum) - Leersia (lenticularis, virginica) Herbaceous Vegetation

(Swamp Smartweed, Dotted Smartweed) - (Catchfly Cutgrass, White Cutgrass) Herbaceous Vegetation

Smartweed - Cutgrass Beaver Pond

Ecological Group (SCS;MCS): Eastern Emergent Marshes (480-20; 1.4.1.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association incorporates vegetation of beaver ponds and other semipermanent impoundments in the Piedmont, South Atlantic Coastal Plain, Upper East Gulf Coastal Plain, scattered localities in the Blue Ridge, and possibly other adjacent provinces. Stands of this vegetation are dominated by some combination of *Polygonum punctatum, Polygonum hydropiperoides, Leersia lenticularis*, and/or *Leersia virginica*. Other herbaceous species present include *Saururus cernuus*, *Proserpinaca* sp., *Bidens aristosa (= Bidens polylepis)*, and *Xanthium strumarium*. Scattered individuals of *Cephalanthus occidentalis* and *Acer saccharinum* may be present. A Piedmont North Carolina example contains *Impatiens capensis, Boehmeria cylindrica*, and the exotic *Murdannia keisak*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: PALUSTRINE

Great Smoky Mountains National Park Environment: This community is associated with a limestone sinkhole that serves as an impoundment at 1970 feet in the Kinzel Springs quadrangle.

Global Environment: This association incorporates vegetation of beaver ponds and other semipermanent impoundments.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The only stand of this association in the park is dominated by *Polygonum* spp. and *Polygonum virginianum* with some overhanging canopy trees such as *Aesculus flava, Carya alba, Nyssa sylvatica*, and *Fraxinus americana*. In addition, herbaceous species such as *Sanicula canadensis, Lobelia siphilitica, Collinsonia canadensis*, and *Spigelia marilandica* are present.

Global Vegetation: Stands of this vegetation are dominated by some combination of *Polygonum punctatum, Polygonum hydropiperoides, Leersia lenticularis*, and/or *Leersia virginica*. Other herbaceous species which may be present include *Polygonum densiflorum, Saururus cernuus, Proserpinaca* sp., *Sparganium americanum, Typha latifolia, Scirpus cyperinus, Lobelia cardinalis, Onoclea sensibilis, Penthorum sedoides, Boehmeria cylindrica, Sambucus canadensis, Bidens aristosa (= Bidens polylepis)*, and *Xanthium strumarium*. Scattered individuals of *Cephalanthus occidentalis* and *Acer saccharinum* or other woody plants may be present. Examples which have become dried-out (through drought and/or beaver dam failure) may exhibit greater dominance by *Leersia* rather than *Polygonum*. The combination of *Polygonum punctatum - Leersia virginica* was first noted, but the combination of *Polygonum hydropiperoides* and *Leersia lenticularis* has also been observed in the Oconee National Forest.

Global Dynamics: This community is highly dynamic, affected by changes in water level related to flooding, beaver activity, beaver abandonment, etc. The dominance of *Polygonum* spp. may vary depending on hydroperiod. Examples which have become dried-out (through drought and/or beaver dam failure) may exhibit greater dominance by *Leersia* rather than *Polygonum*. Conversely, deeper water for sustained periods would promote relatively more *Polygonum* dominance.

GRank & Reasons: G4? (00-12-21). This association is found in the Coastal Plain and Interior from Tennessee and Alabama to the Carolinas. The full extent of its distribution is not known. This is not a rare community type, but it is threatened by filling of wetlands.

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park: The example within the park is only marginally related to similar associations in the Coastal Plain. It is most likely more akin to Piedmont examples of this association.

Global Classif Comments: Documented from a beaver pond in the floodplain of Owl Creek, Shiloh National Battlefield, Tennessee, on soils of the Collins silt loam; also from documented on Bailey Island in the ACE

Basin (C. Aulbach-Smith pers. comm.). Also seen in the Bankhead National Forest, Alabama, and the Oconee National Forest, Georgia.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: An example of this community only exists in one place in the park, a limestone sinkhole in the Kinzel Springs quad at approximately 1970 feet in elevation.

Global Range: This association is found in the Coastal Plain and Interior from Tennessee and Alabama to the Carolinas. The full extent of its distribution is not known.

Nations: US
States/Provinces: AL:S?, GA:S?, NC:S?, SC:S?, TN:S?
TNC Ecoregions: 42:?, 43:C, 44:P, 50:C, 51:P, 52:C, 53:C, 56:C, 57:P
USFS Ecoregions: 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221Hd:CC?, 221He:CCC, 222Ce:CCP, 222Cf:CCP, 222Cg:CCC, 222Eb:CCC, 222Eg:CCP, 222Ej:CCC, 222En:CCC, 222Eo:CCC, 231Aa:CCC, 231Ae:CCP, 231Af:CCP, 231Ao:CCC, 231Bc:CC?, 231Bd:CC?, 231Be:CC?, 231Cd:CCC, 232Bl:CCC, M221Cd:CCC
Federal Lands: DOD (Fort Benning); NPS (Great Smoky Mountains, Shiloh); USFS (Bankhead, Daniel Boone?, Oconee, Talladega?)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004290
REFERENCES (type in full citation below if reference is new): Aulbach-Smith pers. comm., Gallyoun et al. 1996, NatureServe Ecology - Southeast U.S. unpubl. Data

Asplenium montanum - Heuchera villosa Felsic Cliff Sparse Vegetation

Mountain Spleenwort - Rock Alumroot Felsic Cliff Sparse Vegetation
Appalachian Felsic Cliff
Ecological Group (SCS;MCS): Eastern Dry Acid Cliffs (430-40; 2.4.3.3)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs in the Blue Ridge and upper Piedmont of Georgia, North Carolina, South Carolina, Tennessee, and Virginia. It includes vertical rock faces associated with felsic, metamorphic and igneous geologies. This community generally has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses (e.g., *Thuidium* spp., *Fissidens* spp., *Campylium* sp., *Bryoandersonia* sp., *Plagiomnium* sp.) and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. *Asplenium montanum* and *Heuchera villosa* are characteristic components. Other typical species include *Agrostis perennans, Arisaema triphyllum, Aristolochia macrophylla, Asplenium trichomanes, Eurybia divaricata (= Aster divaricatus), Cystopteris protrusa, Dryopteris marginalis, Hydrangea arborescens, Parthenocissus quinquefolia, Polypodium appalachianum*, and *Rubus canadensis*. These cliffs are typically dry, although small seepages may occur. They are usually shaded by trees rooted on ledges and by the surrounding forest.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: This community includes vertical rock faces associated with felsic, metamorphic and igneous geologies. These cliffs are typically dry, although small seepages may occur. They are usually shaded by trees rooted on ledges and by the surrounding forest.

Global Environment: This community includes vertical rock faces associated with felsic, metamorphic and igneous geologies. Some occurrences attributed to this type appear to be on subcalcareous substrates. These cliffs are typically dry, although small seepages may occur. They are usually shaded by trees rooted on ledges and by the surrounding forest.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: This community has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses (e.g., *Thuidium* spp., *Fissidens* spp., *Campylium* sp., *Bryoandersonia* sp., *Plagiomnium* sp.) and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. *Asplenium montanum* and *Heuchera villosa* are characteristic components. Other typical species include *Agrostis perennans, Arisaema triphyllum, Aristolochia macrophylla, Asplenium trichomanes, Eurybia divaricata (= Aster divaricatus), Cystopteris protrusa, Dryopteris marginalis, Hydrangea arborescens, Parthenocissus quinquefolia, Polypodium appalachianum*, and *Rubus canadensis*.

Global Vegetation: This community has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses (e.g., *Thuidium* spp., *Fissidens* spp., *Campylium* sp., *Bryoandersonia* sp., *Plagiomnium* sp.) and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. *Asplenium montanum* and *Heuchera villosa* are characteristic components. Other typical species include *Agrostis perennans, Arisaema triphyllum, Aristolochia macrophylla, Asplenium trichomanes, Eurybia divaricata (= Aster divaricatus), Cystopteris protrusa, Dryopteris marginalis, Hydrangea arborescens, Parthenocissus quinquefolia, Polypodium appalachianum*, and *Rubus canadensis*. An example of a shaded rock outcrop from the Chattahoochee National Forest (Georgia) which is assigned here contains low coverages of the woody plants *Hydrangea arborescens, Kalmia latifolia, Vaccinium arboreum*, and *Vaccinium simulatum*, along with the herbs *Campanula divaricata, Dryopteris marginalis, Galax urceolata, Iris cristata, Muhlenbergia tenuiflora, Polygonatum biflorum, Silene stellata*, and *Solidago sphacelata*. An example in Great Smoky Mountains National Park (Tennessee) consisted of *Heuchera villosa, Pilea pumila, Impatiens pallida, Sedum ternatum*, and various moss species but did not contain *Asplenium montanum*.

Global Dynamics: These cliffs are typically dry, although small seepages may occur. They are usually shaded by trees rooted on ledges and by the surrounding forest.

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
FORB	*Heuchera villosa*
FERN	*Asplenium montanum*

Global

Stratum	Species
FORB	*Heuchera villosa*
FERN	*Asplenium montanum*

GRank & Reasons: G3G4 (98-01-04).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park:

Great Smoky Mountains National Park Other Comments: This community is not mappable and usually occurs beneath a forest canopy.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community was sampled on the Cades Cove and Mount Le Conte quadrangles. It is likely in other areas of the park. On the Cades Cove quadrangle it was sampled from cliffs in the northeast portion of the quadrangle, along Rowans Creek (2200 feet) and Crooked Arm Branch (2960 feet). On the Mount Le Conte quadrangle, this community was sampled from cliffs northwest of Bullhead (3840 feet) and above Highway 441, in the vicinity of Fort Harry (3400 feet).

Global Range: This community occurs in the Blue Ridge and upper Piedmont of Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

Nations: US
States/Provinces: GA:S?, NC:S?, SC:S?, TN:S?, VA?
TNC Ecoregions: 51:C, 52:C
USFS Ecoregions: 231Aa:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee, Cherokee, George Washington, Jefferson, Nantahala, Pisgah, Sumter)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004980
REFERENCES (type in full citation below if reference is new): NatureServe Ecology - Southeast U.S. unpubl. data, Peet et al. 2002, Schafale 1998b, Schafale and Weakley 1990

Asplenium ruta-muraria - Pellaea atropurpurea Sparse Vegetation

Wall-rue - Purple Cliffbrake Sparse Vegetation
Montane Cliff (Calcareous Type)
Ecological Group (SCS;MCS): Eastern Dry Alkaline Cliffs (430-50; 2.4.3.1)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs in areas of limestone or dolomite geology in Alabama, Kentucky, Maryland, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia, and may possibly range into South Carolina. It has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. Calciphilic herbs, such as *Asplenium ruta-muraria, Pellaea atropurpurea, Pellaea glabella ssp. glabella, Asplenium resiliens, Aquilegia canadensis*, are characteristic. Moister microhabitats of the crevice may have mosses such as *Anomodon rostratus* and *Anomodon attenuatus*. This community includes dry to rather moist limestone and dolomite outcrops, usually shaded by trees rooted in adjacent forested communities.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: A very low-quality occurrence of this community may exist in the area adjacent to Gregorys Cave near Cades Cove. However, the occurrence was too small to map or to document as a plot.

Global Environment: This community includes dry to rather moist limestone and dolomite outcrops, usually shaded by trees rooted in adjacent forested communities. It has little vegetative cover, often with 90% of the rock surface unvegetated. Mosses and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: The example within the park contains herbs such as *Pellaea atropurpurea* but does not contain the other nominals in the association name.

Global Vegetation: Stands of this association have little vegetative cover, often with 90% of the rock surface unvegetated. Mosses and lichens can have moderate coverage, and vascular plants occur on ledges and rooted in cracks. Calciphilic herbs, such as *Asplenium ruta-muraria, Pellaea atropurpurea, Pellaea glabella ssp. glabella, Asplenium resiliens, Aquilegia canadensis*, are characteristic. Moister microhabitats of the crevice may have mosses such as *Anomodon rostratus* and *Anomodon attenuatus*.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
FERN	*Pellaea atropurpurea*

CHARACTERISTIC SPECIES

Global

Stratum	Species
FORB	*Aquilegia canadensis*
FERN	*Asplenium resiliens, Asplenium ruta-muraria, Pellaea atropurpurea, Pellaea glabella ssp glabella*

GRank & Reasons: G3G4 (97-08-11).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park: This community is extremely uncommon in the park and may only exist near Gregorys Cave. Even this occurrence is so small and poorly developed that the attribution to CEGL004476 remains up for debate. This community may be distinguished from CEGL004394 by the presence of *Pellaea atropurpurea* and the absence of all of the nominals for CEGL004394.

Global Classif Comments: This community is extremely uncommon in the Southern Blue Ridge.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community potentially exists in the vicinity of Gregorys Cave on the Cades Cove quadrangle.

Global Range: This community occurs in areas of limestone or dolomite geology from Pennsylvania south to Alabama. It is found primarily in the Ridge and Valley and Cumberland Plateau, but ranges into scattered areas in the Blue Ridge.

Nations: US
States/Provinces: AL:S?, GA?, KY:S?, MD:S?, NC:S?, PA:S?, SC:S?, TN:S?, VA:S?, WV:S?
TNC Ecoregions: 50:C, 51:C, 59:C
USFS Ecoregions: 221Hb:CCC, 221Hc:CCC, 221Ja:CCC, 222Eo:CCC, M221Aa:CCC, M221Ac:CCC, M221Bb:CCP, M221Be:CCC, M221Dc:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Pisgah)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: SCS **Confidence:** 2 **Identifier:** CEGL004476
REFERENCES (type in full citation below if reference is new): Allard 1990, CAP pers. comm. 1998, Fleming et al. 2001, Schafale 1998b, Schafale and Weakley 1990

Cystopteris bulbifera - (Asplenium rhizophyllum) Sparse Vegetation

Bulblet Bladderfern - (Walking Fern) Sparse Vegetation
Appalachian Wet Limestone Cliff
Ecological Group (SCS;MCS): Eastern Moist Alkaline Cliffs (430-55; 2.4.3.2)

ELEMENT CONCEPT

GLOBAL SUMMARY: This broadly defined type represents vegetation dominated by *Cystopteris bulbifera* and *Asplenium rhizophyllum* from Kentucky to Virginia and south to Georgia. Stands have substantial cover by bare rock and bryophytes, along with scattered vascular plants. An example from the Chattahoochee National Forest contains *Heuchera villosa, Adiantum pedatum, Asplenium rhizophyllum, Carex platyphylla, Cystopteris protrusa, Hepatica nobilis var. acuta, Laportea canadensis*, and *Solidago flexicaulis*. Additional species at a similar site in Great Smoky Mountains National Park included *Sedum ternatum, Physocarpus opulifolius, Pellaea atropurpurea,* and *Packera obovata*. Additional types may be developed as more information becomes available.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland

Great Smoky Mountains National Park Environment: The only occurrence within the park exists on a southeast-facing limestone cliff at about 1800 feet elevation at White Oak Sink in the Kinzel Springs quadrangle.

Global Environment: This vegetation is found on calcareous cliffs in the Southern Blue Ridge and adjacent ecoregions, from Kentucky to Virginia and south to Georgia.

VEGETATION DESCRIPTION

Great Smoky Mountains National Park Vegetation: Within the park, only one occurrence of this community has been documented. This example contained *Sedum ternatum, Physocarpus opulifolius, Pellaea atropurpurea,* and *Packera obovata* in addition to *Cystopteris bulbifera*.

Global Vegetation: Vegetation assigned here from Chattahoochee National Forest (Chattooga Ranger District, 231Ab33) contains substantial cover by bare rock and bryophytes, along with scattered vascular plants, including *Heuchera villosa, Adiantum pedatum, Asplenium rhizophyllum, Carex platyphylla, Cystopteris protrusa, Hepatica nobilis var. acuta, Laportea canadensis*, and *Solidago flexicaulis*. Another example from Great Smoky Mountains National Park contains *Sedum ternatum, Physocarpus opulifolius, Pellaea atropurpurea,* and *Packera obovata*. Additional types may be developed as more information becomes available.

MOST ABUNDANT SPECIES

Great Smoky Mountains National Park

Stratum	Species
SHRUB	*Hydrangea arborescens, Physocarpus opulifolius, Ulmus rubra*
FORB	*Heuchera villosa, Sedum ternatum*
FERN	*Cystopteris bulbifera*

Global

Stratum	Species
Same as local	

CHARACTERISTIC SPECIES

Great Smoky Mountains National Park

Stratum	Species
SHRUB	*Physocarpus opulifolius*
FERN	*Cystopteris bulbifera*

Global

Stratum	Species
Same as local	

1.1.1.1.2

GLOBAL SIMILAR ASSOCIATIONS [NVC association gname (CEGL code)]:
- Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292)

GRank & Reasons: G? (97-12-01).

CLASSIFICATION COMMENTS

Great Smoky Mountains National Park: This community may be distinguished from *Asplenium ruta-muraria - Pellaea atropurpurea* Sparse Vegetation (CEGL004476) by the difference in herbaceous species composition.

Global Classif Comments: This broadly defined type is being geographically subdivided into an eastern type and an Ozarkian placeholder, which is being split off. In Missouri, and perhaps elsewhere in the Interior Highlands region of the Midwest, this vegetation [now see *Cystopteris bulbifera - Asplenium rhizophyllum* Ozark Sparse Vegetation [Placeholder] (CEGL008486)] is synonymous with Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292); so it is not tracked there. Further Midwest/Southeast review is needed.

ELEMENT DISTRIBUTION

Great Smoky Mountains National Park Range: This community most likely only exists at one location near the White Oak Sinks area on the Kinzel Springs quadrangle. Other occurrences are not likely since the geology that this association requires is not present in the right combination elsewhere in the park.

Global Range: This generally defined alkaline cliff type is found in the southeastern United States, from Kentucky to Virginia and south to Georgia.

Nations: US
States/Provinces: GA:S?, KY:S?, NC?, TN:S?, VA?, WV:S?
TNC Ecoregions: 50:C, 51:C, 52:C
USFS Ecoregions: 221:C, 231Ab:CCC, M221Dd:CCC
Federal Lands: NPS (Great Smoky Mountains); USFS (Chattahoochee)

ELEMENT SOURCES

Great Smoky Mountains National Park Inventory Notes:
Authors: A.S. Weakley, SCS **Confidence:** 3 **Identifier:** CEGL004394
REFERENCES (type in full citation below if reference is new): Allard 1990

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APPENDICES

Appendix I. Plot survey forms for collecting vegetation data

Location name _____ *Jurisdiction (State): NC or TN*

Location organization (NPS, USFS, etc.) __NPS__

Air photo # (if known) ____ Polygon code (if known)_____ Subplot? Y or N Subplot Parent Code _____

Provisional community name_____

*Classified community name*_____

Classifyer _____ Date_____

*TUSNVC Elcode*_____ *EONum-Suffix*_____ **Sublocation (I.D.able feature on topo map)** _____

USGS Quad name_____ *Quad code (if known)* _____

*Survey date:*_____ *Surveyors:*_____

Directions to plot:

Tagged tree is a _____ of _____ cm dbh with tag #_____. Conduit is at a bearing of ____ degrees and ____ m from tree.

Directions to tag tree (including any notes on best access route:

Vegetation Plot length (m)__50__ Plot width (m)__20__ Plot shape (rectangle?) ___YES___ Permanent? N

__**Digital photos** __**Regular camera** __**No pictures taken** **Roll# or disc #**_____ **Frame #**_____

Plot representativeness (is the matrix the same?)_____

____**UTM** ____ **Lat/long** **(If lat/long, then values are** _____ **N** _____ **W**

GPS Techniques/Equipment _____ **GPS file name** ___ ___ ___ ___ ___ ___ ___ ___

Field UTM X ___ ___ ___ ___ ___ ___ **m E** **Field UTM Y** ___ ___ ___ ___ ___ ___ ___ **m N**

Coordinate accuracy _____ **m / ft** **UTM Zone**_____ **GPS location with respect to permanent marker if not 0,0: x**___ **y**___

__ *Estimated position marked on Topo. Sheet.* **Elevation** _____ **m / ft** topo map? altimeter? DEM? GPS?

ENVIRONMENTAL / SITE INFORMATION

Measured Slope _____ ° _____ %

_ Flat	0 °	0 %
_ Gentle	0-5 °	1-9%
_ Moderate	6-14 °	10-25%
_ Somewhat steep	15-25 °	26-49%
_ Steep	27-45 °	50-100%
_ Very steep	45-69 °	101-275%
_ Abrupt	70-100 °	276-300
_ overhanging/sheltered	>100 °	>300%

Measured Aspect __ ___ ° (N=0 °)

_ Flat	
_ Variable	
_ N	338-22 °
_ NE	23-67 °
_ E	68-112 °
_ SE	113-157 °
_ S	158-202 °
_ SW	203-247 °
_ W	248-292 °
_ NW	293-337

Topographic Postion

_ Interfluve (Ridge, summit or crest)
_ High Slope (upper slope, convex slope)
_ Midslope (middle slope)
_ Lowslope (lower slope, footslope)
_ Toeslope (alluvial toeslope)
_ Low level (terrace)
_ Channel bed

Cowardin System

_ *Upland* _ *Palustrine*
_ *Estuarine* _ *Lacustrine*
_ *Riverine*

Landform (check most applicable)

_ Alluvial flat
_ Alluvial terrace
_ Bank
_ Bar
_ Bench
_ Cliff
_ Colluvial Slope
_ Cove
_ Debris slide
_ Depression
_ Draw
_ Floodplain
_ Gap
_ Hanging valley
_ Knob
_ Midslope
_ Mima mound
_ Nose slope
_ Ravine
_ Ridge
_ Ridgetop bedrock outcrop
_ Saddle
_ Scour
_ Seep
_ Toe slope
_ Slope
_ Streambed
_ Slough
_ Streamhead_

Geology

Igneous Rocks:

_ Granitic(Granite, Schyolite, Syenite, Trachyte)
_ Dioritic (Diorite, Dacite, Andesite)
_ Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite Diabase, Traprock)

Sedimentary Rocks:

_Conglomerates and Breccias
_Sandstone & conglomerate
_Siltstone (calcareous or noncalc)
_ Shale (calcareous or noncalc)
_Limestone and Dolomite
_Gypsum
_Marl

Metamorphic Rocks:

_ Gneiss
_Schist
_ Slate and Phyllite
_Marble
_Serpentine (Ultramafic)
_ Other _____

Hydrologic Regime (check only for wetlands)

_ Intermittently flooded
_ Permanently flooded
_ Semipermanently flooded
_ Temporarily Flooded (e.g. floodplains)
_ Seasonally Flooded (e.g. seasonal ponds)
_ Saturated (e.g. bogs, perennial seeps)
_ Unknown

_ Not a wetland (Upland: XERIC : DRY - MESIC : MESIC)

_ Permanently flooded – Tidal
_ Tidally flooded
_ Irregularly flooded
_ Irregularly exposed

Salinity/Halinity Modifiers:

_ *Upland (N/A)*
_ *Coastal Tidal: Saltwater- Tidal*
_ *Coastal Tidal – Brackish*
_ *Coastal Tidal – Freshwater*
_ *Inland Saltwater*
_ *Inland Brackish seeps)*
_ *Unknown*

Hydrology Evidence (Describe the hydrological factors that caused you to assign the type to the hydrologic regime that you chose.):

Environmental comments:

_____

Landscape comments:

Soil Texture:

_ Sand
_ Sandy loam
_ Loam
_ Silt loam
_ Clay loam
_ Clay
_ Peat
_ Muck

Soil Taxon Description:
_____
_____
_____

Drainage:

_ Rapidly drained _ Somewhat poorly drained
_ Well drained _ Poorly drained
_ Moderately well drained _ Very poorly drained

2. Soil depth (optional):_____

Ground cover

_____% Bedrock _____% Litter, duff _____% Bryophyte/lichen
_____% Large rocks (cobbles, boulders >10cm) _____% Wood (> 1 cm) _____% Other _____
_____% Small rocks (gravel, 0.2-10 cm) _____% Water
_____% Sand (0.1-2 mm) _____% Bare soil

Leaf type:
_Broad-leaved
_Needle-leaved
_Microphyllous
_Graminoid
_Broad-leaved herbaceous
_Pteridophyte
_Extremely xeromorphic

Leaf phenology (dominant stratum)

_ Evergreen
_ Cold-deciduous
_ Drought-deciduous
_ Mixed evergreen-cold-deciduous
_ Mixed evergreen drought deciduous
_ Herb - Annual
_ Herb - Perennial

Physiognomic Class
_ Forest (closed tree canopy)
_ Woodland (open tree canopy)
_ Shrubland
_ Dwarf Shrubland
_ Herbaceous (less than 25% woody layers)
_ Nonvascular
_ Sparse Vegetation

DISTURBANCE

Natural and Anthropogenic Disturbance

_ logging _ fire _ Hydrologic
_ erosion _ trails/roads _ Agriculture
_ grazing/browsing _ wind/ice damage _ Old Growth
_ pine bark beetle _ exotic plants _ Fire Suppression
_ dogwood anthracnose _ adelgid _ RCW
_ ORV _ feral hogs

Disturbance in plot, of type an dseverity (0-5, 0=no disturbance, 5= extreme disturbance):

___
*human:*_____

___ *natural:*_____

___ *fire: when?*_____

___ *clear-cut: when?*_____

___ *animal:*_____

Disturbance comments:

Current land use:

Former land use:

Qualitative Assessment (Write a brief word picture of community. Describe variation within occurrence in terms of veg structure and environment. Describe dominant and characteristic species and inclsion communities (if present). If community occursa sa mosaic describe spatial districtution and associated community types . Describe to what degree the example by the assigned classification unit Include landscape context information (adjacent communities):

QUANTITATIVE VEGETATION SAMPLE

STRATA	STRATA **HEIGHT**	COVER CLASS	DOMINANT/DIAGNOSTIC SPECIES	Height scale	Cover cls for strata
Emergent – T1				**01** < .5m	**5%**
Tree Canopy T2				**02** .5-1m	**10%**
Understory T3				**03** 1-2m	**20%**
Tall shrub S1				**04** 2-5m	**30%**
Short shrub S2				**05** 5-10m	**40%**
Herbaceous				**06** 15-20m	**50%**
Non-vascular				**07** 15-20m	**60%**
Vine/liana				**08 20-35m**	**70%**
Other notable species (indicators of distinctive conditions, e.g. high pH soil, elevation, geographic region, other particularly abundant species):				**09 35-50m**	**80%**
				10 >50m	**90%**
					100%

T1: *Emergent * ***T2:*** *Tree Canopy * ***T3*** *Subcanopy * ***S1*** *Tall Shrub (>1m; to 5m) * ***S2*** *Short Shrub (< 1m) * ***H*** *Herbaceous * ***N*** *Nonvascular * ***V*** *Vines (lianas) * ***E*** *Epiphytes*

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM (enter cover values for each stratum AND for Total cover)

T 1	T 2	T 3	S 1	S 2	H	N	V	E	Total Cover	Name (7 letter code or full name)	Collected ? Spec	Diagn ostic?

Cover cls
1 trace
2 0.1-1%
3 1-2%
4 2-5%
5 5-10%
6 10-25%
7 25-50%
8 50-75%
9 75-95%

10

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM

T1	T2	T3	S1	S2	H	N	V	E	Total cover	Name (7 letter acronym or full name)	Collected? Spec #?	Diagnostic?

Cover classes
1. trace
2. 0.1-1%
3. 1-2%
4. 2-5%
5. 5-10%
6. 10-25%
7. 25-50%
8. 50-75%
9. 75-95%
10. >95%

T1: Emergent

T2: Tree Can

T3 Subcanopy

S1 Tall Shrub (>1m; to 5m)

S2 Short Shrub (< 1m)

H Herbaceous

N Nonvascular

V Vines (lianas)

E Epiphytes

Appendix II. Glossary of terms on data sheets, classification document, and in report text.

ALLIANCE: Level of National Vegetation Classification System reflecting a physiognomically uniform group of plant associations sharing one or more diagnostic species (dominant, differential, indicator, or character), which (generally) are found in uppermost stratum of the vegetation.

ASPECT
The prevailing direction of the slope.

CANOPY COVER
The proportion of ground, usually expressed as a percentage, that is occupied by the perpendicular projection down on to it of the aerial parts of the vegetation or the species under consideration. The additive cover of multiple strata or species may exceed 100%.

CHARACTERISTIC SPECIES
Plant species not necessarily most abundant, but which are characteristic or diagnostic of the association when taken singly or in combination with other species (both local and global).

CLASSIFICATION
The grouping of similar types (in this case, vegetation) according to criteria (in this case, physiognomic and floristic) which are considered significant for this purpose. The rules for classification must be clarified prior to identification of the types within the classification system. The classification methods should be clear, precise, where possible quantitative and based upon objective criteria so that the outcome would be the same whoever performs the definition (or description). Classification necessarily involves definition of class boundaries.

CLASSIFICATION COMMENTS (GLOBAL AND LOCAL)
Any other comments about this association not covered in the fields above such as landscape relationships, inclusion communities, etc.

COLD DECIDUOUS
A class of vegetation in which the leaves drop in the unfavorable season of winter frost and freeze. The foliage is dropped every year.

COMMUNITY TYPE
A general term for any group of organisms belonging to a number of different species that co-occur in the same habitat or area and interact through trophic (feeding) and spatial relationships.

COMMON NAME
Association common name; same as the GNAME, but with common names instead of scientific names for the species.

CONSERVATION RANK
Global Element rank which characterizes the relative rarity or endangerment of the association world-wide (see methods discussion in report for details).

COVER TYPE
A designation based upon the plant species forming a plurality of composition within a given area (e.g., Oak-Hickory).

COWARDIN SYSTEM
USFWS system that describes the hydrology and landform of a site, if it is a wetland.

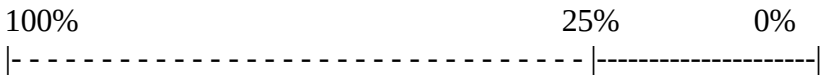
CULTURAL
See Planted/Cultivated.

DECIDUOUS COVER
Vegetation classes in which 75% or more of the diagnostic vegetation is made up of tree or shrub species that shed foliage simultaneously in response to an unfavorable season. There is usually one "leaf-off" season every year.

DOMINANCE
The extent to which a given species or life form predominates in a community because of its size, abundance or cover and affects the fitness of associated species. Dominance is interpreted in two different ways for vegetation classification purposes:



Where one or more vegetation strata (life form) covers greater than 25%, the life form greater than 25% which constitutes the uppermost canopy is referred to as the dominant life form.



Where no vegetation life form covers greater than 25%, the life form with the highest percent canopy cover is referred to as the dominant life form. In the case of a 'tie,' the upper canopy will be referred to as the dominant life form.

DROUGHT DECIDUOUS
Vegetation in which the leaves drop in response to an annual unfavorable season characterized by drought. The foliage is dropped every year.

DWARF-SHRUBLAND
A class of vegetation dominated by a life form of shrubs and/or trees under 0.5 m tall. These types generally have greater than 25% cover of dwarf shrubs and less than 25% cover of trees and shrubs. Herbs and non-vascular plants may be present at any cover value. In rare cases (e.g., alpine and polar regions), dwarf shrub cover may exceed the cover of trees, shrubs, herbs and non-vascular plants and be less than 25% of the total cover.

DWARF SHRUBS

Multi-stemmed woody plants with a life form at a height of less than 0.5 m due either to genetic or environmental constraints.

ECOLOGICAL GROUP
Broad physiognomic group to which the association is assigned.

ELEMENT DISTRIBUTION (GLOBAL AND LOCAL)
Description of the association's present range, including states of occurrence, both globally and within the park boundary (if known).

ELEVATION
Estimate of the elevation of the plot in feet or meters using either a GPS unit or a topo map.

ENVIRONMENTAL DESCRIPTION, GLOBAL
Most important environmental determinants of the biological composition or structure of this association and/or its subtypes.

ENVIRONMENTAL DESCRIPTION, LOCAL
Important environmental determinants of the biological composition or structure of this association within the Park (if known).

EVERGREEN COVER
Vegetation classes in which 75% or more of the diagnostic vegetation consists of trees or shrubs having leaves all year. Canopy is never without green foliage. Examples are pine, spruce, juniper and laurel.

FOREST
A class of vegetation that is dominated by trees with interlocking or overlapping crowns (generally forming 60-100% crown cover).

FORMATION
A level in the classification based on ecological groupings of vegetation units with broadly defined environmental and additional physiognomic factors in common. This level is the sixth level of the National Vegetation Classification System.

FORMATION CLASS
A level in the classification hierarchy defined by the relative percent canopy cover of the tree, shrub, dwarf shrub, herb and nonvascular life form in the uppermost strata during the peak of the growing season.

FORMATION GROUP
A level in the classification defined by a combination of climate, leaf morphology and leaf phenology. Different variables are applied to this hierarchical level in the sparse vegetation class.

FORMATION SUBCLASS

A level in the classification determined by the predominant leaf phenology of classes defined by tree, shrub or dwarf shrub stratum (evergreen, deciduous, mixed evergreen-deciduous) and the average vegetation height for the herbaceous stratum (tall, medium, short). Different variables are applied to this hierarchical level in the sparse vegetation class.

GLOBAL NAME
Association name based on Latin names of dominant or characteristic plant species. The association (or plant association) is the finest level of the classification system. It is the level at which community inventory and conservation action are aimed.

GLOBAL SIMILAR ASSOCIATIONS:
Associations that are easily confused with this association

HERBACEOUS VEGETATION
A class of vegetation dominated by non-woody plants known as herbs (graminoids, forbs and ferns). Herbs generally form at least 25% cover. Trees, shrub and dwarf shrub generally have less than 25% cover. In rare cases, herbaceous cover exceeds the combined cover of trees, shrubs, dwarf shrubs and non-vascular plants and is less than 25% cover. Height classes for the graminoids are short (<0.5 m), medium-tall (0.5-1 m) and tall (>1 m). Height classes for the forbs are low (<1 m) and tall (>1 m). For both graminoids and forbs, the height classes are measured when the inflorescences are fully developed.

HERBS
Non-woody vascular plants such as grasses, grass-like plants and forbs.

HYDROPHYTE
A plant which has evolved with adaptations to live in aquatic or very wet habitats, e.g., cattail, water lily, water tupelo.

LANDFORM
See Driscoll, R.S. et al. 1984. An Ecological Land Classification Framework for the United States. USDA Forest ServiceMiscellaneous Publication # 1439. U.S.Government Printing Office, Washington D.C. 32-48.

LEAF PHENOLOGY
The type of leaves that are present in a given stand of trees (evergreen, cold deciduous, drought deciduous, mixed evergreen-deciduous, perennial, annual, etc.).

LEAF TYPE
Description of a particular leaf. Types include broad-leaf, needle-leaf, microphyllous, graminoid, broad-leaf herbaceous, and pteridophyte (ferns and fern allies).

LEGEND
The list of classification types that are portrayed on a map. The legend will contain a subset of the total classes in the overall classification system.

LIFE FORM (GROWTH FORM)
A classification of plants based upon their size, morphology, habit, life span and woodiness.

MESIC
Wet/moist.

MIXED EVERGREEN-DECIDUOUS COVER
A class of vegetation types in which trees (or shrubs) are the dominant life form and neither deciduous nor evergreen species represent more than 75% of cover present.

MOST ABUNDANT SPECIES
Most abundant species by stratum (both local and global may be filled out).

NATURAL/SEMI-NATURAL
Areas dominated by native or naturalized vegetation that have not been cultivated or treated with any annual management or manipulation regime. In cases where it cannot be assessed whether the vegetation was planted or cultivated by humans, the vegetation is considered "Natural/Semi-Natural."

NATURALIZED
Species that invade, occupy and reproduce on a non-native site.

NONVASCULAR VEGETATION
Bryoids and lichens dominate with generally at least 25% canopy cover, while trees, shrubs, dwarf shrubs and herbs generally make up less than 25% cover. In some regions, non-vascular cover may exceed trees, shrubs, dwarf shrubs and herbs and be less than 25% of the total cover.

NON-VEGETATED
A class with less than 1% vegetation cover naturally or from which vegetation is removed and replaced by human-made surfaces or structures.

OTHER NOTEWORTHY SPECIES
High ranked species, animals, endemics, disjuncts, exotics that are found within occurrences of this association (both local and global).

PHYSIGNOMY
The structure and life form of a plant community, e.g. crown shape and spacing, leaf type, plant height. Physiognomic characters can be assessed without requiring species identification.

PHYSIOGNOMIC CLASS
The second level of National Vegetation Classification System which is a vegetation structural classification adapted from UNESCO 1973 and Driscoll et al. 1984. This level is based on the structure of the vegetation. This is determined by the height and relative percentage of cover of the dominant life-forms: tree, shrub, dwarf-shrub, herbaceous and nonvascular.

PHYSIOGNOMIC GROUP

The fourth level of National Vegetation Classification System. The group generally represents a grouping of vegetation units based on leaf characters, such as broad-leaf, needle-leaf, microphyllous, and xeromorphic. These units are identified and named with broadly defined macroclimatic types to provide a structural-geographic orientation, but the ecological climate terms do not define the groups *per se*.

PHYSIOGNOMIC SUBCLASS
The third level of National Vegetation Classification System. This level is determined by the predominant leaf phenology of classes defined by a tree, shrub or dwarf-shrub stratum, the persistence and growth form of herbaceous and nonvascular vegetation, and particle size of the substrate for sparse vegetation (e.g., consolidated rocks, gravel/cobble).

PHYSIOGNOMIC SUBGROUP
The fifth level of National Vegetation Classification System represents a distinction between natural vegetation, including natural, semi-natural and some modified vegetation, and cultural vegetation (planted/cultivated).

PLANT ASSOCIATION
The finest level of the classification system. The Plant Association is a physiognomically uniform group of vegetation stands that share one or more diagnostic (dominant, differential, indicator or character) overstory and understory species. These elements occur as repeatable patterns of assemblages across the landscape and are generally found under similar habitat conditions. (The Plant Association refers to existing vegetation, not a potential vegetation type).

PLANT COMMUNITY
A group of plant species that co-occur in the same habitat or area and that interact through trophic (feeding) or spatial relationships. The term can apply to any level of the hierarchy.

PLANTED/CULTIVATED
Areas dominated with vegetation that has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage or other intensive management or manipulation. The majority of vegetation in these areas is planted and/or maintained for the production of food, feed, fiber or seed. This includes (1) vegetation planted in built-up settings, for recreation, erosion control or aesthetic purposes, (2) all areas used for the production of crops, such as corn, soybeans, vegetables, tobacco, cotton, wheat and rice, (3) grasses, legumes or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, and (4) orchards, vineyards and tree plantations planted for the production of fruit, nuts, fiber (wood) or ornamental. In cases where one can not assess whether it was planted by humans (e.g., some mature planted forests), the vegetation is considered “Natural/Semi-Natural.”

POLAR
Geographically, regions that have all months below an average temperature of 50 degrees Fahrenheit or 10 degrees Celsius.

REFERENCES

Sources of information used to define or describe the association

SHRUBS
Woody plants greater than 0.5 m in height that generally exhibit several erect, spreading or prostrate stems and have a bushy appearance.

SHRUBLAND
A class of vegetation defined by areas dominated by shrubs generally greater than 0.5 m tall with individuals or clumps not touching to interlocking. Shrub canopy cover is generally greater than 25% while tree cover is generally less than 25%. In rare cases, shrub cover exceeds the tree, dwarf shrub, herb, non-vascular plant cover and is less than 25% cover.

SLOPE
Measure of the degree of slope using a clinometer.

SOIL TAXON
Soil name that best describes the soil type and origin.

SOIL DRAINAGE
The ability of the soil to drain water, determined by (1) actual moisture content (in excess of field moisture capacity), and (2) the extent of the period during which excess water is present in the plant-root zone.

SPARSE VEGETATION
A class of vegetation types that is defined as having 1-10% vegetation cover over the landscape at the peak of the growing season.

SUBGROUP
A level of the hierarchy that splits Natural/Semi-Natural vegetation types from the Planted/Cultivated vegetation types.

SUBPOLAR
(also called Boreal) — Geographically, regions that have only 1 (warmest) month at an average temperature of 50 degrees Fahrenheit or 10 degrees Celsius or above.

SUBTROPICAL
Geographically, regions that have an average temperature of 50 degrees Fahrenheit or 10 degrees Celsius or above for 5 to 8 months of the year.

SURFICIAL GEOLOGY
The geologic substrate influencing the plant community in question (bedrock or surficial materials). Some examples of surficial geology choices include:

IGNEOUS ROCKS
Granitic (Granite, Schyolite, Syenite, Trachyte)
Dioritic (Diorite, Dacite, Andesite)
Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite)

SEDIMENTARY ROCKS
Conglomerates and Breccias
Sandstone
Siltstone
Shale
Limestone and Dolomite
Marl
Gypsum
METAMORPHIC ROCKS
Gneiss
Schist
Slate and Phyllite
Marble
Serpentine
GLACIAL DEPOSITS:
undifferentiated glacial deposit
till
moraine
bedrock and till
ORGANIC DEPOSITS:
Peat (with clear fibric structure)
Muck
SLOPE AND MODIFIED DEPOSITS:
talus and scree slopes
colluvial
solifluction, landslide
AEOLIAN DEPOSITS
dunes
aeolian sand flats
loess deposits
cover sands

SYNONYM
A unique name by which the community may be more easily recognized or described.

TEMPERATE
Geographically, regions that have an average temperature of 50 degrees Fahrenheit or 10 degrees Celsius or above for only 2 to 4 months of the year.

TOPOGRAPHIC POSITION
The position of the plot within the landscape (low slope, cove, upper slope, ridge, etc).

TREE
Woody plants that generally have a single main stem and have more or less definite crowns.

TROPICAL
Geographically, regions characterized by a climate with high temperature, humidity and rainfall and having very rare light frosts at night (an average temperature of 65 degrees Fahrenheit or 18 degrees Celsius for the coolest month).

UNESCO
United Nations Educational, Scientific, and Cultural Organization

USFWS WETLAND SYSTEM:
USFWS Wetland Classification System, if applicable. (Cowardin, L.M., V. Carter, F.C. Golet, E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* United States Fish and Wildlife Service. Washington, DC.).

VEGETATED
Areas having 1% or more of the land or water with live vegetation cover at the peak of the growing season.

VEGETATION
The collective plant cover over an area.

VEGETATION COVER
Vegetation that covers or is visible at or above the land or water surface. The percentage of the ground covered by a vertical projection of the outermost perimeter of the natural spread of the foliage of plants.

VEGETATION DATA
The attributes of the vegetation that are used to classify and characterize the vegetation type and to map a vegetation stand. These data come from the interpretation of remotely sensed imagery, field work and other thematic data sources.

VEGETATION DESCRIPTION, GLOBAL
Additional comments on vegetation attributes of the association including species richness, diversity, physiognomic structure, spatial distribution of vegetation, strata height, dominant life-forms, coverage of unvegetated substrate, and additional compositional comments.

VEGETATION DESCRIPTION, LOCAL
Vegetation description for the association in the park.

VEGETATION STANDS
Contiguous areas that are homogenous with respect to the current condition of vegetation; that is, these are plant communities possessing sufficient uniformity in regard to composition and structure to be clearly different from adjacent areas.

WOODLAND
A class of vegetation types dominated by trees with crowns not touching, generally forming 25-60% cover. In rare cases, tree cover may exceed the combined cover of shrubs, dwarf shrubs, herbs and non-vascular plants and be less than 25% of the total cover.

XERIC
Dry.

XEROMORPHIC
Having structural characteristics common among plants adapted to drought, i.e., small thick leaves with sunken stomata or revolute margins, surfaces that are heavily pubescent, waxy or highly reflective and small vein islets.

Appendix III. Index of plots with the association to which they were assigned and their GPSed locations within the park.

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL002591	1	GRSM.561	Cades Cove	Cades Cove	245782	3944013	NAD27		
CEGL003560							NAD27		No plot documented
CEGL003624	1	GRSM.307	Off of Little Bottoms Trail	Calderwood	237122	3944517	NAD27		
CEGL003814		GRSM.135	Western Ridge off Balsam Point	Mt. Leconte	275307	3947672	NAD27		
CEGL003814		GRSM.153	Razorback ridge on Alum Cave Trail	Mt. Leconte	278473	3946293	NAD27		
CEGL003814	2	GRSM.534	Spruce Mountain	Bunches Bald	303389	3943270	NAD27		
CEGL003814	2	GRSM.535	Spruce Mountain	Bunches Bald	303542	3943522	NAD27		
CEGL003814	?	GRSM.71	Alum Cave Trail	Mt. Leconte	278850	3946080	NAD27		
CEGL003814		GRSM.73	Brushy mtn.	Mt. Leconte	280059	3950753	NAD27		
CEGL003814		GRSM.74	Brushy Mtn	Mt. Leconte	279960	3950625	NAD27		
CEGL003814		GRSM.76	Gap East of Bull Head	Mt. Leconte	275258	3948870	NAD27		
CEGL003814		GRSM.AA2	Brushy Mountain	Mount LeConte	280028	3950737	NAD27		
CEGL003814		GRSM.AA6	Chimneys	Mt LeConte	275559	3945472	NAD27		
CEGL003836		GRSM.243	Abrams Creek	Cades Cove	242905	3942550	NAD27		
CEGL003890	?	3002	Davis Ridge	Thunderhead	259730	3943682	NAD27		
CEGL003890		GRSM.125	South of Pond Knob	Cades Cove	248828	3935099	NAD27		
CEGL003890		GRSM.131	North of Potato Ridge	Mt. Leconte	282971	3952793	NAD27		
CEGL003890		GRSM.132	North of Potato Ridge	Mt. Leconte	282863	3952824	NAD27		
CEGL003890		GRSM.139	North of Mt. Winnesoka	Mt. Leconte	279082	3953056	NAD27		
CEGL003890		GRSM.220	Rowans Branch	Cades Cove	248047	3941411	NAD27		
CEGL003890	1	GRSM.560	West Prong	Wear Cove	255825	3946993	NAD27	x	
CEGL003890	1	Photopt10			n/a	n/a	n/a	n/a	Photo-point
CEGL003890	1	Photopt6		Thunderhead	252222	3943639	NAD27	n/a	Photo-point
CEGL003893	2	GRSM.501	Andrew's Bald Trail	Clingmans Dome	273869	3937055	NAD27		
CEGL003893		GRSM.93	Gap between Cliff top and High top	Mt Leconte	279089	3947997	NAD27		
CEGL003893		GRSM.94	East of Cliff Top	Mt Leconte	278965	3948012	NAD27		
CEGL003893		GRSM.95	North of Cliff Top	Mt Leconte	278863	3948059	NAD27		
CEGL003895	1	GRSM.559	Abram's Creek	Calderwood	234766	3945042	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL003909	1	GRSM.546	Goldmine Loop Trail	Bryson City	268596	3926845	NAD27		
CEGL003910	1	GRSM.556	Fontana Lake	Fontana Dam	248078	3930023	NAD27	x	
CEGL004048	1	GRSM.416	Big Cove Road	Smokemont	291344	3931780	NAD27		
CEGL004103		GRSM.113	Greenbrier	Mt. Leconte	281651	3957206	NAD27		
CEGL004103	1	GRSM.322	Oconaluftee River	Smokemont	291133	3931903	NAD27		
CEGL004103		GRSM.81	Little Pigeon River	Mt Leconte	283945	3955264	NAD27		
CEGL004112		GRSM.244	Inside Cades Cove loop on the west end.	Cades Cove	242937	3942265	NAD27		
CEGL004242		GRSM.213	Russell Field Bald	Cades Cove	248883	3939009	NAD27		
CEGL004242		GRSM.247	Gregory Bald	Cades Cove	240111	3934328	NAD27		
CEGL004242		GRSM.248	Gregory Bald	Cades Cove	240224	3934381	NAD27		
CEGL004242	1	GRSM.314	Spence Fields	Thunderhead	252818	3938643	NAD27		
CEGL004242	1	GRSM.536	Andrew's Bald	Clingman's Dome	273927	3935488	NAD27		
CEGL004277							NAD27		No plot documented
CEGL004278		GRSM.146	Boulevard Trail	Mt. Leconte	279977	3948060	NAD27		
CEGL004278		GRSM.151	Alum Cave Trail	Mt. Leconte	279205	3946653	NAD27		
CEGL004278		GRSM.91	Upper Alum Cave Trail	Mt Leconte	278966	3947771	NAD27		
CEGL004290	3	GRSM.309	Rich Mountain Gap	Kinzel Springs	246203	3948090	NAD27		
CEGL004293	1	GRSM.510	Flat Creek Trail	Bunches Bald	303050	3935940	NAD27		
CEGL004293	1	GRSM.511	Flat Creek Trail	Bunches Bald	303760	3936404	NAD27	x	
CEGL004293	1	GRSM.527	Heintooga Spur	Bunches Bald	301819	3940335	NAD27	x	
CEGL004293	1	Photopt8			n/a	n/a	n/a	n/a	Photo-point
CEGL004296		GRSM.105	Leconte creek	Mt Leconte	276717	3949141	NAD27		
CEGL004296		GRSM.232	Pole Knob Branch	Cades Cove	248425	3939610	NAD27		
CEGL004296		GRSM.250	Rich Gap	Cades Cove	241448	3934670	NAD27		
CEGL004296		GRSM.62	Baskins Creek	Mt. Leconte	274880	3952950	NAD27		
CEGL004296	1	Photopt3		Bunches Bald	302245	3942761	NAD27	n/a	Photo-point
CEGL004302		GRSM.141	Place of a thousand drips	Mt. Leconte	275492	3954461	NAD27		
CEGL004302		GRSM.150	Grotto Falls	Mt. Leconte	278280	3950390	NAD27		
CEGL004302		GRSM.159	Rainbow Falls	Mt. Leconte	277030	3949080	NAD27		
CEGL004302	1	Photopt7		Luftee Knob	307152	3956539	NAD27	n/a	Photo-point
CEGL004394	1	GRSM.300	White Oak	Kinzel Springs	250906	3946998	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
			Sink						
CEGL004420		GRSM.240	Abrams Creek	Cades Cove	242112	3942433	NAD27		
CEGL004420	1	Photopt1		Fontana Dam	242354	3942429	NAD27	n/a	Photo-point
CEGL004476	?	GRSM.239	Gregory's Cave	Cades Cove	245846	3944094	NAD27		
CEGL004691		GRSM.215	Forge Creek Road and Mill Creek	Cades Cove	242880	3941272	NAD27		
CEGL004691	2	GRSM.516	Deep Creek	Bryson City	280131	3929182	NAD27		
CEGL004691	1	GRSM.525	Kephart Prong	Smokemont	286175	3940494	NAD27		
CEGL004973	?	2040		Cades Cove	249761	3939048	NAD27		
CEGL004973		2042	Ledbetter Ridge	Cades Cove	249678	3938777	NAD27		
CEGL004973		2043	Ledbetter Ridge	Cades Cove	250549	3938813	NAD27		
CEGL004973		2054	Ledbetter Ridge	Cades Cove	249464	3938908	NAD27		
CEGL004973	?	2130		Cades Cove	241177	3935007	NAD27		
CEGL004973		2133	Gregory Ridge	Cades Cove	240103	3934974	NAD27		
CEGL004973	?	2134	North of Gregory Bald	Cades Cove	240174	3934634	NAD27		
CEGL004973	?	2135		Cades Cove	240246	3934985	NAD27		
CEGL004973	?	2151		Cades Cove	241165	3934615	NAD27		
CEGL004973		3006	Davis Ridge	Thunderhead	260376	3940682	NAD27		
CEGL004973	?	3016		Thunderhead	261677	3939399	NAD27		
CEGL004973		GRSM.108	Walker Camp Prong	Mt. Leconte	277274	3945402	NAD27		
CEGL004973		GRSM.231	Upper ploe knob Ranch	Cades Cove	248475	3939375	NAD27		
CEGL004973		GRSM.29	Cove below Chimney tops	Mount LeConte	275553	3945217	NAD27		
CEGL004973		GRSM.30	Beech Flats	Mt LeConte	276391	3945464	NAD27		
CEGL004973		GRSM.45	Forge Knob West	Cades Cove`	242149	3934425	NAD27		
CEGL004973		GRSM.46	Mud Gap	Cades Cove	244729	3935366	NAD27		
CEGL004973	1	GRSM.507	Newfound Gap Road	Clingmans Dome	279807	3943319	NAD27		
CEGL004973		GRSM.53	North of Ekaneetlee Gap	Cades Cove	245370	3936745	NAD27		
CEGL004973		GRSM.58	Devils Tater Patch	Cades Cove	248017	3937562	NAD27		
CEGL004973		GRSM.59	Upper Anthony Creek Trail	Cades Cove	249188	3939332	NAD27		
CEGL004973		GRSM.7	"Grassy Patch" above Alum Cave Creek	Mount LeConte	278610	3945506	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL004980		GRSM.156	Bullhead Trail	Mt. Leconte	274306	3949153	NAD27		
CEGL004980		GRSM.160	Above 441 in the Fort Harry vicinity	Mt. Leconte	275280	3946970	NAD27		
CEGL004980		GRSM.223	Rowans Branch	Cades Cove	248014	3941603	NAD27		
CEGL004980		GRSM.241	Crooked Arm Branch	Cades Cove	248930	3944721	NAD27		
CEGL004980	1	GRSM.310	Bull Cave	Kinzel Springs	246022	3947918	NAD27		
CEGL004982		GRSM.104	LeConte Creek	Mt Leconte	276649	3948774	NAD27		
CEGL004982		GRSM.106	Leconte Creek	Mt Leconte	276735	3949039	NAD27		
CEGL004982		GRSM.17	Bull Head Trail-Southwest of Balsam Point	Mount LeConte	275676	3947577	NAD27		
CEGL004982		GRSM.251	Forge Knob Branch headwaters	Cades Cove	242380	3934610	NAD27		
CEGL004982		GRSM.75	Ravine West of Trillium Gap	Mt. Leconte	279420	3949840	NAD27		
CEGL004983		GRSM.152	Below Alum Cave	Mt. Leconte	278600	3946371	NAD27		
CEGL004983	2	GRSM.552	Balsam Mtn. Road	Bunches Bald	301316	3942077	NAD27	x	
CEGL004983		GRSM.70	Alum cave trail	Mt. Leconte	278530	3946580	NAD27		
CEGL004995							NAD27		No plot documented
CEGL006049	?	6133		Mt. LeConte	278512	3948296	NAD27		
CEGL006049	?	6134		Mt. LeConte	279157	3948510	NAD27		
CEGL006049	?	6135		Mt. LeConte	278737	3948173	NAD27		
CEGL006049	?	6136		Mt. LeConte	279181	3948403	NAD27		
CEGL006049	?	6137		Mt. LeConte	279624	3948169	NAD27		
CEGL006049	?	6139		Mt. LeConte	278457	3948611	NAD27		
CEGL006049		GRSM.147	Boulevard Trail -- past Myrtle Point	Mt. Leconte	279480	3948120	NAD27		
CEGL006049		GRSM.92	Mt. Leconte Summit	Mt Leconte	279090	3948090	NAD27		
CEGL006124	1	GRSM.541	Forney Ridge Trail	Clingmans Dome	273495	3935310	NAD27	x	
CEGL006124		GRSM.98	North slope of Leconte, on Rainbow Falls trail.	Mt Leconte	277974	3949264	NAD27		
CEGL006130		GRSM.12	Trillium Gap	Mt LeConte	279742	3950290	NAD27		
CEGL006130	1	GRSM.410	Bunches Bald	Bunches Bald	303954	3936661	NAD27		
CEGL006192	?	1029		Calderwood	237077	3937542	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL006192		2052	Ledbetter Ridge	Cades Cove	249432	3940474	NAD27		
CEGL006192	?	2056		Cades Cove	249131	3940817	NAD27		
CEGL006192	?	2058		Cades Cove	248714	3941054	NAD27		
CEGL006192	?	2100		Cades Cove	243068	3937139	NAD27		
CEGL006192		2106	Gregory Ridge	Cades Cove	243384	3936580	NAD27		
CEGL006192		2109	Gregory Ridge	Cades Cove	242681	3937697	NAD27		
CEGL006192	?	2115		Cades Cove	243063	3937560	NAD27		
CEGL006192	?	2124		Cades Cove	242540	3936531	NAD27		
CEGL006192		2127	Gregory Ridge	Cades Cove	241998	3935553	NAD27		
CEGL006192		2129	Gregory Ridge	Cades Cove	243119	3936122	NAD27		
CEGL006192		3003		Thunderhead	259252	3944201	NAD27		
CEGL006192	?	3019		Thunderhead	258921	3943378	NAD27		
CEGL006192	?	3028	Davis Ridge	Thunderhead	259983	3943705	NAD27		
CEGL006192		GRSM.120	Eagle Creek	Cades Cove	250283	3934399	NAD27		
CEGL006192		GRSM.14	Baskin's Creek Trail South	Mount LeConte	275814	3950843	NAD27		
CEGL006192		GRSM.16	Piney Mountain-Northwest	Mount LeConte	276452	3951274	NAD27		
CEGL006192	?	GRSM.266	McCampbell Gap	Cades Cove	249725	3938310	NAD27		
CEGL006192		GRSM.31	Boring Ridge-Rabbit Creek Road	Cades Cove	240775	3941436	NAD27		
CEGL006192		GRSM.4	Horseshoe Cove-North Porter's Mountain	Mount LeConte	283947	3952076	NAD27		
CEGL006192	2	GRSM.414	Bunches Bald	Bunches Bald	299323	3944246	NAD27	x	
CEGL006246	1	GRSM.508	Poll's Gap	Bunches Bald	304520	3936622	NAD27		
CEGL006246	2	GRSM.509	Hemphill Bald	Bunches Bald	304403	3936713	NAD27	x	
CEGL006256		GRSM.142	Above Trillium Gap	Mt. Leconte	279321	3949601	NAD27		
CEGL006256		GRSM.145	Boulevard Trail	Mt. Leconte	280622	3946799	NAD27		
CEGL006256		GRSM.157	Bullhead Trail -- Balsam Point	Mt. Leconte	275883	3947646	NAD27		
CEGL006256		GRSM.25	Boulevard Trail	Mount LeConte	283222	3945572	NAD27		
CEGL006256	3	GRSM.540	Trail from Newfound Gap	Clingmans Dome	280828	3943403	NAD27	x	
CEGL006271	?	1015		Calderwood	235941	3938085	NAD27		
CEGL006271	?	1028		Calderwood	237448	3936898	NAD27		
CEGL006271	?	1056		Cades Cove	241742	3944964	NAD27		
CEGL006271	?	1058		Cades Cove	241943	3944955	NAD27		
CEGL006271	?	1085		Calderwood	238407	3945493	NAD27		
CEGL006271	?	2053		Cades Cove	249280	3941762	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL006271		2110	Gregory Ridge	Cades Cove	242719	3937449	NAD27		
CEGL006271		2114	Gregory Ridge	Cades Cove	243099	3937559	NAD27		
CEGL006271	?	2122		Cades Cove	243198	3936196	NAD27		
CEGL006271	?	2123		Cades Cove	243689	3936052	NAD27		
CEGL006271	?	2154		Cades Cove	244988	3937113	NAD27		
CEGL006271	?	2157		Cades Cove	245093	3937383	NAD27		
CEGL006271	?	2158		Cades Cove	243962	3937420	NAD27		
CEGL006271	?	2160		Cades Cove	244609	3937494	NAD27		
CEGL006271	?	2167		Cades Cove	244384	3936473	NAD27		
CEGL006271		3014	Davis Ridge	Thunderhead Mtn.	260298	3941657	NAD27		
CEGL006271		GRSM.109	Cherokee Orchard	Mt Leconte	275429	3951090	NAD27		
CEGL006271		GRSM.110	Cherokee Orchard	Mt. Leconte	275392	3951176	NAD27		
CEGL006271		GRSM.111	Cherokee Orchard	Mt. Leconte	275231	3951113	NAD27		
CEGL006271		GRSM.122	Nuna Ridge	Cades Cove	250514	3936281	NAD27		
CEGL006271		GRSM.124	Big Grill Ridge	Cades Cove	248650	3934840	NAD27		
CEGL006271		GRSM.128	Paw Paw Ridge	Cades Cove	250116	3932738	NAD27		
CEGL006271		GRSM.130	Potato Ridge	Mt. Leconte	283162	3952697	NAD27		
CEGL006271		GRSM.18	Lower Rainbow Falls Trail	Mount LeConte	275632	3949796	NAD27		
CEGL006271		GRSM.212	Russell Field trail	Cades Cove	249464	3940315	NAD27		
CEGL006271		GRSM.22	High South Slope -- Potato Ridge	Mount LeConte	282538	3952503	NAD27		
CEGL006271	1	GRSM.319	Laurel Falls Trail	Gatlinburg	264414	3951128	NAD27		
CEGL006271	1	GRSM.320	Laurel Falls Trail	Gatlinburg	264281	3951177	NAD27		
CEGL006271		GRSM.35	Anthony Creek Trail-West Cooper Branch	Cades Cove	249036	3942128	NAD27		
CEGL006271	2	GRSM.415	Oconaluftee River	Smokemont	291042	3935896	NAD27		
CEGL006271		GRSM.42	Forge Creek	Cades Cove	243058	3937122	NAD27		
CEGL006271	1	GRSM.503	McKee Creek	Dellwood	309126	3940948	NAD27		
CEGL006271		GRSM.54	Mollies Ridge - Lonesome Branch	Cades Cove	245572	3937070	NAD27		
CEGL006271		GRSM.80	Grapeyard Trail	Mt Leconte	284099	3953800	NAD27		
CEGL006271		GRSM.9	Baskin's Creek Trail	Mount LeConte	276235	3952777	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL006271		GRSM.99	Hills Creek	Mt Leconte	280340	3956530	NAD27		
CEGL006272		GRSM.11	Trillium Gap-LeConte Trail	Mount LeConte	279661	3950053	NAD27		
CEGL006272		GRSM.72	Alum Cave Trail	Mt Leconte	279030	3946375	NAD27		
CEGL006286		GRSM.100	Hills Creek	Mt Leconte	280320	3956385	NAD27		
CEGL006308	2	GRSM.532	Spruce Mountain	Bunches Bald	302847	3942772	NAD27		
CEGL007078							NAD27		No plot documented
CEGL007097	?	1001		Calderwood	23462	393942	NAD27		
CEGL007097	?	1009		Calderwood	237766	3941811	NAD27		
CEGL007097	?	1014		Calderwood	235274	3937758	NAD27		
CEGL007097	?	1026		Calderwood	234355	3935797	NAD27		
CEGL007097	?	1064		Cades Cove	240156	3938298	NAD27		
CEGL007097	?	1065		Cades Cove	240108	3938523	NAD27		
CEGL007097	?	1067		Cades Cove	239577	3938427	NAD27		
CEGL007097	?	1068		Cades Cove	239514	3938362	NAD27		
CEGL007097	?	1069		Cades Cove	239487	3938282	NAD27		
CEGL007097		2057	Ledbetter Ridge	Cades Cove	249472	3940581	NAD27		
CEGL007097	?	2103		Cades Cove	242606	3936942	NAD27		
CEGL007097	?	2119		Cades Cove	242609	3936026	NAD27		
CEGL007097	?	2153		Cades Cove	243783	3937394	NAD27		
CEGL007097	?	2155		Cades Cove	244581	3937267	NAD27		
CEGL007097	?	2156		Cades Cove	245184	3937270	NAD27		
CEGL007097	?	2159		Cades Cove	244608	3937425	NAD27		
CEGL007097		GRSM.102	Cobbs Butt	Cades Cove	246760	3940141	NAD27		
CEGL007097		GRSM.103	Injun Creek	Mt Leconte	281357	3954550	NAD27		
CEGL007097		GRSM.140	Grapeyard Trail	Mt. Leconte	277218	3952618	NAD27		
CEGL007097		GRSM.224	Cobb Butt	Cades Cove	246500	3940132	NAD27		
CEGL007097		GRSM.226	Allnight Ridge	Cades Cove	250012	3942584	NAD27		
CEGL007097		GRSM.34	Anthony Cr. Trail-East Cooper Branch	Cades Cove	249191	3942104	NAD27		
CEGL007097		GRSM.39	North of Tater Ridge	Cades Cove	245366	3945346	NAD27		
CEGL007097		GRSM.77	Bull Head	Mt Leconte	274987	3949005	NAD27		
CEGL007097		GRSM.84	Below Turkey Rock	Leconte	280651	3951923	NAD27		
CEGL007097		GRSM.86	Ridge N. of Copeland Creek	Mt Leconte	283505	3957058	NAD27		
CEGL007097		GRSM.AA3	Baskin's Creek Trail	Mount LeConte	275761	3950959	NAD27		
CEGL007100	1	GRSM.515	Deep Creek	Bryson City	279420	3928176	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL007102	?	1050		Cades Cove	240811	3941927	NAD27		
CEGL007102	?	1052		Cades Cove	240249	3943501	NAD27		
CEGL007102		GRSM.209	Arbutus branch	Cades Cove	241115	3942910	NAD27		
CEGL007102		GRSM.217	Wildcat Branch	Cades Cove	242892	3939255	NAD27		
CEGL007102		GRSM.33	Coon Butt Ravine	Cades Cove	239920	3940939	NAD27		
CEGL007102		GRSM.69	Slope of Little Pigeon River	Mt Leconte	282238	3956800	NAD27		
CEGL007119	?	1027		Calderwood	238947	3950315	NAD27		
CEGL007119	?	1033		Calderwood	234931	3940288	NAD27		
CEGL007119	?	1035		Calderwood	238250	3949880	NAD27		
CEGL007119	?	1036		Calderwood	238440	3949973	NAD27		
CEGL007119	?	1062		Cades Cove	241278	3941389	NAD27		
CEGL007119	?	1070		Calderwood	235172	3943829	NAD27		
CEGL007119	?	1072		Calderwood	235100	3943788	NAD27		
CEGL007119	?	1073		Calderwood	235056	3943456	NAD27		
CEGL007119	?	1080		Calderwood	230351	3938972	NAD27		
CEGL007119	?	1082		Calderwood	230688	3939174	NAD27		
CEGL007119	?	1088		Blockhouse	238879	3946003	NAD27		
CEGL007119	?	1089		Cades Cove	240596	3945671	NAD27		
CEGL007119		GRSM.200	Tater Ridge	Cades Cove	244622	3944415	NAD27		
CEGL007119		GRSM.216	Forge Creek Road	Cades Cove	242488	3939187	NAD27		
CEGL007119		GRSM.32	Boring Ridge	Cades Cove	240741	3941109	NAD27		
CEGL007119		GRSM.38	Rich Mountain Road	Cades Coves	243842	3944541	NAD27		
CEGL007130		GRSM.144	Boulevard trail	Mt. Leconte	283032	3946124	NAD27		
CEGL007130		GRSM.154	Alum Cave Trail	Mt. Leconte	279060	3947078	NAD27		
CEGL007130		GRSM.158	Above Rocky Spur on Rainbow Falls Trail	Mt. Leconte	278426	3948804	NAD27		
CEGL007131		GRSM.155	Alum Cave Trail	Mt. Leconte	278836	3947803	NAD27		
CEGL007131		GRSM.24	Boulevard trail	Mt LeConte	283308	3945930	NAD27		
CEGL007131		GRSM.26	Boulevard Trail	Mount LeConte	283483	3945315	NAD27		
CEGL007131	1	GRSM.403	Clingmans Dome	Clingmans Dome	275736	3942439	NAD27	x	
CEGL007131	3	GRSM.533	Spruce Mountain	Bunches Bald	303037	3943039	NAD27		
CEGL007136		GRSM.205	Abrams Creek	Cades Cove	240875	3942547	NAD27		
CEGL007136		GRSM.43	Tipton's Sugar Cove Branch	Cades Cove	242054	3937979	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL007219		GRSM.119	Eagle Creek	Cades Cove	250214	3934579	NAD27		
CEGL007219		GRSM.222	Rowans Branch	Cades Cove	248119	3941369	NAD27		
CEGL007219	2	GRSM.408	Little River Trail	Thunderhead Mountain	261559	3941545	NAD27	x	
CEGL007219	1	GRSM.521	Big Cove Road	Smokemont	292030	3932887	NAD27	x	
CEGL007219	1	GRSM.526	Newfound Gap Road	Smokemont	285255	3940793	NAD27	x	
CEGL007219		GRSM.67	Lower little pigeon river	Mt Leconte	281080	3956870	NAD27		
CEGL007219		GRSM.79	Rhododendron Creek	Mt Leconte	281910	3953510	NAD27		
CEGL007219		GRSM.AA1	Porter's Creek Flats	Mount LeConte	283714	3952086	NAD27		
CEGL007230	?	1008		Calderwood	238068	3941945	NAD27		
CEGL007230	?	1025		Calderwood	233638	3935979	NAD27		
CEGL007230	?	1031		Calderwood	235107	3940838	NAD27		
CEGL007230	?	1060		Cades Cove	241340	3941466	NAD27		
CEGL007230	?	1077		Calderwood	230510	3938538	NAD27		
CEGL007230	?	1078		Calderwood	230292	3938826	NAD27		
CEGL007230	?	1081		Calderwood	230573	3938726	NAD27		
CEGL007230	?	1083		Calderwood	239763	3946042	NAD27		
CEGL007230	?	2136		Cades Cove	239847	3935647	NAD27		
CEGL007230	?	2144		Cades Cove	243179	3934717	NAD27		
CEGL007230	?	2162		Cades Cove	245639	3936605	NAD27		
CEGL007230	?	2164		Cades Cove	245863	3936539	NAD27		
CEGL007230		GRSM.118	Copeland Creek	Mt. Leconte	282880	3958085	NAD27		
CEGL007230		GRSM.127	West of Paw Paw Ridge	Cades Cove	249946	3932586	NAD27		
CEGL007230		GRSM.257	Greer knob	Cades Cove	245230	3933520	NAD27		
CEGL007230		GRSM.260	Greer Knob South	Cades Cove	245050	3933125	NAD27		
CEGL007230		GRSM.261	Big Grill Ridge	Cades Cove	247217	3936792	NAD27		
CEGL007230	1	GRSM.308	Off of Little Bottoms Trail	Abram's Creek	237241	3944384	NAD27		
CEGL007230	2	GRSM.321	Laurel Falls Trail	Gatlinburg	264057	3951245	NAD27		
CEGL007230	?	GRSM.37	Rich Mountain Road Gate	Cades Cove	244120	3944144	NAD27		
CEGL007230		GRSM.47	Appalachian Trail south of Doe Knob	Cades Cove	244336	3934529	NAD27		
CEGL007230		GRSM.48	Brier Lick Gap	Cades Cove	243317	3934621	NAD27		
CEGL007230		GRSM.52	North of Ekaneetlee	Cades Cove	245581	3936327	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
			Gap						
CEGL007230	2	GRSM.520	Beaugard Ridge	Bryson City	277288	3928744	NAD27	x	
CEGL007230	1	GRSM.524	Mingus Mill	Smokemont	289361	3932827	NAD27	x	
CEGL007230	3	GRSM.558	Abram's Creek	Calderwood	234766	3945042	NAD27		
CEGL007230		GRSM.65	Dudley creek	Mt Leconte	279010	3956680	NAD27		
CEGL007230		GRSM.85	Copeland Creek	Mt Leconte	282921	3957896	NAD27		
CEGL007230		GRSM.88	Cades Cove Loop	Cades Cove	246143	3943768	NAD27		
CEGL007230?		GRSM.256	Ridge south of Doe Knob	Cades Cove	244280	3934220	NAD27		
CEGL007240	3	GRSM.301	White Oak Sink Bluff	Kinzel Springs	250906	3946998	NAD27	x	
CEGL007240	2	GRSM.312	Rich Mountain Gap	Kinzel Springs	245876	3948145	NAD27		
CEGL007267	?	1003		Calderwood	235314	3939679	NAD27		
CEGL007267	?	1007		Calderwood	237803	3941930	NAD27		
CEGL007267	?	1047		Calderwood	235527	3943005	NAD27		
CEGL007267	?	1055		Cades Cove	241807	3944856	NAD27		
CEGL007267	?	1057		Cades Cove	241338	3944866	NAD27		
CEGL007267	?	1061		Cades Cove	241204	3941328	NAD27		
CEGL007267	?	1063		Cades Cove	240174	3941673	NAD27		
CEGL007267	?	1084		Calderwood	239103	3945901	NAD27		
CEGL007267	?	1087		Calderwood	238594	3945702	NAD27		
CEGL007267	?	2152		Cades Cove	243464	3937769	NAD27		
CEGL007267		GRSM.21	East slope of Potato Ridge	Mount LeConte	283697	3952779	NAD27		
CEGL007267		GRSM.23	Copeland Divide	Mount LeConte	282980	3956426	NAD27		
CEGL007267	?	GRSM.237	Anthony Creek	Cades Cove	249775	3942110	NAD27		
CEGL007267	?	GRSM.238	Green Branch adjacent to the Cades Cove loop road	Cades Cove	249555	3943570	NAD27		
CEGL007267		GRSM.40	Cooper Road-Stony Ridge	Cades Cove	240974	3945388	NAD27		
CEGL007267		GRSM.41	Cooper Road-Arbutus Ridge	Cades Cove	241550	3944677	NAD27		
CEGL007267	1	GRSM.519	Noland Divide Trail	Bryson City	277693	3928770	NAD27	x	
CEGL007267		GRSM.66	Lower Little Pigeon River	Mt Leconte	281480	3957003	NAD27		
CEGL007285	?	2132		Cades Cove	240330	3934701	NAD27		
CEGL007285	?	2139		Cades Cove	239868	3934357	NAD27		
CEGL007285	?	2140		Cades Cove	240040	3934524	NAD27		
CEGL007285	?	2141		Cades Cove	240224	3934475	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL007285		2142	Gregory Ridge	Cades Cove	242125	3934384	NAD27		
CEGL007285	?	2145		Cades Cove	242357	3934395	NAD27		
CEGL007285	?	2147		Cades Cove	240711	3934431	NAD27		
CEGL007285	?	3011		Thunderhead	261257	3939375	NAD27		
CEGL007285	?	3012		Thunderhead	261198	3939482	NAD27		
CEGL007285	?	3022		Thunderhead	260582	3941043	NAD27		
CEGL007285		GRSM.114	Masa Knob	Mt. Leconte	284806	3945831	NAD27		
CEGL007285		GRSM.143	Trillium Gap Trail	Mt. Leconte	279142	3949123	NAD27		
CEGL007285		GRSM.214	North slope of McCampbell Knob	Cades Cove	249054	3939042	NAD27		
CEGL007285	1	GRSM.404	Clingmans Dome	Clingmans Dome	275483	3942361	NAD27	x	
CEGL007285	2	GRSM.411	Bunches Bald	Bunches Bald	304021	3937172	NAD27		
CEGL007285		GRSM.49	Upper Gregory Ridge Trail	Cades Cove	241038	3934703	NAD27		
CEGL007285	1	GRSM.504	Flat Creek Trail	Bunches Bald	303028	3935939	NAD27		
CEGL007285		GRSM.51	Mollies Ridge Shelter	Cades Cove	246780	3936970	NAD27		
CEGL007285	2	GRSM.531	Spruce Mountain	Bunches Bald	Missing	Missing	NAD27		Missing x and y
CEGL007285		GRSM.56	Devils Tater Patch	Cades Cove	247382	3937227	NAD27		
CEGL007285		GRSM.57	Devils Tater Patch	Cades Cove	247776	3937451	NAD27		
CEGL007295	2	GRSM.518	Purchase Knob	Dellwood	311923	3939884	NAD27		
CEGL007298		GRSM.137	Western Ridge of Balsam Pt	Mt. Leconte	274878	3947563	NAD27		
CEGL007298	1	GRSM.551	Balsam Mtn. Road	Bunches Bald	300632	3941146	NAD27	x	
CEGL007299		GRSM.228	MacCampbell Knob	Cades Cove	249189	3939063	NAD27		
CEGL007299	3	GRSM.502	Cattaloochee Divide	Dellwood	311600	3939637	NAD27		
CEGL007299	3	GRSM.506	Balsam Mtn. Road	Bunches Bald	303336	3944769	NAD27		
CEGL007300	?	2146		Cades Cove	240957	3934430	NAD27		
CEGL007300	?	2148		Cades Cove	241138	3934723	NAD27		
CEGL007300	?	2149		Cades Cove	240461	3934324	NAD27		
CEGL007300	?	3013		Thunderhead	261207	3939205	NAD27		
CEGL007300		GRSM.249	Gregory Bald, south slope	Cades Cove	234697	3934190	NAD27		
CEGL007300		GRSM.262	Lower Big Grill Ridge at Pond Knob	Cades Cove	248539	3935473	NAD27		
CEGL007300	3	GRSM.402	Bunches Bald	Bunches Bald	298047	3942919	NAD27	x	
CEGL007300	1	GRSM.412	Bunches Bald	Bunches Bald	301210	3941099	NAD27	x	

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL007300	2	GRSM.413	Bunches Bald	Bunches Bald	302221	3943364	NAD27		
CEGL007300		GRSM.44	Moore Spring Camp	Cades Cove	240792	3934208	NAD27		
CEGL007300		GRSM.55	Mollies Ridge	Cades Cove	246052	3937105	NAD27		
CEGL007339	1	GRSM.316	Ocanaluftee	Smokemont	291261	3931790	NAD27		
CEGL007388		GRSM.242	Gum pond	Cades Cove	242762	3941875	NAD27		
CEGL007493									No plot documented
CEGL007517									No plot documented
CEGL007519	?	1076		Calderwood	235431	3943758	NAD27		
CEGL007519		GRSM.204	Abrams Creek	Cades Cove	241028	3942320	NAD27		
CEGL007519		GRSM.206	Crooked Arm Ridge	Cades Cove	248810	3944240	NAD27		
CEGL007519		GRSM.208	Abrams Creek	Cades Cove	241282	3942703	NAD27		
CEGl007519		GRSM.218	Wildcat Branch	Cades Cove	242788	3939197	NAD27		
CEGL007519		GRSM.36	Laurel Creek	Cades Cove	250172	3943368	NAD27		
CEGL007519		GRSM.AA5	Tipton's Sugar Cove Branch	Cades Cove	241970	3937995	NAD27		
CEGL007539									No plot documented
CEGL007543	?	1002		Calderwood	235017	3940269	NAD27		
CEGL007543	?	1005		Calderwood	236953	3942612	NAD27		
CEGL007543	?	1022		Calderwood	237072	3943689	NAD27		
CEGL007543	?	1030		Calderwood	235308	3940881	NAD27		
CEGL007543	?	1034		Calderwood	234612	3939304	NAD27		
CEGL007543	?	1051		Cades Cove	241387	3941854	NAD27		
CEGL007543	?	2046		Cades Cove	250024	3940882	NAD27		
CEGL007543		2101		Cades Cove	243166	3936813	NAD27		
CEGL007543	?	2113		Cades Cove	243030	3937558	NAD27		
CEGL007543		2116		Cades Cove	242844	3935721	NAD27		
CEGL007543	?	3004		Thunderhead	261463	3942286	NAD27		
CEGL007543	?	3018		Thunderhead	259694	3942139	NAD27		
CEGL007543	?	3027		Thunderhead	261124	3943049	NAD27		
CEGL007543		GRSM.201	Streamside N of Tater Ridge	Cades Cove	244709	3944931	NAD27		
CEGL007543		GRSM.254	Ekaneetlah confluence	Cades Cove	246200	3934710	NAD27		
CEGL007543	1	GRSM.305	Indian Prong Branch	Thunderhead Mountain	261672	3940943	NAD27		
CEGL007543	1	GRSM.405	Clingmans Dome	Clingmans Dome	274296	3942338	NAD27		
CEGL007543	1	GRSM.407	Little River Trail	Thunderhead Mountain	261068	3943491	NAD27		
CEGL007543	1	GRSM.409	Silers Bald	Silers Bald	263155	3942263	NAD27	x	
CEGL007543	3	GRSM.513	Gatlinburg	Gatlinburg	263656	3949250	NAD27	x	

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL007543	1	GRSM.543	Smokemont Campground	Smokemont	290260	3936900	NAD27	x	
CEGL007543	1	GRSM.553	Balsam Mtn. Road	Bunches Bald	301196	3944300	NAD27	x	
CEGL007691	2	GRSM.514	Smokemont	Smokemont	291466	3936215	NAD27		
CEGL007691	1	GRSM.545	Goldmine Loop Trail	Bryson City	268873	3926834	NAD27		
CEGL007691	1	GRSM.549	Goldmine Loop Trail	Bryson City	268481	3926230	NAD27		
CEGL007692	2	GRSM.311	Rich Mtn Gap	Kinzel Springs	245827	3947990	NAD27		
CEGL007692	1	GRSM.523	Job Corps Center	Smokemont	291221	3932890	NAD27	x	
CEGL007692	1	GRSM.550	Smokemont - Tow String	Smokemont	292065	3935170	NAD27		
CEGL007693	?	2041		Cades Cove	250022	3939454	NAD27		
CEGL007693	?	2047		Cades Cove	249431	3939332	NAD27		
CEGL007693		2055	Ledbetter Ridge	Cades Cove	249125	3939414	NAD27		
CEGL007693		2105	Gregory Ridge	Cades Cove	243252	3936606	NAD27		
CEGL007693	?	2117		Cades Cove	242557	3935412	NAD27		
CEGL007693		3007	Davis Ridge	Thunderhead	260664	3941009	NAD27		
CEGL007693		3008		Thunderhead	260499	3940748	NAD27		
CEGL007693	?	3015		Thunderhead	260671	3939352	NAD27		
CEGL007693	?	3023		Thunderhead	260886	3941127	NAD27		
CEGL007693	?	3024		Thunderhead	260359	3941324	NAD27		
CEGL007693	?	3025	Davis Ridge	Thunderhead	260426	3941520	NAD27		
CEGL007693	?	3026		Thunderhead	260887	3941772	NAD27		
CEGL007693		GRSM.1	Cherokee Orchard-Rainbow Falls Trailhead	Mount LeConte	240775	3941436	NAD27		
CEGL007693		GRSM.10	Trillium Gap-Grotto Falls	Mount LeConte	277222	3950974	NAD27		
CEGL007693		GRSM.148	North watershed of Rocky Spur	Mt. Leconte	277519	3949904	NAD27		
CEGL007693		GRSM.5	Upper Porter's Creek	Mount Guyot	285325	3947414	NAD27		
CEGL007693		GRSM.6	Porter's Creek-Horseshoe Branch	Mount LeConte	283944	3948849	NAD27		
CEGL007693		GRSM.60	Left prong Anthony Crk.	Cades Cove	250000	3940690	NAD27		
CEGL007695	?	1011		Calderwood	235686	3938387	NAD27		
CEGL007695	?	2104		Cades Cove	242675	3936750	NAD27		
CEGL007695	?	2131		Cades Cove	242476	3936200	NAD27		
CEGL007695	?	2163		Cades Cove	245675	3936663	NAD27		
CEGL007695		GRSM.101	Bunting	Cades Cove	246851	3940480	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
			Branch						
CEGL007695		GRSM.133	Fort Harry	Mt. Leconte	275700	3946770	NAD27		
CEGL007695		GRSM.134	Ravine E and S of Balsam Point	Mt. Leconte	274949	3947237	NAD27		
CEGL007695		GRSM.138	N. of Mt. Winnesoka	Mt. Leconte	279187	3952352	NAD27		
CEGL007695		GRSM.149	N.watershed below Rocky Spur	Mt. Leconte	277343	3950480	NAD27		
CEGL007695		GRSM.15	Piney Mtn-Northeast	Mount LeConte	276571	3951285	NAD27		
CEGL007695		GRSM.19	Rainbow Falls Trail	Mount LeConte	276144	3949314	NAD27		
CEGL007695		GRSM.2	Cherokee Orchard-LeConte Creek	Mount LeConte	275010	3949896	NAD27		
CEGL007695		GRSM.207	Scotts Mountain Trail	Kinzel Springs	249742	3945539	NAD27		
CEGL007695		GRSM.225	Cove below Cobb Butt	Cades Cove	246648	3940369	NAD27		
CEGL007695		GRSM.236	Upper Fanny Branch	CAdes Cove	248938	3941657	NAD27		
CEGL007695		GRSM.246	Pine Ridge north slope	Cades Cove	240762	3937934	NAD27		
CEGL007695		GRSM.27	Chimineys Picnic area - Nature trail	Mount LeConte	274021	3946118	NAD27		
CEGL007695		GRSM.3	Porter's Creek	Mt LeConte	283032	3950858	NAD27		
CEGL007695		GRSM.50	Mid- Gregory Ridge Trail	Cades Cove	242303	3935956	NAD27		
CEGL007695		GRSM.78	Lower Bullhead Trail	Mt Leconte	274290	3949450	NAD27		
CEGL007695		GRSM.83	Long Branch	Mt Leconte	281152	3951500	NAD27		
CEGL007697		GRSM.115	Icewater Springs	Mt. Leconte	283846	3945381	NAD27		
CEGL007697	1	GRSM.537	Andrew's Bald	Clingman's Dome	273693	3935397	NAD27		
CEGL007710		GRSM.210	Abrams creek	Cades Cove	240325	3943196	NAD27		
CEGL007710		GRSM.211	Russell Field Trail before it gets steep	Cades Cove	250195	3941350	NAD27		
CEGL007710		GRSM.221	Cork Branch/ Rowans Brnch junction	Cades Cove	248148	3941140	NAD27		
CEGL007710	?	GRSM.258	Birch Springs Shelter	Cades Cove	244830	3932125	NAD27		
CEGL007710	1	GRSM.554	Fontana Lake	Fontana Dam	248198	3928646	NAD27	x	
CEGL007710		GRSM.63	Lower Baskins Ck	Mt.Leconte	273883	3953564	NAD27		

CEGL	Confidence	Plot Number	Sublocation	Quads	UTM X	UTM Y	Datum	Quick plot?	Comments
CEGL007710		GRSM.87	Indian Creek	Mt Leconte	278152	3953003	NAD27		
CEGL007710	1	Photopt2		Fontana Dam	248591	3928911	NAD27	n/a	Photo-point
CEGL007710	1	Photopt4		Wear Cove	255892	3947112	NAD27	n/a	Photo-point
CEGL007861	?	2138		Cades Cove	240406	3935346	NAD27		
CEGL007861		3010		Thunderhead	261605	3940939	NAD27		
CEGL007861		GRSM.107	Alum Cave Creek	Mt Leconte	278143	3945476	NAD27		
CEGL007861		GRSM.116	Chimney's Trailhead	Mt. Leconte	276153	3946090	NAD27		
CEGL007861		GRSM.117	Trout Branch	Mt. Leconte	277452	3945920	NAD27		
CEGL007861		GRSM.13	East Limb of Rocky Spur Branch	Mount LeConte	278095	3950478	NAD27		
CEGL007861		GRSM.136	Cove off Balsam Ridge	Mt. Leconte	275272	3947463	NAD27		
CEGL007861		GRSM.28	Alum Cave Creek/Walker Camp Prong	Mount LeConte	277750	3945410	NAD27		
CEGL007861	1	GRSM.406	Clingmans Dome	Clingmans Dome	274243	3941999	NAD27		
CEGL007861	1	GRSM.528	Balsam Mtn. Road	Bunches Bald	301623	3942479	NAD27		
CEGL007861	2	GRSM.530	Balsam Mtn. Road	Luftee Knob	301736	3944476	NAD27		
CEGL007861		GRSM.8	Alum Cave Creek-Steep Rhodo Pass	Mount LeConte	278565	3945484	NAD27		
CEGL007876	?	6138		Mt. LeConte	278630	3948184	NAD27		
CEGL007876	1	GRSM.538	Charlies Bunion	Mount Le Conte	284795	3946132	NAD27		
CEGL007876	1	GRSM.539	Charlies Bunion	Mt Le Conte	284795	3946132	NAD27		
CEGL007876		GRSM.96	Rocky Spur	LeConte	278036	3949089	NAD27		
CEGL007876		GRSM.97	Rocky Spur	Mt Leconte	278032	3949078	NAD27		
CEGL007876		GRSM.AA4	Jumpoff	Mt LeConte	283635	3945783	NAD27		
CEGL007877		GRSM.90	Alum Cave trail	Mt Leconte	279013	3947786	NAD27		
CEGL007878		2045	Ledbetter Ridge	Cades Cove	249241	3941084	NAD27		
CEGL007878		GRSM.121	West of Nuna Ridge	Cades Cove	250399	3936091	NAD27		
CEGL007878		GRSM.252	Upper Big Tommy Creek	Cades Cove	244717	3934660	NAD27		
CEGL007878		GRSM.255	Ekaneetlah Creek	Cades Cove	246025	3935111	NAD27		
CEGL007878		GRSM.265	Big Abrams Gap (south slope in NC.)	Cades Cove	248801	3938219	NAD27		
CEGL007878	1	GRSM.401	Hyatt Ridge Trail	Bunches Bald	297947	3943524	NAD27		

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CEGL007879	1	GRSM.302	?	?			NAD27	x	
CEGL007879	1	GRSM.547	Goldmine Loop Trail	Bryson City	268570	3926861	NAD27	x	
CEGL007879	1	GRSM.548	Goldmine Loop Trail	Bryson City	268397	3926271	NAD27	x	
CEGL007879		GRSM.61	Baskins Creek	Mt Leconte	275295	3952910	NAD27		
CEGL007880		GRSM.112	Greenbrier - Little Pigeon River	Mt. Leconte	283114	3955789	NAD27		
CEGL007880		GRSM.20	Greenbrier Flats	Mount LeConte	284326	3955018	NAD27		
CEGL007880		GRSM.219	Rowan Branch	Cades Cove	247485	3942354	NAD27		
CEGL007880	1	GRSM.512	Bullhead Branch	Gatlinburg	271575	3950254	NAD27		
CEGL007880		GRSM.64	Dudley Creek	Mt. LeConte	279030	3956360	NAD27		
CEGL007880		GRSM.82	Lower Little Pigeon River	Mt Leconte	281570	3957420	NAD27		
CEGL007880		GRSM.89	Alluvial flat along Abrams Creek	Cades Cove	241779	3941993	NAD27		
CEGL007880	1	Photopt5		Calderwood	234204	3943977	NAD27	n/a	Photo-point
CEGL007944	3	GRSM.544	Bradley Fork - Oconaluftee	Smokemont	290110	3936904	NAD27		
CEGL007944	1	GRSM.557	Abram's Creek	Calderwood	234530	3944541	NAD27		
CEGL008433	1	GRSM.318	441 Bog	Smokemont	290619	3936295	NAD27		
CEGL008438	1	GRSM.315	Ocanaluftee	Smokemont	291547	3931717	NAD27		
CEGL008438	1	GRSM.317	Deep Creek Trail Bog	Bryson City	280934	3928795	NAD27		
CEGL008438	3	GRSM.517	Deep Creek	Bryson City	279913	3928830	NAD27	x	
CEGL008558	2	GRSM.303	Deerkill Branch	Thunderhead	260831	3943255	NAD27		
CEGL008558	2	GRSM.304	Log Ridge	Thunderhead	261572	3942569	NAD27		
CEGL008558	2	GRSM.313	Bote Mtn. Trail	Thunderhead	252240	3940073	NAD27		
CEGL008558	2	GRSM.323	Little River Trail	Silers Bald	270610	3944312	NAD27		
CEGL008558	2	GRSM.324	Little River Trail	Silers Bald	270576	3944342	NAD27		
CEGL008558	2	GRSM.505	Balsam Mtn. Road	Bunches Bald	303238	3944584	NAD27		
CEGL008558	1	GRSM.529	Round Bottom Creek	Bunches Bald	301412	3942566	NAD27		
CEGL008558	3	GRSM.542	Thomas Divide Trail	Clingmans Dome	281890	3941625	NAD27	x	
CEGL008558	1	GRSM.562	Lynn Camp Prong	Thunderhead Mountain	260843	3943325	NAD27	x	
?		GRSM.306					NAD27		Plot missing
?	?	GRSM.522	Big Cove Rd	Smokemont	292068	3932988	NAD27	x	Not Idable
?	n/a	GRSM.555	Fontana Lake	Fontana Dam	248144	3928574	NAD27		Not Idable

Appendix IV. Index of digital images with their approximate location, plot number, and community type, if known.

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
No picture taken	300	8/14/00	4394	250906	3946998	NAD27		Kinzel Springs
No picture taken	301	8/14/00	7240	250906	3946998	NAD27		Kinzel Springs
No picture taken	302	8/14/02	7879			n/a		?
No picture taken	303	8/15/02	8558	260831	3943255	NAD27		Thunderhead Mountain
No picture taken	304	8/15/02	8558	261572	3942569	NAD27		Thunderhead Mountain
GRSM305.bmp	305	8/15/02	7543	261672	3940943	NAD27		Thunderhead Mountain
GRSM306a.bmp	306						Plot sheet missing	
GRSM306b.bmp	306						Plot sheet missing	
GRSM307a.bmp	307	8/16/02	3624	237122	3944517	NAD27		Calderwood
GRSM307b.bmp	307	8/16/02	3624	237122	3944517	NAD27		Calderwood
GRSM308.bmp	308	8/16/02	7230	237241	3944384	NAD27		Abram's Creek
GRSM309a.bmp	309	9/18/00	4290	246203	3948090	NAD27		Kinzel Springs
GRSM309b.bmp	309	9/18/00	4290	246203	3948090	NAD27		Kinzel Springs
GRSM310a.bmp	310	9/18/00	4980	246022	3947918	NAD27		Kinzel Springs
GRSM310b.bmp	310	9/18/00	4980	246022	3947918	NAD27		Kinzel Springs
GRSM311a.bmp	311	9/18/00	7692	245827	3947990	NAD27		Kinzel Springs
GRSM311b.bmp	311	9/18/00	7692	245827	3947990	NAD27		Kinzel Springs
GRSM312a.bmp	312	9/18/00	7240	245876	3948145	NAD27		Kinzel Springs
GRSM312b.bmp	312	9/18/00	7240	245876	3948145	NAD27		Kinzel Springs
GRSM312c.bmp	312	9/18/00	7240	245876	3948145	NAD27		Kinzel Springs
GRSM313a.bmp	313	9/19/00	8558	252240	3940073	NAD27		Thunderhead Mountain
GRSM313b.bmp	313	9/19/00	8558	252240	3940073	NAD27		Thunderhead Mountain
GRSM314a.bmp	314	9/19/00	4242	252818	3938643	NAD27		Thunderhead Mountain
GRSM314b.bmp	314	9/19/00	4242	252818	3938643	NAD27		Thunderhead Mountain
GRSM315a.bmp	315	9/20/00	8438	291547	3931717	NAD27		Smokemont
GRSM315b.bmp	315	9/20/00	8438	291547	3931717	NAD27		Smokemont

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
GRSM316a.bmp	316	9/20/00	7339	291261	3931790	NAD27		Smokemont
GRSM316b.bmp	316	9/20/00	7339	291261	3931790	NAD27		Smokemont
GRSM317a.bmp	317	9/20/00	8438	280934	3928795	NAD27		Bryson City
GRSM317b.bmp	317	9/20/00	8438	280934	3928795	NAD27		Bryson City
GRSM317c.bmp	317	9/20/00	8438	280934	3928795	NAD27		Bryson City
GRSM318a.bmp	318	9/20/00	8433	290619	3936295	NAD27		Smokemont
GRSM318b.bmp	318	9/20/00	8433	290619	3936295	NAD27		Smokemont
GRSM319a.bmp	319	9/21/00	6271	264414	3951128	NAD27		Gatlinburg
GRSM319b.bmp	319	9/21/00	6271	264414	3951128	NAD27		Gatlinburg
GRSM320a.bmp	320	9/21/00	6271	264281	3951177	NAD27		Gatlinburg
GRSM320b.bmp	320	9/21/00	6271	264281	3951177	NAD27		Gatlinburg
GRSM321a.bmp	321	9/21/00	7230	264057	3951245	NAD27		Gatlinburg
GRSM321b.bmp	321	9/21/00	7230	264057	3951245	NAD27		Gatlinburg
GRSM322a.bmp	322	9/20/00	4103	291133	3931903	NAD27		Smokemont
GRSM322b.bmp	322	9/20/00	4103	291133	3931903	NAD27		Smokemont
GRSM322c.bmp	322	9/20/00	4103	291133	3931903	NAD27		Smokemont
GRSM322d.bmp	322	9/20/00	4103	291133	3931903	NAD27		Smokemont
GRSM323.bmp	323	9/22/00	8558	270610	3944312	NAD27		Silers Bald
GRSM324.bmp	324	9/22/00	8558	270576	3944342	NAD27		Silers Bald
No picture taken	401	8/27/01	7878	297947	3943524	NAD27		Bunches Bald
No picture taken	402	8/27/01	7300	298047	3942919	NAD27		Bunches Bald
GRSM403a.bmp	403	8/28/01	7131	275736	3942439	NAD27		Clingmans Dome
GRSM403b.bmp	403	8/28/01	7131	275736	3942439	NAD27		Clingmans Dome
GRSM403c.bmp	403	8/28/01	7131	275736	3942439	NAD27		Clingmans Dome
GRSM404a.bmp	404	8/28/01	7285	275483	3942361	NAD27		Clingmans Dome
GRSM404b.bmp	404	8/28/01	7285	275483	3942361	NAD27		Clingmans Dome
GRSM405a.bmp	405	8/28/01	7543	274296	3942338	NAD27		Clingmans Dome
GRSM405b.bmp	405	8/28/01	7543	274296	3942338	NAD27		Clingmans Dome
GRSM406a.bmp	406	8/28/01	7861	274243	3941999	NAD27		Clingmans Dome
GRSM406b.bmp	406	8/28/01	7861	274243	3941999	NAD27		Clingmans Dome
GRSM406c.bmp	406	8/28/01	7861	274243	3941999	NAD27		Clingmans Dome
GRSM406d.bmp	406	8/28/01	7861	274243	3941999	NAD27		Clingmans Dome

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
GRSM407a.bmp	407	8/29/01	7543	261068	3943491	NAD27		Thunderhead Mountain
GRSM407b.bmp	407	8/29/01	7543	261068	3943491	NAD27		Thunderhead Mountain
GRSM407c.bmp	407	8/29/01	7543	261068	3943491	NAD27		Thunderhead Mountain
GRSM408a.bmp	408	8/29/01	7219	261559	3941545	NAD27		Thunderhead Mountain
GRSM408b.bmp	408	8/29/01	7219	261559	3941545	NAD27		Thunderhead Mountain
GRSM408c.bmp	408	8/29/01	7219	261559	3941545	NAD27		Thunderhead Mountain
GRSM409a.bmp	409	8/29/01	7543	263155	3942263	NAD27		Silers Bald
GRSM409b.bmp	409	8/29/01	7543	263155	3942263	NAD27		Silers Bald
GRSM409c.bmp	409	8/29/01	7543	263155	3942263	NAD27		Silers Bald
GRSM410a.bmp	410	8/30/01	6130	303954	3936661	NAD27		Bunches Bald
GRSM410b.bmp	410	8/30/01	6130	303954	3936661	NAD27		Bunches Bald
GRSM410c.bmp	410	8/30/01	6130	303954	3936661	NAD27		Bunches Bald
GRSM410d.bmp	410	8/30/01	6130	303954	3936661	NAD27		Bunches Bald
GRSM410e.bmp	410	8/30/01	6130	303954	3936661	NAD27		Bunches Bald
GRSM411a.bmp	411	8/30/01	7285	304021	3937172	NAD27		Bunches Bald
GRSM411b.bmp	411	8/30/01	7285	304021	3937172	NAD27		Bunches Bald
GRSM412a.bmp	412	8/30/01	7300	301210	3941099	NAD27		Bunches Bald
GRSM412b.bmp	412	8/30/01	7300	301210	3941099	NAD27		Bunches Bald
GRSM412c.bmp	412	8/30/01	7300	301210	3941099	NAD27		Bunches Bald
GRSM413a.bmp	413	8/30/01	7300	302221	3943364	NAD27		Bunches Bald
GRSM413b.bmp	413	8/30/01	7300	302221	3943364	NAD27		Bunches Bald
No picture taken	414	8/30/01	6192	299323	3944246	NAD27		Bunches Bald
No picture taken	415	8/31/01	6271	291042	3935896	NAD27		Smokemont
No picture taken	416	8/31/01	4048	291344	3931780	NAD27		Smokemont
GRSM501a.bmp	501	5/8/02	3893	273869	3937055	NAD27	Looking downslope	Clingmans Dome
GRSM501b.bmp	501	5/8/02	3893	273869	3937055	NAD27	Looking along slope	Clingmans Dome

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
GRSM501c.bmp	501	5/8/02	3893	273869	3937055	NAD27	Fire cherry prior to leaf out	Clingmans Dome
GRSM502a.bmp	502	5/9/02	7299	311600	3939637	NAD27	Tom Govus in background	Dellwood
GRSM502b.bmp	502	5/9/02	7299	311600	3939637	NAD27		Dellwood
GRSM502c.bmp	502	5/9/02	7299	311600	3939637	NAD27		Dellwood
GRSM503a.bmp	503	5/9/02	6271	309126	3940948	NAD27	Phyllis Jackson sitting	Dellwood
GRSM503b.bmp	503	5/9/02	6271	309126	3940948	NAD27		Dellwood
GRSM503c.bmp	503	5/9/02	6271	309126	3940948	NAD27		Dellwood
No picture taken	504	5/10/02	7285	303028	3935939	NAD27		Bunches Bald
No picture taken	505	5/10/02	8558	303238	3944584	NAD27		Bunches Bald
GRSM506a.bmp	506	5/10/02	7299	303336	3944769	NAD27	Photo taken from trail	Bunches Bald
GRSM506b.bmp	506	5/10/02	7299	303336	3944769	NAD27	Photo taken from trail	Bunches Bald
GRSM506c.bmp	506	5/10/02	7299	303336	3944769	NAD27	Photo taken from trail	Bunches Bald
No picture taken	507	5/8/02	4973	279807	3943319	NAD27		Clingmans Dome
GRSM508a.bmp	508	7/22/02	6246	304520	3936622	NAD27		Bunches Bald
GRSM508b.bmp	508	7/22/02	6246	304520	3936622	NAD27		Bunches Bald
GRSM509a.bmp	509	7/22/02	6246	304403	3936713	NAD27		Bunches Bald
GRSM509b.bmp	509	7/22/02	6246	304403	3936713	NAD27		Bunches Bald
GRSM510a.bmp	510	7/22/02	4293	303050	3935940	NAD27	Salamander shot	Bunches Bald
GRSM510b.bmp	510	7/22/02	4293	303050	3935940	NAD27		Bunches Bald
GRSM510c.bmp	510	7/22/02	4293	303050	3935940	NAD27	Jeff Jackson and Salamander	Bunches Bald
GRSM510d.bmp	510	7/22/02	4293	303050	3935940	NAD27		Bunches Bald
GRSM510e.bmp	510	7/22/02	4293	303050	3935940	NAD27		Bunches Bald
GRSM510f.bmp	510	7/22/02	4293	303050	3935940	NAD27		Bunches Bald

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
GRSM510g.bmp	510	7/22/02	4293	303050	3935940	NAD27		Bunches Bald
GRSM510h.bmp	510	7/22/02	4293	303050	3935940	NAD27		Bunches Bald
GRSM511.bmp	511	7/22/02	4293	303760	3936404	NAD27		Bunches Bald
GRSM512.bmp	512	7/22/02	7880	271575	3950254	NAD27		Gatlinburg
GRSM513.bmp	513	7/22/02	7543	263656	3949250	NAD27		Gatlinburg
Alan has the pics	514	7/22/02	7691	291466	3936215	NAD27		Smokemont
Alan has the pics	515	7/23/02	7100	279420	3928176	NAD27		Bryson City
Alan has the pics	516	7/23/02	4691	280131	3929182	NAD27		Bryson City
Alan has the pics	517	7/23/02	8438	279913	3928830	NAD27		Bryson City
GRSM518.bmp	518	7/23/02	7295	311923	3939884	NAD27		Dellwood
No picture taken	519	7/23/02	7267	277693	3928770	NAD27		Bryson City
GRSM520a.bmp	520	7/23/02	7230	277288	3928744	NAD27		Bryson City
GRSM520b.bmp	520	7/23/02	7230	277288	3928744	NAD27		Bryson City
GRSM520c.bmp	520	7/23/02	7230	277288	3928744	NAD27		Bryson City
GRSM521a.bmp	521	7/24/02	7219	292030	3932887	NAD27		Smokemont
GRSM521b.bmp	521	7/24/02	7219	292030	3932887	NAD27		Smokemont
GRSM521c.bmp	521	7/24/02	7219	292030	3932887	NAD27		Smokemont
GRSM522a.bmp	522	7/24/02	?	292068	3932988	NAD27	Not idable	Smokemont
GRSM522b.bmp	522	7/24/02	?	292068	3932988	NAD27	Not idable	Smokemont
GRSM523a.bmp	523	7/24/02	7692	291221	3932890	NAD27		Smokemont
GRSM523b.bmp	523	7/24/02	7692	291221	3932890	NAD27		Smokemont
GRSM523c.bmp	523	7/24/02	7692	291221	3932890	NAD27		Smokemont
GRSM523d.bmp	523	7/24/02	7692	291221	3932890	NAD27		Smokemont
GRSM524a.bmp	524	7/24/02	7230	289361	3932827	NAD27		Smokemont
GRSM524b.bmp	524	7/24/02	7230	289361	3932827	NAD27		Smokemont
GRSM525a.bmp	525	7/24/02	4691	286175	3940494	NAD27		Smokemont
GRSM525b.bmp	525	7/24/02	4691	286175	3940494	NAD27		Smokemont
GRSM525c.bmp	525	7/24/02	4691	286175	3940494	NAD27		Smokemont
GRSM525d.bmp	525	7/24/02	4691	286175	3940494	NAD27		Smokemont
Picture missing	526	7/24/02	7219	285255	3940793	NAD27		Smokemont
GRSM527a.bmp	527	7/24/02	4293	301819	3940335	NAD27		Bunches Bald
GRSM527b.bmp	527	7/24/02	4293	301819	3940335	NAD27		Bunches Bald
GRSM528.bmp	528	7/24/02	7861	301623	3942479	NAD27		Bunches Bald
GRSM529a.bmp	529	7/24/02	8558	301412	3942566	NAD27		Bunches Bald

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
GRSM529b.bmp	529	7/24/02	8558	301412	3942566	NAD27		Bunches Bald
GRSM530.bmp	530	7/24/02	7861	301736	3944476	NAD27		Luftee Knob
Alan has the pics	531	7/24/02	7285	Missing	Missing	NAD27		Bunches Bald
Alan has the pics	532	7/24/02	6308	302847	3942772	NAD27		Bunches Bald
Alan has the pics	533	7/24/02	7131	303037	3943039	NAD27		Bunches Bald
No picture taken	534	7/24/02	3814	303389	3943270	NAD27		Bunches Bald
Alan has the pics	535	7/24/02	3814	303542	3943522	NAD27		Bunches Bald
GRSM536a.bmp	536	7/25/02	4242	273927	3935488	NAD27		Clingman's Dome
GRSM536b.bmp	536	7/25/02	4242	273927	3935488	NAD27		Clingman's Dome
GRSM536c.bmp	536	7/25/02	4242	273927	3935488	NAD27		Clingman's Dome
GRSM537a.bmp	537	7/25/02	7697	273693	3935397	NAD27		Clingman's Dome
GRSM537b.bmp	537	7/25/02	7697	273693	3935397	NAD27		Clingman's Dome
GRSM538a.bmp	538	7/25/02	7876	284795	3946132	NAD27		Mount Le Conte
GRSM538b.bmp	538	7/25/02	7876	284795	3946132	NAD27		Mount Le Conte
GRSM538c.bmp	538	7/25/02	7876	284795	3946132	NAD27		Mount Le Conte
GRSM538d.bmp	538	7/25/02	7876	284795	3946132	NAD27		Mount Le Conte
GRSM539a.bmp	539	7/25/02	7876	284795	3946132	NAD27		Mount Le Conte
GRSM539b.bmp	539	7/25/02	7876	284795	3946132	NAD27		Mount Le Conte
GRSM539c.bmp	539	7/25/02	7876	284795	3946132	NAD27		Mount Le Conte
GRSM540.bmp	540	7/25/02	6256	280828	3943403	NAD27		Clingmans Dome
GRSM541a.bmp	541	7/25/02	6124	273495	3935310	NAD27		Clingmans Dome
GRSM541b.bmp	541	7/25/02	6124	273495	3935310	NAD27		Clingmans Dome
GRSM541c.bmp	541	7/25/02	6124	273495	3935310	NAD27		Clingmans Dome
GRSM541d.bmp	541	7/25/02	6124	273495	3935310	NAD27		Clingmans Dome

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
GRSM541e.bmp	541	7/25/02	6124	273495	3935310	NAD27		Clingmans Dome
GRSM542a.bmp	542	7/26/02	8558	281890	3941625	NAD27		Clingmans Dome
GRSM542b.bmp	542	7/26/02	8558	281890	3941625	NAD27		Clingmans Dome
No picture taken	543	7/26/02	7543	290260	3936900	NAD27		Smokemont
No picture taken	544	7/26/02	7944	290110	3936904	NAD27		Smokemont
GRSM545a.bmp	545	7/26/02	7691	268873	3926834	NAD27		Bryson City
GRSM545b.bmp	545	7/26/02	7691	268873	3926834	NAD27		Bryson City
GRSM546a.bmp	546	7/26/02	3909	268596	3926845	NAD27		Bryson City
GRSM546b.bmp	546	7/26/02	3909	268596	3926845	NAD27		Bryson City
GRSM547a.bmp	547	7/26/02	7879	268570	3926861	NAD27		Bryson City
GRSM547b.bmp	547	7/26/02	7879	268570	3926861	NAD27		Bryson City
GRSM547c.bmp	547	7/26/02	7879	268570	3926861	NAD27		Bryson City
GRSM547d.bmp	547	7/26/02	7879	268570	3926861	NAD27		Bryson City
GRSM548a.bmp	548	7/26/02	7879	268397	3926271	NAD27		Bryson City
GRSM548b.bmp	548	7/26/02	7879	268397	3926271	NAD27		Bryson City
No picture taken	549	7/26/02	7691	268481	3926230	NAD27		Bryson City
Alan has the pics	550	7/22/02	7692	292065	3935170	NAD27		Smokemont
GRSM551a.bmp	551	8/26/02	7298	300632	3941146	NAD27		Bunches Bald
GRSM551b.bmp	551	8/26/02	7298	300632	3941146	NAD27		Bunches Bald
GRSM551c.bmp	551	8/26/02	7298	300632	3941146	NAD27		Bunches Bald
GRSM551d.bmp	551	8/26/02	7298	300632	3941146	NAD27		Bunches Bald
GRSM552a.bmp	552	8/26/02	4983	301316	3942077	NAD27		Bunches Bald
GRSM552b.bmp	552	8/26/02	4983	301316	3942077	NAD27		Bunches Bald
GRSM552c.bmp	552	8/26/02	4983	301316	3942077	NAD27		Bunches Bald
GRSM553a.bmp	553	8/26/02	7543	301196	3944300	NAD27		Bunches Bald
GRSM553b.bmp	553	8/26/02	7543	301196	3944300	NAD27		Bunches Bald
GRSM554a.bmp	554	8/27/02	7710	248198	3928646	NAD27		Fontana Dam
GRSM554b.bmp	554	8/27/02	7710	248198	3928646	NAD27		Fontana Dam
GRSM555a.bmp	555	8/27/02	?	248144	3928574	NAD27	Need more replicates - may be new assoc.	Fontana Dam

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
GRSM555b.bmp	555	8/27/02	?	248144	3928574	NAD27	Need more replicates - may be new assoc.	Fontana Dam
GRSM556a.bmp	556	8/27/02	3910	248078	3930023	NAD27		Fontana Dam
GRSM556b.bmp	556	8/27/02	3910	248078	3930023	NAD27		Fontana Dam
GRSM556c.bmp	556	8/27/02	3910	248078	3930023	NAD27		Fontana Dam
GRSM556d.bmp	556	8/27/02	3910	248078	3930023	NAD27		Fontana Dam
GRSM557a.bmp	557	8/28/02	7944	234530	3944541	NAD27		Calderwood
GRSM557b.bmp	557	8/28/02	7944	234530	3944541	NAD27	Canopy shot	Calderwood
GRSM557c.bmp	557	8/28/02	7944	234530	3944541	NAD27		Calderwood
No picture taken	558	8/28/02	7230	234766	3945042	NAD27		Calderwood
GRSM559a.bmp	559	8/28/02	3895	234766	3945042	NAD27	Streamside shot	Calderwood
GRSM559b.bmp	559	8/28/02	3895	234766	3945042	NAD27	Streamside shot	Calderwood
GRSM560a.bmp	560	8/28/02	3890	255825	3946993	NAD27		Wear Cove
GRSM560b.bmp	560	8/28/02	3890	255825	3946993	NAD27		Wear Cove
GRSM560c.bmp	560	8/28/02	3890	255825	3946993	NAD27		Wear Cove
GRSM560d.bmp	560	8/28/02	3890	255825	3946993	NAD27		Wear Cove
GRSM561a.bmp	561	8/29/02	2591	245782	3944013	NAD27		Cades Cove
GRSM561b.bmp	561	8/29/02	2591	245782	3944013	NAD27		Cades Cove
GRSM561c.bmp	561	8/29/02	2591	245782	3944013	NAD27		Cades Cove
GRSM561d.bmp	561	8/29/02	2591	245782	3944013	NAD27		Cades Cove
GRSM562a.bmp	562	8/29/02	8558	260843	3943325	NAD27		Thunderhead Mountain
GRSM562b.bmp	562	8/29/02	8558	260843	3943325	NAD27		Thunderhead Mountain
GRSM562c.bmp	562	8/29/02	8558	260843	3943325	NAD27		Thunderhead Mountain
GRSM562d.bmp	562	8/29/02	8558	260843	3943325	NAD27		Thunderhead Mountain
GRSM562e.bmp	562	8/29/02	8558	260843	3943325	NAD27		Thunderhead Mountain
CEGL4420a-08-29-02.bmp	n/a	8/29/02	4420	242354	3942429	NAD27		
CEGL4420b-08-29-02.bmp	n/a	8/29/02	4420	242354	3942429	NAD27		
CEGL4420c-08-29-02.bmp	n/a	8/29/02	4420	242354	3942429	NAD27		
CEGL4420d-08-29-02.bmp	n/a	8/29/02	4420	242354	3942429	NAD27		

Name of file	Plot Number	Date taken	CEGL	UTM X	UTM Y	Datum	Notes	Quad
CEGL7710a-08-27-02.bmp	n/a	8/27/02	7710	248591	3928911	NAD27		
CEGL7710b-08-27-02.bmp	n/a	8/27/02	7710	248591	3928911	NAD27		
CEGL4296a-08-26-02.bmp	n/a	8/26/02	4296	302245	3942761	NAD27		
CEGL4296b-08-26-02.bmp	n/a	8/26/02	4296	302245	3942761	NAD27		
CEGL4296c-08-26-02.bmp	n/a	8/26/02	4296	302245	3942761	NAD27		
CEGL4296d-08-26-02.bmp	n/a	8/26/02	4296	302245	3942761	NAD27		
CEGL7710iffya-08-28-02.bmp	n/a	8/28/02	7710	255892	3947112	NAD27		
CEGL7710iffyb-08-28-02.bmp	n/a	8/28/02	7710	255892	3947112	NAD27		
CEGL7880a.08-28-02.bmp	n/a	8/28/02	7880	234204	3943977	NAD27		
CEGL7880b.08-28-02.bmp	n/a	8/28/02	7880	234204	3943977	NAD27		
CEGL3890a-08-29-02.bmp	n/a	8/29/02	3890	252222	3943639	NAD27		
CEGL3890b-08-29-02.bmp	n/a	8/29/02	3890	252222	3943639	NAD27		
CEGL4302a-08-30-02.bmp	n/a	8/30/02	4302	307152	3956539	NAD27		
CEGL4302b-08-30-02.bmp	n/a	8/30/02	4302	307152	3956539	NAD27		
CEGL4302c-08-30-02.bmp	n/a	8/30/02	4302	307152	3956539	NAD27		
CEGL4293-7-22-02.bmp	near plot 510	7/22/02	4293					
CEGL4293-7-22-02b.bmp	near plot 510	7/22/02	4293					
CEGL3687iffy-08-28-02.bmp	n/a	8/28/02	3687					
CEGL3687iffyb-08-28-02.bmp	n/a	8/28/02	3687					
CEGL3687iffyc-08-28-02.bmp	n/a	8/28/02	3687					
CEGL3890-08-28-02.bmp	n/a	8/28/02	3890					
CEGL3890b-08-28-02.bmp	n/a	8/28/02	3890					

Appendix V. Selected digital image reprints from Great Smoky Mountains National Park



Plot 305 – Southern Appalachian Acid Cove Forest (Typic Type) – CEGL007543 –

Plot 306 – Plot Sheet Missing





Plot 307 - (CEGL003624) - Blue Ridge Acid Shale Woodland



Plot 308 – (CEGL007230) - Appalachian Montane Oak Hickory Forest (Typic Acidic Type)

Plot 309 – (CEGL004290) - Smartweed - Cutgrass Beaver Pond





Plot 309 – (CEGL004290) - Smartweed - Cutgrass Beaver Pond



Plot 310 – (CEGL004980) - Appalachian Felsic Cliff

Plot 311 – (CEGL007692) - Appalachian Montane Oak - Hickory Forest (Rich Type)





Plot 311 – (CEGL007692) - Appalachian Montane Oak - Hickory Forest (Rich Type)



Plot 312 – (CEGL007240) - Ridge-and-Valley Dry-Mesic White Oak - Hickory Forest

Plot 313 (CEGL008558) - Southern Appalachian Mixed Hardwood Forest





Plot 313 – (CEGL008558) - Southern Appalachian Mixed Hardwood Forest



Plot 314 – (CEGL004242) - Grassy Bald (Southern Grass Type)

Plot 315 – (CEGL008438) - Southern Appalachian Wet Seepage Meadow





Plot 315 – (CEGL008438) - Southern Appalachian Wet Seepage Meadow



Plot 316 – (CEGL007339) - Montane Alluvial Forest (Cades Cove/Ocanaluftee)

Plot 317 – (CEGL008438) - Southern Appalachian Wet Seepage Meadow





Plot 318 – (CEGL008433) - Southern Blue Ridge Beaver Pond Marsh



Plot 319 – (CEGL006271) - Chestnut Oak Forest (Xeric Ridge Type)

Plot 320 – (CEGL006271) - Chestnut Oak Forest (Xeric Ridge Type)





Plot 321 – (CEGL007230) - Appalachian Montane Oak Hickory Forest (Typic Acidic Type)



Plot 322 – (CEGL004103) - Rocky Bar and Shore (Twisted Sedge Type)

Plot 323 – (CEGL008558) - Southern Appalachian Mixed Hardwood Forest





Plot 324 – (CEGL008558) - Southern Appalachian Mixed Hardwood Forest



Plot 403 – (CEGL007131) - Red Spruce - Fraser Fir Forest (Deciduous Shrub Type)

Plot 403 – (CEGL007131) - Red Spruce - Fraser Fir Forest (Deciduous Shrub Type)





Plot 404 – (CEGL007285) - Southern Appalachian Northern Hardwood Forest (Typic Type)



Plot 405 – (CEGL007543) - Southern Appalachian Acid Cove Forest (Typic Type)

Plot 406 – (CEGL007861) - Blue Ridge Hemlock - Northern Hardwood Forest





Plot 406 and photointerpreter Phyllis Jackson – (CEGL007861) - Blue Ridge Hemlock - Northern Hardwood Forest



Plot 407 – (CEGL007543) - Southern Appalachian Acid Cove Forest (Typic Type)

Plot 408 – (CEGL007219) - Early Successional Appalachian Hardwood Forest





Plot 409 – (CEGL007543) - Southern Appalachian Acid Cove Forest (Typic Type)



Plot 410 – (CEGL006130) - Southern Appalachian Beech Gap (South Slope Sedge Type

Plot 411 – (CEGL007285) - Southern Appalachian Northern Hardwood Forest (Typic Type) with dead beeches in background





Plot 412 – (CEGL007300) - High-Elevation Red Oak Forest (Deciduous Shrub Type)



Plot 413 – (CEGL007300) - High-Elevation Red Oak Forest (Deciduous Shrub Type)

Ecologist Alan Weakley using GPS unit.





Photointerpreter Marguerite Madden (UGA) with camera and GPS unit.



Plot 501 – (CEGL003893) - High-Elevation Blackberry Thicket

Plot 501 – (CEGL003893) - High-Elevation Blackberry Thicket





Plot 502 – (CEGL007299) - High-Elevation Red Oak Forest (Evergreen Shrub Type)



Plot 503 – (CEGL006271) - Chestnut Oak Forest (Xeric Ridge Type) and Photointerpreter Phyllis Jackson

Plot 506 – (CEGL007299) - High-Elevation Red Oak Forest (Evergreen Shrub Type) and botanist Tom Govus





Plot 508 – (CEGL006246) - So. Appalachian Beech Gap (North Slope Tall Herb Type)



Plot 508 – (CEGL006246) - So. Appalachian Beech Gap (North Slope Tall Herb Type)

Plot 509 - (CEGL006246) - So. Appalachian Beech Gap (North Slope Tall Herb Type)





Plot 509 – (CEGL006246) - So. Appalachian Beech Gap (North Slope Tall Herb Type)



Plot 510 – (CEGL004293) - Rich Montane Seep (High-Elevation Type)

Plot 510 – (CEGL004293) - Rich Montane Seep (High-Elevation Type)





Plot 511 – (CEGL004293) - Rich Montane Seep (High-Elevation Type)



Plot 512 – (CEGL007880) - Montane Sweetgum Alluvial Flat

Plot 513 – (CEGL007543) - Southern Appalachian Acid Cove Forest (Typic Type)





Plot 514 – (CEGL007691) - Appalachian Montane Oak - Hickory Forest (Low-Elevation Xeric Type)



Plot 515 – (CEGL007100) - Southern Appalachian White Pine Forest

Plot 516 – (CEGL004691) - Appalachian Montane Alluvial Forest





Plot 517 – (CEGL008438) - Southern Appalachian Wet Seepage Meadow



Plot 518 – (CEGL007295) - Southern Blue Ridge High-Elevation White Oak Forest

Plot 520 – (CEGL007230) - Appalachian Montane Oak Hickory Forest (Typic Acidic Type)





Plot 521 – (CEGL007219) - Early Successional Appalachian Hardwood Forest



Plot 522 – (CEGL00??)

Plot 523 – (CEGL007692) - Appalachian Montane Oak - Hickory Forest (Rich Type)





Plot 524 – (CEGL007230) - Appalachian Montane Oak Hickory Forest (Typic Acidic Type)



Plot 525 – (CEGL004691) - Appalachian Montane Alluvial Forest

Plot 527 (CEGL004293) - Rich Montane Seep (High-Elevation Type)





Plot 528 – (CEGL007861) - Blue Ridge Hemlock - Northern Hardwood Forest



Plot 529 – (CEGL008558) - Southern Appalachian Mixed Hardwood Forest

Plot 530 – (CEGL007861) - Blue Ridge Hemlock - Northern Hardwood Forest





Plot 531 – (CEGL007285) - Southern Appalachian Northern Hardwood Forest (Typic Type)



Plot 532 - (CEGL006308) - Fraser Fir Forest (Evergreen Shrub Type)

Plot 533 – (CEGL007131) - Red Spruce - Fraser Fir Forest (Deciduous Shrub Type)





Plot 535 – (CEGL003814) - Southern Appalachian Mountain Laurel Bald



Plot 536 – (CEGL004242) - Grassy Bald (Southern Grass Type)

Plot 537 – (CEGL007697) - Blue Ridge High-Elevation Seep (Sedge Type)





Plot 538 – (CEGL007876) - Southern Appalachian Heath Bald



Plot 538 – Milo Pyne surveying CEGL007876 - Southern Appalachian Heath Bald

Plot 539 – (CEGL007876) - Southern Appalachian Heath Bald





Plot 540 – (CEGL006256) - Red Spruce - Northern Hardwood Forest (Herb Type)



Plot 541 – (CEGL006124) - Southern Appalachian Boulderfield Forest (Currant and Rockcap Fern Type)

Plot 541 – (CEGL006124) - Southern Appalachian Boulderfield Forest (Currant and Rockcap Fern Type)





Plot 542 – (CEGL008558) - Southern Appalachian Mixed Hardwood Forest



Plot 545 – (CEGL007691) - Appalachian Montane Oak - Hickory Forest (Low-Elevation Xeric Type)

Plot 546 – (CEGL003909) - Montane Low-Elevation Seep and Ecologist Alan Weakley





Plot 547 – (CEGL007879) - Successional Black Walnut Forest



Plot 548 – (CEGL007879) - Successional Black Walnut Forest

Plot 551 – (CEGL007298) - High-Elevation Red Oak Forest (Tall Herb Type)





Plot 552 – (CEGL004983) - Red Spruce - Northern Hardwood Forest (Shrub Type)



Plot 553 – (CEGL007543) - Southern Appalachian Acid Cove Forest (Typic Type)

Plot 554 – (CEGL007710) - Southern Appalachian Cove Forest (Typic Montane Type)





Plot 555 – (CEGL00??)



Plot 556 – (CEGL003910) - Artificial Lake Drawdown Zone

Plot 557 – (CEGL007944) - Eastern White Pine Successional Forest





Plot 559 – (CEGL003895) - Rocky Bar and Shore (Alder - Yellowroot Type)



Plot 560 – (CEGL003890) - Montane Grape Opening

Plot 561 – (CEGL002591) - Virginia Pine Successional Forest





Plot 562 – (CEGL008558) - Southern Appalachian Mixed Hardwood Forest



CEGL4420 - Montane Floodplain Slough Forest

CEGL004296 - Rich Montane Seep (Cove Type)





CEGL004302 - Southern Blue Ridge Spray Cliff