Southern Blue Ridge: An Analysis of Matrix Forests

Produced by The Nature Conservancy
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EXECUTIVE SUMMARY

The Southern Blue Ridge (SBR) Ecoregion's forested landscape (portions of Georgia, North Carolina, South Carolina, Tennessee, and Virginia) is comprised of intact temperate forest over a diversity of landforms, elevation zones, and bedrock geologies, making it one of the most biologically-diverse areas in North America. This region contains several of the few remaining mega-blocks of relatively unfragmented forest in the eastern United States, supporting the highest diversity of salamanders in the world, a tremendous diversity of tree and herbaceous species, and very high densities of forest breeding birds. These large contiguous forests provide fundamental ecosystem services that sustain underlying natural processes, ensuring the continued persistence of plant and animal populations as well as the provisioning, regulating, and cultural ecosystem services on which humans depend (e.g., quality drinking water, flood control). From a global perspective, the Southern Blue Ridge forested landscape is a huge and irreplaceable ecosystem recovering from regional-scale deforestation. These reestablished forests are facing compounding and interacting threats due to increased human population, forest fragmentation, pests and pathogens, soil acidification and global climate change.

Previous efforts by The Nature Conservancy (TNC) and its partners identified priority SBR conservation locations, focusing largely on occurrences of rare species and communities at the scale of individual patches; however, the scope and magnitude of today's conservation challenges mean that we must expand our focus to include landscapes and strategies beyond a protected network of preserves. The Conservancy's approach to the long-term conservation of the Southern Blue Ridge critical forest resource envisions the conservation of a connected, representative, well managed, ***matrix forests***, embedded with large areas of ***core forest(s)***. The matrix forest blocks sustain natural cover through multiple-use working forests, while the core forests are protected and managed for natural ecological function that promotes biodiversity and natural disturbance regimes (i.e., a dynamic mosaic of stands in different age and seral classes).

This report summarizes the process and results of the Southern Blue Ridge Matrix Forest Analysis, completed in 2011, which identified a representative network of matrix forest blocks, large and contiguous enough to maintain key ecosystem processes and services, resilience, and movement of organisms, and to provide for accommodation of catastrophic disturbances and the breeding needs of forest interior species. In 2011, TNC staff from Eastern North America Division Science and five state operating units (with significant contributions from several state and regional partners) completed a four-step analysis process to identify priority SBR matrix forests, involving (1) delineating matrix forest blocks (discrete blocks of contiguous forest, using roads and other fragmenting features in GIS), (2) screening each matrix forest block for size and condition using land cover and size criteria, related to disturbance and species' needs, (3) classifying the matrix forest blocks into representative forest landscape types, using elevation, geology and landforms (Ecological Land Units), and (4) evaluating and prioritizing a network of functional matrix forest blocks representative of the diversity of ecoregional forest landscape types, using additional data and expert review.

The results give us a much clearer understanding of the status, distribution, and spatial context of large, contiguous matrix forests in the Southern Blue Ridge, and will provide a clearer direction for near-term conservation priorities and foster a more focused set of conservation actions around which TNC and partners can organize and cooperate. The Nature Conservancy's vision for the conservation of these identified priority SBR matrix forest blocks is to work with partners to (1) ensure adequate long-term

protection and ecologically-compatible management practices, (2) retain connectedness of forest cover among and between them, and 3) work to abate region-wide forest threats.

An Approach to Lasting Forest Conservation in the Southern Appalachians

If one imagines oneself looking out a plane window on a flight from Atlanta, GA toward Pittsburgh, PA, a large-scale perspective on the Southern Blue Ridge (SBR) Ecoregion can be visualized (Figure 1). At this elevation, some of the few remaining mega-blocks of relatively unfragmented forest in the eastern United States are readily apparent to even the untrained eye. For instance, 10 of the matrix forest blocks identified in this study are between 100,000 and 300,000 acres in size. These forests are important for the people inhabiting the region, who depend on them not only for provisioning and regulating ecosystem services (e.g., quality drinking water, natural resource extraction and use, erosion and flood control) but also for cultural services (i.e., the non-material benefits and renewal that comes from beautiful scenery and recreation). Of course, these large contiguous forests also provide fundamental ecosystem services that sustain underlying natural processes, ensuring the continued persistence of plant and animal populations as well as the provisioning, regulating, and cultural ecosystem services on which humans depend. The driving force behind these benefits to people and the reason the Southern Blue Ridge elicits both scientific and spiritual awe is this ecoregion's well-renowned globally-significant biodiversity (e.g., unique natural communities like globally-rare grassy balds, Carolina hemlock bluffs, and southern Appalachian bogs).

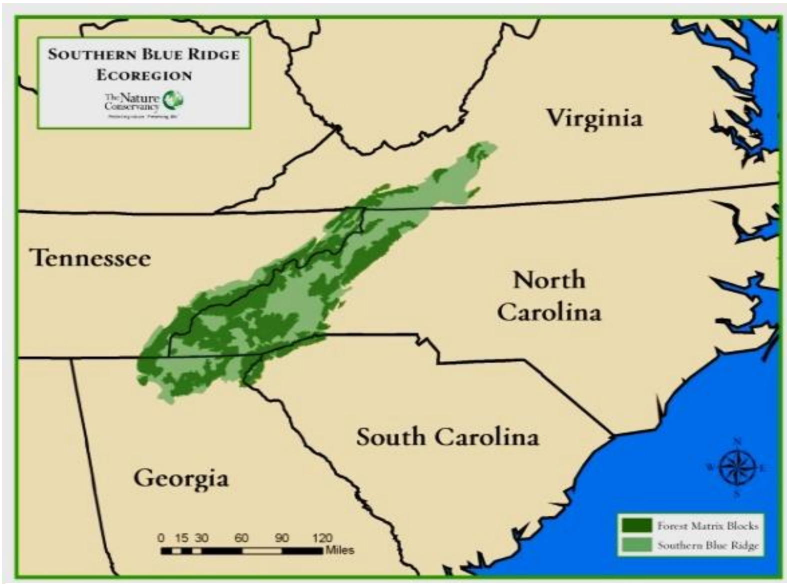

Figure 1. Southern Blue Ridge Ecoregional Boundaries.

The Southern Blue Ridge Ecoregion means many things to many different people. Its 9.4 million acres are home to approximately two million people (US Census 2010), composed of some families that have been rooted in the land for generations, and others, lured largely by quality-of-life factors, that have recently migrated there. Countless other part-time residents and visitors appreciate the beauty and recreation of the Southern Blue Ridge mountains, valleys, and coldwater streams, including enjoying scenic vistas along the Blue Ridge Parkway and within the Great Smoky Mountain National Park, as well as fishing, hunting, hiking, and biking on 3.2 million acres of National Forest. Natural beauty and bounty meet cultural richness in small-to-mid-sized cities like Asheville, NC, Johnson City, TN, and Roanoke, VA, as well as in rural pockets of artistic expression like Yancey County, NC, and Blue Ridge, GA. The headwaters of the Southern Blue Ridge also influence several large cities, as the sources of drinking and recreational waters for Atlanta, GA, Charlotte, NC, Knoxville, TN, and Greenville, SC. Research shows that one-third of the world's 105 largest cities' drinking water sources arise from protected areas, demonstrating the benefit of well-managed natural forests to urban populations (Dudley and Stolton 2003).

The Southern Blue Ridge is a forested landscape of steeps slopes, high mountains, deep ravines, and wide valleys. The combination of intact temperate forest over a diversity of landforms, elevation zones, and bedrock geologies, makes it one of the most biologically diverse areas in North America. "The region supports the highest diversity of salamanders in the world, extremely rich forests with a tremendous diversity of tree and herbaceous species, and very high densities of breeding birds" (Hunter et al. 1999). Five broad forest types, characteristic of the region, form the dominant matrix (Appalachian oak hardwoods, dry oak pine, cove forests, northern hardwoods, and spruce-fir), and their distribution tracks change with elevation. Other forest types (such as riparian forests) occur at a smaller scale, usually in conjunction with a landform or specific setting. At the scale of large intact forest areas (5,000 – 50,000 acres), the individual forest types blend and intermix to form a larger functioning unit that shares many processes and exhibits structural and compositional heterogeneity. Each forest type will display a range of successional classes, given the ability of various processes and disturbances to play out across the landscape.

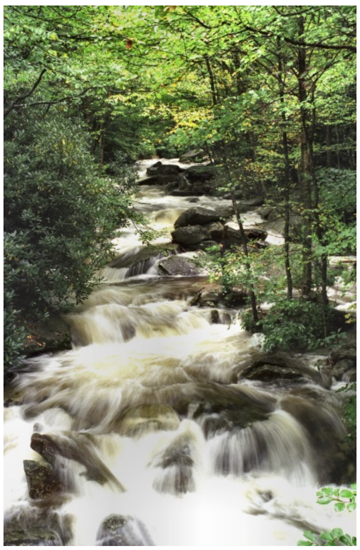

Photo by Hugh Morton

From a global perspective, the temperate deciduous and mixed forest of the Southern Blue Ridge is a huge and irreplaceable ecosystem recovering from regional-scale deforestation. The great majority of the current forest is mid-to-late successional; however much of its species and structural composition has been altered by past land uses and practices such as agriculture, pasturing, fire suppression, and logging. Concurrent with forest re-establishment, the human population has increased exponentially, leading to increased densities of roads and other urban environments which have led to greater forest fragmentation. Other stresses have expanded to include and compound habitat fragmentation, and threats such as increased pests and pathogens, soil acidification and global climate change continue to increase.

In 2000, The Nature Conservancy (TNC) and its partners (Southern Appalachian Forest Coalition and Association for Biodiversity Information) conducted an Ecoregional Assessment for the Southern Blue Ridge, identifying priority conservation locations (portfolio sites) known to harbor conservation targets (i.e., globally-rare plants, animals, and natural communities) (TNC & SAFC 2000). The Ecoregional Assessment, however, did not include identification and evaluation of large contiguous forested habitats themselves for conservation priorities, which form the very matrix supporting embedded conservation targets. The scope and magnitude of today's conservation challenges mean that we can no longer afford to limit our strategies to protecting a network of preserves, but must consider strategies and landscapes large enough to maintain key ecosystem processes and services, resilience, and movement of organisms. TNC has recognized the need for this new "whole system" approach that involves working at multiple scales, with an increasing emphasis on managing for connectivity and a permeable matrix of lands and waters that vary in quality, surrounding portfolio sites of high ecological integrity. In the Southern Blue Ridge, this means looking across the landscape at large blocks of native habitat that can support the species, communities, and ecosystem processes and functions that will protect biodiversity and support people's well-being now and into the future.

The first iteration of the Southern Blue Ridge Ecoregional Assessment in 2000 (TNC & SAFC 2000) focused largely on rare species and communities or elements of biodiversity that occurred at the scale of individual patches. This follow up study was designed to specifically spatially-define the contiguous, large matrix-forming forest types (herein, "***matrix forest***") across the landscape (Anderson 2008). Developed by TNC operating units in the northern Appalachians, this new assessment for the southern sections of the Appalachian Mountains has resulted in a much clearer understanding of the status and distribution of matrix forest conservation targets in this ecoregion. This report presents the process, methods, and results of the analysis, completed in 2011. It closes a significant gap in our understanding of the spatial context and characteristics of large contiguous forests in the Southern Blue Ridge, and will provide a clearer direction for near-term conservation priorities, and foster a more focused set of conservation actions around which TNC and partners can organize and cooperate.

Scientists have wrestled with how to conserve such a critical but compromised forest resource. The Nature Conservancy's vision for the conservation of this forest includes employing strategies to (1) ensure adequate long-term protection and management of a network of representative ***matrix forest blocks,*** embedded ***core forests*** surrounded with working forest buffer (Noss and Cooperrider 1994, Figure 2), (2) retain connectedness of forest cover among and between those matrix forests and across the landscape, and 3) abate region-wide forest threats. The identification of a representative network of matrix forest blocks large enough to sustain forest ecosystem processes is the subject of this planning effort (Anderson 2008).

The Conservancy's approach to the long-term conservation of the Southern Blue Ridge critical forest resource envisions the conservation of a connected, representative, well managed, matrix of forest, embedded with large core forest areas. The matrix sustains natural cover through multiple-use working forests, while the core forests are protected and managed for natural ecological function that promotes biodiversity and natural disturbance regimes. The desired condition of embedded core forest is not a solid stand of old-growth trees, but rather, a mosaic of stands in different age classes, from early to late successional, that retain biological legacies (such as coarse woody debris and standing snags), and reflect the natural disturbance regimes of the region. This assessment describes the delineation of matrix forest areas large enough to provide for accommodation of catastrophic disturbances and the breeding needs of forest interior species. Our methods anticipate forest matrix blocks that include a range of habitats and a shifting mosaic of seral stages (see section on Size in Relation to Disturbances).

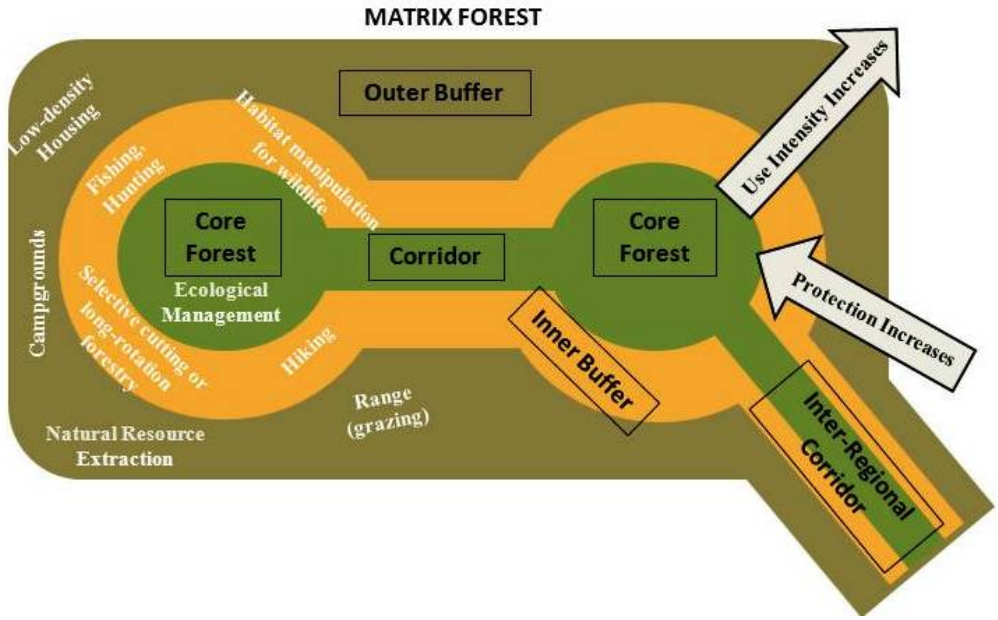

Figure 2. Regional Forest Conservation Model (adapted from Noss and Cooperridge 1994). This displays the concept of a model regional reserve network, consisting of core forests, connecting corridors or linkages, and multiple-use buffer zones. "Matrix forests" refer to the overall contiguous forested landscape, while "core forests" refer to areas managed for natural ecological integrity. Inner buffer zones would be strictly protected, while outer buffer zones would allow for a wider range of compatible human uses. The inter-regional corridor connects this system to a similar network nearby.

OVERVIEW: THE SBR MATRIX FOREST BLOCK ANALYSIS PROCESS

The Southern Blue Ridge Matrix Forest Block Analysis was a joint effort among TNC's Eastern North America Division Science staff and staff from the five TNC state operating units partially within the ecoregion (Georgia, North Carolina, South Carolina, Tennessee, and Virginia). Significant contributions and feedback were also provided by several state and regional partners (Appendix A). This process was similar to the Conservancy's matrix forest analysis in the Central Appalachian and Northern Appalachian Ecoregions to facilitate regional consistency in the identification and evaluation of Appalachian spatial conservation targets and ecological goals. The major steps and details of the analysis process are summarized in this report, and supporting documents and additional details can be found at: *http://www.conservationgateway.org/Files/Pages/SouthernBlueRidgeAnAnalysisofMatrixForests.aspx*.

We developed a four-step analysis process to assess, prioritize, and direct conservation strategies to protect the Southern Blue Ridge matrix forest system:

- **Delineate matrix forest blocks** to identify and subdivide the forested landscape into discrete blocks of contiguous forest, using roads and other fragmenting features in GIS.
- **Screen each matrix forest block** for size and condition using land cover and size criteria, related to disturbance and species' needs.
- **Classify the candidate matrix forest blocks** into multiple groups that reflect similar combinations of elevation, geology, and landforms (Ecological Land Units).
- **Evaluate and prioritize** a network of functional matrix forest blocks representative of the diversity of ecoregional forest landscape types, using additional data and expert review.

DELINEATING MATRIX FOREST BLOCKS

Using GIS data, we subdivided the entire forested landscape of the Southern Blue Ridge into discrete units ("***matrix forest blocks***"), bounded on all sides by major roads (road classes 1-4; ESRI 2009), lakes, or large rivers (>3,681m^2 drainage area) (USEPA and USGS 2008) (Table 1 and Appendix B). Roads were an appropriate choice for this task, as they disrupt the movement of some organisms and the flow of some ecological processes, and they increase the level of access into interior forest areas. Additionally, we analyzed and sometimes adjusted blocks according to the location of roads, railroads, powerlines, logging trails, housing developments, agricultural lands, and mining operations from obtained digital data or aerial imagery (Table 1) that can be highly correlated with human natural resource extractive or other ecologically-incompatible activities that can impair connectivity and forest processes. Delineated SBR matrix forest blocks were bounded on all sides by connected fragmenting roads (or other features), forming polygons that completely encircled large contiguous patches of forest. However, delineated blocks are not necessarily roadless, as blocks can contain intersecting roads (roads that extend into block boundaries, but do not bisect the block).

Table 1. Data used to evaluate potential fragmenting features in matrix forest block delineation.

Potential Fragmenting Feature	Data Analyzed (Year)	Description of Analysis	Final Decision: Fragmenting Feature?
Roads	Streetscarto layer from ESRI GIS data (ESRI 2009)	Detailed road data was evaluated against aerial imagery (accessed using Google Earth and ArcGIS Online 2010-2011) to determine accuracy and completeness of road coverage.	Road classes 1 through 4, which roughly equates to Interstates (1), U.S. Routes and some State Routes (2), State Routes and old highways (3), and exit and on ramps, service roads, and rest area roads (4), were determined to be fragmenters.
Powerlines	Ventyx powerline transmission data (Ventyx 2010)	Powerline Transmission data was evaluated against aerial imagery (accessed using Google Earth and ArcGIS Online 2010-2011) to assess vegetation cuts (width and management intensity).	Due to high variability of the width of the powerlines and the degree to which they were maintained as cut areas across the region, powerlines were not uniformly viewed as fragmenting features but were considered on a case-by-case basis; where powerlines were large in width and required vegetation management continuously throughout individual blocks, these were viewed as fragmenters.
Railroads	Ventyx Railroad data (Ventyx 2010)	Railroad corridors were evaluated against aerial imagery (accessed using Google Earth and ArcGIS Online 2010-2011) to assess vegetation gaps (width, management, tunnel openings, and adjacency to roads/ rivers).	Due to sporadic traffic and often narrow openings made for trains, railroads were not viewed as uniform fragmenting features; railroad attributes (width, management, tunnel openings, and adjacency to roads/rivers) were considered as potential fragmenters within individual blocks.
Lakes	National Hydrography Database (USEPA and USGS 2008)	Waterbodies were evaluated to determine if they created significant gaps in forest canopy.	Determined to be fragmenting features.
Rivers	National Hydrography Database (USEPA and USGS 2008)	Waterbodies were evaluated to determine if they created significant gaps in forest canopy.	Large rivers or stream segments (draining >3,861 miles^2) were determined to be fragmenting features.
Developed/ Disturbed Areas	SE GAP NLCD 2006 land cover (Fry et al. 2011)	Land cover data was utilized to visually assess fragmentation of forest cover.	Not used as fragmenting features during initial block identification. Some modifications to blocks were manually made based on this later in the process.

SCREENING MATRIX FOREST BLOCKS FOR SIZE AND CONDITION

Our work to identify a network of representative forest reserves posed several important questions related to the size and condition of matrix forest blocks: How large must a forest reserve be to remain resilient in the face of a changing climate? How large must it be to contain all of its expected biodiversity? How can we tell if a forest occurrence has integrity with regard to its internal processes? In this section, we describe the criteria developed to identify qualifying matrix forest blocks in this analysis.

Our goal was to identity matrix forest blocks large enough to function as viable, resilient forest ecosystems. At a minimum, we assumed that a viable matrix forest patch includes both the biota and the functions that arise from their interactions (e.g. pollination, decomposition), and the intactness of the physical setting and external processes that sustain the ecosystem (Forman 1995, Franklin 1993). Further, our working definition of **resilience** was the ecosystem's "capacity to renew itself or adapt within a dynamic environment" (Gunderson 2000). We assumed that viable, resilient systems are more likely to persist, not in a static manner but in a dynamic state that fluctuates within some bounds of variation or that adjusts gradually to new situations if the underlying environmental conditions change. Under a changing climate, the individual species that compose the system may change in abundance, and new species may be introduced to the system, but overall the forest continues to support a diversity of species and maintain its essential processes.

LAND COVER CRITERIA

To ensure that this analysis focused on the identification of contiguous forest, we used the SE GAP land cover GIS database (2008) to tabulate the amount of forest cover within each potential matrix forest block. All blocks containing at least 80% forest cover qualified for further review.

SIZE CRITERIA

The ability of a forest patch to provide adequate breeding territories for multiple pairs of forest interior species, and to remain resilient under a suite of expected large disturbances, is correlated with its size (Poiani et al 2000, Anderson 2008). To understand the matrix forest block size necessary for effective forest conservation in this region, we identified two independent sets of size criteria, using (a) the scale and frequency of natural disturbances to estimate the minimum dynamic area, and (b) the breeding area requirements of interior-forest specialist bird species, to ensure that conserved matrix forests are of adequate size to function as a "coarse-filter" habitat for associated species, accommodating a broad range of seral stages, at different elevations (Hunter 1996).

Size in Relation to Disturbance

To persist over time, a forest block must be large enough to absorb large, infrequent, disturbances. Natural disturbances, although catastrophic relative to the mortality of living trees, ultimately rejuvenate ecosystems by releasing and redistributing resources, and creating successional habitat that favors a different set of species. Spatial variation in disturbance severity and frequency breaks homogeneous areas into a mosaic of overlapping heterogeneous patches, and keeps the system in a dynamic state of flux. The area necessary to maintain processes and ensure persistence has been called the system's minimum dynamic area (Pickett and Thompson 1978).

Primary natural disturbances in the Southern Blue Ridge are fire, drought, floods, tornadoes, hurricanes, ice storms, landslides, pathogens, and insects. Some sites, because of their position along environmental gradients, are more prone to certain disturbances. For example, ice damage occurs more frequently at cooler and higher elevations, wind-throw is more likely on exposed slopes, drought mortality is more frequent on ridge sites, and fires are more likely on dry, warm, low-elevation southern exposures.

To estimate the minimum dynamic area needed to absorb the largest likely disturbance over the course of several centuries, we collected and reviewed published information and expert knowledge on the largest known disturbance patch sizes created by wind and fire in the SBR. We multiplied these disturbance patch sizes by four, theorizing that resilience would be enhanced if less than one-quarter of the forest block was in the immediate stages of recovery at any one time (Anderson 2008). We emphasize that this is a ballpark estimate, as there is much more detailed research underway to identify occurrence probabilities for forest patch sizes of varying disturbances. Ideally, one would model various disturbances in specific areas to extract the maxima and minima and other distributional information (D. Loftis pers. com.). By scaling to the four-times the largest recorded damage patch, we attempt to identify a robust size criterion to allow for a variety of scenarios to play out.

In the Southern Blue Ridge, wind disturbance (tornadoes, hurricanes, and downbursts) primarily creates small gaps on the scale of 0.1 acre (5-6 m^2) and ranging up to 2.7 acres (0.2-1.1 ha). New gaps form at an average rate of 1% of total land area per year, and in sample areas covered 9.5% of the land area (Runkle 1981, Runkle 1982, Greenberg and McNab 1998, Ventyx 2010). A recent tornado touched down in the western tip of the Great Smoky National Park in April of 2011, creating a disturbance patch 11.5 miles long and one-quarter mile wide, equivalent to 2,080 acres in size (D. Ray, pers. comm.). Using this information, the estimated minimum dynamic area (four-times largest known disturbance size) would be 0.4 acres for small wind disturbance gaps, 10.8 acres for hurricane downbursts, and 8,320 acres for tornado damage patches in the Southern Blue Ridge.

The role of fire in the Southern Blue Ridge is not well understood, but it is likely that the fire regimes of the mountains are distinct from the well-studied Piedmont and Coastal Plain. There is evidence that fires have regularly burned across some mountainous areas over the past 4,000 years, although the seasonality and severity of these fires remains unknown (Fesenmyer and Christensen 2010). Recent studies in the nearby Central Appalachians found the average disturbance size of 344 natural burns was 3 acres (1.2 ha) and the largest known natural fire was 2,938 acres (1,189 ha, Lafon et al 2005). In a study on Tennessee and North Carolina forest fires, the average disturbance size of 126 lighting-caused fires was 2 acres (8 ha), with the largest lightning fire on record burning 81 acres (33ha) (Barden and Woods 2008). Evidence suggests that fires throughout the Southern Blue Ridge similarly occur, mainly as low intensity burns. Scaling up to four-times the largest known natural fire damage area, the estimated minimum dynamic area would be 11,752 acres for fire disturbances.

Size in Relation to Species

To understand the area needs of species associated with Southern Blue Ridge forests and forest interior habitat, we identified a set of species typical of, or restricted to, this ecoregion and used available information on home range, resource, or breeding habitat needs to determine the minimum forest size area requirements. We restricted the analysis to vertebrates, as they are usually the most space-demanding and wide-ranging, and therefore assumed that the space requirements of smaller species would be met at sizes sufficient for representative vertebrates. We focused on bird species requiring or associated with forest interior habitat, as these species have the most restrictive requirements with regard to forest size (Martin and Finch 1995). The effects of forest patch size and forest fragmentation on particular species (specifically on migratory songbirds) have received extensive attention in the literature, and it is well documented that the density of many neotropical forest dwelling bird species is greater in large forested tracts than small forested tracts (Robbins et al. 1989, McIntyre 1995). The differences may be due to: increased pairing success, more suitable foraging or nesting sites, decreased competition for resources, decreased nest predation and/or decreased nest parasitism (Paton 1994, Hartley and Hunter 1997, Fahrig 2003).

The Southern Blue Ridge ecoregion supports an estimated 155 species of breeding birds (Hunter et al. 1999). Nearly 62% of all these species are associated with forest habitats, ranging in size from small woodlots and groves at lower elevations, to large, extensively forested tracts at mid to high elevations. Low elevation forests support six species of woodpeckers, along with many songbird species. Forest patches at higher elevations contain species that use mid-to-late- successional spruce-fir forests as breeding or foraging habitat (Hamel 1992). Hunter et al. (1999) estimated that 49 species of neotropical migrant birds are forest-dependent, and 14 species are associated with wetland or riparian habitats. Population declines have been evident since 1996 in nearly 70% of nearctic-neotropical migrant bird species that breed in mid-to-late successional forests, while 26% have declined significantly. In addition, 31% of wetland and riparian neotropical migrants have also declined (Hunter et al. 1999), and populations of most disturbance-dependent bird species (e.g., golden-winged warbler) in eastern North America have declined steeply (Hunter et al. 2001).

Breeding territory sizes, home ranges, and resource needs for characteristic forest-interior specialist bird species were compiled from Birds of North America (Poole and Gill 1992-ongoing). To determine the size needed for matrix forest block occurrences to contain multiple populations and potentially function as a source area for breeding species, we multiplied the average female territory size by 25, using the guideline that at least 50 genetically-effective individuals are necessary to conserve genetic diversity within a metapopulation over several generations (Lande 1988). In using this guideline, we were approximating the area needed to accommodate 25 breeding females within a single patch of forest, not the needed population size to sustain the species, which would be much larger. Results show that the territory sizes of SBR forest interior bird specialists ranged from 2 acres to over 1000 acres depending on the species (Table 2).

Table 2. Average Territory Size of Characteristic SBR Forest Birds (compiled by M. Lynch and supplemented by Poole et al. 2012).

Southern Blue Ridge Birds[1]	Average Territory (Acres)	Acres X 25
Early Successional		
Golden-winged Warbler	2	50
Vesper Sparrow	10.4	260
Cove Hardwoods		
Acadian Flycatcher	2.7	68
Black-throated Blue Warbler	2	50
Cerulean Warbler	2.6	65
Louisiana Waterthrush	1.3	33
Swainson's Warbler	2	50
Hemlock-White Pine-Mixed Hardwoods		
Blackburnian Warbler	3	75
Black-throated Green Warbler	1.5	38
High Elevation Hardwoods		
Ruffed Grouse	5.4	135
Yellow-bellied Sapsucker	14	350
Black-billed Cuckoo	15	375
Blue-headed Vireo	0.7	18
Rose-breasted Grosbeak	2.5	63
Veery	0.5	13
Spruce-Fir		
Black-capped Chickadee	10	250
Brown Creeper	11	275
Northern Saw-whet Owl	247	6175
Red-breasted Nuthatch	12.6	315
Golden-crowned Kinglet	2	50
Winter Wren	7.2	180
Large Territory		
Barred Owl	600	15,000
Common Raven	1,200	30,000
Cooper's Hawk	500	12,500
Broad-winged Hawk	569	14,224

To determine the matrix forest block size necessary for effective forest conservation in this region, we plotted these SBR forest-interior species' area requirements on the same scale as the collected disturbance patch minimum dynamic area estimates (Figure 3). For instance, a 1,000 acre patch of forest provides adequate space for 25 breeding pairs of yellow-bellied sapsuckers and red breasted warblers,

[1] Additional requirements beyond size exist for breeding success for many birds, especially early successional species.

but is below the size needed for northern saw-whet owls, and is less than half the size of the largest severe fire recorded in the area.

In reviewing these results, it was evident that a 15,000 acre forest would be adequate for all the species and disturbances examined. We therefore decided to use 15,000 acres of contiguous forest as our base size criteria, but to still evaluate blocks in the smaller size range of 10,000-15,000 acres, because we expected that large blocks may not be available in certain environments (rich soils for example) and the 10,000 acre block size would still be adequate for most disturbances and species (in the end all the Tier 1 blocks were greater than 15,000 acres in size but some of the Tier 2 blocks and connectors were smaller). Thus our minimum size criterion for viable SBR matrix forest blocks was 15,000 acres. This size will provide adequate breeding territories for multiple pairs of forest interior species, and can remain resilient under a suite of expected severe wind and fire disturbances of all types.

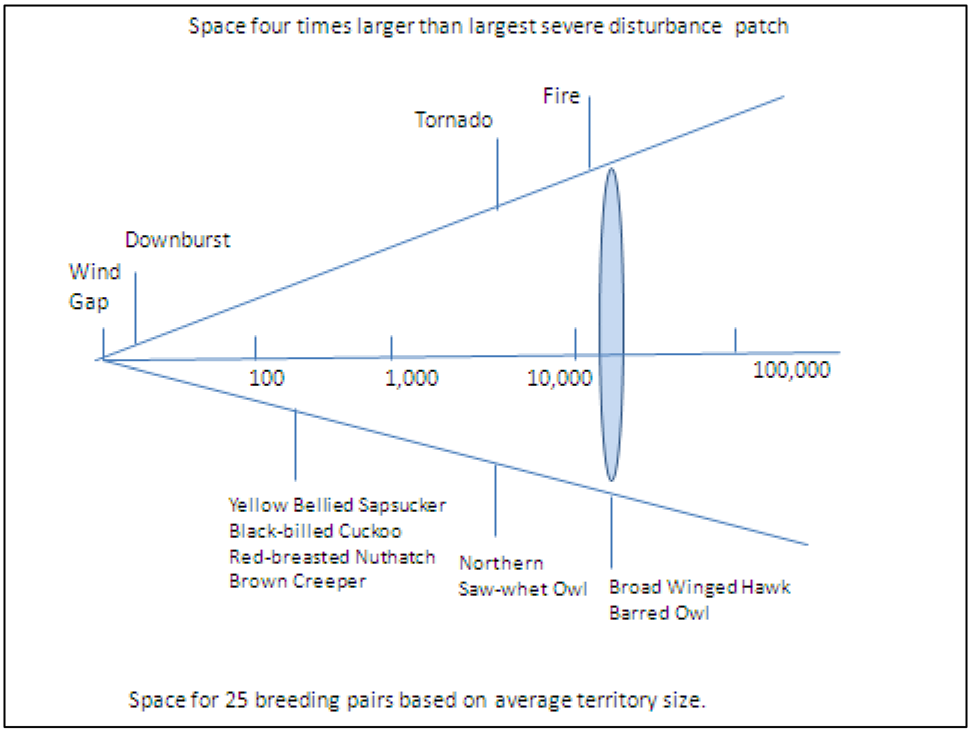

Figure 3. Minimum Dynamic Area for SBR Matrix Forest Blocks, known disturbance patch sizes and select interior-forest breeding specialists' territory sizes. The blue circle indicates approximately where the 15,000 acre criteria stand in relation to the other features.

Classifying The Matrix Forest Blocks

An understanding of patterns of environmental variation and biological diversity is fundamental to conservation planning at any scale—regional, landscape level, or local. Moreover, maintaining forest biodiversity through a forest reserve network is a tradeoff between distributing risk over many reserves representing the full spectrum of environmental settings (the goal of this analysis stage) and minimizing the probability of loss in each individual reserve (the goal of the size criteria analysis stage).

In order to identify a *representative* network of matrix forest blocks, a dataset was developed to assess the geophysical character of the landscape, which can also be used to approximate the distribution and composition of many community assemblages across those landscapes. The close relationship of the physical environment to ecological process and biotic distributions underpins the ecological sciences, and given the changing climate and associated changing species distributions, geophysical diversity may be an appropriate target for conservation planning (Anderson and Ferree 2010) Research has repeatedly demonstrated especially strong links between ecosystem pattern and processes, climate, bedrock, soils, and topography.

To quantify the physical diversity of the Southern Blue Ridge, we developed individual 30m cell GIS datasets of elevation, geology, and landforms, and integrated them into a single unit called the Ecological Land Unit (ELU). Each ELU code represents a specific landform (e.g., cove), composed of a specific bedrock type (e.g., calcareous), within a specific elevation zone (e.g., low elevation). The ELU dataset describes only the physical information, but it can be combined with land use or land cover maps to approximate vegetation types. We present a brief description of each of the ELU dataset layers below.

Elevation

Elevation is a strong predictor of the distribution of forest communities. Temperature, precipitation, and exposure commonly vary with changing altitude, as does the dominant vegetation type. Red spruce begins to occur within northern hardwood forests at around 1,405m (4,500ft) and becomes more dominant with increasing elevation. Fraser fir species abundance increases above 1,720m (5,500ft) and can occur in pure stands over 1,875m (6,000ft). Hemlock-dominated forests, along with white pine and hardwood mixed habitats, occur at middle elevations and often in small stands along north-facing slopes at elevations between about 762-1,220m (2,500-4,000ft). Variations of cove forest can be found throughout the Southern Appalachians at elevations from 305 to 1,372m (1,000-4,500ft). Appalachian oak forests composed of northern red, chestnut, white, and black oaks, in combination with many other species (especially pignut and mockernut hickory and red maple) typically occur at elevations from 250m to 1,280m (820-4,200ft) elevations (Stephenson et al. 1993, Hunter et al. 1999).

We used the following elevation cutoffs to map distinct elevation zones:

Very High	5,500ft+
High	4,200-5,500ft
Medium High	3,500-4,200ft
Medium Low	2,300-3,500ft
Low	2,300ft or less

Geology

Bedrock geology strongly influences area soil and water chemistry. Bedrock types also differ in how they weather and in the physical characteristics of the residual soil type. Because of this, local lithology is usually the principle determinant of soil chemistry, texture, and nutrient availability. Many ecological community types are closely related to the chemistry and drainage of the soil or are associated with particular bedrock exposures.

We grouped bedrock units on the bedrock geology maps of Virginia, North Carolina, Tennessee, South Carolina, and Georgia into nine general classes, designed to have particular relevance to vegetation distributions. The nine categories listed below were based on the chemical and physical properties of the soils derived from them, and are correlated with regional biodiversity patterns (Anderson and Ferree 2010, Appendix C).

Acidic sedimentary**:** Fine to coarse-grained, acidic sedimentary or meta-sedimentary rock. This group includes: mudstone, claystone, siltstone, non-fissile shale, sandstone, conglomerate, breccia, greywacke, and arenites. Metamorphic equivalents inlcude: slates, phyllites, pelites, schists, pelitic schists, and granofels.

Acidic shale: This group includes any fine-grained loosely compacted acidic fissile shale.

Calcareous: Alkaline, soft, sedimentary or metasedimentary rock with high calcium content. This group includes: limestone, dolomite, dolostone, marble, and other carbonate-rich clastic rocks.

Moderately Calcareous**:** Neutral to alkaline, moderately soft sedimentary or meta-sedimentary rock with some calcium but less so than the calcareous rocks. This group includes: calcareous shales, pelites and siltstones, calcareous sandstones, lightly metamorphosed calcareous pelites, quartzites, schists and phyllites, and calc-silicate granofels.

Acidic Granitic**:** Quartz-rich, resistant acidic igneous and high grade meta-sedimentary rock. This group includes: granite, granodiorite, rhyolite, felsite, pegmatite, granitic gneiss, charnockites, migmatites, quartzose gneiss, quartzite, and quartz granofel.

Mafic: Quartz-poor alkaline to slightly acidic rock. This group includes: (ultrabasic) anorthosite (basic), gabbro, diabase, basalt (intermediate), quartz-poor: diorite/ andesite, syenite/ trachyte, greenstone, amphibolite, epidiorite, granulite, bostonite, and essexite.

Ultramafic: Magnesium-rich alkaline rock. This group includes: serpentine, soapstone, pyroxenites, dunites, peridotites, and talc schist.

Coarse Surficial Sediment**:** This group includes deep unconsolidated sand and gravel.

Fine Surficial Sediment**:** This group includes deep unconsolidated silt and mud.

Landform

Landforms anchor and control terrestrial ecosystems by breaking broad landscapes into local topographic units and creating meso- and micro-climates. Topography is largely responsible for local variation in solar radiation, soil development, moisture availability, and susceptibility to wind and other disturbances. To map SBR ecoregional landforms, we created an 11-part GIS landform model that delineated local environments, representing distinct combinations of moisture, radiant energy, deposition, and erosion. The model, based on land surface models developed for soil mapping, categorizes various combinations of slope, land position, aspect, and moisture accumulation. Development methods were based on Fels and Matson (1997) and are described in detail in Anderson et al. 2012. The model is derived from a 30-meter Digital Elevation Model and maps the following landforms (Figure 4):

1) ***Cliff or steep slope*** (includes cliffs and steep slopes of warm and cool aspects)
2) ***Summit or ridgetop*** (includes flat summit, upper ridges, and slope crests)
3) ***Northeast sideslope*** (includes moderately steep sideslopes of cooler aspects)
4) ***Southwest sideslope*** (includes moderately steep sideslopes of warmer aspects)
5) ***Cove or slope bottom*** (includes slope bottom flats, and coves of warm and cool aspects)
6) ***Low hill***
7) ***Low hilltop flat***
8) ***Valley or toeslope***
9) ***Dry flat***
10) ***Wet flat***
11) ***Water*** (includes lakes, ponds, rivers and estuaries)

Ecological Land Units

To integrate the elevation, geology, and landform characteristics, we used GIS to code every 30-meter cell in the region with its elevation zone, geology class, and landform type. For example, a cell at 1,400 feet (elevation class 2000) on granitic bedrock (substrate class 500) in a wet flat (landform 31) would be coded 2531 (Figure 4, Table 3). In total, the Southern Blue Ridge Ecoregion had 453 unique combinations of elevation zone, substrate type, and landform. These ELU data were used to provide an abiotic characterization of each of the candidate matrix forest blocks (Figure 5).

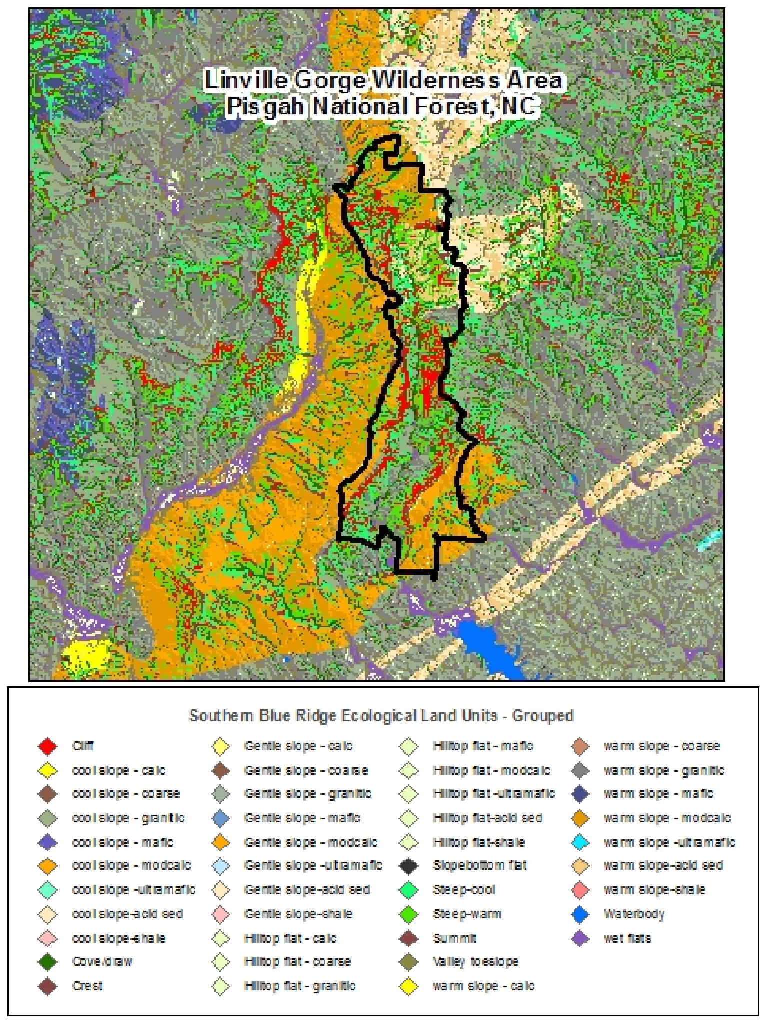

Figure 4. An example of landforms, used for Ecological Land Unit development, in Linville Gorge Wilderness Area in North Carolina.

Table 3. Ecological Land Units Coding Scheme.

Elevation class (ft)	+	Substrate class	+	Landform
1000 (0-2300)		100 acidic sed/metased		4 steep slope
2000 (2300-3500)		200 acidic shale		5 cliff
3000 (3500-4200)		300 calc sed/metased		11 flat summit/ridgetop
4000 (4200-5500)		400 mod. calc sed/metased		13 slope crest
5000 (> 5500)		500 acidic granitic		21 Hilltop (flat)
		600 mafic/intermed granitic		22 Hill (gentle slope)
		700 ultramafic		23 NW-facing sideslope
		800 coarse sediments		24 SE-facing sideslope
		900 fine sediments		30 Dry flat
				31 Wet flat
				32 Valley/toe slope
				41 Flat at bottom of steep slope
				43 NW-facing cove/draw
				44 SE-facing cove/draw
				51 Polygonal rivers from NHD
				52 NHD lakes/ponds/reservoirs

Classifying Matrix Forest Blocks by ELU Components

We overlaid potential matrix forest block boundaries (meeting size and land cover criteria as described above) with the ELU data layer, and tabulated the area of each unique ELU code within each block, summarizing the types and amounts of physical features contained. We used this information to classify the forest blocks, using a standard quantitative cluster analysis (CLUSTER and TWINSPAN) within PC-ORD version 6 (McCune and Mefford 1992, McCune and Grace 2002) to aggregate the forest matrix blocks into groups that shared a similar combination of physical features. This ordination process resulted in groups of similar recognizable forest-landscape combinations, which we termed “ELU groups” (Figure 6).

The analysis resulted in 25 ELU groups, based largely on differences in elevation zones and geology types. Among ELU groups, the types and proportions of landforms varied less (the largest variations were related to the proportion of flats and wet flats in each block). We further subdivided some of the groups into subgroups (labeled a, b, or c) based on both ecological characteristics and the geographic distribution of the blocks. For example if a group contained two spatially-disjunct sets of blocks that were found in different physiographic regions, we split that ELU group into subgroups (Figure 6).

The resulting ELU groups and subgroups, and the names of the matrix forest blocks they contain, are listed below (arranged by elevation zone):

LOW ELEVATION

- **Group 3: Low elevation acidic sedimentary blocks, mostly sideslopes with coves prevalent –** Examples: Fort Mt., Hiwassee, Hiwassee Lake, Web Mt.
- **Group 4: Low elevation, mix of granite and acidic sedimentary, no summits, mostly sideslopes -** Examples: Lower Chattooga, Mid-Chattooga, Sumter
- **Group 13b: Low elevation block on granite and mafic bedrock, steep landforms, valleys few flats -** Examples: South Mt. Connector

LOW to MID ELEVATION

- **Group 1: Low to mid elevation, mixed acidic sedimentary and shale, mostly slopes -** Examples: Cohutta, Lover's Leap, Sol Messer Mt., Meadow Creek Mt., Starr Mountain
- **Group 2: Low to mid elevation, acidic sedimentary with bits of granite or mafic, mostly sideslope -** Examples: Amicalola West, Burnt/Sassafras, Dahlonega/Amicalola, Payne Mt.
- **Group 5: Low to mid elevation with acidic sedimentary, granite and mafic bedrock. Slopes, few flats -** Examples: Bull Mountain, Fairy Stone, Pinnacles of Dan
- **Group 8: Low to mid elevation, very diverse geo: acidic sedimentary, granite, moderately calcareous and calcareous. Mostly steep features, few gentle hills -** Examples: Max Patch
- **Group 13a: Low to mid elevation on moderately calcareous and granite bedrock, various land forms -** Examples: Adams Mt., Globe, Linville Gorge
- **Group 14a: Low to mid elevation on granite and coarse surficial sediment. Sideslope, no wet flats -** Examples: Poor Mountain
- **Group 14b Mid to low elevation on granite, Mostly slopes and slope crests, no wet flats -** Examples: Mack’s Mountain
- **Group 14b Mid to low elevation on granite, Mostly slopes and slope crests, no wet flats** Examples: Mack’s Mountain
- **Group 14c: Mid to low elevation on granite, variety of landforms no wet flats** Examples: Horse Trough Mt., Raven Cliffs, Unicoi, Blood Mt.
- **Group 15: Low to mid elevation on granite or with bits of mafic and mod calc, various landforms** Examples: Honeycut Mt./Humpback Mt., Little Switzerland, Doughton/Stone Mt., Elk Ridge, Rendezvous Mt., Vannoy, Yadkin Headwaters, Bent Mountain
- **Group 16-18: Low to mid elevation on granite with substantial component of acidic sedimentary, sideslopes and a wide variety of landforms** Examples: Blue Wall, Green River, Chimney Rock, Great Smokies West, Hickory Nut Gorge, Jocassee, Mt. Bridge, Mt. Bridge West, Spring Creek Mt., Headwaters, Tiger, Upper Chattooga/Whitewater, Duncan Ridge, Rocky Mt., Asheville Watershed, Grandfather Mt.

MID ELEVATION

- **Group 6: Mid elevation block of calcareous limestone with steep slopes and sideslopes -** Examples: Doe Mt.
- **Group 22-24: Mid elevation blocks on granite, coves prevalent along with sideslope, steep slopes -** Examples: Big Bald, Roan Mt West, Cowee, Cullasaja, Newfound Mountains, Panthertown Valley, Pink Beds, Standing Indian, Looking Glass, Mt. Pisgah, Roy Taylor, Richland Balsam, Shining Rock
- **Group 25: Mid elevation blocks with substantial mafic bedrock. Mostly sideslope -** Examples: Amphibolite Mts., Roan Mt. East
- **Group 19b: Mid elevation block on granite, sideslopes and steep slope -** Examples: Cathy's Creek, N. Fork French Broad, Mount Rogers
- **Group 19a: Mid elevation on granite with substantial acidic sedimentary. Mostly sideslope and valley -** Examples: Dupont, Dupont West
- **Group 20b: Mostly mid- elevation and mostly granite and a variety of landforms -** Examples: Big Laurel, Hurricane Mts., Pond Mt., Unaka , Mt. Wilder

MID to HIGH ELEVATION

- **Group 10: Mid to high elevation with moderately calcareous and acidic sedimentary. Mostly slopes -** Examples: Nantahala
- **Group 21: Mid to high elevation with limestone and granite, mostly sideslopes, and steep slopes -** Examples: Jefferson/Iron Mt., Sugar Grove

ALL ELEVATION ZONES

- **Group 7: Diverse blocks with many elevation zones, and many types of sedimentary bedrocks. No wet flats, mostly sideslopes and steep slopes -** Examples: Buffalo Mountain, Holsten Mt., Rocky Fork, Scioto-Stone Mt. Stone Mountain, The Snake
- **Group 9: All elevation zones, sedimentary bedrock with sideslopes, steep slopes and coves -** Examples: Brasstown Bald, Cheoah, Cove Mt. WMA, Fires Creek, Great Smokies East, Harmon Den, Joyce Kilmer/Unicoi, Rich Mt., Yellow Creek
- **Group 11: All elevation zones on sedimentary and granite. Mostly sideslopes and steep slopes -** Examples: Black Mts., Little Tennessee, Plott Balsams, Qualla, Rabun Bald
- **Group 12: All elevation zones, diverse blocks with granite, sedimentary and shale no flats or gentle slopes of any kind -** Examples: Forge Mt. /Mt. Rogers, Nolichucky
- **Group 20a: All elevation zones and equal parts granite and sedimentary. Steep slopes, with few flats or gentle slopes -** Examples: Chunky Gal, Tri-County

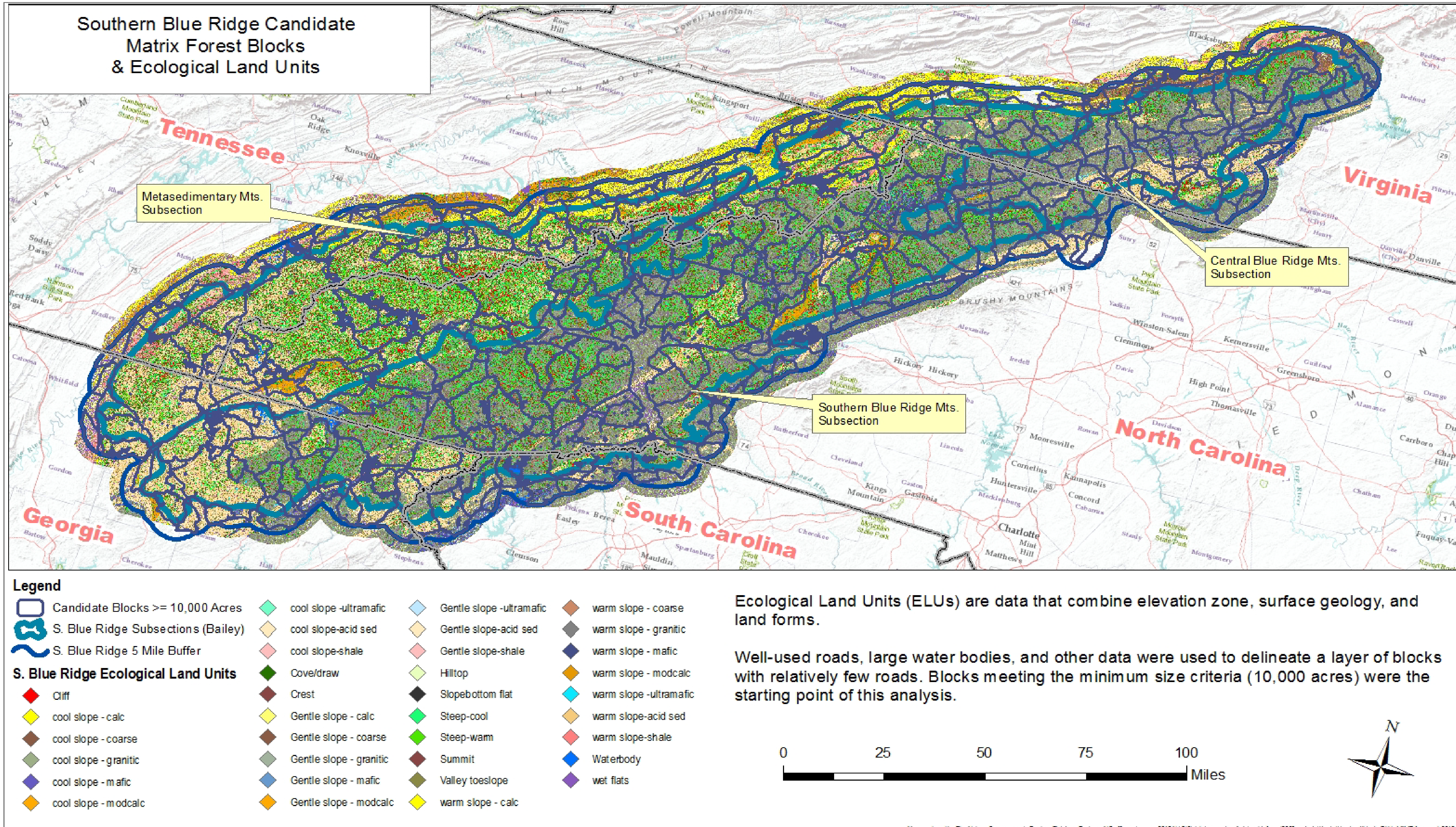

Figure 5. Southern Blue Ridge Potential Matrix Forest Blocks and Ecological Land Units.

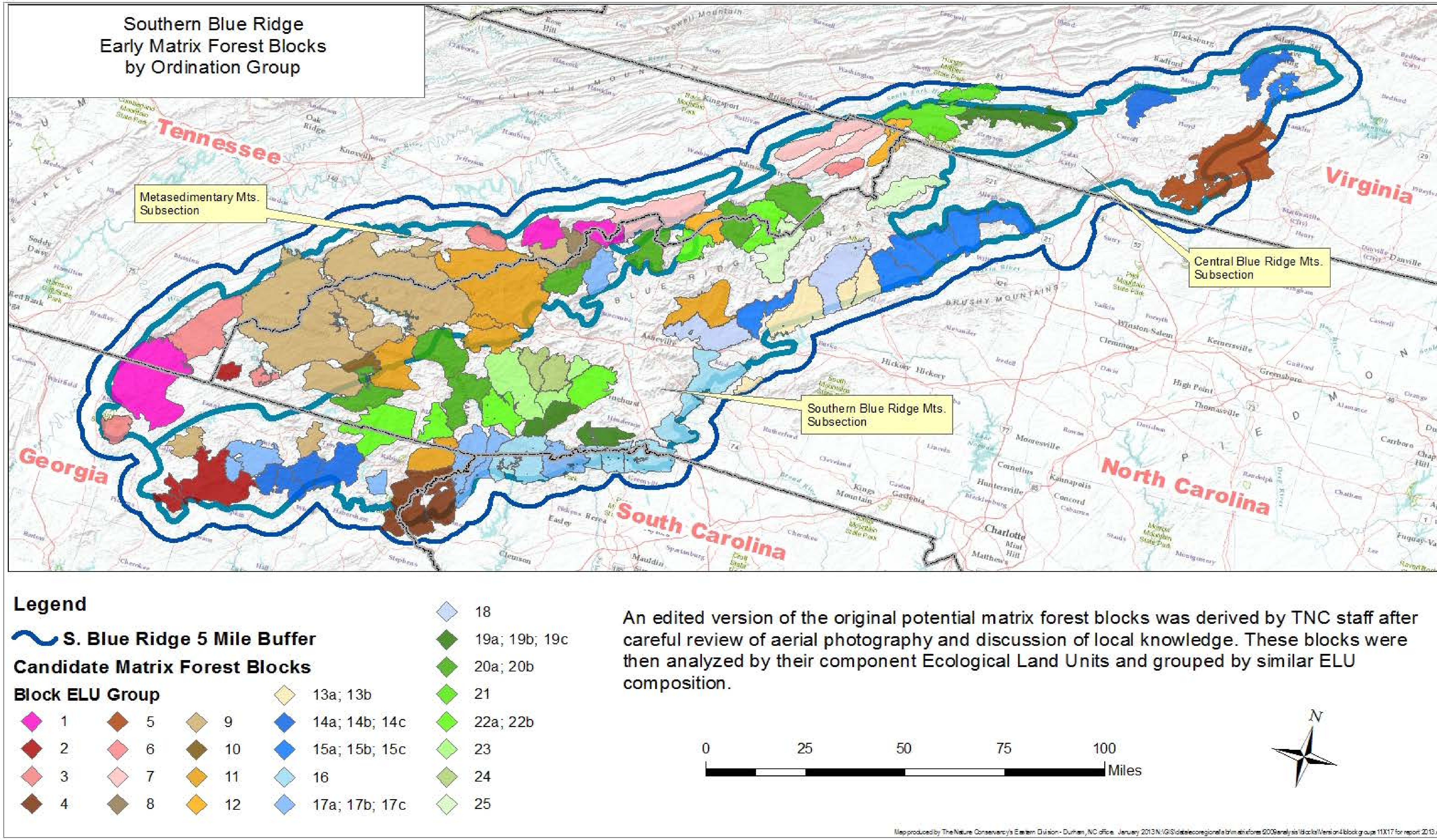

Figure 6. Southern Blue Ridge Early Matrix Forest Blocks by similar Ecological Land Unit Groupings.

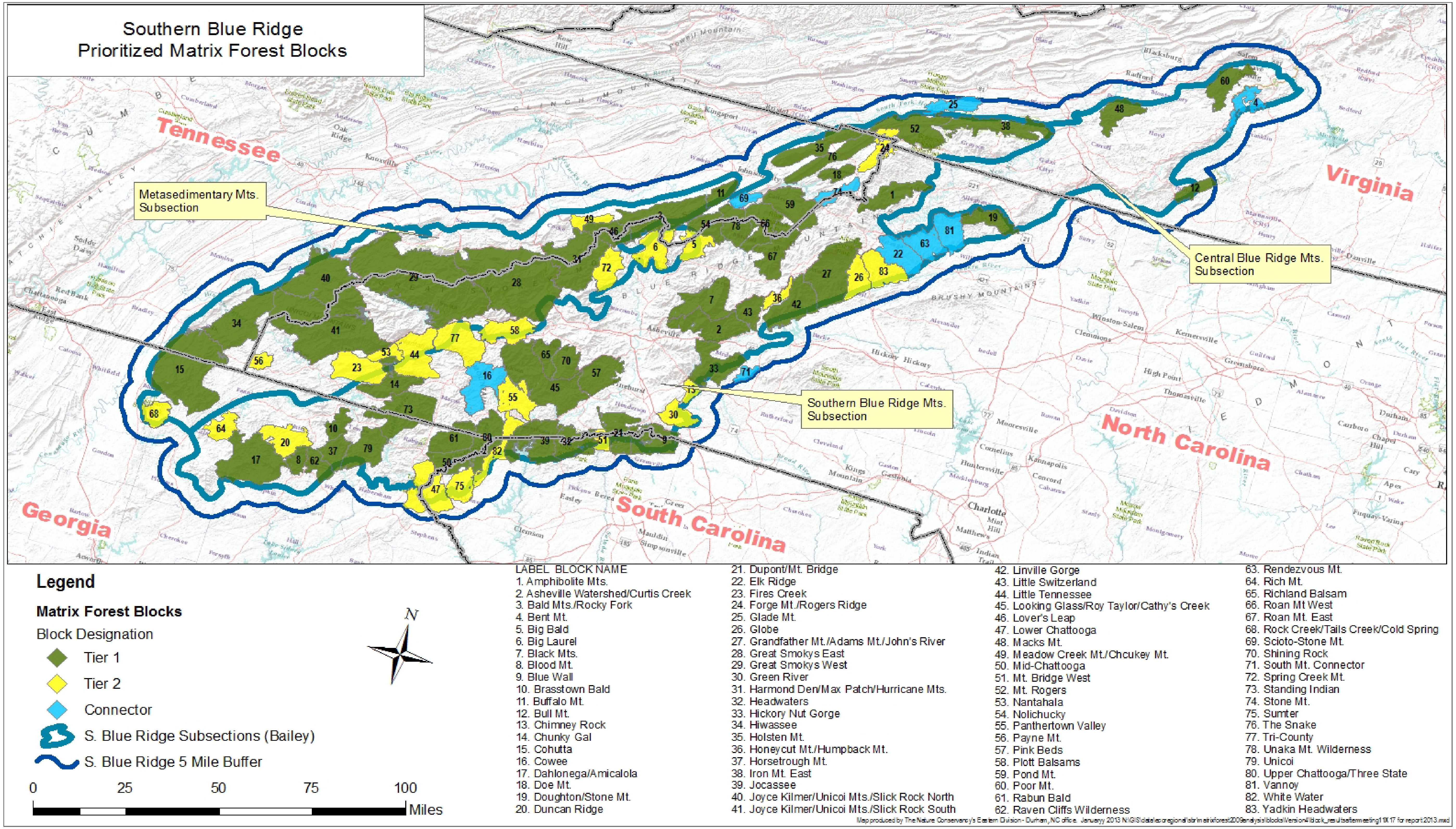

Figure 7. Prioritized Southern Blue Ridge Matrix Forest Blocks, with Tier 1 and 2 Priorities and Key Connectors Delineated.

EVALUATING AND PRIORITIZING A NETWORK OF MATRIX FOREST BLOCKS

The final step of this process was to evaluate the matrix forest blocks and prioritize a subset for conservation focus. Following internal TNC ecoregion-wide staff meetings to delineate potential matrix forest blocks, expert meetings were set up in each of the five SBR states between October 2010 and February 2011, to which a wide range of forest experts and partners were invited to attend and evaluate draft matrix forest block results (Appendix A). State expert review meetings followed a process that compared and contrasted attributes of potential matrix forest blocks in each ELU group, first orienting experts to block locations and basic properties, then examining compiled data and documenting comments on the appropriateness of block boundaries, natural heritage and forest condition qualities, and land ownership patterns. Copious notes were taken during the expert meetings and can be found at *http://www.conservationgateway.org/Files/Pages/SouthernBlueRidgeAnAnalysisofMatrixForests.aspx*.

State expert teams evaluated detailed block information compiled for the process, as well as discussing personal knowledge of the areas. Additional information provided and/or discussed by participants included:

- The amount and type of conservation land within each block
- The density of internal roads
- The number and types of rare species and natural communities found within each block
- The number and types of unique natural communities found in each block
- The degree of development or agriculture within the block
- Known old-growth sites (from Southern Appalachian Forest Coalition)
- The type and number of unique ELUs within each block
- Satellite or Air photo imagery from Google Earth
- The degree of invasive species within each block
- The condition of the forest within each block
- Rare species and natural community information was provided by the Natural Heritage programs from the five states and used with their permission. A summarized table of this information can be found within Appendix E.

Following expert meetings, TNC staff reviewed all compiled feedback and attributes and determined consensus around final block boundaries for each of the 107 potential matrix forest blocks. This review was conducted systematically, by ELU-based groupings, with the goal of identifying at least one priority block within each of the 25 unique ELU groups in the SBR. This ensured that our final network of prioritized matrix forest blocks would be not only be those relatively intact blocks of sufficient size, but also representative of all geophysical variation in the region (Figure 7, Appendix D). Information about decisions made at this meeting concerning final block boundaries and priorities can also be found at *http://www.conservationgateway.org/Files/Pages/SouthernBlueRidgeAnAnalysisofMatrixForests.aspx*.

Results of Analysis

All final SBR matrix forest blocks were categorized as Tier 1 (higher priority blocks), or Tier 2 (important, but lower conservation priority) (Figure 7, Appendix D). Some initial potential blocks were excluded from final delineated priority matrix forest block results for this analysis, but they may still merit other conservation considerations. The team also decided to categorize nine blocks as "connector blocks[2];" those blocks that appear to have high connectivity value among and between blocks designated as Tier 1 or Tier 2. The resulting GIS database of spatially-delineated Tier 1, Tier 2, and Connector SBR Forest Matrix Blocks and relevant metadata is available for download and use at *http://www.conservationgateway.org/Files/Pages/SouthernBlueRidgeAnAnalysisofMatrixForests.aspx*.

Size of Matrix Forest Blocks

Of the original 107 potential blocks, the final analysis resulted in the identification of 83 Southern Blue Ridge priority matrix forest blocks (comprised of 50 Tier 1 and 24 Tier 2 blocks, totaling 4,721,577 acres), plus nine connector blocks (Figure 7, Appendices D, E). The average size of all of the blocks was 53,822 acres. Eighty percent of the final block acreage was categorized as Tier 1 priority (3,791,877 acres). Amongst the Tier 1 matrix forest blocks, block size ranged from 19,338 acres (Doe Mountain) to 340,182 acres (Great Smokies West), with the number of blocks falling into various size cohorts (Table 4). Amongst the 929,700 acres of Tier 2 forest blocks, block size ranged from 13,733 (Chimney Rock) to 78,235 acres (Lower Chattooga), with the number of blocks falling into various size cohorts (Table 5). Most of the unique SBR ELU groups were represented by at least one or two Tier 1 blocks, except for ELU groups 10, 17a, and 17c (which are represented by Tier 2 blocks) and 15c and 19b (for which no blocks justified representation) (Tables 4, 5).

Table 4. Tier 1 Matrix Forest Block Size Cohorts and ELU Groups Represented.

Block Size	Number of Tier 1 Blocks	ELU Groupings Represented in Cohort
15,000 – 30,000 acres	6	5, 6, 7, 9, 14c
30,001 – 50,000 acres	12	1, 4, 11, 12, 14a, 14b, 14c, 15a, 15b, 20b, 24
50,001 – 70,000 acres	15	7, 14c, 16, 17b, 19a, 19c, 20a, 20b, 22a, 22b, 25
70,001 – 100,000 acres	7	7, 11, 13a, 16, 18, 21, 22b
100,001 – 150,000 acres	6	2, 3, 8, 9, 13a, 23
150,001 acres or more	4	1, 9, 11

[2] The designation of "connector blocks" was not made in a concertedly consistent fashion during the review process. It is expected that a GIS connectivity analysis will be conducted for the SBR ecoregion that will refine these designations and likely point to additional areas of high connectivity potential.

Table 5. Tier 2 Matrix Forest Block Size Cohorts and ELU Groups Represented.

Block Size	Number of Tier 1 Blocks	ELU Groupings Represented in Cohort
10,000 – 30,000 acres	8	1, 2, 3, 9, 10, 15a, 16
30,001 – 50,000 acres	12	4, 11, 12, 13a, 15b, 16, 17a, 17b, 17c, 20b, 22a, 22b
50,001 – 70,000 acres	2	9, 20a
70,001 – 100,000 acres	2	4, 11
100,001 – 150,000 acres	0	n/a
150,001 acres or more	0	n/a

Conservation Status and Condition of Matrix Forest Blocks

GAP Status as a Proxy for Protection and Management

Computed characteristics, including land ownership and conservation status, are summarized by block and ELU grouping in Appendix E. One way to assess current condition or conservation status in relation to protection and management intentions of these blocks is to use GAP Status designations (Crist et al. 1998). Using the GAP Status, we determined that a large percentage of the blocks are already within some type of conservation status, with land either secured explicitly for the conservation of biodiversity and ecological processes (e.g., GAP 1 and 2 Status), or land secured for multiple uses (e.g., GAP 3 Status, Figure 8, Crist et al. 1998). We recognize that GAP Status designations are not the only way to assess the current level of protection or intensity of intended management activities and can sometimes be misinterpreted[3], but we have used these designations to coarsely assess our blocks on a landscape-scale. Additional work with land managers and stakeholders is necessary to better determine current conservation status, management intentions, and opportunities for spatially-explicit ecologically-compatible management goals, using these results.

On average, 7% of each block was designated as GAP 1 Status (or 7, 411 acres), with an average of 3% (1,571 acres) and 40% (21,675 acres) of each block designated as GAP 2 or 3 Status, respectively (Figure 8). Half of the area within all of the matrix forest blocks is unsecured (Appendix E). The majority of land within GAP 1 Status is owned by the National Park Service (Great Smoky Mountains National Park) and the US Forest Service (designated Wilderness Areas within National Forests). These lands are considered permanently protected and are usually managed for natural or mimicked (through management activities) disturbance events. The majority of land within GAP 2 Status is owned by State Wildlife Agencies and State Parks. These lands also are considered permanently protected, but they are designated to receive use or management which may result in some degradation of the quality of existing natural communities. The majority of land within GAP 3 Status is owned by US Forest Service (multiple use areas within the National Forests). These lands are considered to have some permanent

[3] E.g., GAP 1 designated areas can also be considered ecologically-degraded (e.g., as a result of the inability to effectively reintroduce ecologically-appropriate fire into a system).

protection, but are subject to natural resource extractive uses that can result in more significant degradation of biodiversity or natural ecological integrity.

Fragmenting Features and Nonforest Land Cover Within Blocks

We determined the size of the largest roadless (unfragmented) area within each of the blocks. Fifty-five percent of all of the blocks (26,774 acres) were determined to be roadless, while the average road density per block was 3.45 miles/1,000 acres.

Nonforest land cover information within matrix forest blocks was also analyzed and summarized (Appendix E). On average, pasturelands and developed open space land cover classes each comprised 3% of blocks. An average of 1% was classed as evergreen plantations or managed pines, and 1% was classed as successional shrub/scrub land within blocks.

Species and Natural Communities

Statistics regarding known occurrences of tracked species and natural communities were also calculated (Appendix E). On average, for each block, there were:

- 12.1 tracked natural community occurrences,
- 62 tracked vascular plant species occurrences,
- 36.6 tracked fish species occurrences,
- 25.6 tracked amphibian species occurrences,
- 11.8 tracked non-vascular plant species occurrences,
- 10.9 tracked mammal species occurrences,
- 8.2 tracked invertebrate species occurrences,
- 2.9 tracked bird species occurrences,
- 1.9 tracked reptile species occurrences,

There were 172 total known element occurrences overlapping matrix forest blocks, representing a total of 41 species (total taxa) (Appendix E). The majority of the Conservancy's portfolio sites and rare species occurrences that were identified in the SBR Ecoregional Assessment in 2000 are nested within these matrix forest blocks (TNC & SAFC 2000). Further analysis is needed to determine how best to incorporate those originally identified portfolio sites (i.e., islands of biodiversity) not nested within this newly identified contiguous, connected matrix forest habitat (Ward et al. 2011).

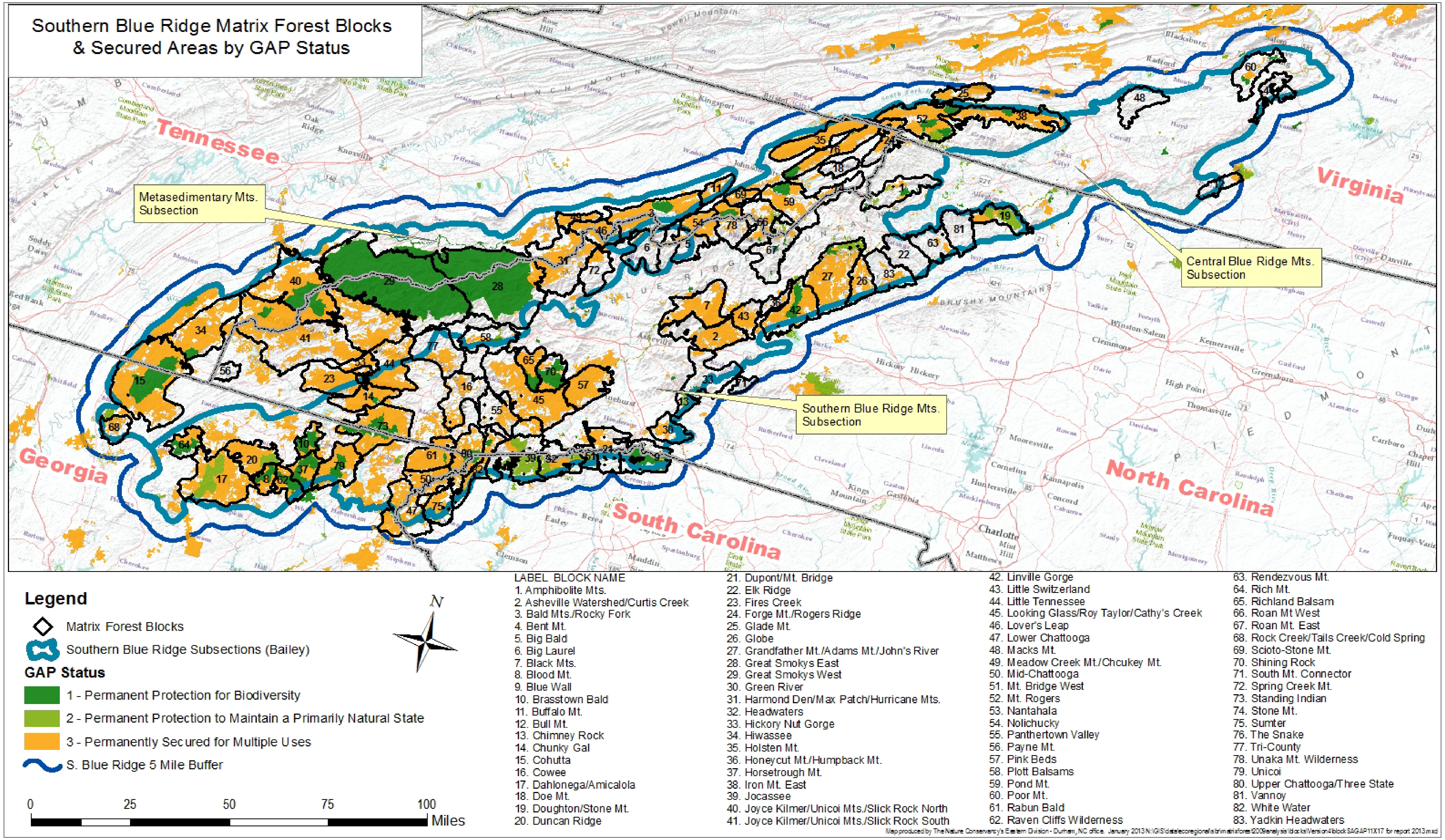

Figure 8. SBR Matrix Forest Blocks Overlapping GAP Status (a proxy for determining the level of protection and intensity of management expected).

CONCLUSIONS

The goal of this analysis was to identify and evaluate a network of representative contiguous forests in the Southern Blue Ridge, which are large enough to sustain forest ecosystem processes and the embedded conservation targets within them. The Nature Conservancy's vision for the conservation of these identified priority SBR ***matrix forest blocks*** is to work with partners to: (1) ensure adequate long-term protection and ecologically-compatible management of this network of representative matrix forest blocks***,*** with embedded ***core forests*** surrounded with multiple ***working forest buffers*** (Noss and Cooperrider 1994, Figure 2), (2) retain connectedness of forest cover among and between those matrix forests and across the landscape, and 3) abate region-wide forest threats.

Overall, the Southern Blue Ridge matrix forest blocks that were delineated, screened, classified, evaluated, and prioritized have resulted in considerable information that can be used to inform conservation strategies in this region. These results close a significant gap in our understanding of the spatial context and characteristics of large contiguous forests in the Southern Blue Ridge, which are important for the people inhabiting the region, as well as for the fundamental ecosystem services that they provide. The Conservancy believes the results of this analysis will provide a clearer direction for near-term conservation priorities, and foster a more focused set of conservation actions around which TNC and partners can organize and cooperate.

Furthermore, we recommend that TNC operating units and interested partners within the SBR, both individually and jointly, use the priority matrix forest block information derived from this exercise to enhance our understanding of the highest conservation priorities and strategies in the SBR. Examples of this include:

- Consideration of new or redrawn priority conservation landscapes;
- Assessment of collaborative partnership opportunities (e.g., major land management entities within priority blocks, with whom collaboration could improve forest condition in alignment with matrix forest, core forest, and working forest buffer principles (see Figure 2);
- Reassessment of land protection opportunities that could lead to improved forest block management practices in priority areas, in alignment with matrix forest, core forest, and working forest buffer principles; and
- Reassessment of the appropriate balance and strategic success of both localized and landscape-scale land protection, land management, and policy-oriented strategies, coordinated and executed across multiple (versus individual) program offices and operating units.

It is important to note that our regional forest network model is based on the concept that in an "ideal" situation, the full spatial extent of all priority matrix forests would be managed primarily for biodiversity protection, long term ecological monitoring, and low impact human use (with the overall goals of maintaining forest cover, habitat diversity, rare species, significant natural communities, and water quality), we recognize that this is not practical. With this in mind, we recommend that within each matrix forest block, single or multiple core forests of adequate size be identified and managed primarily for biodiversity and the maintenance of natural processes, while surrounding multiple use buffer areas are managed for a wider variety of biological, social, and economic values (Figure 2). Additionally, it is worth mentioning that matrix forest blocks and their associated core forests will require varying levels of active ecological management (though certainly there will be areas within these biological cores that are essentially unmanaged) to achieve the desired future conditions of these important forests. It is also critical to emphasize that the identified core forests can support a variety of low impact recreation.

Therefore, we conducted a draft analysis to spatially-identify the best opportunities for these **core forests** (i.e., we delineated unfragmented blocks (≥5,000 acres) of heterogeneous, interior forest landscapes that, being nested within the matrix forest blocks, provide the opportunity for relatively natural processes to occur or be mimicked through management, resulting in a healthy range of structural and compositional forest attributes). These delineated draft interior core forests are intended to be used as an initial discussion point with partnering agencies (e.g., U.S. Forest Service) and are by no means definitive in their extent. The results of these delineations are dependent upon the inputs of statewide and national datasets, and are therefore best suited for regional, broad-scale planning. Finer-scale planning should incorporate more locally-based county and city datasets and air-or- ground-truthing to reflect the most current conditions and appropriate boundaries of these delineated interior core forests. The methods and results of this 2012 SBR Core Forest Analysis will be summarized in a report, expected to be released in May 2013.

In addition to the identification of core forests, TNC Southern Blue Ridge staff has identified additional priority follow-up steps to this SBR Matrix Forest Block Analysis, including conducting Climate Change Resiliency Analyses related to connectivity of terrestrial and freshwater landscapes in the southeastern United States. TNC is currently undertaking both Southeastern Terrestrial and Freshwater Resilience Analyses, to complement completed analyses for the northeastern US. The southeastern US Resiliency Analyses are expected to be complete by 2014 (for terrestrial) and 2013 (for freshwater). Once these analyses are complete, SBR TNC staff and partners should revisit the results of the Matrix Forest and Core Forest Analyses in order to better incorporate areas of expected high resilience in the face of climate change and redefine terrestrial and freshwater priorities accordingly. Furthermore, future consideration of Ecological Land Units, classified and grouped based on watershed-scale is necessary to better incorporate and prioritize representative freshwater systems.

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Appendix A: State Expert Review Teams and TNC Analysis Team Members

State	Name	Agency	Date
E. Div.	Mark Anderson	TNC	select meetings
E. Div.	John Prince	TNC	all meetings
GA	Nathan Klaus	GA Dept. of Natural Resources	November 12, 2010
GA	Tom Patrick	GA Dept. of Natural Resources	November 12, 2010
GA	Jon Ambrose	GA Dept. of Natural Resources	November 12, 2010
GA	Jason Wiesnewski	GA Dept. of Natural Resources	November 12, 2010
GA	Tom Govus	NatureServe contractor	November 12, 2010
GA	Malcolm Hodges	TNC	November 12, 2010
GA	Randy Tate	TNC	November 12, 2010
GA	Wade Harrison	TNC	November 12, 2010
GA	Sara Gottlieb	TNC	November 12, 2010
GA	Deron Davis	TNC	November 12, 2010
GA	Jim Wentworth	USFS	November 12, 2010
GA	Joanne Baggs	USFS	November 12, 2010
NC	Curtis Smalling	Audubon	October 27, 2010
NC	Kevin Caldwell	independent biologist	October 27, 2010
NC	Dennis Herman	NC Dept. of Transportation	October 27, 2010
NC	Marshall Ellis	NC Division of Parks and Recreation	October 27, 2010
NC	Mike Schafale	NC Natural Heritage Program	October 27, 2010
NC	Steve Hall	NC Natural Heritage Program	October 27, 2010
NC	James Padgett	NC Natural Heritage Program	October 27, 2010
NC	Ed Schwartzman	NC Natural Heritage Program	October 27, 2010
NC	Kendrick Weeks	NC Wildlife Resources Commission	October 27, 2010
NC	Lori Williams	NC Wildlife Resources Commission	October 27, 2010
NC	Christine Kelly	NC Wildlife Resources Commission	October 27, 2010
NC	Jay Leutze	Southern Appalachian Highlands Conservancy	October 27, 2010
NC	David Ray	TNC	all meetings
NC	Rick Studenmund	TNC	October 27, 2010
NC	Merrill Lynch	TNC	October 27, 2010
NC	Megan Sutton	TNC	October 27, 2010
NC	Catherine Burns	TNC	October 27, 2010
NC	Carolyn Wells	U.S. Fish and Wildlife Service	October 27, 2010
NC	Gary Kauffman	USFS, National Forests in NC	October 27, 2010
SC	Patrick McMillan	Clemson University	October 26, 2010

State	Name	Agency	Date
SC	Vic Shelburn	Clemson University	October 26, 2010
SC	Rob Baldwin	Clemson University	October 26, 2010
SC	Ed Pivorun	Clemson University	October 26, 2010
SC	Joe Pollard	Furman University	October 26, 2010
SC	Mark Hall	SC Dept. of Natural Resources	October 26, 2010
SC	Stan Hutto	SC Dept. of Parks, Recreation, and Tourism	October 26, 2010
SC	Tim Lee	SC Dept. of Parks, Recreation, and Tourism	October 26, 2010
SC	Kristen Austin	TNC	October 26, 2010
SC	Sarah Fraser	TNC	October 26, 2010
SC	Eric Krueger	TNC	October 26, 2010
SC	Colette DeGarady	TNC	October 26, 2010
SC	Maria Whitehead	TNC	October 26, 2010
SC	Jeff Magniez	USFS	October 26, 2010
SC	Tom Waldrop	USFS Research Station-Clemson	October 26, 2010
TN	Jamey Donaldson	independent biologist	February 18, 2011
TN	Jesse Webster	NPS, GSMNP	February 18, 2011
TN	Hugh Irwin	Southern Appalachian Forest Coalition	February 18, 2011
TN	Pete Wyatt	TN Wildlife Resources Agency	February 18, 2011
TN	Alex Wyss	TNC	February 18, 2011
TN	Sally Palmer	TNC	February 18, 2011
TN	Katherine Medlock	TNC	February 18, 2011
TN	Geoff Call	U.S. Fish and Wildlife Service	February 18, 2011
TN	Ed Clebsch	University of TN-Knoxville	February 18, 2011
TN	Mark Pistrang	USFS, Cherokee National Forest	February 18, 2011
TN	Joe McGuiness	USFS, Cherokee National Forest	February 18, 2011
TN	Josh Kelly	Wild Law	February 18, 2011
VA	Angela Watland	TNC	November 4, 2010
VA	Claiborne Woodall	VA Dept. of Conservation and Recreation	November 4, 2010
VA	Steve Croy	USFS	November 4, 2010
VA	Allen Boynton	VA Dept. of Game and Inland Fisheries	November 4, 2010
VA	Joe Miller	VA Forestry	November 4, 2010

Appendix B: Fragmenting Features: Detailed GIS info

Roads: Roads were considered the primary feature that fragments forested landscapes in the Southern Blue Ridge. Detailed road GIS data (ESRI 2009) were evaluated against aerial imagery (Google Earth and ESRI ArcGIS Online accessed 2010-2011) for accuracy and completeness. This GIS vector dataset classed roads from most intensively traveled (i.e., Interstates) to least intensively traveled roads (including some driveways and trails). While the geographic extent and detail of road lines were good, road classifications were not always consistently applied, especially for middle-sized and smaller road classes. Nonetheless, the group settled on using road classes 1 through 4 which roughly equates to Interstates (1), U.S. Routes and some State Routes (2), State Routes and old highways (3) and exit and on ramps, service roads, and rest area roads (4), were determined to be fragmenters.

Power Transmission Lines and Railroads: The team acquired a vector GIS dataset from Ventyx (January 2010), containing power transmission line and railroad location information, and assessed its accuracy via visual comparisons with recent aerial imagery (Google Earth). The team noted large variations in the width of vegetation cuts made for power lines, as well as in how intensively these areas were managed to remain non-forested. In many places (primarily in ravines and other depressions), no visible vegetation cuts were observed, as some power lines were constructed well above the tree-line in these areas. Due to this variation, power transmission lines were not considered a consistent fragmenting feature across the landscape, but instead were assessed for each individual block following draft delineation. The distance of power lines in each applicable potential block was calculated and included in the Matrix Forest Block Report Statistics. The presence of railroads was also excluded as a consistent fragmenting feature in this landscape, due to the sporadic traffic, tunnels, and often narrow canopy openings made for them, as well as their adjacency to roads or rivers. Similar to the power lines, the distance of railroads in each applicable potential block was calculated and included in block reports. These details are accessible at *http://www.conservationgateway.org/Files/Pages/SouthernBlueRidgeAnAnalysisofMatrixForests.aspx*.

Lakes and Rivers: The team used the National Hydrography Database (NHD Plus 2008) to assess water bodies (lakes) and rivers as potential fragmenting features. The team determined that all lakes and only large rivers would be considered fragmenting features. Large rivers were determined to be those stream segments that drain over 3,861 square miles. There were very few river segments that met this threshold in the ecoregion.

Analysis Area (Southern Blue Ridge Ecoregional Boundaries): The Nature Conservancy's Ecoregional Boundaries are derived from the U.S. Forest Service Ecoregions developed by Keys et al. (1995). The Southern Blue Ridge Ecoregion "analysis area" was considered the ecoregional boundaries, buffered (extended out) by five miles. All data was clipped and assessed using this five-mile ecoregional buffered polygon in order to avoid excluding relevant, connected forested roadless areas and other data of interest that do not follow ecoregional lines.

Developed/Disturbed Areas: Developed and otherwise disturbed areas were not used as fragmenting features to delineate the GIS-generated iteration of matrix forest block boundaries. Road data was a good proxy for excluding developed areas from this analysis because most roadless areas in developed landscapes were below the minimum acreage threshold for matrix forest block consideration. Urban and other built environments were visually assessed, using the most recent aerial imagery available, and used to edit/ refine draft matrix forest polygons in partner and other team meetings later in the process.

Appendix C: Southern Blue Ridge Geology Classes

Geology class	Lithotypes	Meta-equivalents	Comments
100: ACIDIC SEDIMENTARY / METASEDIMENTARY: fine- to coarse-grained, acidic sed/metased rock	Mudstone, claystone, siltstone, non-fissile shale, sandstone, conglomerate, breccia, greywacke, arenites	(Low grade:) slates, phyllites, pelites; (Mod grade:) schists, pelitic schists, granofels	Low to moderately resistant rocks typical of valleys and lowlands with subdued topography; pure sandstone and meta-sediments are more resistant and may form low to moderate hills or ridges
200: ACIDIC SHALE: Fine-grained acidic sedimentary rock with fissile texture	Fissile shales		Low resistance; produces unstable slopes of fine talus
300: CALCAREOUS SEDIMENTARY / META-SEDIMENTARY: basic/alkaline, soft sed/metased rock with high calcium content	Limestone, dolomite, dolostone, other carbonate-rich clastic rocks	Marble	Lowlands and depressions, stream/river channels, ponds/lakes, groundwater discharge areas; soils are thin alkaline clays, high calcium, low potassium; rock is very susceptible to chemical weathering; often underlies prime agricultural areas
400: MODERATELY CALCAREOUS SEDIMENTARY / METASED: Neutral to basic, moderately soft sed/metased rock with some calcium but less so than above	Calc shales, calc pelites and siltstones, calc sandstones	Lightly to mod. metamorphosed calc pelites and quartzites, calc schists and phyllites, calc-silicate granofels	Variable group depending on lithology but generally susceptible to chemical weathering; soft shales often underlie agricultural areas

Geology class	Lithotypes	Meta-equivalents	Comments
500: ACIDIC GRANITIC: Quartz-rich, resistant acidic igneous and high grade meta-sedimentary rock; weathers to thin coarse soils	Granite, granodiorite, rhyolite, felsite, pegmatite	Granitic gneiss, charnockites, migmatites, quartzose gneiss, quartzite, quartz granofels	Resistant, quartz-rich rock, underlies mts and poorly drained depressions; uplands & highlands may have little internal relief and steep slopes along borders; generally sandy nutrient-poor soils
600: MAFIC / INTERMEDIATE GRANITIC: quartz-poor alkaline to slightly acidic rock, weathers to clays	(Ultrabasic:) anorthosite (Basic:) gabbro, diabase, basalt (Intermediate, quartz-poor:) diorite/ andesite, syenite/ trachyte	Greenstone, amphibolites, epidiorite, granulite, bostonite, essexite	Moderately resistant; thin, rocky, clay soils, sl acidic to sl basic, high in magnesium, low in potassium; moderate hills or rolling topography, uplands and lowlands, depending on adjacent lithologies; quartz- poor plutonic rocks weather to thin clay soils with topographic expressions more like granite
700: ULTRAMAFIC: magnesium-rich alkaline rock	Serpentine, soapstone, pyroxenites, dunites, peridotites, talc schists		Thin rocky iron-rich soils may be toxic to many species, high magnesium to calcium ratios often contain endemic flora favoring high magnesium, low potassium, alkaline soils; upland hills, knobs or ridges

Appendix D: Matrix Forest Block Information

Tier	BlockName	Ord Group	Label	Acres
connector	Bent Mt.	15c	4	31925.5
connector	Cowee	20a	16	63642.1
connector	Elk Ridge	15b	22	51881.8
connector	Glade Mt.	21	25	32183.7
connector	Rendezvous Mt.	15b	63	41992.1
connector	Scioto-Stone Mt.	7	69	15440.7
connector	South Mt. Connector	13b	71	11265.6
connector	Stone Mt.	7	74	24352.4
connector	Vannoy	15b	81	45355.4
T1	Amphibolite Mts.	25	1	51023.2
T1	Asheville Watershed/ Curtis Creek	18	2	72746.4
T1	Bald Mts./Rocky Fork	7	3	97470.9
T1	Black Mts.	11	7	71337.8
T1	Blood Mt.	14c	8	20206.3
T1	Blue Wall	16	9	56339.7
T1	Brasstown Bald	9	10	23504.7
T1	Buffalo Mt.	7	11	21424.0
T1	Bull Mt.	5	12	21803.9
T1	Chunky Gal	20a	14	51993.4
T1	Cohutta	1	15	195868.2
T1	Dahlonega/Amicalola	2	17	115582.0
T1	Doe Mt.	6	18	19337.6
T1	Doughton/Stone Mt.	15b	19	38053.0
T1	Dupont/Mt. Bridge	19a	21	53812.5
T1	Grandfather Mt./Adams Mt./John's River	13a	27	109890.1
T1	Great Smokies East	11	28	254767.9
T1	Great Smokies West	9	29	340182.5
T1	Harmon Den/Max Patch/Hurricane Mts.	8	31	113580.3
T1	Headwaters	17b	32	52211.9
T1	Hickory Nut Gorge	16	33	65899.2

Tier	BlockName	Ord Group	Label	Acres
T1	Hiwassee	3	34	100197.3
T1	Holsten Mt.	7	35	58984.2
T1	Horsetrough Mt.	14c	37	31871.9
T1	Iron Mt. East	19c	38	69166.4
T1	Jocassee	16	39	82215.6
T1	Joyce Kilmer/Unicoi Mts./Slick Rock North	9	40	148829.8
T1	Joyce Kilmer/Unicoi Mts./Slick Rock South	9	41	230016.7
T1	Linville Gorge	13a	42	72650.5
T1	Little Switzerland	15a	43	30207.8
T1	Looking Glass/Roy Taylor/Cathy's Creek	23	45	139871.7
T1	Lover's Leap	1	46	38842.0
T1	Macks Mt.	14b	48	42005.6
T1	Mid-Chattooga	4	50	38681.0
T1	Mt. Rogers	21	52	75884.1
T1	Nolichucky	12	54	33877.0
T1	Pink Beds	22b	57	57300.1
T1	Pond Mt.	20b	59	69800.2
T1	Poor Mt.	14a	60	45353.1
T1	Rabun Bald	11	61	49823.7
T1	Raven Cliffs Wilderness	14c	62	27077.3
T1	Richland Balsam	24	65	30703.7
T1	Roan Mt West	22a	66	55225.0
T1	Roan Mt. East	25	67	65580.8
T1	Shining Rock	24	70	35818.2
T1	Standing Indian	22b	73	95508.2
T1	The Snake	7	76	55846.4
T1	Unaka Mt. Wilderness	20b	78	46593.9
T1	Unicoi	14c	79	58029.1
T1	Upper Chattooga/Three State	17b	80	58880.2
T2	Big Bald	22a	5	32524.5
T2	Big Laurel	20b	6	49652.7
T2	Chimney Rock	16	13	13733.2

Tier	BlockName	Ord Group	Label	Acres
T2	Duncan Ridge	17c	20	49468.7
T2	Fires Creek	9	23	60413.3
T2	Forge Mt./Rogers Ridge	12	24	37112.3
T2	Globe	13a	26	35589.1
T2	Green River	16	30	30218.8
T2	Honeycut Mt./Humpback Mt.	15a	36	15930.1
T2	Little Tennessee	11	44	74459.7
T2	Lower Chattooga	4	47	78235.5
T2	Meadow Creek Mt./ Chuckey Mt.	1	49	17612.8
T2	Mt. Bridge West	16	51	14065.6
T2	Nantahala	10	53	16621.3
T2	Panthertown Valley	22b	55	49657.6
T2	Payne Mt.	2	56	15275.1
T2	Plott Balsams	11	58	48520.4
T2	Rich Mt.	9	64	29728.2
T2	Rock Creek/Tails Creek/Cold Spring	3	68	27047.9
T2	Spring Creek Mt.	17a	72	40589.6
T2	Sumter	4	75	34910.8
T2	Tri-County	20a	77	68618.6
T2	White Water	17b	82	39868.5
T2	Yadkin Headwaters	15b	83	49846.0

ELU_Group	Block Name	Revised Name	States	Acres	Largest Roadless Block	% of block	Acres GAP1	Acres GAP 2	Acres GAP 3	%GAP 1	%GAP 2	%GAP 3	%Unsecured	Roads 1-5 (Hwy & Routes)	Roads 6-8 (Local roads)	Roads (4wd and trails)	Road density per 1000 acres	% Pasture/Hay	% % Developed Open Space	Evergreen Plantations or Managed Pine	% Row Crop	% Low Intensity Developed	% Clearcut - Grassland/Herbaceous	% Successional Shrub/Scrub (Utility Swath)	% Successional Shrub/Scrub (Other)	% Successional Shrub/Scrub (Clear Cut)	Communities	Amphibians	Birds	Fish	Mammals	Reptiles	Invertebrates	Non-Vascular Plants	Vascular Plants	Total Taxa	Total Element Occurrences	Hectares
1	Cohutta	Cohutta	GA,NC,TN	195,868	40,752	21	45,550		126,975	23	0	65	12	30	299	27	1.68	1	1	2				1				45	1	708	17	5	23	6	166	97	971.0	79,265
1	Lover's Leap	Lover's Leap	NC,TN	38,842	20,849	54			28,720	0	0	74	26	55	74	6	3.32	3	3					2			9	12		37	5	3	15	5	69	70	153.0	15,719
1	Sol Messer Mt.	Sol Messer Mt.	TN	39,312	11,113	28			16,803	0	0	43	57	11	140		3.82	5	3					2				1		20	3		5		15	14	44.0	15,909
1 Average				**91,341**	**24,238**	**34**	**15,183**		**57,499**	**8**	**0**	**61**	**32**	**32**	**171**	**11**	**2.94**	**3**	**2**	**1**				**2**			**3**	**19.3**	**0.33**	**255**	**8.33**	**2.67**	**14.3**	**3.67**	**83.3**	**60.33**	**389.3**	
2	Dahlonega/Amicalola?	Dahlonega/Amicalola	GA	102,229	36,366	36		24,644	54,494	0	24	53	23	93	199	9	2.86	1	2	2							1	8			4	1		8	101	29	123.0	41,370
2	Burnt/Sassafras Mt.?	Burnt/Sassafras Mt.	GA	13,302	6,923	52		1,204	4,273	0	9	32	59	12	30		3.15	1	3	1				1						1	1				1	3	3.0	5,383
2	Amicalola West?	Amicalola West	GA	11,344	9,715	86			2,321	0	0	20	80	47	26		6.45	2	4	2				1						1							1.0	4,591
2	Payne Mt.	Payne Mt.	NC,TN	15,275	14,595	96				0	0	0	100	6	36		2.72	3	2	1				2			2	1		2		1				5	6.0	6,182
2 Average				**35,538**	**16,900**	**68**		**6,462**	**15,272**	**0**	**8**	**26**	**65**	**39**	**73**	**2**	**3.80**	**2**	**3**	**2**							**0.75**	**2.25**		**1**	**1.25**	**0.5**		**2**	**25.5**	**9.25**	**33.3**	**14,382**
3	Hiwassee	Hiwassee	TN	100,197	15,573	16	4,571		68,991	5	0	69	27	85	232	4	3.16	2	3	1				2				18	2	137	6	1	51	10	96	75	321.0	40,548
3	Web Mt.	Web Mt.	TN	26,389	8,854	34	1,190			5	0	0	95	21	102		4.65	3	3	1				1			3	1		23	1		1	1	2	10	29.0	10,679
3	Fort Mt.	Rock Creek/Tails Creek/Cold Spring	GA	27,048	26,713	99		317	10,026	0	1	37	62	18	49		2.50	1	2	2				1											1	1	1.0	10,946
3	Hiwassee Lake	Hiwassee Lake	NC	14,891	9,865	66			8,519	0	0	57	43	11	52	18	4.18	3	5	5		1		2			3	7					1			8	11.0	6,026
3 Average				**42,131**	**15,252**	**54**	**1,440**	**79**	**21,884**	**2**	**0**	**41**	**57**	**34**	**109**	**6**	**3.62**	**2**	**3**	**2**		**0**		**2**			**1.5**	**6.5**	**0.5**	**40**	**1.75**	**0.25**	**13.3**	**2.75**	**24.8**	**23.5**	**90.5**	
4	Mid-Chattooga	Mid-Chattooga	GA,SC	38,681	13,853	36	3,210		26,866	8	0	69	22	58	166	12	5.78	3	3	1				1				1			12	1	6	7	46	30	73.0	15,654
4	Lower Chattooga	Lower Chattooga	GA,SC	78,235	35,825	46	1,337	2,532	42,977	2	3	55	40	41	224		3.38	3	3	3				1			8	16			14		7	17	199	73	263.0	31,661
4	Sumpter	Sumter	SC	34,911	10,210	29	501		22,420	1	0	64	34	32	203		6.74	4	3	4				1	1		8	1			23		4	37	244	72	320.0	14,128
4 Average				**50,609**	**19,963**	**37**	**1,682**	**844**	**30,754**	**4**	**1**	**63**	**32**	**44**	**197**	**4**	**5.30**	**3**	**3**	**3**				**1**	**0**		**5.33**	**6**			**16.3**	**0.33**	**5.67**	**20.3**	**163**	**58.33**	**218.7**	
5	Fairy Stone	Fairy Stone	VA	130,828	39,133	30		4,732	2,781	0	4	2	94	51	315	19	2.80	8	3	3					1													52,944
5	Bull Mountain	Bull Mt.	VA	21,804	11,017	51		389	2,249	0	2	10	88	4	43	23	2.15	2	1	3				1														8,824
5	Pinnacles of Dan	Pinnacles of Dan	VA	42,550	24,210	57				0	0	0	100	8	105	6	2.67	4	2	1				1														17,219

ELU_Group	Block Name	Revised Name	States	Acres	Largest Roadless Block	% of block	Acres GAP1	Acres GAP 2	Acres GAP 3	%GAP 1	%GAP 2	%GAP 3	%Unsecured	Roads 1-5 (Hwy & Routes)	Roads 6-8 (Local roads)	Roads (4wd and trails)	Road density per 1000 acres	% Pasture/Hay	% % Developed Open Space	Evergreen Plantations or Managed Pine	% Row Crop	% Low Intensity Developed	% Clearcut - Grassland/Herbaceous	% Successional Shrub/Scrub (Utility Swath)	% Successional Shrub/Scrub (Other)	% Successional Shrub/Scrub (Clear Cut)	Communities	Amphibians	Birds	Fish	Mammals	Reptiles	Invertebrates	Non-Vascular Plants	Vascular Plants	Total Taxa	Total Element Occurrences	Hectares
5 Average				**65,061**	**24,786**	**46**		**1,707**	**1,677**	**0**	**2**	**4**	**94**	**21**	**154**	**16**	**2.54**	**5**	**2**	**2**				**1**	**0**													
6	Doe Mt.	Doe Mt.	TN	19,338	18,666	97			2	0	0	0	100	19	36	0	2.82	8	2		1			1				1		2				2	3	6	8.0	7,826
6 Average				**19,338**	**18,666**	**97**			**2**	**0**	**0**	**0**	**100**	**19**	**36**	**0**	**2.82**	**8**	**2**		**1**			**1**				**1**		**2**				**2**	**3**	**6**	**8.0**	
7	The Snake	The Snake	VA,TN	55,846	24,572	44	6,545		41,225	12	0	74	14	43	75	7	2.12	3	1					1				100	4	39	15		6	6	120	47	290.0	22,600
7	Rocky Fork	Bald Mts./Rocky Fork	NC,TN	97,471	86,354	89	7,966		54,546	8	0	56	36	75	129	3	2.09	2	2					2			7	10	5	102	12	1	33	1	97	81	268.0	39,445
7	Holstien Mt.	Holsten Mt.	VA,TN	58,984	37,621	64			53,387	0	0	91	9	26	67	1	1.57	1	1					1				45	3	10	12	1	2	5	118	44	196.0	23,870
7 Average				**70,767**	**49,516**	**66**	**4,837**		**49,719**	**7**	**0**	**73**	**20**	**48**	**90**	**4**	**1.93**	**2**	**1**					**1**			**2.33**	**51.7**	**4**	**50.3**	**13**	**0.67**	**13.7**	**4**	**112**	**57.33**	**251.3**	
8	Max Patch	Max Patch	NC,TN	36,268	12,459	34			19,821	0	0	55	45	49	116	2	4.53	5	3					1			1		2	12	2		6	3	23	28	49.0	14,677
8 Average				**36,268**	**12,459**	**34**			**19,821**	**0**	**0**	**55**	**45**	**49**	**116**	**2**	**4.53**	**5%**	**3**					**1**			**1**		**2**	**12**	**2**		**6**	**3**	**23**	**28**	**49.0**	
9	Great Smokies West	Great Smokies West	NCTN	340,182	313,035	92	297,838		3,104	88	0	1	12	148	400	16	1.61	1	2					1			15	826	14	886	93	31	25	49	133	158	2072.0	137,667
9	Cove Mt. WMA	Cove Mt. WMA	TN	13,600	13,494	99	7,838			58	0	0	42	29	18		3.45		2									8		4	5	4	1	3	2	19	27.0	5,504
9	Brasstown Bald?	Brasstown Bald	GA	23,505	23,338	99	13,076	31	6,333	56	0	27	17	10	24	4	1.44		1	1							2				8				41	36	51.0	9,512
9	Rich Mt.	Rich Mt.	GA	29,728	24,290	82	10,312	195	11,037	35	1	37	28	17	22	1	1.34		1								1				2				16	15	19.0	12,031
9	Joyce Kilmer/Unicoi Mts./Slick Rock	Joyce Kilmer/Unicoi Mts./Slick Rock	NCTN	378,846	84,087	22	37,485		215,162	10	0	57	33	166	832	16	2.64	2	3	1				1			12	424	32	1388	112	15	60	87	157	156	2287.0	153,314
9	Cheoah	Cheoah	NC	39,676	38,558	97		225	23,479	0	1	59	40	85	77	7	4.08	2	3					1			4	19	4	1	4	1	4	2	17	29	56.0	16,056
9	Fires Creek	Fires Creek	NC	60,413	45,199	75			41,342	0	0	68	32	48	138	1	3.07	2	2					1				16		4	1	2	4	3	2	13	32.0	24,448
9	Harmon Den	Harmon Den	NCTN	37,555	27,552	73			24,254	0	0	65	35	32	108	2	3.74	3	3					1			8	1		3	6		1		6	19	21.0	15,198
9	Yellow Creek	Yellow Creek	NC	40,684	14,687	36			22,209	0	0	55	45	72	111	11	4.47	3	4		1			1			26	2	5		2		12	3	5	20	30.0	16,464
9 Average				**107,132**	**64,915**	**75**	**39,219**	**50**	**40,055**	**27**	**0**	**41**	**32**	**67**	**192**	**6**	**2.87**	**1**	**2**	**0**	**0**			**1**			**7.56**	**144**	**6.11**	**254**	**25.9**	**5.89**	**11.9**	**16.3**	**42.1**	**51.67**	**510.6**	
10	Nantahala	Nantahala	NC	16,621	15,597	94			10,061	0	0	61	39	43	32		4.56	1	3					1				2	1	1	1	1	2	5	12	15	25.0	6,726
10 Average				**16,621**	**15,597**	**94**			**10,061**	**0**	**0**	**61**	**39**	**43**	**32**		**4.56**	**1**	**3**					**1**				**2**	**1**	**1**	**1**	**1**	**2**	**5**	**12**	**15**	**25.0**	
11	Great Smokies East	Great Smokies East	NCTN	254,768	197,392	77	194,895	960	10,250	76	0	4	19	149	526		2.65	2	2					1			30	255	32	5	109	10	20	76	155	147	692.0	103,101
11	Plot Balsams	Plott Balsams	NC	48,520	31,847	66	1,714	1,940	5,716	4	4	12	81	65	171	0	4.85	2	4					1			17	3	1		5		4	13	19	30	62.0	19,636
11	Rabun Bald	Rabun Bald	GANC	49,824	23,149	46	1,092		41,948	2	0	84	14	56	135	10	3.83	1	3					1			4	14		1	22	1	1	13	45	55	101.0	20,163

ELU_Group	Block Name	Revised Name	States	Acres	Largest Roadless Block	% of block	Acres GAP1	Acres GAP 2	Acres GAP 3	%GAP 1	%GAP 2	%GAP 3	%Unsecured	Roads 1-5 (Hwy & Routes)	Roads 6-8 (Local roads)	Roads (4wd and trails)	Road density per 1000 acres	% Pasture/Hay	% % Developed Open Space	Evergreen Plantations or Managed Pine	% Row Crop	% Low Intensity Developed	% Clearcut - Grassland/Herbaceous	% Successional Shrub/Scrub (Utility Swath)	% Successional Shrub/Scrub (Other)	% Successional Shrub/Scrub (Clear Cut)	Communities	Amphibians	Birds	Fish	Mammals	Reptiles	Invertebrates	Non-Vascular Plants	Vascular Plants	Total Taxa	Total Element Occurrences	Hectares
11	Qualla	Qualla	NC	15,463	6,762	44	180	938		1	6	0	93	47	62		7.05	2	6			1		1						2		1	1			4	4.0	6,258
11	Black Mts.	Black Mts.	NC	71,338	36,193	51		2,635	47,725	0	4	67	29	106	94	5	2.80	1	2					1			47	10	32		47	2	34	26	97	90	295.0	28,869
11	Little Tennessee	Little Tennessee	NC	74,460	25,455	34			48,327	0	0	65	35	95	170	11	3.55	2	3					1			15	6	4	46	2	4	234	20	27	60	358.0	30,133
11 Average				**85,729**	**53,466**	**53**	**32,980**	**1,079**	**25,661**	**14**	**2**	**39**	**45**	**86**	**193**	**4**	**4.12**	**2**	**3**			**0**					**18.8**	**48**	**11.5**	**9**	**30.8**	**3**	**49**	**24.7**	**57.2**	**64.33**	**252.0**	
12	Forge Mt./Rogers Ridge?	Forge Mt./Rogers Ridge	NCVATN	37,112	25,745	69	170		16,424	0	0	44	55	26	53		2.15	2	1					1				6	2	17	1		3		24	20	53.0	15,019
12	Nolichucky	Nolichucky	NCTN	33,877	30,515	90			26,017	0	0	77	23	49	39	3	2.60	1	3					3				51	1	43	5	1	45	5	69	61	220.0	13,710
12 Average				**35,495**	**28,130**	**80**	**85**		**21,220**	**0**	**0**	**61**	**39**	**38**	**46**	**2**	**2.38**	**2**	**2**					**2**				**28.5**	**1.5**	**30**	**3**	**0.5**	**24**	**2.5**	**46.5**	**40.5**	**136.5**	
13a	Linville Gorge	Linville Gorge	NC	72,650	27,624	38	11,701	645	36,777	16	1	51	32	34	133		2.30	2	3	4				2	1		24		8	1	5	1	6	17	64	52	126.0	29,401
13a	Adams Mt./John's River	Adams Mt./ John's River	NC	19,189	16,402	85			10,506	0	0	55	45	51	28	2	4.14	4	2	3				1						1	1		8		7		17.0	7,766
13a	Globe	Globe	NC	35,589	14,609	41			17,716	0	0	50	50	51	71	3	3.42	3	2	3				1					1		3		1	2	2	7	9.0	14,402
13a Average				**42,476**	**19,545**	**55**		**215**	**25,567**	**0**	**0**	**57**	**43**	**46**	**77**	**1**	**3.29**	**3**	**2**	**3**				**1**	**0**		**8**		**3**	**0.67**	**3**	**0.33**	**5**	**6.33**	**24.3**	**19.67**	**50.7**	
13b	South Mt. Connector	South Mt. Connector	NC	11,266	9,316	83				0	0	0	100	3	17		1.78	2	1	2				1										1	3	4	4.0	4,559
13b Average				**11,266**	**9,316**	**83**				**0**	**0**	**0**	**100**	**3**	**17**		**1.78**	**2**	**1**	**2**				**1**										**1**	**3**	**4**	**4.0**	**4,559**
14a	Poor Mountain	Poor Mt.	VA	45,353	39,287	87	2,630	33	4,061	6	0	9	85	0	95		2.09	2	3			1				1												18,354
14a Average				**45,353**	**39,287**	**87**	**2,630**	**33**	**4,061**	**6**	**0**	**9**	**85**	**0**	**95**		**2.09**	**2**	**3**			**1**				**1**												
14b	Macks Mountain	Macks Mt.	VA	42,006	17,250	41		10		0	0	0	100		68	22	1.62	2	1	2				1														16,999
14b Average				**42,006**	**17,250**	**41**		**10**		**0**	**0**	**0**	**100**		**68**	**22**	**1.62**	**2**	**1**	**2**				**1**														
14c	Horsetrough Mt.?	Horsetrough Mt.	GA	31,872	25,070	79	17,087		12,380	54	0	39	8	54	45	33	3.12		2								3	1			1				33	18	38.0	12,898
14c	Blood Mt.?	Blood Mt.	GA	20,206	9,585	47	7,733	408	11,221	38	2	56	4	36	33	18	3.38		2	1				1			8	1			6			2	43	36	57.0	8,177
14c	Raven Cliffs Wilderness?	Raven Cliffs Wilderness	GA	27,077	20,543	76	9,338		15,124	34	0	56	10	56	28	18	3.12	1	2	1							1	1			3			1	19	13	25.0	10,958
14c	Unicoi	Unicoi	GA	46,594	17,749	31	10,510	2,744	34,971	23	6	75	-4	55	102	24	2.70	1	3	1				1			8	6			16		3		58	29	91.0	18,856
14c Average				**31,437**	**18,237**	**58**	**11,167**	**788**	**18,424**	**37**	**2**	**56**	**4**	**50**	**52**	**23**	**3.08**	**1**	**2**	**1**				**1**			**5**	**2.25**			**6.5**		**0.75**	**0.75**	**38.3**	**24**	**52.8**	
15a	Honeycut Mt./Humpback Mt.	Honeycut Mt./Humpback Mt.	NC	15,930	10,535	66		788	1,875	0	5	12	83	51	26	1	4.83	4	4					1			2						1	17	4	20	24.0	6,447
15a	Little	Little	NC	30,20	23,048	76		506	17,34	0	2	57	41	7	60		4.5	1	3					1			1	1	1		1		1	2	5	9	12.0	12,22

ELU_Group	Block Name	Revised Name	States	Acres	Largest Roadless Block	% of block	Acres GAP1	Acres GAP 2	Acres GAP 3	%GAP 1	%GAP 2	%GAP 3	%Unsecured	Roads 1-5 (Hwy & Routes)	Roads 6-8 (Local roads)	Roads (4wd and trails)	Road density per 1000 acres	% Pasture/Hay	% % Developed Open Space	Evergreen Plantations or Managed Pine	% Row Crop	% Low Intensity Developed	% Clearcut - Grassland/Herbaceous	% Successional Shrub/Scrub (Utility Swath)	% Successional Shrub/Scrub (Other)	% Successional Shrub/Scrub (Clear Cut)	Communities	Amphibians	Birds	Fish	Mammals	Reptiles	Invertebrates	Non-Vascular Plants	Vascular Plants	Total Taxa	Total Element Occurrences	Hectares
	Switzerland	Switzerland		8					9					6			1																					5
15a Average				**23,069**	**16,792**	**71**		**647**	**9,612**	**0**	**3**	**35**	**62**	**64**	**43**	**0**	**4.67**	**3**	**4**					**1**			**1.5**	**0.5**	**0.5**		**0.5**		**1**	**9.5**	**4.5**	**14.5**	**18.0**	
15b	Elk Ridge	Elk Ridge	NC	51,882	12,064	23	285	366	50	1	1	0	99	51	122	12	3.34	6	3	1				2			7		3		1	1		3	6	13	21.0	20,996
15b	Doughton/Stone Mt.	Doughton/Stone Mt.	NC	38,053	20,529	54		19,924	6,626	0	52	17	30	64	81	0	3.80	5	3	2				1			11		1		2	7		5	3	13	29.0	15,399
15b	Rendezvous Mt.	Rendezvous Mt.	NC	41,992	12,961	31		1,280	3,224	0	3	8	89	55	74	4	3.06	6	3	1				3			5					1				6	6.0	16,994
15b	Vannoy	Vannoy	NC	45,355	11,770	26		558	91	0	1	0	99	62	94	5	3.44	7	3	2				2									1			1	1.0	18,355
15b	Yadkin Headwaters	Yadkin Headwaters	NC	49,846	19,259	39		96	7,028	0	0	14	86	53	89	4	2.84	4	2	1				1								1			2	3	3.0	20,172
15b Average				**45,426**	**15,316**	**35**	**57**	**4,445**	**3,404**	**0**	**12**	**8**	**80**	**57**	**92**	**5**	**3.30**	**6**	**3**	**1**				**2**			**4.6**		**0.8**		**0.6**	**2**	**0.2**	**1.6**	**2.2**	**7.2**	**12.0**	
15c	Bent Mountain	Bent Mt.	VA	31,926	12,704	40			26	0	0	0	100	12	61		2.30	3	3																			12,920
15c Average				**31,926**	**12,704**	**40**			**26**	**0**	**0**	**0**	**100**	**12**	**61**		**2.30**	**3**	**3**																			
16	Blue Wall	Blue Wall	NCSC	56,340	17,582	31	21,087	131	1,357	37	0	2	60	31	207	0	4.22	4	5	1				1			18	3		1	18	1	1	7	183	78	235.0	22,800
16	Mt. Bridge West	Mt. Bridge West	NCSC	14,066	12,409	88	1,533	4,096	1	11	29	0	60	25	43	0	4.84	2	3	1				1			20	10			19	1		9	70	67	134.0	5,692
16	Chimney Rock	Chimney Rock	NC	13,733	9,937	72	402	3,380	352	3	25	3	70	13	32	3	3.28	4	3					1			22	17	4		2	1	5	6	66	44	123.0	5,558
16	Hickory Nut Gorge	Hickory Nut Gorge	NC	65,899	26,028	39	1,544	745	3,048	2	1	5	92	43	137		2.72	3	2	1				1			24	10	1		1	2	7	6	21	30	72.0	26,668
16	Green River	Green River	NC	30,219	15,719	52	190		13,025	1	0	43	56	10	78	0	2.94	1	3	2				1			24		6			2	2	5	66	32	105.0	12,229
16	Jocassee	Jocassee	NCSC	82,216	45,097	55		32,941	8,778	0	40	11	49	79	184		3.20	2	2	4				1			40	57	2	18	62	13	6	221	854	198	1277.0	33,271
16	Mt. Bridge	Mt. Bridge	NCSC	28,669	11,471	40		1,578	2,931	0	6	10	84	33	69	0	3.55	5	4	2	1		1	1			13	2		1	1	1		2	12	21	27.0	11,602
16 Average				**41,592**	**19,749**	**54**	**3,537**	**6,124**	**4,213**	**8**	**14**	**11**	**67**	**33**	**107**	**1**	**3.53**	**3**	**3**	**2**	**0**		**0**	**1**			**23**	**14.1**	**1.86**	**2.86**	**14.7**	**3**	**3**	**36.6**	**182**	**67.14**	**281.9**	
17a	Spring Creek Mt.	Spring Creek Mt.	NC	40,590	20,039	49			7,107	0	0	18	82	49	95	0	3.55	5	3					2			11			16				2	12	24	41.0	16,426
17a Average				**40,590**	**20,039**	**49**			**7,107**	**0**	**0**	**18**	**82**	**49**	**95**	**0**	**3.55**	**5**	**3**					**2**			**11**			**16**				**2**	**12**	**24**	**41.0**	
17b	Upper Chattooga/Three State	Upper Chattooga/Three State	GANCSC	58,880	11,052	19	4,186	220	38,455	7	0	65	27	71	186	3	4.36	2	3					1			48	29	3	7	25	4	4	58	217	145	396.0	23,828
17b	White Water	White Water	NCSC	39,868	9,837	25	1,457	857	21,948	4	2	55	39	61	147		5.21	2	2	4				1			29	13		5	18		1	27	180	99	276.0	16,134

ELU_Group	Block Name	Revised Name	States	Acres	Largest Roadless Block	% of block	Acres GAP1	Acres GAP 2	Acres GAP 3	%GAP 1	%GAP 2	%GAP 3	%Unsecured	Roads 1-5 (Hwy & Routes)	Roads 6-8 (Local roads)	Roads (4wd and trails)	Road density per 1000 acres	% Pasture/Hay	% % Developed Open Space	Evergreen Plantations or Managed Pine	% Row Crop	% Low Intensity Developed	% Clearcut - Grassland/Herbaceous	% Successional Shrub/Scrub (Utility Swath)	% Successional Shrub/Scrub (Other)	% Successional Shrub/Scrub (Clear Cut)	Communities	Amphibians	Birds	Fish	Mammals	Reptiles	Invertebrates	Non-Vascular Plants	Vascular Plants	Total Taxa	Total Element Occurrences	Hectares
17b	Headwaters	Headwaters	NCSC	52,212	36,876	71	1,677	13,809	11,088	3	26	21	49	47	132	2	3.42	2	3	1			1				17	20	5	2	46	2	1	39	300	139	436.0	21,129
17b	Tiger	Tiger	GA	15,607	15,431	99			11,094	0	0	71	29	9	43		3.35	2	3	3			1												1	1	1.0	6,316
17b Average				**41,642**	**18,299**	**54**	**1,830**	**3,722**	**20,646**	**3**	**7**	**53**	**36**	**47**	**127**	**1**	**4.08**	**2**	**3**	**2**			**1**				**23.5**	**15.5**	**2**	**3.5**	**22.3**	**1.5**	**1.5**	**31**	**175**	**96**	**277.3**	
17c	Duncan Ridge?	Duncan Ridge	GA	49,469	15,226	31	3	7,097	35,186	0	14	71	15	60	138	7	4.00	1	2				1				1	5		1	10	5	1	3	53	29	79.0	20,019
17c	Rocky Mt.?	Rocky Mt.	GA	13,353	12,927	97		194	10,676	0	1	80	19	35	28		4.74	2	2	1			1					2		2					11	8	15.0	5,404
17c Average				**31,411**	**14,077**	**64**	**1**	**3,646**	**22,931**	**0**	**8**	**76**	**17**	**47**	**83**	**3**	**4.37**	**2**	**2**	**1**			**1**				**0.5**	**3.5**		**1.5**	**5**	**2.5**	**0.5**	**1.5**	**32**	**18.5**	**47.0**	
18	Grandfather Mt.	Grandfather Mt.	NC	90,701	18,438	20	2,429	8,901	57,208	3	10	63	24	128	206	18	3.68	3	3	1			1				22	2	6		25	5	9	19	70	63	158.0	36,705
18	Asheville Watershed/Curtis Creek	Asheville Watershed/Curtis Creek	NC	72,746	44,181	61	143	1,435	36,466	0	2	50	48	71	94	3	2.26	1	2								54		9		2	2	7	9	21	38	104.0	29,439
18 Average				**81,724**	**31,309**	**41**	**1,286**	**5,168**	**46,837**	**1**	**6**	**57**	**36**	**99**	**150**	**10**	**2.97**	**2**	**3**	**1**			**1**				**38**	**1**	**7.5**		**13.5**	**3.5**	**8**	**14**	**45.5**	**50.5**	**131.0**	
19a	Dupont West	Dupont West	NC	9,826	7,802	79	171		2,728	2	0	28	70	6	36		4.28	3	3	1			1				9	8					1		39	19	57.0	3,977
19a	Dupont	Dupont	NC	25,144	9,103	36			10,748	0	0	43	57	9	64	1	2.91	3	3	3			1				50	28				1	1	4	48	31	132.0	10,175
19a Average				**17,485**	**8,453**	**58**	**86**		**6,738**	**1**	**0**	**35**	**64**	**7**	**50**	**0**	**3.59**	**3**	**3**	**2**			**1**				**29.5**	**18**				**0.5**	**1**	**2**	**43.5**	**25**	**94.5**	
19b	Cathy's Creek	Cathy's Creek	NC	25,808	10,287	40			18,757	0	0	73	27	59	43		3.95	1	2				1				2	3				3	3	1	6	12	18.0	10,444
19b	N. Fork French Broad	N. Fork French Broad	NC	14,559	4,873	33			7,269	0	0	50	50	42	57		6.83	5	6				1				3	3				1	3	1	6	12	17.0	5,892
19b Average				**20,183**	**7,580**	**37**			**13,013**	**0**	**0**	**61**	**39**	**50**	**50**		**5.39**	**3**	**4**				**1**				**2.5**	**3**				**2**	**3**	**1**	**6**	**12**	**17.5**	
19c	Mount Rogers	Iron Mt. East	VA	69,166	17,659	26	4,549	28	45,960	7	0	66	27	20	126	8	2.11	3	2	4			1															27,991
19c Average				**69,166**	**17,659**	**26**	**4,549**	**28**	**45,960**	**7**	**0**	**66**	**27**	**20**	**126**	**8**	**2.11**	**3**	**2**	**4**			**1**															
20a	Chunky Gal	Chunky Gal	NC	51,993	25,712	49	1,842		37,637	4	0	72	24	70	96		3.19	2	2				1				9	26	2		3	8	10	14	55	56	127.0	21,041
20a	Cowee	Cowee	NC	63,642	13,208	21			20,754	0	0	33	67	88	258		5.45	3	4				1				37	2	1	2	1	6	5	18	62	55	134.0	25,755
20a	Tri-County	Tri-County	NC	68,619	24,190	35			14,794	0	0	22	78	56	244		4.37	3	3				2				6	2	2		1	1		1	15	19	28.0	27,769
20a Average				**61,418**	**21,037**	**35**	**614**		**24,395**	**1**	**0**	**42**	**57**	**72**	**199**		**4.34**	**3**	**3**				**1**				**17.3**	**10**	**1.67**	**0.67**	**1.67**	**5**	**5**	**11**	**44**	**43.33**	**96.3**	
20b	Pond Mt.	Pond Mt.	NCTN	69,800	12,865	18	6,964		26,483	10	0	38	52	49	186	16	3.37	5	4				2					7	5	43	8	1	15	6	265	57	350.0	28,247

ELU_Group	Block Name	Revised Name	States	Acres	Largest Roadless Block	% of block	Acres GAP1	Acres GAP 2	Acres GAP 3	%GAP 1	%GAP 2	%GAP 3	%Unsecured	Roads 1-5 (Hwy & Routes)	Roads 6-8 (Local roads)	Roads (4wd and trails)	Road density per 1000 acres	% Pasture/Hay	% % Developed Open Space	Evergreen Plantations or Managed Pine	% Row Crop	% Low Intensity Developed	% Clearcut - Grassland/Herbaceous	% Successional Shrub/Scrub (Utility Swath)	% Successional Shrub/Scrub (Other)	% Successional Shrub/Scrub (Clear Cut)	Communities	Amphibians	Birds	Fish	Mammals	Reptiles	Invertebrates	Non-Vascular Plants	Vascular Plants	Total Taxa	Total Element Occurrences	Hectares
20b	Unika Mt. Wilderness	Unaka Mt. Wilderness	NCTN	58,029	25,745	55	4,465		17,758	8	0	31	62	56	83	1	2.98	4	2					2			4	73	6	8	59		14	2	64	67	229.0	23,484
20b	Hurricane Mts.	Hurricane Mts.	NC	39,757	16,183	41			11,309	0	0	28	72	72	99		4.30	7	3		1			1			11	1	2		1		1		18	20	34.0	16,089
20b	Big Laurel	Big Laurel	NCTN	49,653	20,321	41			5,100	0	0	10	90	33	112	3	2.94	5	3					2			2	9		1			5		3	10	20.0	20,094
20b Average				**54,310**	**18,779**	**39**	**2,857**		**15,162**	**4**	**0**	**27**	**69**	**53**	**120**	**5**	**3.39**	**5**	**3**		**0**			**2**			**4.25**	**22.5**	**3.25**	**13**	**17**	**0.25**	**8.75**	**2**	**87.5**	**38.5**	**158.3**	
21	Jefferson/Iron Mt.	Mt. Rogers	VA	75,884	34,681	46	9,382	4,569	47,973	12	6	63	18	31	141		2.27	2	1					1			4											30,709
21	Sugar Grove	Glade Mt.	VA	32,184	8,369	26			20,041	0	0	62	38	7	62	6	2.15	2	2								3											13,024
21 Average				**54,034**	**21,525**	**36**	**4,691**	**2,285**	**34,007**	**6**	**3**	**63**	**28**	**19**	**102**	**3**	**2.21**	**2**	**2**					**1**			**3.5**											
22a	Roan Mt West	Roan Mt West	NCTN	55,225	19,463	35	686	1,492	18,042	1	3	33	63	74	135	4	3.79	5	3				1	1			20	149	17	25	48		53	51	232	143	595.0	22,349
22a	Big Bald	Big Bald	NCTN	32,524	19,395	60			6,498	0	0	20	80	45	68	1	3.47	5	3					1				2	4	14	1		6	1	29	37	57.0	13,162
22a Average				**43,875**	**19,429**	**48**	**343**	**746**	**12,270**	**1**	**1**	**26**	**72**	**59**	**102**	**3**	**3.63**	**5**	**3**				**1**	**1**			**10**	**75.5**	**10.5**	**19.5**	**24.5**		**29.5**	**26**	**131**	**90**	**326.0**	
22b	Standing Indian	Standing Indian	GANC	95,508	57,585	60	11,626	315	69,155	12	0	72	15	43	127	15	1.78	1	1					1			34	29	5	9	19	7	2	11	130	102	246.0	38,651
22b	Pink Beds	Pink Beds	NC	57,300	31,636	55		646	45,735	0	1	80	19	52	59		1.94	1	2								42	16	1	1	3	2	1	5	54	39	125.0	23,189
22b	Cullasaja	Cullasaja	NC	32,974	25,535	77			15,614	0	0	47	53	30	112		4.33	2	3					1			38		1		3	5	9	53	39	69	148.0	13,344
22b	Panthertown Valley	Panthertown Valley	NC	49,658	13,996	28			13,074	0	0	26	74	63	166	0	4.62	4	3					2			74	5	1			5	5	55	69	63	214.0	20,096
22b Average				**58,860**	**32,188**	**55**	**2,906**	**240**	**35,894**	**3**	**0**	**56**	**40**	**47**	**116**	**4**	**3.17**	**2**	**2**					**1**			**47**	**12.5**	**2**	**2.5**	**6.25**	**4.75**	**4.25**	**31**	**73**	**68.25**	**183.3**	
23	Mt. Pisgah	Mt. Pisgah	NC	14,202	8,194	58		690	3,163	0	5	22	73	31	43	0	5.22	3	4					1			7		1		4		3	4	8	25	27.0	5,747
23	Roy Taylor	Roy Taylor	NC	93,625	40,730	44		1,643	44,882	0	2	48	50	119	283	0	4.30	3	3					1			59	3	5	15	17	1	2	17	83	60	202.0	37,889
23	Looking Glass	Looking Glass	NC	20,439	17,234	84		350	19,217	0	2	94	4	53	21		3.62	1	3					1			21		4				1	12	41	21	79.0	8,271
23 Average				**42,755**	**22,053**	**62**		**894**	**22,421**	**0**	**3**	**55**	**42**	**68**	**116**	**0**	**4.38**	**2**	**3**					**1**			**29**	**1**	**3.33**	**5**	**7**	**0.33**	**2**	**11**	**44**	**35.33**	**102.7**	
24	Richland Balsam	Richland Balsam	NC	30,704	18,049	59		1,035	24,523	0	3	80	17	69	58		4.13	1	2					1			26	1	7		19		1	8	25	43	87.0	12,425
24	Shining Rock	Shining Rock	NC	35,818	31,825	89		581	26,968	0	2	75	23	78	80		4.38	1	2					2			9	1	10		42	1	1	9	14	44	87.0	14,495
24 Average				**33,261**	**24,937**	**74**		**808**	**25,746**	**0**	**2**	**78**	**20**	**73**	**69**		**4.26**	**1**	**2**					**2**			**17.5**	**1**	**8.5**		**30.5**	**0.5**	**1**	**8.5**	**19.5**	**43.5**	**87.0**	

ELU_Group	Block Name	Revised Name	States	Acres	Largest Roadless Block	% of block	Acres GAP1	Acres GAP 2	Acres GAP 3	%GAP 1	%GAP 2	%GAP 3	%Unsecured	Roads 1-5 (Hwy & Routes)	Roads 6-8 (Local roads)	Roads (4wd and trails)	Road density per 1000 acres	% Pasture/Hay	% % Developed Open Space	Evergreen Plantations or Managed Pine	% Row Crop	% Low Intensity Developed	% Clearcut - Grassland/Herbaceous	% Successional Shrub/Scrub (Utility Swath)	% Successional Shrub/Scrub (Other)	% Successional Shrub/Scrub (Clear Cut)	Communities	Amphibians	Birds	Fish	Mammals	Reptiles	Invertebrates	Non-Vascular Plants	Vascular Plants	Total Taxa	Total Element Occurrences	Hectares
25	Amphibolite Mts.	Amphibolite Mts.	NC	51,023	16,528	32	3,001	2,696	3,659	6	5	7	82	6	108		2.24	5	2					2			93	5	16	3	2	7	2	32	262	128	422.0	20,648
25	Roan Mt. East	Roan Mt. East	NCTN	65,581	38,340	58	1,714	1,152	7,506	3	2	11	84	50	153	0	3.10	6	3					2			20	125	12	26	51	4	7	13	179	96	437.0	26,540
25 Average				**58,302**	**27,434**	**45**	**2,358**	**1,924**	**5,582**	**4**	**4**	**9**	**83**	**28**	**131**	**0**	**2.67**	**6**	**3**					**2**			**56.5**	**65**	**14**	**14.5**	**26.5**	**5.5**	**4.5**	**22.5**	**221**	**112**	**429.5**	
Grand Average				**53,822**	**26,774**	**55**	**7,411**	**1,571**	**21,675**	**7**	**3**	**40**	**50**	**48**	**117**	**5**	**3.45**	**3**	**3**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**12**	**26**	**2.9**	**37**	**11**	**1.9**	**8.2**	**12**	**62**	**40.7**	**171.8**	

Appendix F: Key to Columns in Appendix E

Field Names	Description
ELU_Group	A group of forest blocks with similar geophysical attributes. (The number is derived from a cluster analysis)
Block Name	Original name assigned at the block meetings
Revised Name	Revised names
States	States included in this block
Acres	Block size in acres
Largest Roadless Block	The size of the largest completely roadless block inside the overall block
% of block	Percent of forest block covered by the largest roadless block
Acres GAP1	Acres of GAP 1 secured land (permanent protection for nature)
Acres GAP 2	Acres of GAP 2 secured land (permanent protection with some manipulations)
Acres GAP 3	Acres of GAP 3 secured lands (permanet securement for multiple uses)
%GAP 1	% of block in GAP 1
%GAP 2	% of block in GAP 2
%GAP 3	% of block in GAP 3
%Unsecured	% of block that is unsecured
Roads1-5 (Hwy & Routes)	Miles of roads class 1-5 (interstates, US routes, State routes, Parkways, service roads, ramps)
Roads6-8 (Local roads)	Miles of roads class 6-8 (local roads lanses streets avenues, driveways)
Roads(4wd and trails)	Miles of 4 w drive roads and trails
Rd density per 1000 acres	Miles of class 1-8 roads divided by block size * 1000
Pasture/Hay	% of modified environments based on the SE GAP habitat map
Developed Open Space	% of modified environments based on the SE GAP habitat map
Evergreen Plantations or Managed Pine (can include dense successional regrowth)	% of modified environments based on the SE GAP habitat map
Row Crop	% of modified environments based on the SE GAP habitat map
Low Intensity Developed	% of modified environments based on the SE GAP habitat map
Clearcut - Grassland/Herbaceous	% of modified environments based on the SE GAP habitat map
Successional Shrub/Scrub (Utility Swath)	% of modified environments based on the SE GAP habitat map
Successional Shrub/Scrub (Other)	% of modified environments based on the SE GAP habitat map

Field Names	Description
Successional Shrub/Scrub (Clear Cut)	% of modified environments based on the SE GAP habitat map
Communities	Tracked Community occurrences
Amphib	Occurrences of tracked amphibians
Birds	Occurrences of tracked birds
Fish	Occurrences of tracked fish
Mammals	Occurrences of tracked mammals
Reptiles	Occurrences of tracked reptiles
Inverts	Occurrences of tracked invertebrates (insects, mussels, spiders etc)
Non Vascular	Occurrencs of non vascular plants (mosses, lichens, ferns)
Vascular Plants	Occurrences of vascular plants
Total Taxa	Total number of species
Total EO	Total number of occurrences
Hectares	Block size in hectares