Xeric Longleaf Pine Vegetation of the Atlantic and East Gulf Coast Coastal Plain: an Evaluation and Revision of Associations within the U.S. National Vegetation Classification

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Keywords:
Cluster analysis; ordination; pine barrens; pine savannas; longleaf pine; US National Vegetation Classification

Abbreviations:
CVS=Carolina Vegetation Survey; NMS=Nonmetric multidimensional scaling; USNVC=United States National Vegetation Classification

Nomenclature:
Weakley 2006; Wunderlin and Hansen 2011 for peninsular Florida

Submitted: 22 August 2013
Revised: 25 February 2014

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Abstract

Xeric Longleaf Pine Woodlands of the Atlantic and Gulf Coastal Plains constitute a well-established Group (154) within the U.S. National Vegetation Classification (USNVC), containing 31 Associations in two Alliances. We identified a candidate set of 356 high-quality vegetation plots to span the range of variation in the Group as represented in the Carolinas, Georgia, and Florida. Numerical clustering divided these plots into three geographically coherent subsets that we propose as Alliances. Several sets of plots were subsequently deleted from the analysis because they were found to have higher affinities with other USNVC Groups, resulting in a final dataset of 290 plots. The first Alliance spans the Coastal Plain of North Carolina and northern South Carolina, stopping approximately at the southern edge of the range of *Aristida stricta*, the second extends from central South Carolina to approximately the Florida border, and the third covers much of Florida and immediately adjacent Georgia. We recognize 9 Associations in the first Alliance, most of which are equivalent to or modest revisions of extant types, 10 in the second that again are mostly similar to but refinements of extant types, and 7 in Florida, most of which represent significant changes from Associations previously recognized.

Preamble

Vegetation description and classification are critical for many aspects of theoretical and applied science (Jennings et al. 2009; Peet and Roberts 2013). In particular, they are important to basic research for documenting the ecological context within which observations were made, and for conservation and management initiatives for providing essential observation, inventory, restoration, and protection units. Furthermore, they provide a basis for determining ecological condition, planning ecological restoration, and assessing resource management success. To address these needs in a consistent and efficient manner for multiple stakeholders, the US Federal Geographic Data Committee established a federal standard for vegetation classification (US FGDC 2008). This standard mandates that Associations and Alliances recognized in the US National Vegetation Classification be based on quantitative, publicly available plot data and that proposed changes be evaluated through a peer review system.

Although the USNVC contains a set of approximately 7000 Associations intended to perfectly tile the universe of variation in natural vegetation within the US, most of these Associations have not been verified or documented using quantitative data, and few of the descriptions include the FGDC-mandated detailed summary tables and lists of diagnostic species. Although there is great need to quantitatively validate and fully describe types, and then process the results within a rigorous peer-review system, the best practices for doing so remain ill defined. This project was undertaken as a demonstration of how proposals for validation or revision of sections of the USNVC should be developed, presented, and peer reviewed, and the results disseminated.

Introduction

At the time of European settlement, fire-maintained longleaf pine (*Pinus palustris*) vegetation dominated much of the southeastern Coastal Plain from southern Virginia south through Florida and west to eastern Texas, although today less than 3% of the area once dominated by longleaf pine remains (Frost

2006). Much of what remains is highly degraded, typically from fire suppression. Because this vegetation has primarily one dominant tree species over an understory dominated by grasses, it looks deceptively simple. Nonetheless, this system is rich in endemic species with considerable geographic turnover (Sorrie and Weakley 2001; Peet 2006; Carr et al. 2009; Noss 2013). Locally, composition varies dramatically with small-scale variation in soil texture, moisture, and base-cation availability. Species richness can vary from only a few species on the most sterile sands to the highest values yet reported for temperate North America on more favorable sites (Peet 2006; Carr et al. 2010; Peet, Palmquist, and Tessel 2014). As a consequence of this floristic complexity, in excess of 130 Associations have been described within the USNVC for longleaf pine vegetation. Careful review by Peet (2006) and Carr et al. (2010) has suggested that many of these Associations need revision, and multiple new Associations are needed in order to capture the range of variation in this ecosystem.

Peet (2006) recognized several distinct, higher-order types of longleaf pine vegetation on the southeastern Coastal Plain, including barrens, xeric and subxeric sandy woodlands, flatwoods (wet sands), savannas (moist to wet silty soils), and dry silty woodlands. Here we describe and revise Associations of barrens and xeric and subxeric sandy woodlands that collectively constitute the USNVC Group Xeric Longleaf Pine Woodland (G154). We focus on Associations that occur within the Carolinas, Georgia, and Florida, owing to limitations in publicly available plot data for states west of Florida.

Methods

Scope of Work and Data Selection

The formal scope of this classification initiative includes the 31 currently recognized Associations of USNVC Group 154, Xeric Longleaf Pine Woodland. However, because revision might be needed regarding which Associations should be included in Group 154, we initially considered all longleaf pine vegetation types within the USNVC, which in addition to Group 154, spanned Groups G009 (Dry-mesic Longleaf Pine Woodland), G596 (Mesic Longleaf Pine Flatwoods - Spodosol Woodland), and G190 (Wet-mesic Longleaf Pine Woodland). This also assured we would not miss vegetation plots that had been misclassified.

We first compiled a comprehensive set of longleaf pine vegetation plots from the Carolina Vegetation Survey (CVS) database (Peet et al. 2012a). All plots in the CVS database were originally selected to represent close to natural or reference conditions. For longleaf pine sites, this would include almost exclusively sites with a fire-management regime designed to maintain the natural structure of the ground layer vegetation and its composition.

Plots were selected from the CVS database based on several key criteria. We searched for plots that contained plant species that are characteristically associated with the longleaf pine ecosystem, including *Pinus palustris*, *Pinus elliottii*, *Aristida stricta*, and *Aristida beyrichiana*. We also searched for plots that had been previously assigned to a longleaf pine Association. We went through several iterations of excluding plots not applicable to the current analysis (e.g., *Pinus palustris* was present, but in a community type that was outside of the four focal Groups). We then excluded plots that were outside of the geographic scope of the analysis (North Carolina, South Carolina, Georgia, Alabama and Florida) and

plots that were less than 100 m² in size. The final dataset included 996 plots, ranging in size from 100 to 1000 m² (see Appendix 1 for a link to these plots in VegBank; see Peet et al. 2012b). We subsequently added 7 plots from southern Virginia to represent an area absent in our initial dataset, thus bringing our dataset to 1003 plots.

Field Methods

Of the 1003 plots identified for consideration, 942 are vegetation plots that were sampled using the CVS protocol (Peet et al. 1998, 2012a), which contain nested subplots (0.01, 0.1, 1, 10, 100, usually 400 and 1000 m^2). Presence of all vascular plant species was recorded for all subplot sizes, the CVS cover-class code (see Peet et al. 1998) was recorded for the plot as a whole and for 100 m^2 subplots, and DBH (Diameter at Breast Height, 1.37m) was recorded for all woody stems. Peet et al. (1998) created ten cover class codes to reflect ranges of percent cover; they include: 1 (trace), 2 (0-1%), 3, (1-2%), 4 (2-5%), 5 (5-10%), 6 (10-25%), 7 (25-50%), 8 (50-75%), 9 (75-95%), and 10 (100%). In addition, site data (e.g., aspect, slope, elevation) and soil samples from the A horizon (top 0.1 m mineral soil, sometimes also including part of the E horizon) and usually subsoil (approximately 40-60 cm depth, as an approximation of the B horizon though sometimes spanning some of the E or C) were collected. Soil samples were later analyzed for texture (sand, silt, clay %), exchangeable cations (Ca, Mg, K, Na in ppm), extractable micro-nutrients (Al, Fe, Mn, Cu, B in ppm), percent base saturation for Ca, Mg, K, Na, and H, estimated N release, soluble S, easily extractable P, percent organic matter, percent base saturation, total cation exchange capacity (meq/100g), pH, and bulk density (g/cc). Extractions were carried out using the Mehlich III method (Mehlich 1984) and percent organic matter was determined by loss on ignition. Texture analysis employed the Bouyoucos hydrometer method (Patrick 1958). All analyses were conducted by Brookside Laboratories of New Oxford, Ohio.

The remaining 61 plots were sampled by NatureServe and the Virginia Natural Heritage Program, and differ slightly in methodology. Presence of all vascular plant species was recorded and cover was estimated for each species within the plot using the CVS cover class scale, but DBH for woody stems was not measured. For the NatureServe data, species richness recorded for these plots is typically somewhat lower than for comparable plots collected using the CVS protocol owing to the more rapid survey approach. In addition, soil samples were not collected, so these plots lack detailed soil information. The size of NatureServe and Virginia Heritage plots was similar to CVS plots and ranged from 200 to 1000 m².

Data Preparation and Taxonomic Standardization

To minimize the degree to which differences in the resolution of taxonomic names between studies and field observers influenced community dissimilarity and hence group entitation, we standardized taxonomic names prior to analysis. First, we summarized all of the unique taxonomic names in the dataset. We removed unknown taxa, ambiguous taxa (e.g., *Aster* sp.), hybrid taxa, non-vascular plant taxa, and family- and higher-level taxa. When there were taxa identified to species within a genus (e.g., *Agalinis aphylla*), but also taxa whose highest level of resolution was to genus (*Agalinis* sp.), we usually chose to remove the genus-level taxa. However, if there were many genus-level identifications

relative to species-level identifications (e.g., *Antennaria* [*parlinii* + *plantaginifolia*] = 9; *Antennaria parlinii* =1, and *Antennaria plantaginifolia* = 3), we chose to lump the species-level taxa into a genus-level complex. Juvenile *Serenoa repens* and *Sabal etonia* were often not distinguished in the field, but we retained them as separate species in the dataset because the adults are distinctive, their overall ecologies are quite different, and *Sabal etonia* is endemic to central and southern Florida. We removed 207 taxa from the dataset, while several were lumped into larger taxonomic complexes.

Three grass genera differed greatly in their taxonomic resolution within sections of the dataset: *Dichanthelium*, *Andropogon*, and *Schizachyrium*. Several *Dichanthelium* species were lumped to larger taxonomic complexes or aggregate species (37 unique *Dichanthelium* taxa remained) and 204 occurrences of *Dichanthelium* sp. were removed. Decisions about *Andropogon* and *Schizachyrium* were more challenging and in the end more arbitrary. Most *Andropogon* and *Schizachyrium* species are difficult to identify from vegetative characters alone, which is the only available means for identification in the early to mid-summer months when most of the vegetation sampling took place. Plots in Florida were the exception to this rule and were sampled from late summer through the fall. As a result, there were 374 instances in our dataset where either *Andropogon* or *Schizachyrium* was not identified to species, 300 of which included both genera in a single taxonomic complex: '*[Andropogon + Schizachyrium]'*. Because *Andropogon* and *Schizachyrium* species turn over across community types and define some types, we felt it highly desirable to retain as much species-level information as possible. Thus, we retained all taxa identified to the species-level. Rather than remove the 374 genus-level occurrences, we decided to leave them in with one caveat: we added a genus-level complex placeholder (*[Andropogon + Schizachyrium]*) to plots that contained species-level identification of either genus. This placeholder served to indicate where *Andropogon* or *Schizachyrium* were present and hence plots with either of these species might group together, despite poor identification of these genera to species. Each placeholder *[Andropogon + Schizachyrium]* was then assigned a cover value. If there was only one species of *Andropogon* or *Schizachyrium* present in the plot, the placeholder taxon was assigned the same cover code value as the species. If there were more than one species of *Andropogon* or *Schizachyrium* in a plot, we combined their cover values using the equation suggested by Jennings et al. (2009; see Peet and Roberts 2013).

Because not all plots included separation of species into vertical strata, we combined species cover values spread across multiple strata into a single cover using the equation proposed by Jennings et al. (2009). Although most plots include data from multiple scales of observation, we consistently used the largest scale available, with the result that our plots varied in size from 100 to 1000 m^2. For all multivariate analyses we used the CVS raw cover-code classes (1-10).

Data Analysis

The full dataset consisted of 1003 plots and 1385 species, and spanned nearly all of the known longleaf pine Associations within the four-state Coastal Plain focal area. To partition this dataset to include only the subxeric and xeric longleaf pine types within our scope we used several multivariate techniques (as recommended by Peet and Roberts 2013). First, we calculated a Sørenson dissimilarity matrix from the three-column vegetation dataset (plot, species, cover class code) and then used agglomerative, hierarchical clustering with flexible-group linkage (b= -0.25) on all 996 plots with an initial cluster number of 200 (based on an expectation of 100-150 total Associations of varying internal

heterogeneity). To assess whether plots were assigned to the correct cluster, we used two cluster validity approaches (Peet and Roberts 2013). First, we calculated silhouette width, which is the goodness of fit of a plot to its cluster, to identify plots that were more similar in species composition to a different cluster than the one they were initially assigned to. Second, we used the optpart function in R (package optpart), a non-hierarchical clustering algorithm that improves a classification by swapping plots from one cluster to another to maximize the partana ratio, which compares the mean similarity within clusters to the mean similarity among clusters. Using these methods in tandem with information on soil properties, site conditions, and geographic locations of plots, we identified the groups within the dendrogram with strong affinity with xeric and subxeric longleaf types, yielding a total of 356 plots, containing 883 unique taxa.

Our next step was to rerun agglomerative, hierarchical clustering with flexible-group linkage (b = -0.25) on the 356 candidate xeric plots to complete initial entitation. As above, we used silhouette width and the optpart function to assess cluster validity and reassign plots to better-fit clusters. We also used the optpart function with cluster numbers of 20, 30 and 40 to provide different levels of resolution to allow us to find a level of splitting as close to the extant USNVC Associations as possible. The next steps were to determine the homogeneity and interpretability of the clusters. We used non-metric multidimensional scaling (NMS) ordination using the bestnmds function in R (package labdsv) to visualize the homogeneity of plots within each cluster. The bestnmds function is an iterative approach that uses several random starts to minimize the stress of an NMS ordination (e.g., how well the actual dissimilarities between plots are represented in ordination space). We then highlighted plots in the NMS ordination belonging to the same cluster and overlaid environmental and site vectors (e.g., sand, silt, clay, latitude, longitude, pH, organic matter, and plot species richness at 100 m^2). In addition, we generated constancy tables for each cluster, which included the average cover and constancy of each species in each cluster. Once plots were stable in their assignment to a given cluster, we used the Murdoch Preference Function (R package optpart, function murdoch) to identify indicator taxa for each cluster. This metric uses the modified Murdoch statistic: log ((*p*/*a*) * (*n*-*p*_i)/*n_i*), where *p* = number of samples where species is present, *a* = number of samples where species is absent, *n* = total number of samples (p+a), *p_i* = number of samples in type i where species is present, *n_i* = number of samples in type i. High, positive values indicate very good indicator species for a particular group, but any species above zero is somewhat indicative. Indicator taxa were highlighted in grey in all constancy tables for species that had 0.5 or higher Murdoch statistics. We then calculated homoteneity for each proposed Association, using the homoteneity function in package labdsv in R. Homoteneity is reported for each proposed Association in the constancy tables in Appendix 2. These steps revealed several clusters that were slightly too mesic, silty, or transitional (e.g. transitional to scrub, G596) to be included in G154. Once removed, the final dataset consisted of 290 plots, ultimately found to span 25 Associations. All statistical analyses were conducted using the R Statistical Software (R Core Team 2013).

We compared results obtained with the various clustering methods, seeking groups that were relatively consistent with extant Associations. Where possible we retained extant types, but were open to change in definition of types and to replacement with new types where the clustering results suggested this. The level of lumping versus splitting was somewhat arbitrary, but aimed at consistency with the current USNVC. However, all types described below were the result of the clustering algorithm, and in that sense were entirely objective. Only the level of splitting should be viewed as arbitrary, and that was informed by the level of splitting in the current USNVC.

Format of Results

Results are arranged in five sections, with first a proposal for revision and splitting of the current Alliances into four new Alliances (Part 1), and then four subsequent sections presenting the details of these four new Alliances (Parts 2-5). For three of the newly proposed Alliances, we provide detailed proposals for revision or improvement of extant USNVC Associations contained within those Alliances. We were unable to provide detailed revision of Associations within the fourth proposed Alliance due to a lack of publicly available plot data.

For each of the proposed Alliances described above, we present proposals for revision of Associations in a standard structure. We first present a brief overview of the compositional and environmental variation associated with the recognized Associations. An NMS ordination summarizes variation in composition and its relationship to environmental drivers (Figures 5, 7, 9). Three tables are presented: one shows the relationships between the proposed Associations and previously accepted Associations of the USNVC (Tables 2, 5, 8), a second summarizes the floristic composition of the proposed Associations within an Alliance in terms of their prevalent and indicator species (Tables 3, 6, 9), and a third quantifies variation in species richness at various scales and key environmental variables across the proposed Associations (Tables 4, 7, 10). Tables 3, 6, and 9 list prevalent species for each growth form (i.e. tree, shrub, vine, herb) for each Association. The number of species listed for each growth form corresponds to the mean species richness of that growth form in each Association. Hence, there may be some species that have relatively high constancy, but do not appear in the table. A more complete list of all species with at least 20% constancy can be found in Appendix 2.

In the text of the Results section we present summaries for each of the proposed Associations, including a proposed name, a concept summary description characterizing both vegetation and environment, diagnostic characteristics, similar USNVC types, a paragraph describing proposed Subassociations where relevant, and finally a discussion of the relationship of the proposed Association to previously accepted Associations.

There are also several critical appendices. Appendix 1 provides links to VegBank datasets (Peet et al. 2012b) containing plots used to characterize each Association. These links provide summary lists, links to full plot data, and links to a map showing the spatial distribution of the component plots. Appendix 2 contains detailed constancy tables for all of the proposed Associations, showing frequency and cover for all species that occur in > 20% of plots. In addition, Appendix 2 contains revised formal and detailed descriptions for incorporation into the documentation of the USNVC.

Results

Part 1. Alliances of G154: Xeric and Subxeric Longleaf Pine Woodland.

Two Alliances are currently recognized in the Xeric and Subxeric Longleaf Pine Woodland Group (G154). The first, the *Pinus palustris* / *Quercus incana* Woodland Alliance, contains seven

Associations and is confined to areas west of the Mississippi River, which is also west of the range of the otherwise ubiquitous *Quercus laevis*. The second, the *Pinus palustris* / *Quercus laevis* Woodland Alliance, contains the 24 Associations that occur east of the Mississippi River.

In the USNVC, the Alliance is defined as "A vegetation classification unit containing one or more Associations, and defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation. Alliances reflect regional to subregional climate, substrate, hydrology, moisture/nutrient factors, and disturbance regimes (US FGDC 2008, Jennings et al. 2009)." Numerical analysis of the 290 xeric and subxeric longleaf pine plots suggested three discrete groups that correspond closely to three geographic regions: Associations occurring only in North Carolina and northern South Carolina, Associations occurring only from central South Carolina through Georgia and into parts of adjacent Alabama, and Associations that occur primarily in Florida but also in immediately adjacent Georgia (Figures 1-4, 6, 8, Table 1). We propose division of the current *Pinus palustris* / *Quercus laevis* Woodland Alliance into four new Alliances corresponding to the three major groups that emerged from our analyses of xeric and subxeric longleaf pine woodlands (Figures 2, 3), along with a fourth corresponding to the three Associations that are primarily confined to the outer Coastal Plain of Mississippa and Louisiana. In this document and Appendix 2, we present the descriptions of Associations within each of the first three Alliances in order from most xeric to least xeric.

The first of the four proposed new Alliances is the *Pinus palustris / Quercus laevis / Aristida stricta* Alliance with 9 Associations. This Alliance occurs primarily in the region where *Aristida stricta* is a common ground-layer dominant, though in the extreme north and extreme southeast it extends beyond the range of *Aristida stricta*. The second Alliance is the *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance with 10 Associations. It is confined to areas south of the range of *Aristida stricta* including the wiregrass-free region of central South Carolina and the regions of South Carolina and Georgia where *Aristida beyrichiana* is dominant. Central South Carolina, west-central Georgia and all but southern-most Alabama are largely without wiregrass, but otherwise fit floristically in this Alliance. We use the nominal *Schizachyrium scoparium* to indicate that this is outside the range of *Aristida stricta*. The third Alliance, with 7 Associations, we call the *Pinus palustris / Quercus laevis, Quercus geminata* / *Aristida beyrichiana* Alliance reflecting the increase in evergreen oak and scrub species in Florida, along with increases in species richness and endemism.

In addition to the above three new Alliances, which are defined based on analysis of plot data, we propose recognition of a *Pinus palustris / Quercus laevis / Aristida condensata* Alliance for the three geographically disjunct Associations of southern Mississippi, well beyond the range of wiregrass and with *Aristida condensata* as a common associate.

In the following sections, we evaluate the Associations that occur within the three focal geographic regions of our study. Where appropriate, descriptions are revised or types are created or deleted. For details of the Associations and the proposed changes, see Appendix 2.

Part 2: *Pinus palustris / Quercus laevis / Aristida stricta* Alliance. Xeric longleaf pine Associations of North Carolina and northern South Carolina.

Our quantitative analysis of plot data (N=108) revealed nine distinct Associations within the geographic scope of North Carolina and northern South Carolina. These groups sort according to silt content of the A horizon, distance from the coast, and location along a NE-SW geographic gradient (Figure 5). Seven of the nine Associations (3577, 3584, 3586, 3589, 3590, 3591, 3592) map directly onto existing Associations within the USNVC hierarchy (Table 2). Although the concepts of these types are nearly identical to CEGL003577, CEGL003584, CEGL003586, CEGL003589, CEGL003590, CEGL003591, and CEGL003592, we for the first time provide quantitative descriptions of these types based on plot data, including vegetation composition and environmental attributes. The remaining two Associations (7125, 7126) reflect significant revision and improvement of the break points between types based on available plot data. Table 3 contains a description of prevalent and indicator species for all nine proposed Associations and Appendix 2.1 contains detailed constancy tables and descriptions for each proposed Association.

We first present the five Associations characteristic of extremely sterile and xeric sands (3584, 3590, 7125, 3577, 3592) followed by the four Associations of subxeric sites characterized by soils with somewhat more silt (7126, 3586, 3589, 3591; see Table 4, Figure 5). Although similar in terms of environmental setting, the extremely xeric 3584, 3590, and 7125 occur in different geographic locations and hence capture spatial turnover in species composition, with 3584 located in the inner and middle Coastal Plain, 3590 located in the outer Coastal Plain of North Carolina, and 7125 located in the outer Coastal Plain in the wiregrass-gap region of South Carolina. Two other xeric types (3577 and 3592) emerged from our analysis; they occur in very specific geographic settings reflected in the species composition of these types. Association 3577 is unique in that it occurs in the extreme outer Coastal Plain and hence has a strong prevalence of broadleaf evergreen shrub and trees species, whereas Association 3592 is the most northern in geographic extent, and has several taxa not typical in more southern types (e.g., *Castanea pumila*). The remaining four types (7126, 3586, 3589, 3591) are subxeric and have a greater percentage of silt than the above five types. Although Association 7126 occurs on dry sands, it contains several mesic indicators (e.g. *Pinus serotina*), likely because this type is ecotonal in nature and in close proximity to more mesic types. Type 3586 occurs exclusively in the Fall-line Sandhills region, in contrast to 3589 and 3591, which both occur primarily in the outer Coastal Plain. Type 3591 is distinguished from 3589 in having more silt in the A horizon, higher species richness, and co-dominance by *Quercus incana* in the sub-canopy layer.

CEGL003584: *Pinus palustris* / *Quercus laevis* / *Stipulicida setacea* – *Selaginella acanthonota* Woodland

Concept History: CEGL003584.

Concept Summary: This is one of the driest longleaf pine Associations of infertile white sands (Table 4) of the inner and middle Coastal Plain of southern North Carolina and northern South Carolina. This community is often located on dunes along the northeast sides of major brown-water rivers and on the rims of Carolina bays. *Pinus palustris* occurs very sparsely in the canopy layer, while the sub-canopy

layer is dominated almost exclusively by *Quercus laevis*. Because of the extremely xeric conditions associated with this type, the herbaceous layer is sparse, species poor (Table 3), and comprised of xerophytes such as *Stipulicida setacea, Selaginella acanthonota, Minuartia caroliniana, Cnidoscolus stimulosus*, and *Polygonella polygama* (Table 3). Although within the range of *Aristida stricta*, this Association occupies sites generally too sterile to support the species.

Classification Comments: This Association is the same as the established Association CEGL003584, except that we have provided greater detail as to floristic composition and environmental setting. We have modified the name to more explicitly suggest the extremely xeric nature of the Association by inclusion of *Stipulicida* and *Selaginella*.

Similar Types: This type is similar to CEGL003590, which occurs exclusively on coarse, infertile sands in the outer Coastal Plain. It can be distinguished from 3590 by its lack of characteristic coastal fringe flora (e.g. *Rhynchospora megalocarpa*). CEGL003584 is also similar to 3586, which also has abundant *Quercus laevis*, however 3586 is subxeric and typically has a somewhat dense herbaceous layer dominated by *Aristida stricta*.

Diagnostic Characteristics: This Association can be distinguished from other xeric community types because it is extremely dry, has a scrub oak layer strongly dominated by *Quercus laevis,* and an herbaceous layer lacking *Aristida stricta.*

CEGL003590: *Pinus palustris / Quercus laevis – Quercus geminata / Rhynchospora megalocarpa* Woodland

Concept History: CEGL003590.

Concept Summary: This type occurs on extremely xeric, coarse sands of the outer Coastal Plain of North Carolina and South Carolina. The sub-canopy layer is comprised of a mix of *Quercus laevis*, *Quercus geminata*, and *Quercus hemisphaerica* (Table 3), the latter two indicating coastal proximity and differentiating it from CEGL003584, along with additional coastal indicators including *Rhyncospora megalocarpa*. As with 3584, the herbaceous layer is sparse and species poor due to extremely dry conditions, and consists primarily of extreme xerophytes (Table 4). *Aristida stricta* is often present, but occurs with low abundance, especially compared to other types within the Mid-Atlantic Coastal Plain.

Classification Comments: This type is equivalent to CEGL003590 in the existing USNVC hierarchy. However, CEGL003590 has been described as a broad and vague community type of xeric sands occurring on the coastal fringe, but also in the Fall-line Sandhills of both central South Carolina and Ft. Benning, GA. Our revised description is essentially equivalent to the use of CEGL003590 by Schafale (2012). We narrow the geographic scope of the existing CEGL003590 and exclude sites south of northern South Carolina and designate them as more closely associated with 7125 and 7844 as described below. We revise the name to put more emphasis on coastal fringe indicators.

Similar Types: This Association is similar to CEGL003584, which is also extremely xeric. However, 3584 is located farther inland and lacks the coastal species (e.g. *Quercus geminata, Rhynchospora megalocarpa*) characteristic of CEGL003590.

Diagnostic Characteristics: This type can be distinguished from other sandhill types because it is extremely xeric, has a very sparse canopy cover of *Pinus palustris*, and has an extremely species poor and undeveloped herbaceous layer. In contrast to other sand barrens, it is found primarily in the outer Coastal Plain and hence coastal species, such as *Quercus geminata* and *Quercus hemisphaerica* are common.

CEGL007125: ***Pinus palustris / Quercus laevis - Quercus geminata / Schizachyrium Scoparium* Woodland**

Concept History: New type.

Concept Summary: This extremely xeric type occurs on coarse, white sands in the outer Coastal Plain of South Carolina in the wiregrass gap. *Pinus palustris* forms an open canopy, with *Quercus laevis* dominating in the sub-canopy/shrub layer, although *Quercus geminata* and *Quercus hemisphaerica* are also prevalent. Common shrubs include *Gaylussacia dumosa*, *Vaccinium arboreum*, and *Vaccinium tenellum*. The herbaceous layer is sparse and species poor and lacks *Aristida stricta*.

Classification Comments: This type is based on seven plots located in Georgetown County, South Carolina. Although similar to CEGL003590, which is located farther north in the outer Coastal Plain, we designate this as a new type because it lacks *Aristida stricta* and is characterized by unique diagnostic taxa, particularly in the shrub layer (e.g. *Vaccinium arboreum*). Additional plots in the wiregrass-gap region outside of Georgetown County are needed to more fully circumscribe this type and disentangle it from 3590.

Similar Types: This type is similar to CEGL003590, but occurs farther south in the wiregrass-gap region of South Carolina and hence lacks *Aristida stricta*. In addition, it has less *Quercus geminata* and *Q. hemisphaerica* and contains unique indicators in the shrub layer (e.g. *Vaccinium arboreum).*

Diagnostic Characteristics: This type is defined by its location in the outer Coastal Plain of the wiregrass-gap region of South Carolina, prevalence of coastal fringe indicators (e.g. *Quercus geminata)* and its lack of *Aristida stricta*.

CEGL003577: *Pinus palustris / Quercus geminata – Quercus hemisphaerica / Osmanthus americanus* Woodland

Concept History: CEGL003577.

Concept Summary: Association CEGL003577 occurs on xeric sands (Table 4) within several miles of the coast in southeastern North Carolina and northeastern South Carolina. The overstory is sparse and characterized by a mix of *Pinus palustris* and *Pinus taeda*. *Quercus geminata, Quercus hemisphaerica,* and to a lesser degree *Quercus laevis* are the dominant species in the sub-canopy layer (Table 3). This type can be distinguished from other xeric types in North Carolina and South Carolina by its strong signature of broadleaf evergreen and semi-evergreen coastal fringe shrub and small tree species including

Ilex vomitoria, Persea spp., *Osmanthus americanus,* and *Vaccinium arboreum* (Table 3). The herbaceous layer is sparse, but this Association has a more species-rich shrub and sub-canopy layer than similar types.

Classification Comments: This treatment provides a quantitative basis for the description of the extant Association CEGL003577. We change the formal name to be more reflective of the typical composition. Specifically, we delete reference to *Aristida stricta,* as the South Carolina occurrences are south of the range of this species. Two plots in Georgetown County, South Carolina are similar to this type and also have affinities to CEGL003590, but are somewhat distinct. We do not include these two plots here, as we believe they constitute an unique Association; however, two plots are insufficient to circumscribe a new type. We compare these plots to CEGL03577 and CEGL003590 in Appendix 2.1 to point out their distinct character.

Similar Types: This Association is similar to CEGL004263, which is located in Georgia and Florida and is considered a southern version of 3577. In CEGL004263, *Quercus myrtifolia* is a sub-canopy dominant in addition to *Quercus laevis* and *Quercus hemisphaerica* and *Aristida beyrichiana* replaces *Aristida stricta* as the dominant species in the herbaceous layer. This type is also similar to CEGL003589, which is drier than 3577, contains more *Quercus laevis*, less *Quercus* spp. cover, and less cover of broadleaved evergreen shrubs such as *Osmanthus americanus* and *Persea borbonia/palustris.* In addition, CEGL003589 has a more developed herbaceous layer comprised of *Aristida stricta, Cnidoscolus stimulosus, Carphephorus bellidifolius, Euphorbia ipecacuanhae,* and *Pityopsis graminifolia*.

Diagnostic Characteristics: This type is distinguished from other xeric types in North Carolina and South Carolina by its location along the coastal fringe and by its strong signature of broadleaf evergreen and semi-evergreen coastal fringe shrub and small tree species.

CEGL003592: *Pinus palustris – Pinus taeda / Quercus laevis / Gaylussacia frondosa – Gaylussacia baccata* Woodland

Concept History: CEGL003592.

Concept Summary: This type is unique compared to all other xeric types in that it occurs on sandy soils in northern North Carolina and southeastern Virginia. Because of its location, floristic composition of this type differs substantially from more southern xeric communities. The overstory is characterized by equal parts *Pinus palustris* and *Pinus taeda* with a sub-canopy layer comprised of several scrub oaks including *Quercus laevis, Quercus nigra,* and *Quercus falcata* (Table 3). Other common trees in this type include *Sassafras albidum* and *Castanea pumila*. The shrub layer is dominated by *Gaylussacia frondosa, Gaylussacia baccata, Gaylussacia dumosa, Vaccinium pallidum,* and *Vaccinium tenellum* (Table 3). The herbaceous layer is sparse and species poor, and *Aristida stricta* is lacking (Table 3, Table 4). Very few high-quality examples of this type remain and many have experienced fire suppression.

Classification Comments: The description for this Association has changed based on three CVS plots and seven plots from the Virginia Heritage Program. The concept of this type remains the same, but we

fine-tune the description based on existing plot data. We also fine-tune the name and exclude *Quercus incana* and *Gaylussacia dumosa* and include *Pinus taeda*.

Similar Types: This Association is similar to CEGL003647, but 3647 is considerably wetter than 3592 and has greater abundance of both *Pinus serotina* and *Ilex glabra.*

Diagnostic Characteristics: This type is constrained to the northern portion of the Mid-Atlantic Coastal Plain and hence is characterized by different species than other xeric types including *Quercus nigra, Sassafras albidum, Smilax glauca, Gaylussacia frondosa, Kalmia angustifolia, Gaylussacia baccata,* and *Vaccinium pallidum.*

CEGL007126: *Pinus palustris – Pinus serotina / Quercus laevis / Gaylussacia frondosa / Schizachyrium scoparium* Woodland

Concept History: New type.

Concept Summary: This somewhat xeric Association occurs inland on coarse, dry sands. However, it appears to be ecotonal in nature, and hence includes a unique mix of xerophytes and mesic species. The open canopy is dominated by *Pinus palustris*, although *Pinus serotina* and *Pinus taeda* are often common and abundant. *Gaylussacia frondosa* is the most diagnostic and abundant species in the shrub layer. Other common shrub species include *Gaylussacia dumosa, Vaccinium tenellum, Lyonia mariana,* and *Morella cerifera*. The herbaceous layer of this type is relatively sparse and co-dominated by *Aristida stricta* and *Schizachyrium scoparium*.

Classification Comments: The concept and description are based on 10 CVS plots. Currently, this type does not map onto any existing types within the USNVC hierarchy.

Similar Types: This type is similar to CEGL003584, which occurs inland on coarse sands, but CEGL007126 is more mesic, which is reflected in its species composition (e.g. *Pinus serotina, Gaylussacia frondosa*).

Diagnostic Characteristics: This type is distinguished from others by its location primarily in the inner Coastal Plain and its unique mixture of xerophytic and mesic species, reflecting its ecotonal nature.

CEGL003586: *Pinus palustris / Quercus laevis / Aristida stricta – Baptisia cinerea* Woodland

Concept History: CEGL003586.

Concept Summary: This Association occurs almost exclusively in the Fall-line Sandhills region of North Carolina and South Carolina on dry sands that have a very modest amount of silt (Table 4). The overstory and sub-canopy layer are dominated by *Pinus palustris* and *Quercus laevis*, respectively. The herbaceous layer is relatively species-rich compared to extremely xeric types such as CEGL003584 (Table 4). Prevalent species in the understory layer include *Aristida stricta, Gaylussacia dumosa, Cnidoscolus*

stimulosus, and *Carphephorus bellidifolius*. *Hypericum hypericoides, Baptisia cinerea,* and *Cirsium repandum* are diagnostic of this type (Table 3).

Subassociations: Plots assigned to this Association fall into two discrete sets corresponding to those with a history of recurrent fire, and those where fire frequency had been significantly reduced. This is most evident in the increase in woody species and the decrease in herb species. The fire-suppressed Subassociation B has 19 woody species with a frequency of at least 20% in contrast to only 12 for Subassociation A. In contrast Subassociation A has 39 herbaceous species with a constancy of at least 20% in contrast to only 14 such species in Subassociation B.

Classification Comments: This Association is equivalent to CEGL003586 in the existing USNVC hierarchy. Here we slightly narrow the geographic scope of CEGL003586, which is defined as a broad type that includes infertile sands in the Fall-line Sandhills region and the inner Coastal Plain. The new definition of CEGL003586 is narrower and is essentially limited to the Fall-line Sandhills. We modify the name of this type to put less emphasis on *Gaylussacia dumosa* and include *Baptisia cinerea* as indicative in the herbaceous layer.

Similar Types: This type is distinguished from CEGL003589 by the absence of characteristic coastal fringe flora, such as *Cladina evansii, Rhynchospora megalocarpa, Ilex vomitoria,* and *Quercus geminata,* and by its location in the Fall-line Sandhills. CEGL003586 is also similar to CEGL003584 and CEGL003590, but is distinguished from these communities by having higher plant cover in the herb layer, especially *Aristida stricta,* and by its location in the Fall-line Sandhills.

Diagnostic Characteristics: This Association can be distinguished from other xeric types in North Carolina and South Carolina by its location in the Fall-line Sandhills region, an herbaceous layer dominated by *Aristida stricta,* and a scrub oak layer dominated by *Quercus laevis*.

CEGL003589: *Pinus palustris / Quercus laevis – Quercus geminata / Aristida stricta* Woodland

Concept History: CEGL003589.

Concept Summary: This Association occurs mostly in the outer Coastal Plain of North Carolina and South Carolina, but occasionally farther inland on the inner Coastal Plain. Soils are xeric sands with some silt (Table 4) and are often associated with old beach ridges, relict dunes, well-drained sandy flats and Carolina bay rims. *Pinus palustris* dominates the overstory canopy, with the sub-canopy layer dominated by *Quercus laevis*, with lesser amounts of *Q. incana* and *Q. margarettae* (Table 3). *Quercus geminata* is also abundant in Subassociation A, due to its proximity to the coast. The herbaceous layer is well developed with *Aristida stricta* generally abundant. Other typical species include *Cnidoscolus stimulosus, Carphephorus bellidifolius, Vaccinium tenellum, Euphorbia ipecacuanhae, Pityopsis graminifolia,* and *Morella cerifera* (Table 3).

Subassociations: Here we designate two Subassociations: Subassociation A and Subassociation B, which correspond to the outer Coastal Plain and inner Coastal Plain, respectively.

Classification Comments: This Association is more or less equivalent to CEGL003589 in the existing USNVC hierarchy, but is slightly larger in concept because it encompasses plots located in both the outer and inner Coastal Plains of North Carolina and northern South Carolina (Table 2). Although Subassociation B may deserve designation as a separate type, data are generally lacking for the inner Coastal Plain and more data are needed to determine if Subassociations A and B are separate vegetation types. We simplify the name and remove *Vaccinium tenellum*.

Similar Types: This type is closely related to CEGL003577, but the herbaceous layer is more diverse and developed in this Association, and has a higher abundance of *Aristida stricta.*

Diagnostic Characteristics: This type can be distinguished by its location primarily in the outer Coastal Plain of North Carolina and South Carolina, and hence its signature of coastal fringe species (e.g. *Quercus geminata*, *Smilax auriculata*), along with a diverse herbaceous layer dominated by *Aristida stricta*.

CEGL003591: *Pinus palustris / Quercus laevis – Quercus incana / Gaylussacia dumosa / Aristida stricta* Woodland

Concept History: CEGL003591.

Concept Summary: This Association is found on fine sandy to sandy-loam soils in the outer Coastal Plain of North Carolina and possibly South Carolina, but is known primarily from Onslow and Carteret Counties, North Carolina. *Pinus palustris* and *Quercus incana* dominate the overstory and sub-canopy layers, respectively. Several shrub species are nearly constant and characteristic of this type, including *Gaylussacia dumosa, Gaylussacia frondosa, Morella cerifera, Vaccinium tenellum, Vaccinium stamineum,* and *Ilex glabra*. The herbaceous layer is well developed and dominated by *Aristida stricta* (Table 3). This type has the highest silt content and highest average species richness compared to other types in the Alliance (Table 4) and is characterized by several herbaceous species including *Andropogon ternarius, Carphephorus bellidifolius, Carphephorus odoratissimus, Pityopsis graminifolia, Liatris* spp., *Sericocarpus tortifolius, Solidago odora* var. *odora*, and *Tragia urens* (Table 3).

Classification Comments: This type is equivalent to CEGL003591 in the existing USNVC hierarchy (Table 2). We re-define this type slightly to occur exclusively in the outer Coastal Plain, while the original description of CEGL003591 was defined as broadly distributed throughout the outer and inner Coastal Plain. We simplify the name and put more emphasis on *Quercus incana* by deleting *Quercus margarettae.*

Similar Types: This type is similar to CEGL003592, but 3592 has a much less developed and species-poor herbaceous layer compared to CEGL003591, and is dominated primarily by *Quercus laevis* in the sub-canopy layer.

Diagnostic Characteristics: This type can be distinguished from other subxeric and xeric types in North Carolina by the strong dominance of *Quercus incana* in the sub-canopy/shrub layer.

Part 3: *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance. Xeric longleaf pine Associations of Georgia, southern South Carolina, and eastern Alabama.

Our quantitative analysis of plot data (N=68) suggested nine Associations for this Alliance and we retain an additional, currently recognized Association for which we have no plot data. Associations of the *Pinus palustris* / *Quercus laevis* / *Schizachyrium scoparium* Alliance are complex to sort out because of four primary dimensions of variation: a northeast to southwest geographic gradient, a coastal to sandhill gradient, a xeric to subxeric gradient, and a sand to silt gradient, as seen in Figure 7. The most prominent gradient in the ordination is soil texture with xeric sands represented by CEGL007844 (of the Fall-line Sandhills), CEGL007127 (hyper-xeric longleaf pine woodlands with *Chrysoma,* of the Fall-line Sandhills and Coastal Plain), and 4492 (of the Coastal Plain) separating from the other Associations. We describe these strongly xeric sites first in the discussion below. In addition, we recognize CEGL004263 of the xeric sands of the coastal fringe, though no plots in our analysis fit this Association. Of the remaining six Associations, three are primarily found in the Fall-line Sandhills and three farther out on the Coastal Plain. Among the three of the Fall-line Sandhills, 3593 is subxeric and has more silt than 7844, whereas 7842 and 8491 occur on very silty soils with the second being somewhat more mesic and more inland and out of the range of *Aristida beyrichiana*. Among the three Coastal Plain subxeric and siltier types, 4487 is slightly drier and confined to the outer Coastal Plain of eastern Georgia, whereas 7129 and 4488 occupy the inner Coastal Plain, again mostly in Georgia.

CEGL007127: *Pinus palustris* / *Quercus laevis* / *Chrysoma pauciflosculosa* / *Aristida purpurascens* Woodland

Concept History: New type.

Concept Summary: This extremely dry Association occurs on inland, xeric, coarse sand ridges in the Fall-line Sandhills region and inner Coastal Plain of Georgia and perhaps South Carolina. Species richness is extremely low in this type and the herbaceous layer is poorly developed (Table 7). The open canopy consists of *Pinus palustris* with a mix of shrub oaks in the sub-canopy layer, including *Quercus margarettae*, *Q. laevis,* and *Q. hemisphaerica*. *Chrysoma pauciflosculosa* is the dominant shrub and is indicative of this type, although *Opuntia humifusa* and *Vaccinium stamineum* are also constant. Other characteristic species include *Aristida purpurascens, Bulbostylis coarctata, Dichanthelium acuminatum, Selaginella* sp., and *Galactia* sp. (Table 6).

Classification Comments: The concept and description for this Association are based on three CVS plots. This type does not map onto any existing types within the USNVC hierarchy.

Similar Types: This type is most closely related to CEGL003946, which is a dwarf shrubland dominated by *Chrysoma pauciflosculosa*, but in a different USNVC group (G177, Florida Xeric Scrub) and located farther south. In addition, the canopy and sub-canopy of trees in Association 7127 set it apart from 3946.

Diagnostic Characteristics: This type can be distinguished from other xeric longleaf pine types by the prevalence of *Chrysoma pauciflosculosa* in the shrub layer and a canopy and sub-canopy dominated by *Pinus palustris* and *Quercus margarettae*, respectively.

CEGL007844: *Pinus palustris* / *Quercus laevis* / *Schizachyrium scoparium – Stipulicida setacea* Woodland

Concept History: CEGL007844.

Concept Summary: This xeric type occurs largely in the Fall-line Sandhills region of the South Atlantic Coastal Plain of Georgia and adjacent South Carolina, but can occur on isolated pockets of sand farther east along major rivers. Soils of this type are coarse, white sands, with little organic matter or nutrient content (Table 7). *Pinus palustris* forms an open canopy and *Quercus laevis* is the dominant species in the sub-canopy layer, although *Quercus incana* and *Quercus margarettae* are also typical. This type is found in both the wiregrass-gap region of central South Carolina and adjacent areas farther south; thus, *Aristida beyrichiana* may or may not be present. Typically, *Schizachyrium scoparium* dominates the relatively species-poor herbaceous layer. Other diagnostic species in the herbaceous layer include classic xerophytes such as *Aureolaria pectinata*, *Euphorbia ipecacuanhae*, *Minuartia caroliniana*, and S*tipulicida setacea* (Table 6).

Subassociations: Our analysis revealed two distinct Subassociations of CEGL007844 (see Appendix 2.2 for details). Subassociation A occurs primarily in the wiregrass-gap region of central South Carolina and hence *Schizachyrium scoparium* replaces *Aristida beyrichiana* as the dominant in the herbaceous layer. Subassociation A also has considerably less *Quercus incana* and *Quercus margarettae* than Subassociation B, where *Aristida beyrichiana* is constant and abundant in the herbaceous layer.

Classification Comments: The original concept and description were quite broad, encompassing sandhills from Florida to South Carolina. We propose a more focused description of the type to indicate primarily Fall-line Sandhills of South Carolina and Georgia from the wiregrass gap southwest, but with additional occurrences along major rivers downstream, such as at the Tilman sand ridge in southeastern South Carolina. The former description reports a single plot from the Osceola National Forest (http://vegbank.org/get/comprehensive/observation/81094), but in our numerical analysis this plot clusters with the scrubby flatwoods of CEGL007750, which is in a different USNVC group (G596). Association CEGL003590 has been attributed to the Georgia Coastal Plain, but we see these occurrences as belonging to 7844, with 3590 confined to areas north of the wiregrass gap. CEGL003583 has been attributed to xeric sands of the Georgia Coastal Plain, but these sites as well appear to belong to 7844. We modify the name to more accurately reflect typical composition with an emphasis on *Stipulicida* over *Baptisia,* and constancy of *Schizachyrium scoparium* over *Aristida beyrichiana*.

Similar Types: This type is similar to CEGL003590, which occurs farther north in North Carolina and South Carolina and lacks *Aristida beyrichiana*.

Diagnostic Characteristics: This xeric Association can be distinguished by its location in the Fall-line Sandhills region and the adjacent inner Coastal Plain of South Carolina and Georgia, in part within the

range of *Aristida beyrichiana*. The herbaceous layer is relatively species poor, but *Schizachyrium scoparium* is the most abundant and constant species, while *Aureolaria pectinata* and *Stipulicida setacea* are diagnostic.

CEGL004492: *Pinus palustris / Quercus laevis – Quercus margarettae / Licania michauxii / Aristida beyrichiana* Woodland

Concept History: CEGL004492.

Concept Summary: This Association represents longleaf pine vegetation of xeric, deep, coarse sands of the Georgia Coastal Plane and adjacent South Carolina and Florida (Table 7). The nominal species are the typical dominants, although *Serenoa repens* and *Sporobolus junceus* are also indicative and can be abundant. Other diagnostic or prevalent species include *Andropogon virginicus, Aureolaria pectinata, Commelina erecta, Croton argyranthemus, Dichanthelium acuminatum, Eriogonum tomentosum*, and *Opuntia humifusa* (Table 6).

Classification Comments: Both CEGL004492 and CEGL004490 have been used to represent the xeric sands of the Georgia Coastal Plain. However 4490 has been only vaguely described and has been applied to a diverse range of situations, whereas 4492 was confined to a specific composition only documented from Ft. Stewart. We broaden the definition of 4492 with plots ranging from Ft. Stewart to the Ichauway area in southwest Georgia (Table 5). We also shorten the name by removing the less abundant though frequent *Quercus incana*. We recommend that 4490 be re-designated as occurring in Florida only (see discussion in Part 4).

Similar Types: This type is similar to CEGL007127 and CEGL007844, in that it occurs on sandy, xeric soils. However, it can be differentiated from those types by its geographic location and the prevalence of *Quercus margarattae* and *Licania michauxii*.

Diagnostic Characteristics: This type is characterized by its occurrence on coarse, infertile sands, the dominance of *Licania michauxii* in the shrub layer, and a relatively sparse herbaceous layer comprised mainly of *Aristida beyrichiana*. The sub-canopy/scrub oak layer is made up almost exclusively of *Quercus laevis* and *Q. margarettae*.

CEGL004263: *Pinus palustris / Quercus (hemisphaerica, laevis) / Morella cerifera / Aristida beyrichiana* Woodland

Concept History: CEGL004263.

Concept Summary: This Association of xeric sand ridges of the coastal fringe is the southern equivalent of CEGL003577 of North Carolina and adjacent northern South Carolina, except that the *Aristida* is *A. beyrichiana* rather than *A. stricta*. The type was described from one plot on Cumberland Island. No plots in our dataset match this type, though we have no reason to doubt its legitimacy and broader distribution.

Proper habitat for coastal fringe sandhills is largely absent from Georgetown, SC to Cumberland Island, GA owing to a coastal morphology that focuses the tidal flux and generates ovoid sea islands rather than barrier islands. This type should be expected from Cumberland Island south into northeastern Florida.

Classification Comments: This Association has been previously assigned to Group G009, but should shift to G154 due to the xeric sands of the sites it inhabits. More data is needed before this Association can be further refined.

Similar Types: This type has some affinities with CEGL007133 described below for similar habitats on the coastal fringe of the Florida Panhandle. This type is also similar to CEGL003577, located farther north where *Aristida beyrichiana* is replaced by *A. stricta*.

Diagnostic Characteristics: This type can be distinguished by its location in the coastal fringe of Georgia and likely northern Florida, and hence the presence of coastal indicators.

CEGL003593: *Pinus palustris* / *Quercus laevis* / *Toxicodendron pubescens* / *Schizachyrium scoparium – Lespedeza hirta W*oodland

Concept History: CEGL03593.

Concept Summary: The distribution of this subxeric Association is similar to CEGL007844, in that it is found in the Fall-line Sandhills region, including both the wiregrass gap and the areas south of the gap across South Carolina and northern Georgia. In contrast to 7844, this Association occurs on soils that have a significant amount of silt (Table 7) and hence species richness is moderately high. The canopy and sub-canopy layers are dominated by *Pinus palustris* and *Quercus laevis*, but *Quercus incana* and *Quercus margarettae* may also be present. Constant species include *Vaccinium stamineum, Eupatorium glaucescens*, *Schizachyrium scoparium*, and *Silphium compositum*, while *Toxicodendron pubescens* is an indicator in the shrub layer, and *Cirsium repandum* and *Lespedeza hirta* are indicators in the herbaceous layer (Table 6). *Aristida beyrichiana* may be abundant in occurrences of this type south of the wiregrass gap.

Classification Comments: This Association represents a modest revision of CEGL003593 in the existing USNVC hierarchy. CEGL003593 was formerly defined as occurring only in the wiregrass-gap region of central South Carolina, but we expand the geographic scope to include the wiregrass gap and adjacent areas to the southwest. We change the name to include indicative species in the shrub (*Toxicodendron pubsecens*) and herb layers (*Lespedeza hirta*).

Similar Types: CEGL004083 is similar to this type, but occurs exclusively in the outer Coastal Plain of South Carolina, has a more diverse scrub oak layer, and an herbaceous layer co-dominated by *Schizachyrium scoparium* and *Pteridium aquilinum*. CEGL007844 has a similar range but occurs on more xeric, less silty soils and has substantially lower species richness.

Diagnostic Characteristics: This Association can be differentiated from other subxeric community types by dominance of *Schizachyrium scoparium* in the herbaceous layer and *Toxicodendron pubescens* in the

shrub layer, as well as having a range confined to the Fall-line Sandhills region of South Carolina and northern Georgia.

CEGL007842: *Pinus palustris* / *Quercus marilandica* / *Aristida beyrichiana – Tephrosia virginiana* Woodland

Concept History: CEGL007842.

Concept Summary: This Association occurs in xeric to subxeric habitats of the Fall-line Sandhills region and the inner South Atlantic Coastal Plain of South Carolina and Georgia south of the wiregrass-gap region. Soils of this Association are dry loams with high silt content. Despite the high silt, species richness is relatively low compared to other South Carolina–Georgia types, likely owing to their xeric nature (Table 7). *Pinus palustris* and *Pinus taeda* often co-dominate in the overstory and form a relatively closed canopy with a fairly diverse mix of scrub oaks and hardwoods in the sub-canopy and shrub layers. The herbaceous layer is dominated by a mix of *Aristida beyrichiana* and *Schizachyrium scoparium* and contains several xeric indicators including *Carphephorus bellidifolius, Euphorbia ipecacuanhae*, and *Sericocarpus asteroides*. Other prevalent species in the herbaceous layer include *Anthenantia villosa*, *Dichanthelium tenue*, *Tephrosia virginiana*, *Sericocarpus tortifolius*, and *Stylisma patens* (Table 6).

Classification Comments: This type is approximately equivalent to CEGL007842 in the existing USNVC hierarchy, but is slightly smaller in concept in that it includes only the region where *Aristida beyrichiana* is an understory dominant; the *Aristida*-free region has been assigned to CEGL008491. We change the name and put less emphasis on *Quercus incana* and replace *Nolina georgiana* with *Tephrosia virginiana*.

Similar Types: This Association is similar to CEGL008491, which has more silty soils and lacks *Aristida beyrichiana*, in contrast to 7842. The Association is also similar to CEGL003593, which also occurs in the Fall-line Sandhills, but 7842 occurs on substantially more silty soils.

Diagnostic Characteristics: This type is distinguished from other subxeric types by its high silt content and hence by species that are often found on high-silt soils, such as *Quercus marilandica*, *Toxicodendron pubescens*, *Rhus copallinum*, and *Tephrosia virginiana*. The diverse sub-canopy/shrub layer containing a mix of scrub oaks and hardwood species also sets this type apart.

CEGL008491: *Pinus palustris* / *Schizachyrium scoparium – Pteridium aquilinum* Woodland

Concept History: CEGL008491.

Concept Summary: This longleaf pine woodland Association is known to occur in subxeric situations on upland ridges, knolls, and slopes of the Upper East Gulf Coastal Plain of Georgia and the Fall-line Sandhills region of central South Carolina, and could potentially occur on equivalent sites in between. Surface soils typically have a high silt content, often in association with ironstone hardpans or other clayey B horizons (Table 7). The relatively closed canopy is dominated by *Pinus palustris*, but may also

include *Pinus echinata* and *Pinus taeda*. The sub-canopy layer is typically open and is characterized by a mix of scrub oaks and mesic hardwood species. Despite a high percentage of silt, the herb layer is not particularly species rich, but legume and composite diversity is high compared to other xeric–subxeric types. The two most abundant and constant species in the herbaceous layer are *Pteridium aquilinum* and *Schizachyrium scoparium*. The type is generally found inward of the range of *Aristida beyrichiana*. Other characteristic herbaceous species include *Aristida purpurascens*, *Coreopsis major*, *Eupatorium album*, *Sericocarpus tortifolius*, *Solidago nemoralis*, *Symphyotrichum dumosum*, *Vernonia angustifolia*, and *Viola pedata* (Table 6).

Classification Comments: This type is equivalent to CEGL008491 in the existing USNVC hierarchy. However, CEGL008491 was originally constrained to the Gulf Coastal Plain (including only plots from Ft. Benning, GA) and here we broaden the geographic scope of this concept by expanding the range from Ft. Benning, GA to Ft. Jackson, SC. We simplify the name and add *Pteridium aquilinum* as a good indicator of this type.

Similar Types: This Association is similar to CEGL007842, but CEGL008491 can be distinguished by the lack of *Aristida beyrichiana* dominance.

Diagnostic Characteristics: This type has a very high silt content and hence a mix of scrub oaks and "mesic" hardwood species in the sub-canopy/shrub layer. The herbaceous layer is relatively species poor, but legumes and Asteraceae species are fairly diverse compared to other xeric-subxeric types. *Pteridium aquilinum* is the most constant and abundant species in the herbaceous layer.

CEGL004487: *Pinus palustris* / *Quercus stellata* / *Quercus elliottii* / *Sporobolus junceus* – *Nolina georgiana* Woodland

Concept History: CEGL004487.

Concept Summary: This species-rich, subxeric Association occurs on sandy soils on the outer Coastal Plain of Georgia and the immediate adjacent areas of the inner Coastal Plain (Table 7). *Pinus palustris* dominates the canopy with a scrub oak sub-canopy of *Quercus incana, Q, stellata, and Q. margarettae*. *Quercus laevis* is notably less abundant than other scrub oak species. The shrub layer can be sparse to dense and is characterized by notably southern species such as *Nolina georgiana, Quercus elliottii* and *Vaccinium myrsinites*, but more widespread species such as *Diospyros virginiana, Gaylussacia dumosa* and others are also common. This type occurs exclusively within the range of *Aristida beyrichiana,* and *A. beyrichiana* and *Sporobolus junceus* reach high abundance in the herbaceous layer. The herbaceous layer is diverse, with legumes particularly well represented. Other diagnostic species include *Andropogon elliottii, Andropogon virginicus, Baptisia perfoliata, Dyschoriste oblongifolia, Physalis longifolia* var. *subglabrata, Salvia azurea,* and *Stillingia sylvatica* (Table 6). This type and CEGL007129 are the most species-rich Associations in the Alliance, perhaps owing to somewhat sub-mesic conditions (Table 7).

Classification Comments: This type is equivalent to the established CEGL004487. However we do propose a simplification of the community name such that we shift from six nominal species to five and put emphasis on *Quercus elliottii* as an indicator (Table 5).

Similar Types: This type is similar to both 7129 and 4488. It is slightly drier (as indicated by *Sporobolus junceus*) and has less silt content than 7129. CEGL004488 can be distinguished because it lacks *Sporobolus junceus* as a dominant in the herbaceous layer, and lacks *Quercus elliottii* and *Quercus stellata* in the sub-canopy/shrub layer.

Diagnostic Characteristics: This species-rich, subxeric type is characterized by the dominance of *Quercus incana* and *Q. stellata* in the scrub oak layer and by the species rich herbaceous layer (average richness at 1000m² = 102) co-dominated by *Aristida beyrichiana* and *Sporobolus junceus*.

CEGL007129: *Pinus palustris / Quercus margarettae / Toxicodendron pubescens / Schizachyrium scoparium* Woodland

Concept History: New type.

Concept Summary: Association CEGL007129 spans a broad geographic range of subxeric longleaf pine woodlands of the inner Coastal Plain from central South Carolina to the Alabama border on silty sites (Table 7). Because of its broad spatial distribution, there is some geographic turnover of species in this type. However, the sub-canopy is consistently dominated by *Quercus margarettae* with slightly lesser amounts of *Q. laevis* and *Q. incana*, reflecting the subxeric, silty nature of the sites. The high frequency of *Toxicodendron pubescens* also suggests the silty, subxeric nature of soils this type occurs on, as does the abundance of legumes. *Aristida beyrichiana* can be a ground layer dominant, but the type extends beyond the range of the species, both in central South Carolina and in western Georgia. The herbaceous layer is species-rich, reflecting the silty nature of the soils. Other characteristic species include *Carya tomentosa, Rhus copallinum, Ceanothus americanus, Lespedeza hirta, Mimosa microphylla, Clitoria mariana, Ionactis linariifolia, Pityopsis graminifolia,* and *Solidago odora* (Table 6).

Classification Comments: This is similar but not equivalent to CEGL004488, particularly in that it extends beyond the range of *Aristida beyrichiana* in both the northeast and the west, and in so doing covers variation not previously represented in the USNVC (Table 5).

Similar Types: This type is similar to CEGL004487, but that Association is slightly drier and less silty than 7129. In addition, CEGL004487 occurs exclusively in the outer Coastal Plain. This type is also similar to 4488, but 4488 has consistently less *Quercus margarettae* and different indicators in the shrub and herbaceous layer, including *Aristida beyrichiana*.

Diagnostic Characteristics: This subxeric, silty type is distinguished by the dominance of *Quercus margarettae* in the sub-canopy layer, *Toxicodendron pubescens* in the shrub layer, and a species-rich herbaceous layer, dominated primarily by *Schizachyrium scoparium*.

CEGL004488: *Pinus palustris / Quercus hemisphaerica / Gaylussacia dumosa / Aristida beyrichiana – Dyschoriste oblongfolia* Woodland

Concept History: CEGL004488.

Concept Summary: This subxeric, somewhat silty type occurs in the middle Coastal Plain of Georgia and South Carolina. It occurs on yellow sand soils with a relatively high silt fraction. Stands are dominated by a very sparse canopy of *Pinus palustris* with a sub-canopy consistently dominated by *Quercus hemisphaerica.* The herbaceous layer is very diverse and well developed, especially compared to other xeric and subxeric types within the region. *Aristida beyrichiana* is the most abundant species in the herbaceous layer, but *Andropogon ternarius, Dyschoriste oblongifolia, Lespedeza virginica,* and *Symphyotrichum walteri* are also very constant and diagnostic. One characteristic low shrub is *Gaylussacia dumosa*.

Classification Comments: This type is equivalent to CEGL004488 within the existing USNVC hierarchy. Here, we fine-tune the name and include *Dyschoriste oblongfolia* as an indicator species in the herbaceous layer. We also replace *Quercus laevis* with *Q. hemisphaerica*, as it is diagnostic of the type.

Similar Types: This type is similar to both 4487 and 7129. However, this Association is slightly drier than 4487, and 4487 occurs exclusively in the outer Coastal Plain of South Carolina and Georgia. Although occurring in similar environmental conditions as 7129, 4488 can be distinguished from 7129 by less *Quercus margarettae* in the sub-canopy and by the presence of *Aristida beyrichiana* in the herbaceous layer.

Diagnostic Characteristics: This type is characterized by its location in the middle Coastal Plain, dominance of *Aristida beyrichiana* in the herbaceous layer, and high constancy and dominance of *Quercus hemisphaerica* in the sub-canopy/shrub layer. *Dyschoriste oblongfolia* is an excellent indicator of this type.

Part 4: *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance. Xeric longleaf pine Associations of Florida.

We recognize seven Associations in Group 154 in Florida and adjacent Georgia. Only two of these Associations map onto established Associations, perhaps because of a tradition of coarser-scale vegetation classification in Florida. The principal axes of variation in this Florida Alliance primarily correspond to moisture and geography (Figure 9; Carr et al. 2009). Three Associations represent xeric sandhills, whereas four Associations represent subxeric conditions (gradient from upper right to lower left in Figure 9B with the most xeric sites in the upper right). Within the xeric and subxeric types, there is a compositional gradient from east to west, mostly corresponding to the difference between vegetation of peninsular Florida versus vegetation of the Florida Panhandle. There also appears to be a second gradient from north to south. Among the xeric Associations, 7132 represents peninsular Florida, 3583 the Panhandle, and 7133 the coastal fringe of the Panhandle (all in the upper right of Figure 9B. The coastal fringe of northeast Florida is likely represented by 4263 discussed in the previous section, but we lack plots from that Association that are needed to document the pattern. Among the subxeric Associations, 4490 represents peninsular Florida and 7141 the Panhandle. Somewhat more moist sites, bordering on sub-mesic, are represented in 7135, which spans north Florida from the peninsula through the eastern Panhandle. A final type, 7137, represents sand ridges of north central Florida with a strong hardwood

influence and much more calcium-rich soils.

CEGL007132: *Pinus palustris / Quercus laevis / Aristida beyrichiana – Tephrosia chrysophylla* Woodland

Concept History: Previously CEGL004491 and CEGL008569.

Concept Summary: This Association represents vegetation of the xeric sandhills and barrens of peninsular Florida and is restricted to ridge tops and upper slopes. Soils are extremely dry sands and hence species richness is the lowest of any other xeric types in this Alliance (Table 10). The sparse, open canopy is dominated by *Pinus palustris* and typically lacks a well developed sub-canopy. However, the mid-story shrub layer may be well developed, even under frequent fire conditions, and is dominated by *Quercus laevis, Q. incana,* and *Q. geminata*. *Aristida beyrichiana* is the dominant species in the herbaceous layer, but *Sorghastrum secundum, Schizachyrium scoparium* var. *stoloniferum,* and *Sporobolus junceus* are also common and abundant. *Quercus margarettae* is notably absent from this type. Diagnostic species include *Balduina angustfolia, Bulbostylis warei, Cnidoscolus stimulosus, Eragrostis refracta, Lechea sessiliflora, Opuntia humifusa, Palafoxia integrifolia,* and *Stillingia sylvatica* (Table 9).

Classification Comments: The Association corresponds almost exactly to type XU1, Peninsular Xeric Sandhills, of Carr et al. (2010) and is also similar to CEGL008569 (Table 8). However, 8569, while broadly applied, was originally based on nine patches in the Ocala National Forest with the formal description making reference to NatureServe plots from Hughes and Syracuse Islands. We included NatureServe plots from these two locations in our analysis, but they did not fall out in 7132, or even in G154, but rather represent the scrubby flatwoods of CEGL007750 of group G596. Despite the narrow basis in plots of 8569, the verbal description and application of 8569 spans multiple Associations recognized in our analysis, including 7132 and 4490. Owing to the broad and vague description of CEGL008569 and its inconsistent use, we propose that it be retired.

CEGL004491 also represents extreme xeric sites of Florida and adjacent Georgia, but is vaguely defined and appears to differ from 7132 only in the consistency of occurrence of *Ceratiola.* As we found no plots originally assigned to or fitting the description of 4491 and as the definition is not significantly different from our broader 7132, we propose demoting 4491 to be part of 7132. Examples of 4491 do occur in the sandhills of Alachua and Levy Counties, Florida in the northern reaches of the Brooksville Ridge (Susan Carr, personal observation) with the dominants across strata largely the same, except for *Ceratiola.* We propose to retire CEGL004491 and recognize the concept as part of CEGL007132, until more data becomes available and it can be demonstrated as a distinct Association from CEGL007132.

Similar Types: This type is similar to CEGL007750, which encompasses the xeric sandhills of Southern Lake Wales Ridge. In CEGL007750, south Florida slash pine co-occurs with or replaces longleaf pine as a canopy dominant. Mid-story dominants differ as well; the endemic *Carya floridana* is common, and there is increased abundance of *Quercus chapmanii, Q. myrtifolia,* and *Ceratiola ericoides.*

Diagnostic Characteristics: The absence of the mid-story oak, *Q. margarettae,* distinguishes this Association from xeric sandhills of Panhandle Florida, as well as sandhills of more fertile soils. In addition, this type is distinguished from other sandhills by its occurrence in north and central peninsular Florida, a high level of endemic and range-restricted plant species, low species richness relative to other xeric habitats (e.g. CEGL003583), and dominance of *Aristida beyrichiana* in the herbaceous layer. *Balduina angustifolia* and *Bulbostylis warei* are indicative of this type.

CEGL003583: *Pinus palustris / Quercus laevis / Licania michauxii / Pityopsis aspera* Woodland

Concept History: CEGL003583.

Concept Summary: Xeric sandhills and barrens of the Florida Panhandle differ from those of peninsular Florida and are assigned to CEGL003583. Plots in this Association have somewhat siltier soils than those of CEGL007132, less calcium in the soil, and are generally more species rich at all spatial scales (Table 10). Here *Quercus incana* and *Q. margarettae* are lesser dominants relative to *Q. laevis*, but much more important than in 7132, perhaps reflecting the higher soil silt content. Indicator species include *Gaylussacia dumosa, Licania michauxii,* and *Vaccinium darrowii* among the shrubs, and *Aristida mohrii, Commelina erecta, Croton argyranthemus, Eriogonum tomentosum, Euphorbia floridana, Liatris gracilis, Pityopsis aspera, Rhynchosia cytisoides,* and *Schizachyrium tenerum* among the herbs (Table 9).

Classification Comments: This type corresponds to type XU2, Panhandle Xeric Sandhills, of Carr et al. (2010), except that CEGL007133 belongs in XU2 as well. This type largely corresponds to CEGL003583 in the current USNVC, which is described as pertaining to xeric sites of the east Gulf Coast of the Florida Panhandle and adjacent Alabama, but reference is also made in the description to disjunct occurrences in Georgia and South Carolina. South Carolina and Georgia examples are floristically different and likely correspond to CEGL007844. We re-define CEGL003583 to occur exclusively south of Georgia (Table 8). We change the name to put more emphasis on *Licania* and less emphasis on *Aristida beyrichiana*.

Note that CEGL003587, which is described from the De Soto National Forest of southern Mississippi, includes reference to occurrences in Eglin Air Force Base in Florida. We believe the Eglin plots fit in 3583 and suggest that 3587 is found exclusively in southern Mississippi and possibly adjacent Alabama, and that it belongs in the new *Pinus palustris / Quercus laevis / Aristida condensata* Alliance.

Similar Types: As previously stated, this Association is similar to CEGL003587, which occurs farther west and hence lacks *Aristida beyrichiana*. In 3587, *Schizachyrium scoparium* is the dominant bunchgrass in the herbaceous layer.

Diagnostic Characteristics: This type is distinguished by its location in the Florida panhandle, xeric, sandy soil, dominance by *Quercus incana* and *Q. margarettae,* absence of scrub oaks (*Q. myrtifolia*, *Q. chapmanii*), and relatively high species richness. *Pityopsis aspera* is indicative of this type.

CEGL007133: *Pinus palustris / Quercus geminata / Conradina canescens / Aristida beyrichiana* Woodland

Concept History: New type.

Concept Summary: This Association in the xeric sandhills of the western Panhandle coastal fringe has an understory with dominance shared among *Quercus geminata*, *Q. laevis* and *Q. incana*. Soils are xeric sands with little silt content (Table 10). The abundance and constancy of *Serenoa repens* and *Ilex glabra* suggest some affinities with flatwood types. However, this Association is distinctive in a number of ways. *Conradina canescens* is both ubiquitous and abundant in the plots we observed, and is confined to this Association. *Serenoa repens* is also abundant and ubiquitous. Particularly diagnostic herbs include *Aristida mohrii, Baptisia lanceolata, Chrysopsis hyssopifolia, Dichanthelium tenue, Euphorbia discoidalis, Mimosa microphylla, Pityopsis aspera, Polygonella gracilis, Rhynchospora megalocarpa, Sporobolus junceus,* and *Triplasis americana* (Table 9).

Classification Comments: Plots in this type were included in type XU2, Panhandle Xeric Sandhills, of Carr et al. (2010), along with those of CEGL003583. There are no Associations in the current USNVC that correspond to this type. The equivalent coastal fringe sandhills of eastern Georgia and northeastern Florida are represented by the little-documented CEGL004263 discussed in Part 3 above.

Similar Types: This Association is similar to CEGL003583, which lacks the distinctive coastal fringe flora. In addition, CEGL007133 has affinities to Coastal Scrub types and occurs in close proximity to them.

Diagnostic Characteristics: This type is characterized by its location in extreme western Florida Panhandle and hence by species with ranges restricted or nearly limited to the western Panhandle, including *Chrysopsis hyssopifolia*, *Chrysoma pauciflosculosa*, *Euphorbia discoidalis*, and *Conradina canescens*. It can also be distinguished from other sandhill types in Florida by the presence of mesic and xeric flatwoods species (e.g. *Ilex glabra*).

CEGL004490: *Pinus palustris / Quercus laevis / Aristida beyrichiana – Pterocaulon pycnostachyum* Woodland

Concept History: CEGL004490.

Concept Summary: This Association contains subxeric longleaf pine sandhill communities of northern and central peninsular Florida. It falls between 7132 and 7135 on a moisture gradient, as well as a species richness gradient (Table 10). Dominants, in addition to the nominals, include *Quercus incana, Licania michauxii, Serenoa repens, Vaccinium stamineum* in the sub-canopy/shrub layer and *Pityopsis graminifolia* and *Schizachyrium scoparium* var. *stoloniferum* in the herbaceous layer. As is common among Associations in the middle of a gradient, few species are specific to the type. Diagnostic species

include *Balduina angustifolia, Carphephorus corymbosus, Cnidoscolus stimulosus, Crocanthemum carolinianum, Dalea pinnata, Dyschoriste oblongifolia, Endodeca serpentaria, Eriogonum tomentosum, Lespedeza hirta, Palafoxia integrifolia, Pterocaulon pycnostachyum, Ruellia ciliosa,* and *Tephrosia chrysophylla* (Table 9).

Classification Comments: Type SSU2, North Florida Sub-xeric Sandhills, of Carr et al. (2010) includes this Association, but also spans part of CEGL007135. This Association is approximately equal to CEGL004490 in the current USNVC (Table 8). We revise the name and fine-tune the description based on existing plot data. Specifically, we put more emphasis on *Pterocaulon pycnostachyum*. Association 3569 is asserted to be a xeric sand Association in Florida and is replaced by 7132, but as originally described the composition was vague and in some ways similar to 4490. Regardless, we propose to retire the vaguely described CEGL003569.

Similar Types: This Association is similar to proposed types CEGL007135 and CEGL007132. Type 7135 is slightly more mesic and slightly more species rich than 4490. It is also geographically distinct. Type 7132 is more xeric and species poor than 4490.

Diagnostic Characteristics: This type is distinguished by its high species richness (compared to xeric sandhills), absence of scrub oak species (*Quercus myrtifolia* and *Q. chapmanii*), and lack of *Q. margarettae*.

CEGL007135: *Pinus palustris / Quercus margarettae / Aristida beyrichiana – Rhynchosia reniformis* Woodland

Concept History: New type.

Concept Summary: This Association includes sub-mesic sandhills of northern peninsular Florida, the eastern Florida Panhandle and the adjacent Red Hills region of Georgia (Thomas and Grady Counties). This vegetation is more mesic than that of CEGL004490, yet is sufficiently xeric to justify inclusion in G154. Consistent with the more mesic setting, this is the most species-rich Association in the Alliance at nearly all spatial scales (Table 10). Sub-canopy dominance is spread over *Quercus laevis, Q. hemisphaerica, Q. incana,* and *Q. margarettae*. The more mesic status is indicated by the importance of *Asimina angustifolia* in the shrub layer along with *Rhus copallinum*. The herb layer is dominated by *Aristida beyrichiana*. Important diagnostic species include *Crocanthemum carolinianum, Dyschoriste oblongifolia, Gymnopogon ambiguuus, Elephantopus elatus, Pteridium aquilinum, Rhynchosia reniformis, Symphyotrichum concolor,* and *Vernonia angustifolia* (Table 9).

Classification Comments: There are no types in the current USNVC that correspond to this proposed Association (Table 8). Several plots from the *Aristida beyrichiana*-free portion of Eglin Air Force Base have been attributed to CEGL003587, but our analysis suggests they fit better in CEGL003583. This Association also overlaps SSU1, North Florida Longleaf Woodlands, and SSU2, North Florida Sub-xeric Sandhills, of Carr et al. (2010).

Similar Types: This type is similar to CEGL004490, which is more xeric and less species rich than 7135. These two types can also be differentiated by the dominant oak species in the sub-canopy/shrub layer: *Quercus margarettae* in the case of 7135 and *Q. laevis* in 4490.

Diagnostic Characteristics: This type is distinguished from other xeric and subxeric types by the prevalence of *Quercus margarettae*, the notable absence of *Q. geminata* and *Q. myrtifolia*, and the presence of *Vaccinium arboreum* and *V. stamineum* in the shrub layer. This Association is the most "mesic" and species rich of the G154 types in Florida.

CEGL007137: *Pinus palustris / Quercus falcata / Erythrina herbacea / Aristida condensata* Woodland

Concept History: New type.

Concept Summary: This subxeric Association represents upland longleaf pine woodlands of sand ridges of north central Florida with a strong hardwood influence and calcium-rich soils. Species richness is intermediate at most spatial scales in this type (Table 10). This Association is intermediate between CEGL007135 and upland hardwood forests. Dominants include *Quercus geminata, Carya alba, Quercus myrtifolia, Vaccinium arboreum,* and *Vaccinium stamineum*. Diagnostic species include *Ageratina aromatica, Aristida condensata, Asimina* sp., *Centrosema arenicola, Clitoria mariana, Cyperus plukenetii, Dichanthelium oligosanthes, Erythrina herbacea, Hypericum hypericoides, Indigofera caroliniana, Panicum anceps* var. *rhizomatum, Pteridium aquilinum, Quercus falcata, Salvia azurea, Smilax pumila, Sporobolus clandestinus,* and *Tridens carolinianus* (Table 9).

Classification Comments: There are no types in the current USNVC that correspond to this type (Table 8). The Association is largely contained in SSU1, North Florida Longleaf Woodlands, of Carr et al. (2010).

Similar Types: This type is most similar to CEGL007135, which has a substantially less developed upland hardwood component in the sub-canopy and shrub layers.

Diagnostic Characteristics: This Association is distinguished by the presence of mesic upland hardwood species, lack of wiregrass, and presence of mesic woodland forbs.

CEGL007141: *Pinus palustris / Quercus minima / Aristida beyrichiana – Carphephorus odoratissimus* Woodland

Concept History: New type.

Concept Summary: This Association includes the low, subxeric sandhills of the Panhandle portion of Florida. Almost all of the included plots are located in the Apalachicola embayment, an area of Pliocene-aged deposits. This Association represents an intermediate between mesic flatwoods and low rise sandhills, and constitutes a subsection of Panhandle longleaf pine woodlands that borders on Florida mesic flatwoods. Silt content in the B horizon is the highest of any other Association within this Alliance (Table 10). Dominants include *Quercus laevis, Gaylussacia dumosa, Ilex glabra, Quercus minima, Serenoa repens, Aristida beyrichiana, Schizachyrium scoparium,* and *Pteridium aquilinum*. Indicator species include *Asimina* sp., *Baptisia simplicifolia, Carphephorus odoratissimus, Chrysopsis mariana, Pityopsis aspera, Symphyotrichum adnatum,* and *Vaccinium myrsinites* (Table 9).

Classification Comments: There are no types in the current USNVC that correspond to this type (Table 8). As this type represents slightly siltier sites than other Associations in this Alliance, the Association borders on Group G009, and has overlap with both XU2, Panhandle Xeric Sandhills, and SU2, Panhandle Silty Longleaf Woodlands, of Carr et al. (2010). Association 3601 described from the De Soto National Forest of southern Mississippi has been asserted to occur in the Apalachicola National Forest, but our analysis associates this plot with 7141; we suggest that 3601 be viewed as occurring only in southern Mississippi and Alabama.

Similar Types: This type is similar to CEGL003601, which occurs exclusively in Mississippi and Alabama.

Diagnostic Characteristics: The type is transitional between mesic flatwoods and low rise sandhills, and hence contains a distinctive mix of sandhill and flatwood species in both the mid-story and herbaceous layers.

Part 5: *Pinus palustris / Quercus laevis / Aristida condensata* Alliance. Xeric longleaf pine Associations of southern Mississippi and adjacent Louisiana and Alabama.

The *Pinus palustris / Quercus laevis / Aristida condensata* Alliance occurs along the central Gulf Coast of southern Mississippi and potentially in adjacent Alabama and Louisiana. This area is west of the range of *Aristida beyrichiana,* and *Schizachyrium scoparium* largely replaces it along with the constant but less abundant *Aristida condensata*. Three Associations have been recognized and largely form a gradient from extremely xeric (CEGL003587) occupying the same sites as CEGL003583 in Florida, subxeric (CEGL003588) occupying the same sites as CEGL007135 in Florida, and dry flats transitional to flatwood with ample *Serenoa repens* (CEGL003601), the western equivalent of CEGL007141 in Florida.

CEGL003588. *Pinus palustris* / *Quercus laevis* / *Serenoa repens* / *Aristida condensata* Woodland

This Association contains xeric sandhill longleaf pine vegetation of the central Gulf Coast. We propose no modification until vegetation plots are available.

CEGL003587. *Pinus palustris* / *Quercus laevis* / *Schizachyrium scoparium – Rhynchosia cytisoides* Woodland

This is an Association of subxeric longleaf pine vegetation of the central Gulf Coast. Alleged records from Florida on Eglin Air Force Base appear to better fit the proposed CEGL007135. The description of CEGL003587 should be revised to remove references to Florida occurrences.

CEGL003601. *Pinus palustris* / *Quercus laevis* / *Serenoa repens – Clinopodium coccineum* Woodland

Subxeric longleaf pine flats transitional to dry flatwoods, as evidenced by the abundance of *Serenoa repens*, are represented by this Association. This corresponds to the Subxeric Saw Palmetto Woodland described by Peet and Allard (1993) based on two plots from the De Soto National Forest, which form the basis for creation of 3601. We observe that the Florida plots reported from the Apalachicola National Forest fit well with the proposed 7141. The description of CEGL003601 should be modified to remove references to Florida occurrences.

Acknowledgements

We are indebted to the USNVC Vegetation Panel and ESA; without their support, this document would not have been possible. Special thanks to Jill Parsons, Cliff Duke, Alexa McKerrow, Don Faber-Langendoen, and Scott Franklin. Support for this work came from the US Geological Survey. We would like to thank several reviewers who greatly improved the quality of this document: Mike Schafale, Carl Nordman, Milo Pyne, Cecil Frost, Kay Kirkman, Karen Patterson, Jeff Glitzenstein, Joel Gramling, Becky Sharitz, and Kim Gulledge. We thank the numerous participants of the Carolina Vegetation Survey who have helped with field data collection. In particular, Thomas Wentworth, Mike Schafale, and Alan Weakley joined R.K. Peet in the creation and management of the Carolina Vegetation Survey. Richard Duncan and Eric Kjellmark coordinated data collection from the Fall-line Sandhills of South Carolina and Georgia, and the Coastal Plain of South Carolina and Georgia, respectively. S.C. Carr, R.K. Peet and William Platt planned and then executed fieldwork in Florida. Michael Lee assisted with data management and summarization. Funding for sampling in South Carolina and Georgia was provided by the US Forest Service, and for sampling in Florida, by the Florida Department of Fish and Wildlife Conservation Commission.

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Digital Appendices

1. **Links to VegBank datasets containing the vegetation plots associated with the 25 described Associations.**

2. **Formal descriptions (proposed new and revised content for the formal descriptions of the types in the USNVC database) plus constancy tables.**

   2.1 Xeric longleaf pine Associations of the proposed *Pinus palustris / Quercus laevis / Aristida stricta* Alliance.
   2.2 Xeric longleaf pine Associations of the proposed *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance.
   2.3 Xeric longleaf pine Associations of the proposed *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance.

Tables

Figures

1. **Cluster dendrogram for all plots showing the three major groups (Alliances) that emerged.**
2. **Map showing plot locations by Alliance.**
3. **Non-metric multidimensional scaling (NMS) ordination of all plots. Plots are highlighted by their proposed Alliance.**
4. **Cluster dendrogram for all plots in North Carolina and South Carolina. Plots are labeled according to their proposed Association.**
5. **NMS ordination showing plots in the proposed *Pinus palustris / Quercus laevis / Aristida stricta* Alliance for each combination of NMS axes (1, 2, 3). Plots are highlighted by their proposed community type, and environmental and site attributes are overlaid as vectors.**
6. **Cluster dendrogram for all plots in South Carolina and Georgia. Plots are labeled according to their proposed Association.**
7. **NMS ordination showing plots in the proposed *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance for each combination of NMS axes (1, 2, 3). Plots are highlighted by their proposed community type, and environmental and site attributes are overlaid as vectors.**
8. **Cluster dendrogram for all plots in Florida and immediately adjacent Georgia. Plots are labeled according to their proposed Association.**
9. **NMS ordination showing plots in the proposed *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance for each combination of NMS axes (1, 2, 3). Plots are highlighted by their proposed community type, and environmental and site attributes are overlaid as vectors.**

Table 1. Prevalent species in each of the three proposed new Alliances of the Xeric Longleaf Pine Woodland Group: 1 = *Pinus palustris / Quercus laevis / Aristida stricta* Alliance, 2 = *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance, 3 = *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance. Species shown are prevalent in at least one Alliance and have >30% constancy and average cover class of >2 in at least one Alliance. Indicator species for each Alliance are highlighted in grey.

Groups	**Alliance 1 (NC & SC)**		**Alliance 2 (SC & GA)**		**Alliance 3 (FL &GA)**	
Tree species	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**
Carya pallida	--	--	40%	2	--	--
Crataegus spp.	--	--	51%	2	--	--
Diospyros virginiana	68%	2	93%	2	63%	3
Nyssa sylvatica	--	--	33%	2	--	--
Pinus palustris	96%	6	97%	7	94%	6
Pinus taeda	35%	5	--	--	--	--
Prunus serotina	--	--	39%	2	--	--
Quercus geminata	--	--	--	--	66%	5
Quercus hemisphaerica	--	--	--	--	46%	3
Quercus incana	54%	4	69%	4	79%	5
Quercus laevis	96%	6	90%	6	88%	6
Quercus marilandica	--	--	43%	3	--	--
Quercus margarettae	30%	4	69%	5	48%	5
Sassafras albidum	53%	2	60%	2	--	--
Vine species	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**
Gelsemium sempervirens	30%	2	39%	2	--	--
Smilax auriculata	--	--	--	--	87%	3
Smilax glauca	--	--	55%	2	--	--
Vitis rotundifolia	--	--	39%	3	32%	2
Shrub species	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**
Asimina [*angustifolia + spatulata*]	--	--	--	--	43%	2
Gaylussacia dumosa	72%	5	72%	4	45%	4
Gaylussacia frondosa	36%	6	--	--	--	--
Hypericum hypericoides	30%	2	79%	2	41%	2
Licania michauxii	--	--	--	--	75%	4
Morella [*cerifera + pumila*]	43%	3	--	--	--	--
Opuntia humisfusa	--	--	34%	2	41%	2
Quercus minima	--	--	--	--	31%	5
Rhus copallinum	--	--	85%	2	61%	4
Rubus cuneifolius	--	--	--	--	35%	3
Serenoa repens	--	--	--	--	69%	5
Toxicodendron pubescens	35%	2	61%	2	--	--
Vaccinium arboreum	--	--	67%	3	46%	3
Vaccinium darrowii	--	--	--	--	39%	4
Vaccinium myrsinites	--	--	--	--	30%	4
Vaccinium stamineum	33%	2	84%	3	49%	3

Vaccinium tenellum	55%	4	--	--	--	--
Yucca [*flaccida + filamentosa*]	--	--	--	--	32%	2
Herb species	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**
Ageratina aromatica	--	--	33%	2	47%	2
[*Andropogon+ Schizachyrium*]	55%	2	76%	5	--	--
Andropogon elliottii	--	--	--	--	89%	2
Andropogon ternarius	--	--	--	--	72%	2
Andropogon virginicus	--	--	--	--	70%	3
Aristida beyrichiana	--	--	54%	7	90%	7
Aristida purpurascens	--	--	67%	2	54%	2
Aristida stricta	77%	6	--	--	--	--
Aureolaria pectinata	--	--	40%	2	--	--
Baptisia perfoliata	--	--	30%	2	--	--
Bulbostylis [*ciliatifolia + coarctata*]	--	--	40%	2	68%	2
Carphephorus bellidifolius	64%	2	33%	2	--	--
Chamaecrista nictitans	--	--	--	--	43%	2
Chrysopsis gossypina	--	--	30%	2	--	--
Chrysopsis mariana	--	--	42%	2	--	--
Cirsium repandum	33%	2	--	--	--	--
Clitoria mariana var. *mariana*	--	--	33%	2	--	--
Cnidoscolus stimulosus	76%	2	48%	2	62%	2
Commelina erecta	--	--	43%	2	59%	2
Coreopsis major	--	--	37%	2	--	--
Crocanthemum carolinianum	--	--	--	--	50%	2
Crotalaria rotundifolia	--	--	--	--	65%	2
Croton argyranthemum	--	--	--	--	63%	2
Cyperus [*filiculmis + lupulinus*]	--	--	--	--	53%	2
Desmodium nuttallii	--	--	30%	2	--	--
Desmodium strictum	--	--	30%	2	--	--
Dichanthelium [*aciculare + angustifolium*]	--	--	64%	2	82%	2
Dichanthelium [*ovale + villosissimum*]	--	--	76%	2	86%	3
Dichanthelium tenue	--	--	--	--	48%	2
Dyschoriste oblongifolia	--	--	--	--	46%	3
Elephantopus elatus	--	--	--	--	49%	3
Endodeca serpentaria	--	--	--	--	44%	2
Eragrostis refracta	--	--	--	--	32%	2
Eriogonum tomentosum	--	--	40%	2	59%	2
Eupatorium album	--	--	40%	2	31%	2
Eupatorium compositifolium	--	--	66%	2	63%	2
Eupatorium glaucescens	--	--	54%	2	--	--
Euphorbia ipecacuanhae	74%	2	--	--	--	--
Galactia [*regularis + volubilis*]	38%	2	66%	2	37%	2
Galium pilosum	--	--	34%	2	--	--
Gymnopogon ambiguus	--	--	48%	2	42%	2
Hieracium gronovii	--	--	63%	2	63%	2

Houstonia procumbens	--	--	--	--	65%	2
Ionactis linariifolia	--	--	64%	2	--	--
Lechea sessiliflora	--	--	--	--	63%	2
Lespedeza hirta	--	--	45%	2	45%	2
Lespedeza repens	--	--	46%	2	--	--
Liatris spp.	--	--	58%	2	--	--
Liatris [pilosa + virgata]	32%	2	--	--	--	--
Liatris gracilis	--	--	--	--	38%	2
Liatris tenuifolia	--	--	--	--	69%	2
Mimosa microphylla	--	--	34%	2	44%	2
Palafoxia integrifolia	--	--	--	--	42%	2
Paspalum [*setaceum + propinquum*]	--	--	--	--	67%	2
Pityopsis aspera	--	--	--	--	41%	4
Pityopsis graminifolia	60%	2	90%	3	71%	4
Polygonella gracilis	--	--	--	--	30%	2
Pteridium aquilinum	--	--	41%	6	56%	5
Pterocaulon pycnostachyum	--	--	--	--	46%	2
Ruellia ciliosa	--	--	--	--	43%	2
Rhynchosia reniformis	--	--	43%	2	54%	2
Rhynchospora grayi	--	--	61%	2	73%	2
Scleria [*ciliata + elliotii*]	--	--	66%	2	84%	2
Schizachyrium scoparium	--	--	--	--	88%	4
Schizachyrium tenerum	--	--	--	--	32%	3
Sericocarpus tortifolius	34%	2	63%	2	75%	2
Silphium compositum	--	--	51%	2	--	--
Solidago nemoralis	--	--	33%	2	--	--
Solidago odora var. odora	37%	2	85%	2	68%	3
Sorghastrum secundum	--	--	--	--	85%	4
Sporobolus junceus	--	--	37%	3	67%	3
Stillingia sylvatica	--	--	--	--	76%	2
Stipulicida setacea	39%	2	35%	2	--	--
Stylisma patens	34%	2	78%	2	83%	2
Stylosanthes biflora	--	--	58%	2	68%	2
Symphyotrichum concolor	--	--	54%	2	53%	2
Tephrosia chrysophylla	--	--	--	--	58%	2
Tephrosia florida	--	--	--	--	39%	2
Tephrosia virginiana	--	--	66%	4	--	--
Tragia smallii	--	--	--	--	32%	2
Tragia urens	37%	2	64%	2	77%	2
Triplasis americana	--	--	--	--	30%	2
Vernonia angustifolia	--	--	60%	2	56%	2

Table 2. Relationships of proposed Associations in the *Pinus palustris / Quercus laevis / Aristida stricta* Alliance to established USNVC Xeric Longleaf Pine Woodland Associations. Relationships are depicted by three symbols: ~ indicates that the proposed Association concept is approximately equivalent to the USNVC concept, = indicates that the two concepts are equal, and ≠ indicates the proposed Association is not equal to the USNVC concept. Associations are arranged from xeric to subxeric.

Type	Plots	Proposed longleaf pine Association name	Relationship	USNVC Association	
3584	8	*Pinus palustris / Quercus laevis / Stipulicida setacea – Selaginella acanthonota* Woodland	=	3584	*Pinus palustris / Quercus laevis / Aristida stricta / Cladonia* Spp. Woodland
3590	4	*Pinus palustris / Quercus laevis – Quercus geminata* / *Rhynchospora megalocarpa* Woodland	=	3590	*Pinus palustris / Quercus laevis / Aristida purpurascens* / *Stipulicida setacea* (*Rhynchospora megalocarpa, Selaginella acanthonota*) Woodland
7125	7	*Pinus palustris / Quercus laevis – Quercus geminata / Schizachyrium scoparium* Woodland	≠	3590	*Pinus palustris / Quercus laevis / Aristida purpurascens* / *Stipulicida setacea* (*Rhynchospora megalocarpa, Selaginella acanthonota*) Woodland
3577	5	*Pinus palustris / Quercus geminata – Quercus hemisphaerica / Osmanthus americanus* Woodland	=	3577	*Pinus palustris – Pinus taeda / Quercus geminata – Quercus hemisphaerica – Osmanthus americanus* var. *americanus / Aristida stricta* Woodland
3592	10	*Pinus palustris – Pinus taeda / Quercus laevis / Gaylussacia frondosa – Gaylussacia baccata* Woodland	=	3592	*Pinus palustris / Quercus laevis – Quercus incana / Gaylussacia dumosa – Gaylussacia* (*baccata, frondosa*) Woodland
7126	10	*Pinus palustris – Pinus serotina / Quercus laevis / Gaylussacia frondosa / Schizachyrium scoparium* Woodland	≠	3584	*Pinus palustris / Quercus laevis / Aristida stricta / Cladonia* Spp. Woodland
3586	32	*Pinus palustris / Quercus laevis / Aristida stricta – Baptisia cinerea* Woodland	=	3586	*Pinus palustris / Quercus laevis / Gaylussacia dumosa / Aristida stricta* Woodland
3589	14	*Pinus palustris / Quercus laevis – Quercus geminata* / *Aristida stricta* Woodland	~	3589	*Pinus palustris / Quercus laevis – Quercus geminata / Vaccinium tenellum* / *Aristida stricta* Woodland

3591	18	*Pinus palustris / Quercus laevis – Quercus incana / Gaylussacia dumosa / Aristida stricta* Woodland	=	3591	*Pinus palustris / Quercus laevis – Quercus (incana, margarettae) / Gaylussacia dumosa / Aristida stricta* Woodland

Table 3. Prevalent species for proposed Associations in the *Pinus palustris / Quercus laevis / Aristida stricta* Alliance. Species shown are grouped by growth form and are prevalent in at least one group, and have >40% constancy and average cover class of >2 in at least one group. The number of species listed for each growth form in an Association corresponds to the mean species richness of that growth form in that Association. Indicator species for each type are highlighted in grey.

Association	**3584**		**3590**		**7125**		**3577**		**3592**		**7126**		**3586**		**3589**		**3591**	
Tree species	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**
Castanea pumila	--	--	--	--	--	--	--	--	60%	3	--	--	--	--	--	--	--	--
Diospyros virginiana	--	--	--	--	--	--	--	--	--	--	100%	2	91%	3	71%	2	72%	2
Ilex opaca	--	--	--	--	--	--	80%	2	--	--	--	--	--	--	--	--	--	--
Ilex vomitoria	--	--	--	--	--	--	100%	2	--	--	--	--	--	--	--	--	--	--
Nyssa sylvatica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Osmanthus americanus	--	--	--	--	--	--	80%	3	--	--	--	--	--	--	--	--	--	--
Persea [*borbonia + palustris*]	--	--	--	--	--	--	80%	2	--	--	--	--	--	--	--	--	--	--
Pinus palustris	50%	5	100%	4	100%	6	100%	5	90%	5	100%	6	100%	6	100%	6	100%	6
Pinus serotina	--	--	--	--	--	--	--	--	--	--	70%	5	--	--	--	--	--	--
Pinus taeda	--	--	--	--	43%	4	100%	6	90%	7	80%	4	--	--	--	--	--	--
Quercus geminata	--	--	100%	3	43%	2	80%	6	--	--	--	--	--	--	79%	6	--	--
Quercus hemisphaerica	--	--	50%	5	--	--	100%	6	--	--	--	--	--	--	--	--	--	--
Quercus incana	--	--	--	--	--	--	--	--	--	--	--	--	72%	3	57%	3	100%	5
Quercus laevis	100%	7	100%	7	100%	6	80%	6	100%	6	90%	6	100%	7	100%	6	89%	5
Quercus nigra	--	--	--	--	--	--	--	--	90%	4	--	--	--	--	--	--	--	--
Sassafras albidum	--	--	--	--	--	--	100%	2	100%	3	80%	2	--	--	--	--	78%	2
Vine Species	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**
Gelsemium sempervirens	50%	2	--	--	--	--	--	--	--	--	70%	3	--	--	57%	2	--	--
Smilax auriculata	--	--	--	--	--	--	80%	2	--	--	--	--	--	--	43%	2	--	--
Smilax bona-nox	--	--	--	--	43%	2	--	--	--	--	--	--	--	--	--	--	--	--
Smilax glauca	--	--	--	--	--	--	--	--	80%	2	50%	2	--	--	--	--	--	--
Vitis rotundifolia	--	--	50%	2	--	--	80%	5	--	--	--	--	--	--	--	--	--	--
Shrub Species	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**
Gaulussacia baccata	--	--	--	--	--	--	--	--	50%	6	--	--	--	--	--	--	--	--
Gaylussacia dumosa	--	--	--	--	43%	6	40%	4	60%	5	90%	5	91%	5	57%	3	100%	6
Gaylussacia frondosa	--	--	--	--	--	--	--	--	100%	7	90%	6	--	--	--	--	94%	6
Hypericum hypericoides	--	--	--	--	--	--	--	--	--	--	--	--	50%	2	--	--	--	--
Ilex glabra	--	--	--	--	--	--	--	--	--	--	40%	2	--	--	--	--	89%	2
Kalmia angustifolia	--	--	--	--	--	--	--	--	50%	5	--	--	--	--	--	--	--	--

Lyonia mariana	--	--	--	--	--	--	--	--	--	--	60%	4	--	--	--	--	--	--
Morella cerifera	--	--	--	--	--	--	80%	4	--	--	60%	3	--	--	79%	2	100%	3
Opuntia humifusa	--	--	50%	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polygonella polygama	63%	2	50%	2	--	--	40%	2	--	--	--	--	--	--	--	--	--	--
Vaccinium arboreum	--	--	--	--	43%	6	100%	6	--	--	--	--	--	--	--	--	--	--
Vaccinium pallidum	--	--	--	--	--	--	--	--	80%	4	--	--	--	--	--	--	--	--
Vaccinium stamineum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	57%	2	89%	3
Vaccinium tenellum	--	--	--	--	--	--	60%	2	80%	4	80%	5	--	--	79%	4	100%	4
Herb species	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**	**Const.**	**Cover**
[*Andropogon+ Schizachyrium*]	--	--	--	--	--	--	60%	2	--	--	80%	3	78%	2	--	--	--	--
Amorpha herbacea	--	--	--	--	--	--	40%	2	--	--	--	--	--	--	--	--	--	--
Andropogon ternarius	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	67%	2
Aristida stricta	--	--	75%	4	--	--	80%	5	--	--	80%	3	97%	6	100%	6	100%	6
Baptisia cinerea	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Carphephorus bellidifolius	--	--	--	--	--	--	--	--	60%	2	--	--	88%	2	79%	2	89%	2
Carphephorus odoratissimus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	61%	2
Cirsium repandum	--	--	--	--	--	--	--	--	--	--	--	--	63%	2	--	--	--	--
Coreopsis sp.	--	--	--	--	--	--	40%	2	--	--	--	--	--	--	--	--	--	--
Cnidoscolus stimulosus	50%	2	100%	2	71%	2	40%	2	--	--	--	--	84%	2	86%	2	100%	2
Cuthbertia graminea	50%	2	--	--	--	--	40%	2	--	--	--	--	--	--	--	--	--	--
Dichanthelium sp.	--	--	--	--	--	--	40%	2	--	--	--	--	--	--	--	--	--	--
Euphorbia ipecacuanhae	--	--	75%	2	71%	2	60%	2	60%	2	86%	2	88%	2	79%	2	83%	2
Euphorbia pubentissima	--	--	--	--	--	--	40%	2	--	--	--	--	--	--	--	--	--	--
Ionactis linariifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	83%	2
Liatris [pilosa + virgata]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	83%	2
Pityopsis graminifolia	--	--	--	--	71%	2	--	--	--	--	--	--	--	--	86%	2	94%	2
Pteridium aquilinum	--	--	--	--	--	--	--	--	40%	7	--	--	--	--	--	--	--	--
Rhynchospora grayi	--	--	--	--	--	--	--	--	--	--	--	--	41%	2	--	--	--	--
Rhynchospora megalocarpa	--	--	75%	2	71%	2	--	--	--	--	--	--	--	--	--	--	--	--
Schizachyrium scoparium	--	--	--	--	--	--	--	--	--	--	50%	2	--	--	--	--	--	--
Selaginella acanthonota	75%	3	50%	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sericocarpus tortifolius	--	--	--	--	--	--	--	--	--	--	--	--	--	--	57%	2	89%	2
Silphium compositum	--	--	--	--	--	--	--	--	--	--	--	--	44%	2	--	--	--	--
Solidago odora var. odora	--	--	--	--	--	--	--	--	--	--	--	--	--	--	43%	2	67%	2
Stipulicida setacea	100%	2	75%	2	71%	2	--	--	--	--	50%	2	--	--	--	--	--	--
Stylisma patens ssp. patens	--	--	--	--	71%	2	--	--	--	--	--	--	59%	2	--	--	--	--
Tillandsia usneoides	63%	3	--	--	--	--	--	--	--	--	70%	3	--	--	--	--	--	--

Tragia urens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50%	2	83%	2

Table 4. Mean species richness and environmental attributes of proposed Associations in the *Pinus palustris / Quercus laevis / Aristida stricta* Alliance. NA indicates that soil data were not available for the type.

Type	3584	3590	7125	3577	3592	7126	3586	3589	3591
Avg Richness- 1000m²	14.4	18.5	20.8	30.3	25.4	27.0	31.4	35.5	36.9
Avg Richness- 400m²	13.0	15.5	18.0	23.7	20.8	22.8	26.0	28.5	32.6
Avg Richness- 100m²	9.6	10.2	13.1	18.5	13.7	15.2	16.8	18.6	23.5
Avg Richness- 10m²	5.4	5.4	6.1	7.1	6.3	7.4	8.1	9.0	12.8
Avg Richness- 1m²	2.7	2.5	2.2	3.2	2.6	3.8	3.5	4.1	6.8
Avg Richness- 0.1m²	1.1	0.8	0.7	1.5	1.0	1.6	1.3	1.7	3.2
Avg Richness- 0.01m²	0.4	0.3	0.2	0.5	0.4	0.5	0.4	0.5	1.1
Avg % Sand in A	94.4	96.3	96.6	97	96.0	92.2	79.2	86.8	69.2
Avg % Sand in B	97.5	97.9	97.9	NA	94.4	81.7	NA	93.9	87.6
Avg % Silt in A	3.1	1.5	2.3	1.9	2.3	5.5	16.7	10.5	28.2
Avg % Silt in B	0.9	2.1	0.7	NA	1.4	16.8	NA	3.1	9.4

Table 5. Relationships of proposed Associations in the *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance to established USNVC Xeric Longleaf Pine Woodland Associations. Relationships are depicted by three symbols: ~ indicates that the proposed Association concept is approximately equivalent to the USNVC concept, ≠ indicates that the proposed Association concept does not overlap the USNVC concept, and = indicates that the two concepts are equal. Associations are arranged from xeric to subxeric.

Type	Plots	Proposed longleaf pine Association name	Relationship	USNVC Association	
7127	3	*Pinus palustris / Quercus laevis / Chrysoma pauciflosculosa / Aristida purpurascens* Woodland	≠	3946	*Chrysoma pauciflosculosa* - (*Clinopodium coccineum*) Dwarf-shrubland
7844	14	*Pinus palustris* / *Quercus laevis* / *Schizachyrium scoparium – Stipulicida setacea* Woodland	=	7844	*Pinus palustris* / *Quercus laevis* - *Quercus incana* / *Aristida beyrichiana* - *Baptisia perfoliata* Woodland
		"	≠	3583	*Pinus palustris / Quercus laevis / Aristida beyrichiana - Pityopsis aspera Woodland*
		"	≠	3590	*Pinus palustris / Quercus laevis / Aristida purpurascens / Stipulicida setacea (Rhynchospora megalocarpa, Selaginella acanthonota) Woodland*
4492	7	*Pinus palustris* / *Quercus laevis – Quercus margarettae* / *Licania michauxii* / *Aristida beyrichiana* Woodland	~	4492	*Pinus palustris* / *Quercus laevis – Quercus incana – Quercus margarettiae* / *Licania michauxii* / *Aristida beyrichiana* Woodland
4263	0	*Pinus palustris / Quercus (hemisphaerica, laevis) / Morella cerifera / Aristida beyrichiana* Woodland	=	4263	*Pinus palustris / Quercus (hemisphaerica, laevis) / Morella cerifera / Aristida beyrichiana* Woodland

3593	12	*Pinus palustris* / *Quercus laevis* / *Toxicodendron pubescens* / *Schizachyrium scoparium* - *Lespedeza hirta* Woodland	~	3593	*Pinus palustris* / *Quercus laevis* - (*Quercus incana*) / *Vaccinium tenellum* / *Schizachyrium scoparium* - *Eriogonum tomentosum* Woodland
7842	4	*Pinus palustris* / *Quercus marilandica* / *Aristida beyrichiana* - *Tephrosia virginiana* Woodland	~	7842	*Pinus palustris* - *Quercus incana* - *Quercus marilandica* / *Aristida beyrichiana* - *Nolina georgiana* Woodland
8491	10	*Pinus palustris* / *Schizachyrium scoparium* – *Pteridium aquilinum* Woodland	=	8491	*Pinus palustris* - *Pinus* (*echinata*, *taeda*) / (*Quercus marilandica*, *laevis*) / *Schizachyrium scoparium* Woodland
4487	4	*Pinus palustris* / *Quercus stellata* / *Quercus elliottii* / *Sporobolus junceus* – *Nolina georgiana* Woodland	=	4487	*Pinus palustris* / *Quercus incana* - *Quercus stellata* / *Aristida beyrichiana* - *Sporobolus junceus* - *Nolina georgiana* Woodland
7129	10	*Pinus palustris* / *Quercus margarettae* / *Toxicodendron pubescens* / *Schizachyrium scoparium* Woodland	≠	4488	*Pinus palustris* / *Quercus laevis* / *Gaylussacia dumosa* / *Aristida beyrichiana* - *Helianthus atrorubens* Woodland
4488	4	*Pinus palustris* / *Quercus hemisphaerica* / *Gaylussacia dumosa* / *Aristida beyrichiana* - *Dyschoriste oblongifolia* Woodland	~	4488	*Pinus palustris* / *Quercus laevis* / *Gaylussacia dumosa* / *Aristida beyrichiana* - *Helianthus atrorubens* Woodland

Table 6. Prevalent species for proposed Associations in the *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance. Species shown are grouped by growth form and are prevalent in at least one group, and have >40% constancy and average cover class of >2 in at least one group. The number of species listed for each growth form in an Association corresponds to the mean species richness of that growth form in that Association. Indicator species for each type are highlighted in grey. *Schizachyrium scoparium* * is more than likely *Schizachyrium scoparium*, but at the time of sampling was only identified to [*Andropogon* + *Schizachyrium*].

Association	**7127**		**7844**		**4492**		**3593**		**7842**		**8491**		**4487**		**7129**		**4488**	
Tree species	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**
Carya tomentosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80%	4	--	--
Carya pallida	--	--	--	--	--	--	92%	3	--	--	80%	2	--	--	--	--	--	--
Cornus florida	--	--	--	--	--	--	--	--	100%	2	--	--	--	--	--	--	--	--
Crataegus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100%	2
Diospyros virginiana	--	--	92%	2	--	--	100%	3	100%	2	90%	2	100%	2	100%	3	100%	2
Nyssa sylvatica	--	--	--	--	--	--	--	--	100%	4	80%	2	--	--	--	--	--	--
Osmanthus americanus	67%	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pinus palustris	100%	5	85%	5	100%	6	100%	7	100%	7	100%	7	100%	7	100%	7	100%	4
Pinus taeda	67%	2	--	--	--	--	--	--	100%	6	--	--	--	--	--	--	--	--
Prunus serotina	--	--	--	--	--	--	75%	2	100%	3	--	--	--	--	--	--	100%	2
Quercus hemisphaerica	100%	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100%	4
Quercus falcata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	60%	4	75%	3
Quercus incana	--	--	85%	4	86%	4	50%	4	--	--	--	--	100%	4	100%	4	75%	4
Quercus laevis	100%	7	100%	6	100%	6	100%	5	100%	3	--	--	--	--	90%	5	--	--
Quercus margarettae	100%	5	--	--	71%	6	83%	4	--	--	--	--	75%	2	100%	6	75%	4
Quercus marilandica	--	--	--	--	--	--	--	--	100%	3	80%	3	--	--	70%	3	75%	3
Quercus nigra	--	--	--	--	--	--	--	--	100%	3	--	--	--	--	--	--	75%	4
Quercus stellata	--	--	--	--	--	--	--	--	--	--	--	--	75%	6	--	--	--	--
Sassafras albidum	--	--	--	--	--	--	100%	2	100%	2	--	--	--	--	--	--	--	--
Vine species	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**
Gelsemium sempervirens	--	--	46%	2	--	--	--	--	100%	4	--	--	--	--	--	--	--	--
Smilax bona-nox	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50%	2
Smilax glauca	--	--	--	--	--	--	83%	2%	100%	2	90%	2	--	--	60%	2	75%	2
Vitis rotundifolia	--	--	--	--	--	--	--	--	75%	2	--	--	75%	5	60%	2	--	--
Shrub species	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**
Ceanothus americanus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	60%	2	--	--
Chrysoma pauciflosculosa	100%	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gaylussacia dumosa	--	--	77%	4	--	--	--	--	100%	2	100%	3	75%	4	70%	2	100%	4
Hypericum gentianoides	67%	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypericum hypericoides	--	--	85%	2	--	--	92%	2%	75%	2	80%	2	100%	2	80%	2	--	--
Licania michauxii	--	--	--	--	100%	3	--	--	--	--	--	--	--	--	--	--	--	--
Opuntia humifusa	100%	2	--	--	100%	2	--	--	--	--	--	--	--	--	--	--	--	--
Quercus elliottii	--	--	--	--	--	--	--	--	--	--	--	--	75%	6	--	--	--	--
Rhus copallinum	--	--	--	--	--	--	100%	2	100%	2	100%	2	100%	2	100%	2	100%	2
Rubus cuneifolius	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	4

Serenoa repens	--	--	--	--	71%	4	--	--	--	--	--	--	--	--	--	--	--	--
Toxicodendron pubescens	--	--	--	--	--	--	100%	2	--	--	--	--	--	--	90%	3	75%	2
Vaccinium arboreum	67%	4	77%	3	--	--	75%	2	100%	4	100%	4	--	--	--	--	--	--
Vaccinium myrsinites	--	--	--	--	--	--	--	--	--	--	60%	4	75%	3	--	--	--	--
Vaccinium stamineum	100%	2	92%	4	71%	2	100%	4	100%	3	--	--	--	--	80%	3	100%	2
Vaccinium tenellum	--	--	--	--	--	--	--	--	--	--	60%	3	--	--	--	--	--	--
Herb species	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**
Ageratina aromatica	--	--	--	--	--	--	83%	2	--	--	--	--	--	--	60%	2	--	--
Andropogon elliottii	--	--	--	--	--	--	--	--	--	--	--	--	100%	3	--	--	75%	3
Andropogon ternarius	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100%	3
Andropogon virginicus	--	--	--	--	100%	2	--	--	--	--	--	--	100%	3	--	--	100%	3
Anthenantia villosa	--	--	--	--	--	--	--	--	75%	2	60%	2	--	--	--	--	--	--
Aristida beyrichiana	--	--	69%	7	100%	6	--	--	100%	6	--	--	100%	6	--	--	100%	7
Aristida purpurascens	100%	2	77%	2	57%	2	--	--	--	--	100%	2	--	--	60%	2	--	--
Aristida virgata	--	--	--	--	71%	2	--	--	--	--	--	--	--	--	--	--	--	--
Asclepias verticillata	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Aureolaria pectinata	--	--	69%	2	86%	2	--	--	--	--	--	--	--	--	--	--	--	--
Baptisia cinera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	3
Baptisia perfoliata	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	--	--	--	--
Bulbostylis [*ciliatifolia+coarctata*]	67%	2	69%	2	86%	2	--	--	--	--	--	--	--	--	--	--	--	--
Carphephorus bellidifolius	--	--	--	--	--	--	67%	2	100%	2	--	--	--	--	--	--	--	--
Centrosema virginianum	--	--	--	--	--	--	58%	2	--	--	--	--	--	--	50%	3	--	--
Chamaecrista fasciculata	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Chamaecrista nictitans	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Chrysopsis mariana	--	--	--	--	--	--	--	--	--	--	80%	2	75%	2	60%	2	100%	2
Cirsium repandum	--	--	--	--	--	--	92%	2	--	--	--	--	--	--	--	--	--	--
Clitoria mariana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	70%	2	75%	2
Cnidoscolus stimulosus	--	--	77%	2	71%	2	--	--	--	--	--	--	75%	2	70%	2	--	--
Commelina erecta	--	--	--	--	100%	2	75%	2	--	--	--	--	100%	2	--	--	--	--
Coreopsis major	--	--	--	--	--	--	67%	2	--	--	70%	2	--	--	--	--	--	--
Croton argyranthemus	--	--	--	--	71%	2	--	--	--	--	--	--	--	--	--	--	--	--
Dalea pinnata	--	--	--	--	57%	2	--	--	--	--	--	--	--	--	--	--	--	--
Desmodium laevigatum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	60%	2	--	--
Desmodium lineatum	--	--	--	--	--	--	--	--	--	--	60%	2	75%	2	60%	2	75%	2
Desmodium marilandicum	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Desmodium obtusum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100%	2
Desmodium paniculatum	--	--	--	--	--	--	67%	2	--	--	--	--	--	--	--	--	--	--
Desmodium strictum	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	70%	2	--	--
Dichanthelium [*aciculare+angustifolium*]	--	--	--	--	--	--	--	--	75%	2	90%	2	75%	2	70%	2	100%	3
Dichanthelium acuminatum	67%	2	--	--	100%	2	--	--	--	--	--	--	75%	2	--	--	--	--
Dichanthelium ovale	--	--	85%	2	--	--	67%	2	75%	2	90%	2	--	--	100%	2	100%	4
Dichanthelium oligosanthes	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	--	--

Dichanthelium ravenelii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	70%	2	--	--
Dichanthelium sphaerocarpon	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Dichanthelium tenue	--	--	--	--	--	--	--	--	75%	2	--	--	75%	2	--	--	--	--
Dyschoriste oblongifolia	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	--	--	100%	2
Elephantopus tomentosus	--	--	--	--	--	--	--	--	--	--	--	--	50%	2	--	--	--	--
Endodeca serpentaria	--	--	--	--	--	--	--	--	--	--	--	--	--	--	70%	2	--	--
Eragrostis spectabilis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Eriogonum tomentosum	--	--	62%	2	86%	2	--	--	--	--	--	--	100%	2	--	--	--	--
Eryngium yuccifolium	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Eupatorium album	--	--	--	--	--	--	--	--	--	--	80%	2	75%	2	--	--	--	--
Eupatorium compositifolium	--	--	--	--	100%	3	75%	2	--	--	80%	2	75%	2	70%	2	100%	2
Eupatorium glaucescens	--	--	--	--	--	--	100%	2	--	--	--	--	75%	2	70%	2	100%	3
Euphorbia ipecacuanhae	--	--	62%	2	--	--	--	--	75%	2	--	--	--	--	--	--	--	--
Euphorbia pubentissima	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Euphorbia exserta	--	--	--	--	57%	2	--	--	--	--	--	--	--	--	--	--	75%	2
Galactia erecta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Galactia [*regularis+volubilis*]	100%	2	69%	2	--	--	--	--	--	--	--	--	100%	2	70%	2	75%	2
Galium hispidulum	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Galium pilosum	--	--	--	--	--	--	75%	2	--	--	--	--	--	--	--	--	100%	2
Gaura filipes	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Gymnopogon ambiguus	--	--	--	--	--	--	100%	2	--	--	--	--	75%	2	80%	2	75%	3
Gymnopogon brevifolius	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Helianthus atrorubens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Hieracium gronovii	--	--	--	--	--	--	75%	2	75%	2	100%	2	100%	2	90%	2	--	--
Ipomoea pandurata	--	--	--	--	--	--	--	--	--	--	--	--	75%	2	--	--	--	--
Ionactis linariifolia	--	--	--	--	--	--	83%	2	75%	2	90%	2	--	--	100%	2	100%	2
Lechea minor	--	--	--	--	--	--	67%	2	--	--	--	--	--	--	--	--	75%	2
Lespedeza hirta	--	--	--	--	--	--	100%	2	--	--	--	--	--	--	70%	2	--	--
Lespedeza repens	--	--	--	--	--	--	92%	2	--	--	--	--	100%	2	60%	2	75%	2
Lespedeza virginica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100%	2
Liatris sp.	--	--	92%	2	--	--	67%	2	75%	2	100%	2	--	--	70%	2	--	--
Liatris tenuifolia	--	--	--	--	71%	2	--	--	--	--	--	--	--	--	--	--	--	--
Mimosa microphylla	--	--	--	--	--	--	83%	2	--	--	--	--	--	--	70%	3	75%	2
Minuartia caroliniana	--	--	54%	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Muhlenbergia expansa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Nolina georgiana	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	--	--	--	--
Paspalum setaceum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Pityopsis graminifolia	--	--	92%	2	71%	2	92%	3	100%	2	100%	4	100%	2	100%	3	100%	4
Physalis longifolia var. *subglabrata*	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	--	--	--	--
Physalis virginiana	--	--	--	--	--	--	83%	2	--	--	--	--	--	--	--	--	--	--
Pteridium aquilinum	--	--	--	--	--	--	--	--	--	--	100%	6	--	--	50%	6	75%	2
Rhynchosia reniformis	--	--	--	--	--	--	92%	2	--	--	--	--	100%	2	90%	2	75%	2
Rhynchospora grayi	--	--	85%	2	--	--	67%	2	--	--	--	--	100%	2	--	--	100%	2

Salvia azurea	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	--	--	--	--
Scleria [*ciliata+elliottii*]	--	--	--	--	--	--	--	--	--	--	90%	2	--	--	80%	2	75%	2
Scleria [*nitida+triglomerata*]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	70%	2	--	--
*Schizachyrium scoparium**	67%	2	100%	5	86%	3	100%	6	100%	4	100%	5	--	--	100%	5	100%	6
Selaginella [*acanthonota+arenicola*]	100%	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sericocarpus asteroides	--	--	--	--	--	--	--	--	75%	2	70%	2	--	--	--	--	--	--
Sericocarpus tortifolius	--	--	--	--	--	--	75%	2	100%	2	100%	2	75%	2	90%	2	75%	2
Silphium compositum	--	--	--	--	--	--	100%	2	--	--	70%	2	--	--	70%	2	--	--
Solidago nemoralis	--	--	--	--	--	--	58%	2	--	--	100%	2	--	--			--	--
Solidago odora var. odora	--	--	85%	2	--	--	100%	2	100%	2	100%	2	100%	2	100%	2	100%	2
Sorghastrum secundum	--	--	--	--	71%	2	--	--	--	--	--	--	--	--	--	--	--	--
Sporobolus junceus	--	--	62%	3	86%	4	--	--	--	--	--	--	100%	4	--	--	--	--
Stillingia sylvatica	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	--	--	75%	2
Stipulicida setacea	--	--	85%	2	--	--	83%	2	--	--	--	--	--	--	--	--	--	--
Stylisma patens	67%	2	85%	2	86%	2	83%	2	100%	2	--	--	--	--	70%	2	100%	3
Stylodon carneus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Stylosanthes biflora	--	--	--	--	--	--	--	--	75%	2	--	--	100%	2	70%	2	100%	2
Symphyotrichum concolor	--	--	--	--	--	--	75%	2	--	--	90%	2	100%	2	90%	2	75%	2
Symphyotrichum dumosum	--	--	--	--	--	--	--	--	--	--	80%	2	--	--	60%	2	--	--
Symphyotrichum walteri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100%	2
Tephrosia florida	--	--	--	--	--	--	--	--	--	--	--	--	100%	2	--	--	--	--
Tephrosia hispidula	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Tephrosia virginiana	--	--	69%	4	71%	3	--	--	100%	5	100%	4	--	--	70%	4	75%	2
Tillandsia usneoides	--	--	--	--	86%	2	--	--	--	--	--	--	--	--	--	--	--	--
Tragia urens	--	--	--	--	--	--	100%	2	--	--	--	--	100%	2	90%	2	75%	2
Vernonia angustifolia	--	--	--	--	--	--	92%	2	--	--	90%	2	--	--	100%	2	75%	2
Viola pedata	--	--	--	--	--	--	--	--	--	--	70%	2	--	--	--	--	--	--

Table 7. Mean species richness and environmental attributes of proposed Associations in the *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance. NA indicates that soil data were not available for the type.

Type	7127	7844	4492	3593	7842	8491	4487	7129	4488
Avg Richness- 1000m²	34.3	43.3	53.3	79.9	60.0	65.2	101.8	96.8	103.0
Avg Richness- 400m²	29.7	42.3	47.3	70.8	54.0	57.1	89.5	87.3	90.5
Avg Richness- 100m²	18.6	28.2	29.1	46.9	35.4	37.7	56.3	58.5	60.9
Avg Richness- 10m²	7.9	14.8	15.5	23.9	16.0	20.5	32.3	29.0	32.1
Avg Richness- 1m²	3.1	6.9	7.3	11.7	7.4	10.3	14.9	14.9	16.6
Avg Richness- 0.1m²	1.1	2.7	2.9	4.5	2.6	3.8	5.3	5.2	6.6
Avg Richness- 0.01m²	0.3	0.8	0.9	1.2	0.5	0.8	1.5	1.3	1.6
Avg % Sand in A	91.9	84.1	91.8	76.1	53.6	54.3	88.9	81.8	84.0
Avg % Sand in B	97.9	97.3	92.8	NA	NA	NA	89.5	82.1	63.8
Avg % Silt in A	5.9	11.2	4.6	18.5	36.4	39.2	6.5	15.1	13.7
Avg % Silt in B	2.1	0.8	3.6	NA	NA	NA	4.8	11.9	7.9

Table 8. Relationships of proposed Associations in the *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance to established USNVC Xeric Longleaf Pine Woodland Associations. Relationships are depicted by five symbols: > indicates the proposed Association concept includes the USNVC concept, > < indicates that the two concepts overlap but each contains unique content, ~ indicates that the proposed Association concept is approximately equivalent to the USNVC concept, ≠ indicates that the proposed Association concept does not overlap the USNVC concept, and = indicates that the two concepts are equal. Associations are arranged from xeric to subxeric.

Type	Plots	Proposed longleaf pine vegetation type name	Relationship	USNVC Association	
7132	13	*Pinus palustris / Quercus laevis / Aristida beyrichiana – Tephrosia chrysophylla* Woodland	><	8569	*Pinus palustris / Quercus (laevis, myrtifolia) / Aristida beyrichiana - Chapmannia floridana* Woodland
		"	>	4491	*Pinus palustris / Quercus laevis - Quercus geminata / Ceratiola ericoides* Woodland
3583	19	*Pinus palustris / Quercus laevis / Licania michauxii / Pityopsis aspera* Woodland	~	3583	*Pinus palustris / Quercus laevis / Aristida beyrichiana - Pityopsis aspera* Woodland
		"	≠	3587	*Pinus palustris / Quercus laevis / Schizachyrium scoparium - Rhynchosia cytisoides* Woodland
7133	4	*Pinus palustris / Quercus geminata / Conradina canescens / Aristida beyrichiana* Woodland		NA	
4490	25	*Pinus palustris / Quercus laevis / Aristida beyrichiana – Pterocaulon pycnostachyum* Woodland	~	4490	*Pinus palustris / Quercus laevis / Serenoa repens - Vaccinium stamineum / Aristida beyrichiana* Woodland
7135	28	*Pinus palustris / Quercus margarettae / Aristida beyrichiana – Rhynchosia reniformis* Woodland		NA	
7137	5	*Pinus palustris / Quercus falcata / Erythrina herbacea / Aristida condensata* Woodland		NA	

7141	20	*Pinus palustris /Quercus minima / Aristida beyrichiana – Carphephorus odoratissimus* Woodland		NA	
		"	≠	3601	*Pinus palustris / Quercus laevis / Serenoa repens - Clinopodium coccineum* Woodland

Table 9. Prevalent species for proposed Associations in the *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance. Species shown are grouped by growth form and are prevalent in at least one group, and have >40% constancy and average cover class of >2 in at least one group. The number of species listed for each growth form in an Association corresponds to the mean species richness of that growth form in that Association. Indicator species for each type are highlighted in grey.

Association	**7132**		**3583**		**7133**		**4490**		**7135**		**7137**		**7141**	
Tree species	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**
Carya alba	--	--	--	--	--	--	--	--	--	--	80%	4	--	--
Diospyros virginiana	--	--	100%	4	--	--	--	--	86%	2	--	--	--	--
Persea palustris	--	--	--	--	--	--	--	--	--	--	80%	2	--	--
Pinus palustris	92%	5	95%	6	100%	5	92%	6	89%	6	100%	5	100%	6
Prunus serotina	--	--	--	--	--	--	--	--	68%	3	--	--	--	--
Quercus falcata	--	--	--	--	--	--	--	--	--	--	100%	3	--	--
Quercus geminata	92%	6	84%	4	100%	5	84%	4	--	--	100%	5	--	--
Quercus hemisphaerica	--	--	--	--	--	--	--	--	68%	3	--	--	--	--
Quercus incana	--	--	95%	4	100%	4	80%	5	93%	5	--	--	55%	5
Quercus laevis	100%	6	100%	6	100%	5	96%	6	82%	5	--	--	80%	6
Quercus margarettae	--	--	74%	4	--	--	--	--	86%	5	60%	3	--	--
Quercus myrtifolia	--	--	--	--	--	--	--	--	--	--	60%	5	--	--
Vine species	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**
Smilax auriculata	77%	3	100%	3	100%	3	76%	2	82%	4	100%	2	95%	4
Smilax pumila	--	--	--	--	--	--	--	--	--	--	60%	4	55%	3
Shrub species	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**
Asimina [*angustifolia + spatulata*]	--	--	--	--	--	--	--	--	82%	2	80%	2	80%	2
Conradina canescens	--	--	--	--	100%	5	--	--	--	--	--	--	--	--
Chrysoma pauciflosculosa	--	--	--	--	50%	4	--	--	--	--	--	--	--	--
Erythrina herbacea	--	--	--	--	--	--	--	--	--	--	100%	2	--	--
Gaylussacia dumosa	--	--	74%	4	--	--	--	--	--	--	--	--	90%	3
Hypericum hypericoides	--	--	--	--	--	--	--	--	71%	2	80%	2	--	--
Ilex glabra	--	--	--	--	100%	5	--	--	--	--	--	--	70%	5
Licania michauxii	85%	4	100%	5	100%	4	72%	4	--	--	--	--	70%	4
Morella [*cerifera + pumila*]	--	--	--	--	--	--	--	--	--	--	80%	3	60%	2
Opuntia humifusa	77%	2	74%	2	100%	2	--	--	--	--	--	--	--	--
Quercus minima	--	--	--	--	--	--	--	--	--	--	--	--	80%	6
Rhus copallinum	--	--	--	--	--	--	60%	3	96%	4	--	--	--	--
Rubus cuneifolius	--	--	--	--	--	--	--	--	61%	3	--	--	--	--
Serenoa repens	92%	4	79%	3	100%	6	68%	4	--	--	60%	6	95%	5
Vaccinium arboreum	--	--	--	--	--	--	--	--	75%	4	100%	5	--	--
Vaccinium darrowii	--	--	63%	4	--	--	--	--	--	--	--	--	--	--

Vaccinium myrsinites	--	--	--	--	--	--	--	--	--	--	--	--	50%	5
Vaccinium stamineum	--	--	--	--	--	--	56%	4	82%	3	100%	3	--	--
Herb species	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**	**const.**	**cover**
Ageratina aromatica	--	--	--	--	--	--	68%	2	75%	2	100%	3	--	--
Andropogon elliottii	85%	2	100%	3	100%	2	84%	2	89%	3	100%	2	80%	2
Andropogon ternarius	92%	2	79%	2	--	--	--	--	--	--	100%	2	--	--
Andropogon virginicus	--	--	89%	4	75%	3	--	--	--	--	--	--	--	--
Angelica dentata	--	--	--	--	--	--	--	--	--	--	--	--	60%	2
Aristida beyrichiana	100%	7	68%	7	100%	6	100%	7	100%	7	--	--	100%	6
Aristida condensata	77%	3	--	--	--	--	--	--	--	--	80%	3	--	--
Aristida lanosa	--	--	--	--	--	--	--	--	--	--	80%	3	--	--
Aristida mohrii	--	--	53%	4	75%	4	--	--	--	--	--	--	--	--
Aristida purpurascens	--	--	58%	2	--	--	60%	2	71%	2	80%	2	--	--
Arnoglossum floridanum	--	--	--	--	--	--	52%	2	--	--	--	--	--	--
Balduina angustifolia	85%	2	--	--	--	--	56%	2	--	--	--	--	--	--
Baptisia lanceolata	--	--	--	--	75%	2	--	--	--	--	--	--	--	--
Baptisia simplicifolia	--	--	--	--	--	--	--	--	--	--	--	--	75%	2
Bulbostylis [*ciliatifolia + coarctata*]	100%	3	89%	3	100%	3	72%	2	--	--	--	--	--	--
Bulbostylis warei	77%	3	--	--	--	--	--	--	--	--	--	--	--	--
Carphephorus corymbosus	92%	2	--	--	--	--	68%	3	--	--	--	--	--	--
Carphephorus odoratissimus	--	--	--	--	--	--	--	--	--	--	--	--	75%	3
Centrosema arenicola	--	--	--	--	--	--	--	--	--	--	60%	3	--	--
Chamaecrista nictitans	--	--	--	--	--	--	--	--	71%	2	--	--	--	--
Chrysopsis hyssopifolia	--	--	--	--	75%	4	--	--	--	--	--	--	--	--
Chrysopsis mariana	--	--	--	--	--	--	--	--	--	--	--	--	50%	2
Clitoria mariana	--	--	--	--	--	--	--	--	--	--	80%	4	--	--
Cnidoscolus stimulosus	92%	2	--	--	--	--	84%	2	68%	2	80%	2	--	--
Commelina erecta	--	--	84%	2	75%	2	--	--	68%	2	--	--	55%	2
Crocanthemum carolinianum	--	--	--	--	--	--	84%	2	82%	2	--	--	--	--
Crotalaria rotundifolia	77%	2	--	--	--	--	92%	2	79%	2	--	--	60%	2
Croton argyranthemus	69%	2	95%	3	--	--	80%	2	71%	2	--	--	--	--
Cyperus [*filiculmis + lupulinus*]	--	--	95%	2	75%	2	--	--	--	--	--	--	--	--
Cyperus [*croceus + ovatus + retrorsus*]	92%	2	--	--	--	--	60%	2	--	--	80%	2	--	--
Cyperus plukenetii	--	--	--	--	--	--	--	--	--	--	100%	2	--	--
Dalea pinnata	--	--	--	--	--	--	56%	3	--	--	--	--	--	--
Desmodium floridanum	--	--	--	--	--	--	--	--	61%	2	--	--	--	--
Dichanthelium angustifolium	85%	2	100%	2	75%	2	72%	2	96%	2	100%	3	60%	2
Dichanthelium commutatum	--	--	--	--	--	--	--	--	--	--	80%	3	--	--
Dichanthelium lancearium	--	--	--	--	--	--	--	--	--	--	60%	2	--	--
Dichanthelium oligosanthes	--	--	--	--	--	--	--	--	--	--	100%	3	--	--

Dichanthelium ovale	85%	2	--	--	--	--	92%	2	--	--	--	--	--	--
Dichanthelium tenue	--	--	--	--	100%	2	--	--	64%	2	--	--	60%	2
Dyschoriste oblongifolia	--	--	--	--	--	--	72%	2	86%	4	--	--	--	--
Elephantopus elatus	--	--	--	--	--	--	60%	4	89%	4	--	--	--	--
Endodeca serpentaria	--	--	--	--	--	--	68%	2	75%	2	80%	2	--	--
Eragrostis refracta	62%	2	--	--	--	--	--	--	--	--	--	--	--	--
Eriogonum tomentosum	--	--	100%	3	75%	2	80%	2	--	--	--	--	45%	2
Eupatorium album	--	--	--	--	--	--	--	--	--	--	80%	2	--	--
Eupatorium compositifolium	--	--	79%	2	--	--	88%	3	79%	2	--	--	--	--
Euphorbia discoidalis	--	--	--	--	75%	2	--	--	--	--	--	--	--	--
Euphorbia exserta	--	--	--	--	--	--	--	--	--	--	--	--	45%	2
Euphorbia floridana	--	--	84%	2	75%	2	--	--	--	--	--	--	--	--
Galactia volubilis var. volubilis	69%	2	--	--	--	--	--	--	--	--	--	--	--	--
Galactia minor	--	--	89%	4	--	--	--	--	--	--	--	--	--	--
Galium pilosum	--	--	--	--	--	--	--	--	64%	2	--	--	--	--
Gymnopogon ambiguus	--	--	--	--	--	--	60%	2	82%	2	--	--	--	--
Helianthus radula	--	--	--	--	75%	2	--	--	--	--	--	--	55%	2
Hieracium gronovii	--	--	58%	2	--	--	76%	2	86%	2	--	--	70%	2
Houstonia procumbens	--	--	58%	2	--	--	84%	2	75%	2	80%	2	65%	2
Indigofera caroliniana	--	--	--	--	--	--	--	--	--	--	60%	3	--	--
Ionactis linariifolia	--	--	--	--	75%	2	--	--	--	--	--	--	--	--
Lechea sessiliflora	92%	2	74%	2	--	--	84%	2	64%	3	--	--	--	--
Lespedeza hirta	--	--	--	--	--	--	76%	2	79%	2	--	--	--	--
Liatris gracilis	--	--	79%	3	--	--	--	--	64%	2	--	--	--	--
Liatris tenuifolia	85%	2	89%	2	--	--	84%	2	64%	2	--	--	--	--
Mimosa microphylla	--	--	53%	2	100%	2	--	--	64%	2	--	--	60%	2
Palafoxia integrifolia	62%	2	--	--	--	--	64%	2	--	--	--	--	--	--
Panicum anceps var. *rhizomatum*	--	--	--	--	--	--	--	--	--	--	100%	2	--	--
Piriqueta caroliniana	--	--	--	--	--	--	--	--	57%	2				
Pityopsis aspera	--	--	84%	5	100%	2	--	--	--	--	--	--	65%	3
Pityopsis graminifolia	100%	4	--	--	--	--	100%	4	86%	4	--	--	--	--
Physalis walteri	--	--	--	--	--	--	--	--	61%	2	--	--	--	--
Polygonella gracilis	--	--	--	--	100%	2	--	--	--	--	--	--	--	--
Pteridium aquilinum	--	--	--	--	--	--	--	--	82%	5	100%	2	80%	5
Pterocaulon pycnostachyum	--	--	--	--	--	--	84%	2	--	--	--	--	--	--
Rhynchosia cinerea	--	--	--	--	--	--	--	--	--	--	60%	2	--	--
Rhynchosia cytisoides	--	--	68%	4	--	--	--	--	--	--	--	--	--	--
Rhynchospora megalocarpa	--	--	--	--	75%	4	--	--	--	--	--	--	--	--
Rhynchosia reniformis	--	--	--	--	--	--	72%	2	93%	2	--	--	--	--
Rhynchospora grayi	85%	2	89%	2	--	--	92%	2	68%	2	--	--	--	--

Ruellia ciliosa	--	--	--	--	--	--	64%	2	71%	2	--	--	--	--
Salvia azurea	--	--	--	--	--	--	--	--	--	--	60%	3	--	--
Scleria ciliata	--	--	84%	2	--	--	--	--	96%	2	80%	2	60%	2
Schizachyrium scoparium var. *stoloniferum*	100%	2	100%	5	100%	5	100%	3	96%	3	80%	2	95%	3
Schizachyrium tenerum	--	--	89%	3	75%	4	--	--	--	--	--	--	--	--
Sericocarpus tortifolius	--	--	--	--	75%	2	80%	2	89%	3	100%	2	90%	2
Silphium compositum	--	--	--	--	75%	2	--	--	--	--	--	--	--	--
Solidago odora	--	--	95%	2	--	--	--	--	86%	4	100%	3	--	--
Sophronanthe hispida	--	--	--	--	75%	2	--	--	--	--	--	--	--	--
Sorghastrum secundum	100%	3	84%	4	100%	3	96%	4	93%	5	100%	3	45%	3
Sporobolus clandestinus	--	--	--	--	--	--	--	--	--	--	80%	2	--	--
Sporobolus junceus	85%	2	89%	3	100%	2	76%	3	71%	3	--	--	--	--
Stillingia sylvatica	100%	2	--	--	--	--	96%	2	93%	2	--	--	70%	2
Stylisma patens	--	--	100%	2	100%	3	--	--	93%	2	--		85%	2
Stylosanthes biflora	--	--	95%	2	--	--	76%	2	79%	2	--	--	65%	2
Symphyotrichum adnatum	--	--	--	--	--	--	--	--	--	--	--	--	65%	2
Symphyotrichum concolor	--	--	53%	2	--	--	--	--	82%	2	--	--	60%	2
Tephrosia chrysophylla	85%	3	53%	3	--	--	88%	2	--	--	--	--	--	--
Tephrosia florida	--	--	--	--	--	--	--	--	--	--	--	--	50%	2
Tragia smallii	--	--	--	--	75%	2	--	--	--	--	--	--	65%	2
Tragia urens	85%	2	74%	2	--	--	88%	2	86%	2	--	--	65%	2
Tridens carolinianus	--	--	--	--	--	--	--	--	--	--	60%	3	--	--
Triplasis americana	69%	2	--	--	75%	3	--	--	--	--	--	--	--	--
Vernonia angustifolia	--	--	58%	2	--	--	--	--	96%	2	--	--	60%	2

Table 10. Mean species richness and environmental attributes of proposed Associations in the *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance. Mean species richness at 1000 m² for proposed Association 7141 was calculated by excluding the NatureServe plots assigned to this type because of uncertainty related to whether CVS and NatureServe plots have the same level of floristic comprehensiveness.

Type	7132	3583	7133	4490	7135	7137	7141
Avg Richness- 1000m²	59.8	78.1	69.0	85.4	103.8	85.4	79.1
Avg Richness- 400m²	49.9	68.8	62.5	75.2	91.6	71.8	68.7
Avg Richness- 100m²	32.3	47.8	41.7	50.2	60.0	45.7	44.3
Avg Richness- 10m²	15.2	25.2	20.3	24.8	30.1	22.2	22.0
Avg Richness- 1m²	6.7	11.6	9.1	10.7	14.7	10.5	10.9
Avg Richness- 0.1m²	2.4	4.4	3.6	3.5	5.0	3.1	4.2
Avg Richness- 0.01m²	0.8	1.4	1.3	1.0	1.3	0.6	1.2
Avg % Sand in A	97.4	94.9	97.2	96.1	94.2	96.6	93.6
Avg % Sand in B	97.6	88.5	94.9	95.9	93.3	95.4	88.9
Avg % Silt in A	1.7	3.3	1.8	2.5	4.1	2.4	4.2
Avg % Silt in B	1.3	7.8	3.3	2.4	4.1	4.1	8.9
Ca ppm in B	95.1	43.0	91.4	160.5	145.1	244.4	98.7

Figures

Figure 1. Cluster dendrogram for all plots showing the three major groups (Alliances) that emerged from analysis on the original 346 plots: communities occurring in North Carolina and northern South Carolina, South Carolina and Georgia, and Florida and immediately adjacent Georgia.

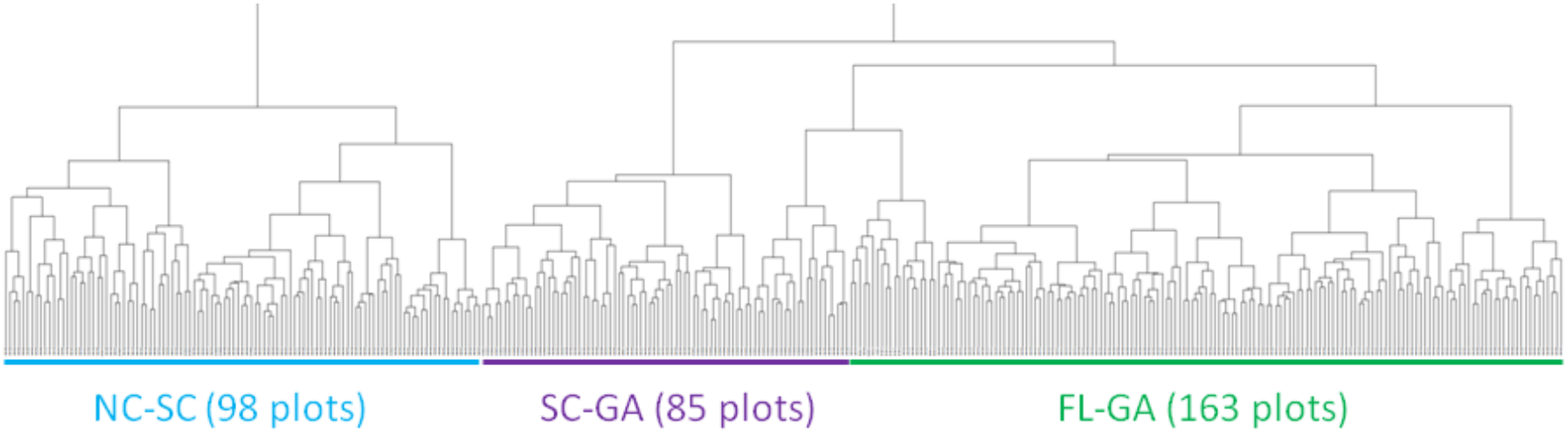


Figure 2. Map showing plot locations by Alliance.

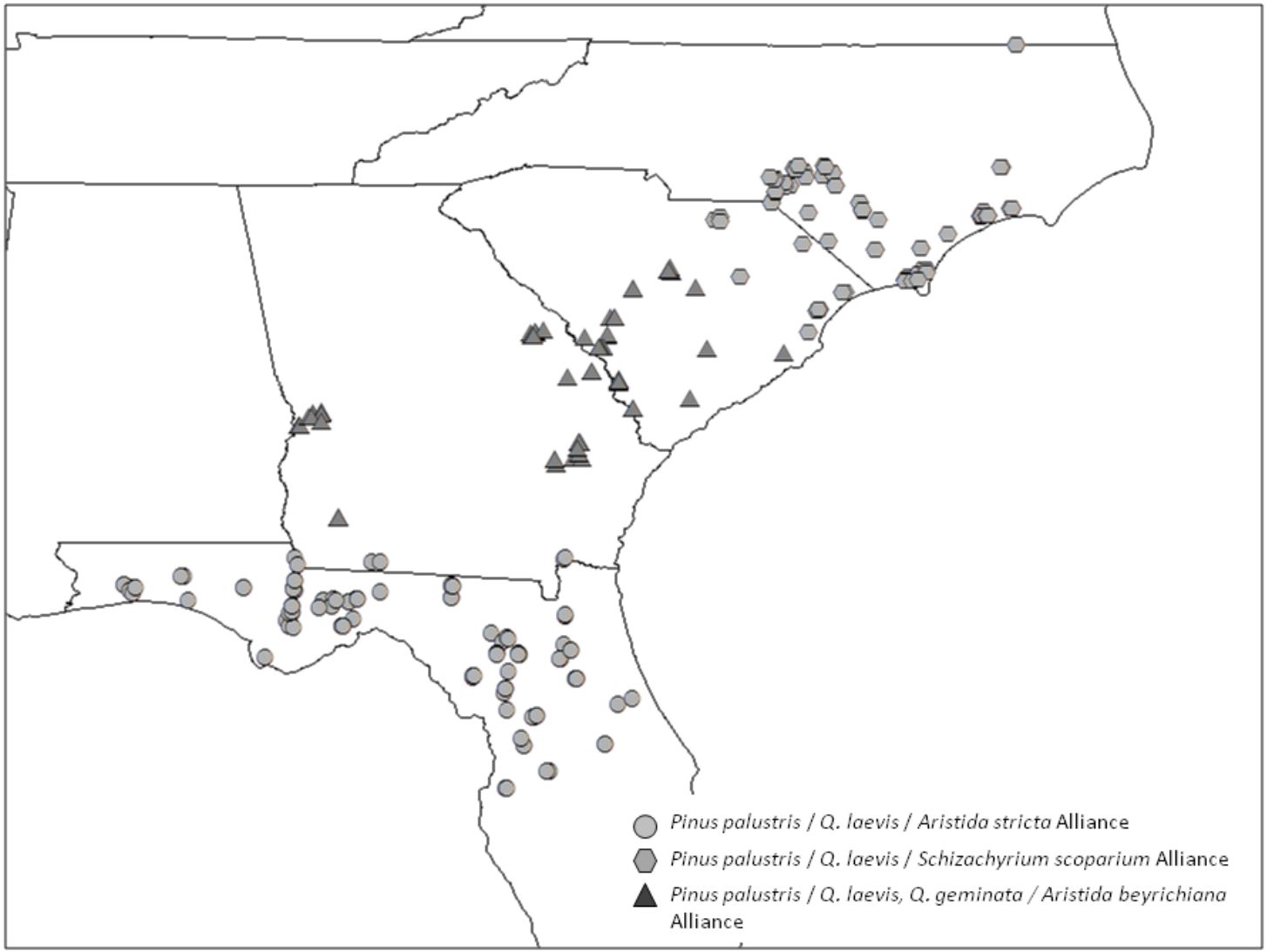


Figure 3. Non-metric multidimensional scaling (NMS) ordination of all plots. Plots are highlighted by their proposed Alliance of the Xeric Longleaf Pine Woodland Group: NC.SC = *Pinus palustris / Quercus laevis / Aristida stricta* Alliance, SC.GA = *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance, FL.GA = *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance.

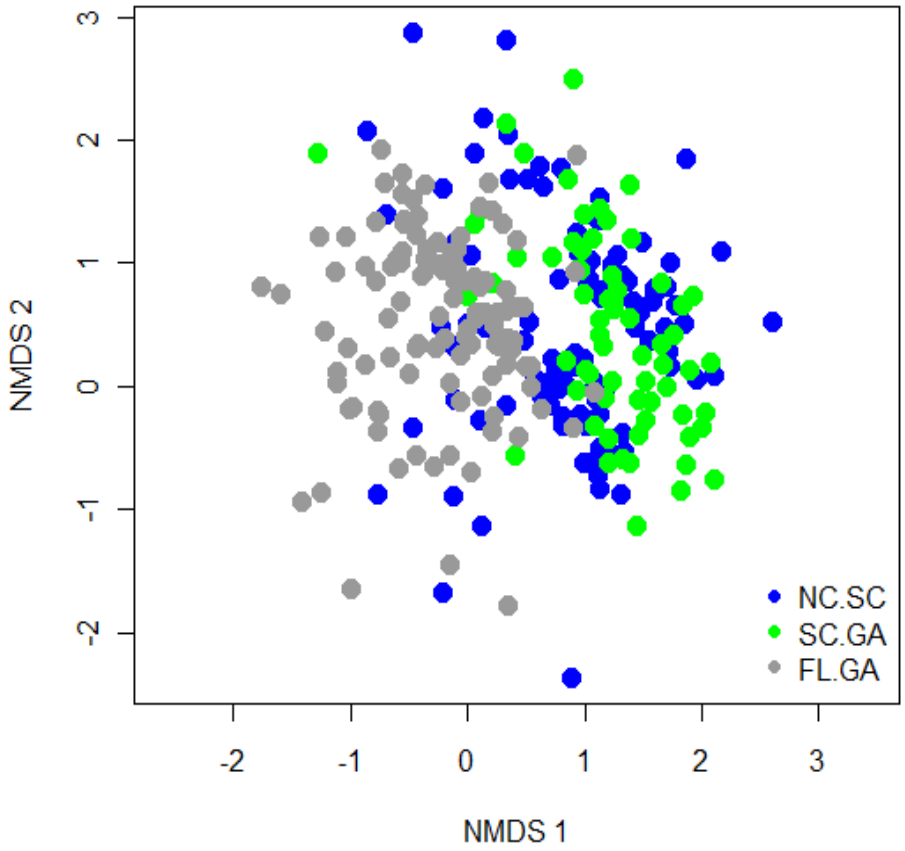


Figure 4. Cluster dendrogram for all plots in North Carolina and South Carolina (the proposed *Pinus palustris / Quercus laevis / Aristida stricta* Alliance). Plots are labeled according to their proposed Association.

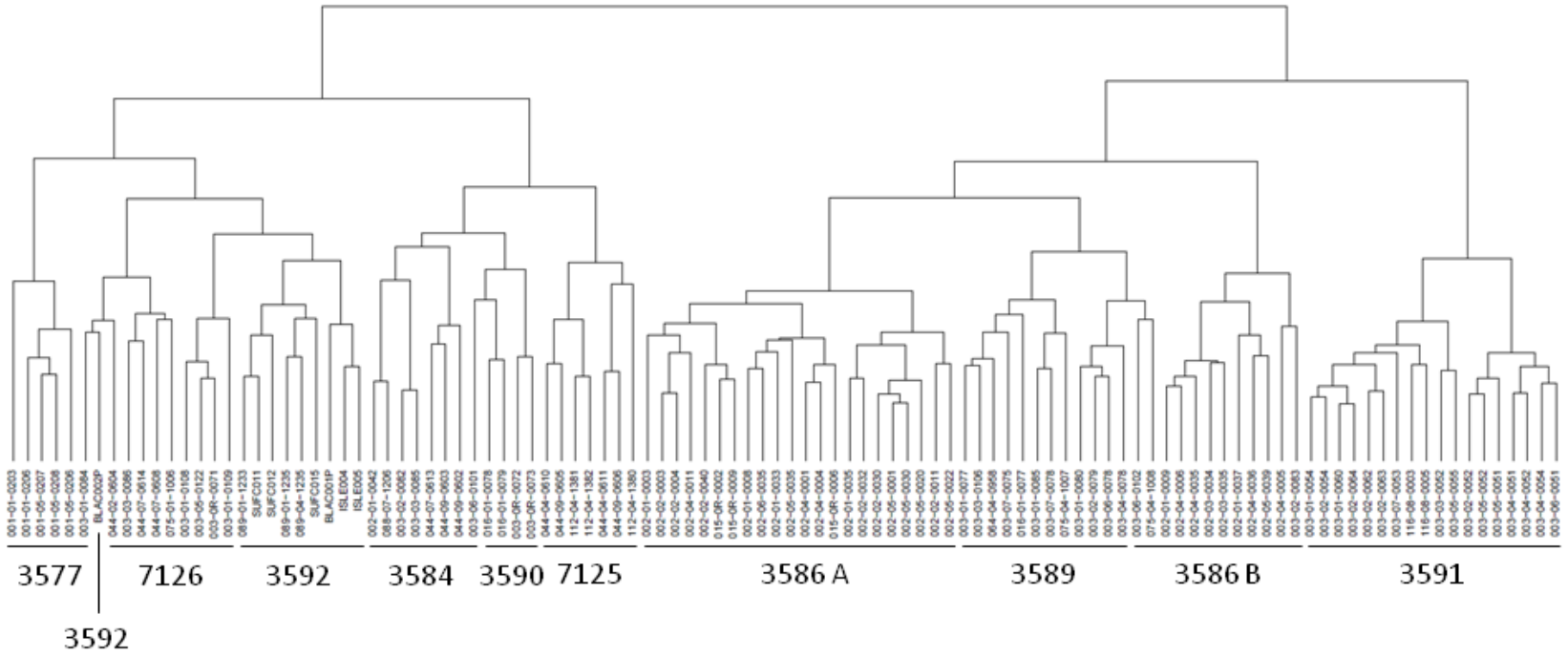


Figure 5. NMS ordination showing plots in the proposed *Pinus palustris / Quercus laevis / Aristida stricta* Alliance for each combination of NMS axes (1, 2, 3). Plots are highlighted by their proposed community type, and environmental and site attributes are overlaid as vectors showing the direction and magnitude of increase for species richness, longitude, latitude, pH, organic matter, silt % in the A and B horizons, clay %, and sand % in the A and B horizons.

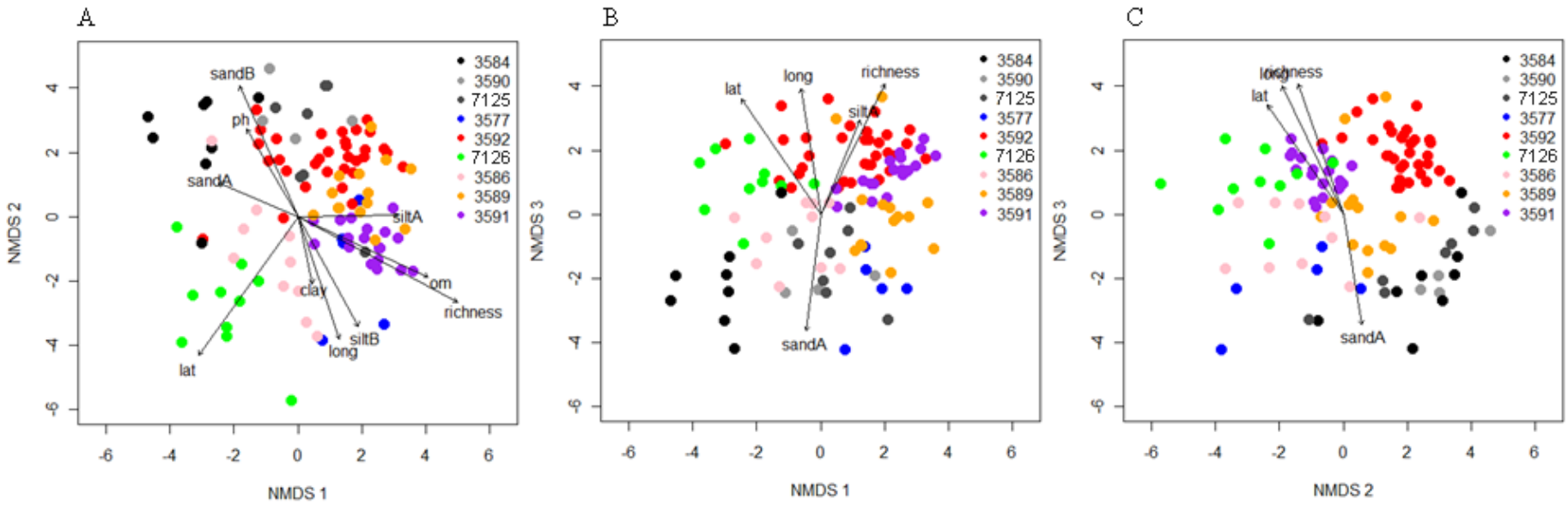


Figure 6. Cluster dendrogram for all plots in South Carolina and Georgia (the proposed *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance). Plots are labeled according to their proposed Association.

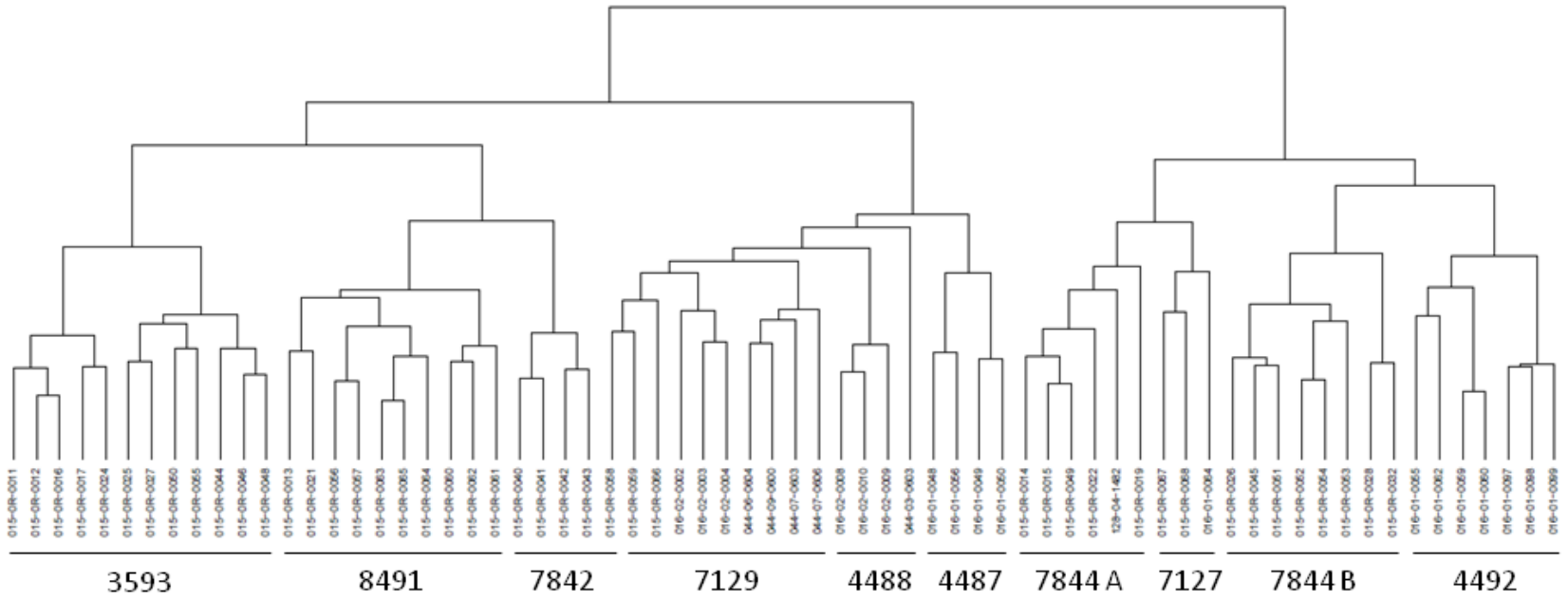


Figure 7. NMS ordination showing plots in the proposed *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance for each combination of NMS axes (1, 2, 3). Plots are highlighted by their proposed community type, and environmental and site attributes are overlaid as vectors showing the direction and magnitude of increase for species richness, longitude, latitude, pH, silt %, clay%, organic matter content, and sand %.

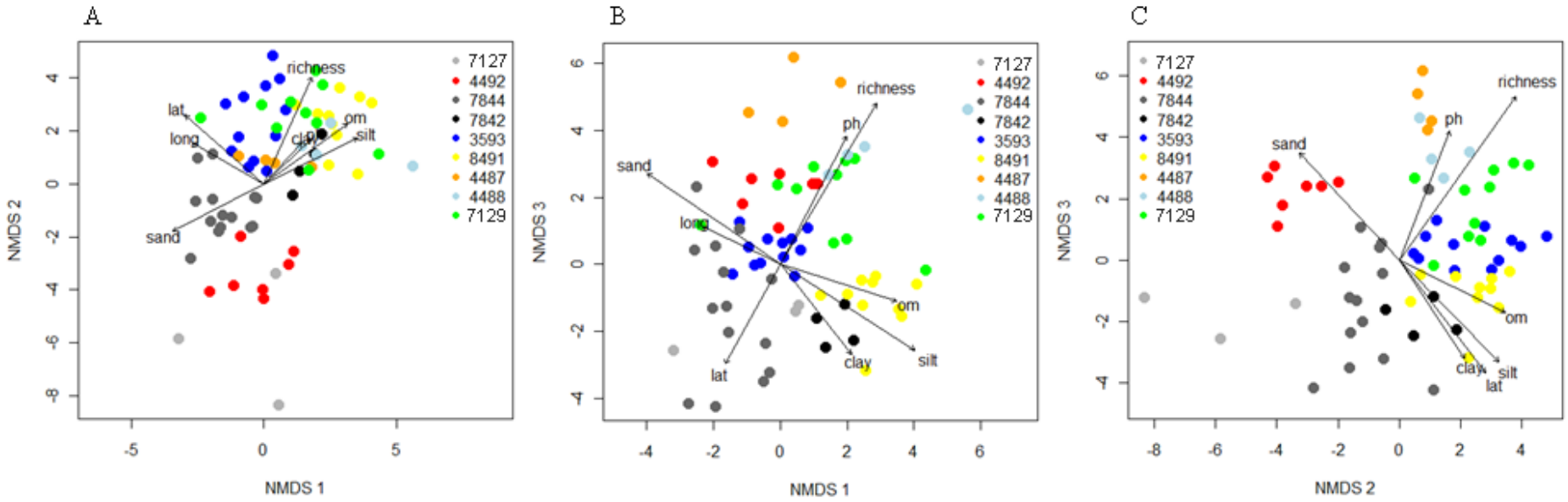


Figure 8. Cluster dendrogram for all plots in Florida and immediately adjacent Georgia (the proposed *Pinus palustris / Quercus laevis*, *Quercus geminata / Aristida beyrichiana* Alliance). Plots are labeled according to their proposed Association.

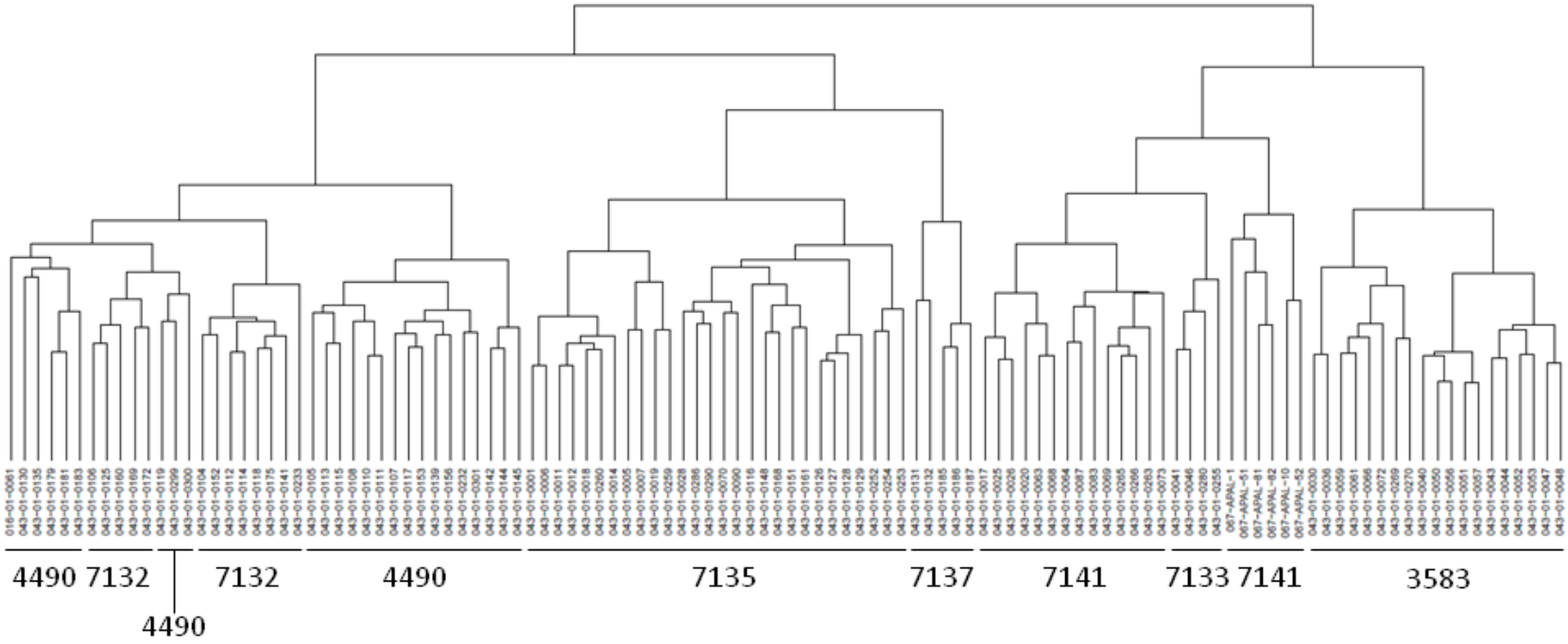
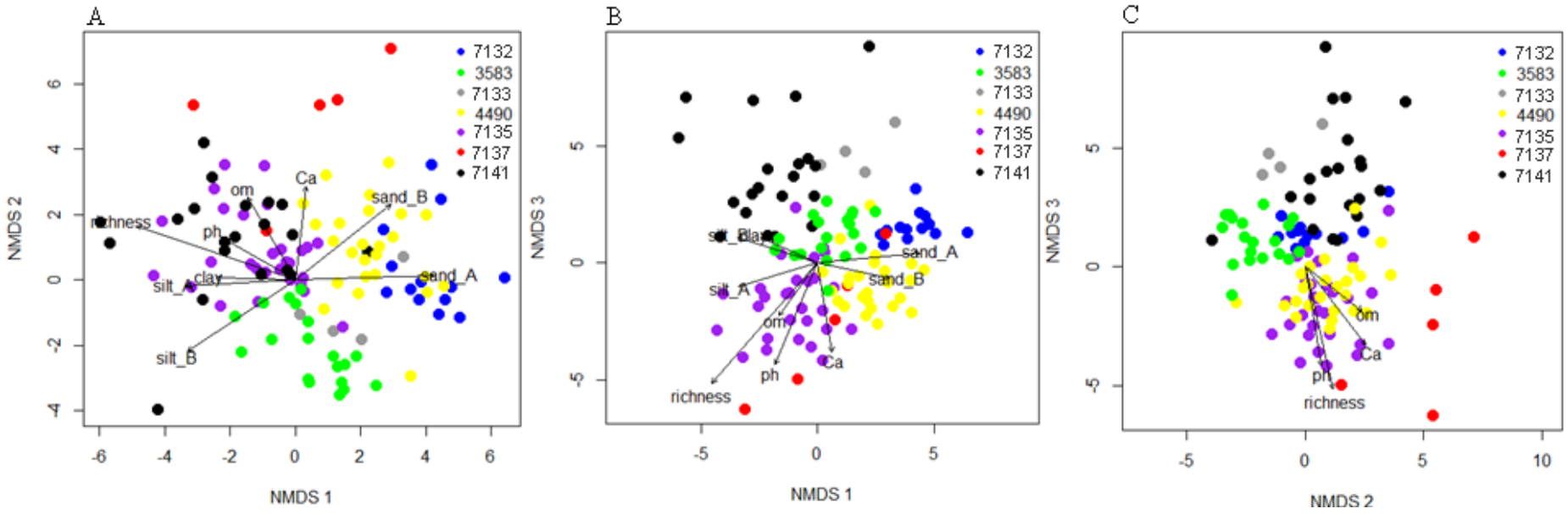


Figure 9. NMS ordination showing plots in the proposed *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance for each combination of NMS axes (1, 2, 3). Plots are highlighted by their proposed community type, and environmental and site attributes are overlaid as vectors showing the direction and magnitude of increase for species richness, longitude, latitude, pH, silt %, clay %, sand %, organic matter content, and Ca in ppm from the B horizon. Soil texture components are shown from the A and B horizons.



Appendix 1.

Links to VegBank datasets containing the vegetation plots associated with the 25 described Associations

Navigating VegBank. To see a list of plots in VegBank (Peet et al. 2012b) used to define an Association, click on the appropriate link below. To see the details for any one plot in the resulting list, click on the "link" to the left of the plot id. To see a more expanded list of plots that shows dominants, click on the "observation" link to the right of "Items in this dataset". From this more complete list with dominants, you can click on the link "map these plots" at the top of the page to generate a map of the plots.

Caveats. The Associations assigned to plots have not been updated to reflect the current proposal, and will not be updated until such time as the proposal is formally accepted by the peer review process. The map function should work for all Associations, but will not work for the full dataset because the plot count exceeds the capacity of the program. In addition, the taxonomic determinations for species occurrences in the plots have not been updated. Upon acceptance of this proposal by the peer review process, we will upload to each plot record in VegBank the taxonomic determinations used for our numerical analysis. However, because in some cases this represents reduced precision, we will not change the primary determination available from a simple view of the plot.

1.1 All 996 Longleaf plots examined for this analysis

http://vegbank.org/cite/VB.ds.199699.CVSLONGLEAF

1.2 Plots representing the 9 Associations of the proposed *Pinus palustris / Quercus laevis / Aristida stricta* Alliance.

Pinus palustris / Quercus laevis / Stipulicida setacea – Selaginella acanthonota Woodland
http://vegbank.org/cite/VB.ds.199635.CEGL003584

Pinus palustris / Quercus laevis – Quercus geminata / Rhynchospora megalocarpa Woodland
http://vegbank.org/cite/VB.ds.199638.CEGL003590

Pinus palustris / Quercus laevis – Quercus geminata / Schizachyrium scoparium Woodland
http://vegbank.org/cite/VB.ds.199679.CEGL007125

Pinus palustris / Quercus geminata – Quercus hemisphaerica / Osmanthus americanus Woodland
http://vegbank.org/cite/VB.ds.199634.CEGL003577

Pinus palustris – Pinus taeda / Quercus laevis / Gaylussacia frondosa – Gaylussacia baccata Woodland
http://vegbank.org/cite/VB.ds.199640.CEGL003592

Pinus palustris – Pinus serotina / Quercus laevis / Gaylussacia frondosa / Schizachyrium scoparium
http://vegbank.org\cite\VB.ds.199876.CEGL007126

Pinus palustris / Quercus laevis / Aristida stricta – Baptisia cinerea Woodland
http://vegbank.org/cite/VB.ds.199636.CEGL003586

Pinus palustris / Quercus laevis – Quercus geminata / Aristida stricta Woodland
http://vegbank.org/cite/VB.ds.199637.CEGL003589

Pinus palustris / Quercus laevis – Quercus incana / Gaylussacia dumosa / Aristida stricta Woodland
http://vegbank.org/cite/VB.ds.199639.CEGL003591

Plots representing the 9 Associations of the proposed *Pinus palustris / Quercus laevis / Schizachyrium scoparium* Alliance.

Pinus palustris / Quercus laevis / Chrysoma pauciflosculosa / Aristida purpurascens Woodland
http://vegbank.org/cite/VB.ds.199642.CEGL007127
Pinus palustris / Quercus laevis / Schizachyrium scoparium – Stipulicida setacea Woodland
http://vegbank.org/cite/VB.ds.199650.CEGL007844
Pinus palustris / Quercus laevis – Quercus margarettae / Licania michauxii / Aristida beyrichiana Woodland
http://vegbank.org/cite/VB.ds.199646.CEGL004492
Pinus palustris / Quercus laevis / Toxicodendron pubescens / Schizachyrium scoparium – Lespedeza hirta Woodland
http://vegbank.org/cite/VB.ds.199641.CEGL003593
Pinus palustris / Quercus marilandica / Aristida beyrichiana – Tephrosia virginiana Woodland
http://vegbank.org/cite/VB.ds.199649.CEGL007842
Pinus palustris / Schizachyrium scoparium – Pteridium aquilinum Woodland
http://vegbank.org/cite/VB.ds.199651.CEGL008491
Pinus palustris / Quercus stellata / Quercus elliottii / Sporobolus junceus – Nolina georgiana Woodland
http://vegbank.org/cite/VB.ds.199644.CEGL004487
Pinus palustris / Quercus margarettae / Toxicodendron pubescens / Schizachyrium scoparium Woodland
http://vegbank.org/cite/VB.ds.199645.CEGL007129
Pinus palustris / Quercus hemisphaerica / Gaylussacia dumosa / Aristida beyrichiana – Dyschoriste oblongifolia Woodland
http://vegbank.org/cite/VB.ds.199884.CEGL004488

1.3 Plots representing the 7 Associations of the proposed *Pinus palustris / Quercus laevis, Quercus geminata / Aristida beyrichiana* Alliance

Pinus palustris / Quercus laevis / Aristida beyrichiana – Tephrosia chrysophylla Woodland
http://vegbank.org/cite/VB.ds.199700.CEGL007132
Pinus palustris / Quercus laevis / Licania michauxii / Pityopsis aspera Woodland
http://vegbank.org/cite/VB.ds.199701.CEGL003583
Pinus palustris / Quercus geminata / Conradina canescens / Aristida beyrichiana Woodland
http://vegbank.org/cite/VB.ds.199702.CEGL007133
Pinus palustris / Quercus laevis / Aristida beyrichiana – Pterocaulon pycnostachyum Woodland
http://vegbank.org/cite/VB.ds.199703.CEGL004490
Pinus palustris / Quercus margarettae / Aristida beyrichiana – Rhynchosia reniformis Woodland
http://vegbank.org/cite/VB.ds.199704.CEGL007135

Pinus palustris / Quercus falcata / Erythrina herbacea / Aristida condensata Woodland
http://vegbank.org/cite/VB.ds.199705.CEGL007137

Pinus palustris / Quercus minima / Aristida beyrichiana – Carphephorus odoratissimus Woodland
http://vegbank.org/cite/VB.ds.199706.CEGL007141