

Field Manual for Rapid Assessment Metrics for Wildlife and Biodiversity in Southern Open Pine Ecosystems



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Contents

1.0 INTRODUCTION.....	1
2.0 APPLYING RAPID ASSESSMENT METRICS IN SOUTHERN OPEN PINE ECOSYSTEMS.....	3
2.1 DETERMINE THE ASSESSMENT AREA AND DETERMINE THE TARGET SOUTHERN OPEN PINE GROUPINGS (BASED ON FABER-LANGENDOEN ET AL. 2012, ROCCHIO 2015).	3
2.2 CONDUCT THE FIELD ASSESSMENT AND ENTER DATA COLLECTED ON FIELDSHEET.....	7
2.3 COMPLETE METRIC ASSESSMENT SCORES TO CALCULATE A SCORE FOR THE CANOPY, MIDSTORY, GROUND LAYER, AND AN OVERALL SCORE.	8
2.4 ENTER/UPLOAD RESULTS.....	8
3.0 DEFINITIONS OF KEY FIELDS ON DATA SHEETS.....	8
SITE / ASSESSMENT AREA INFORMATION	8
LOCATION.....	9
CLASSIFICATION	10
REFERENCES.....	11
APPENDIX A. KEY TO SOUTHERN OPEN PINE HABITAT GROUPINGS.....	13
Key to Open Pine Groupings.....	14
Notes on Some Ambiguous or Confusing Habitats.....	20
APPENDIX B. RAPID ASSESSMENT FIELD COVER SHEET.....	21
APPENDIX C. RAPID ASSESSMENT METRICS DATA/SCORING SHEETS (BY HABITAT GROUPING)	23

Figures

Figure 1. Example of delineated Assessment Areas (AAs). 6

Tables

Table 1. Cover Classes **Error! Bookmark not defined.**

1.0 Introduction

This document describes a new, highly flexible, rapid, efficient approach to assessment of open pine ecosystems that can be applied by a wide range of landowners, land managers, wildlife technicians, biologists, and other natural resource scientists to help them understand their land's contribution to biodiversity and target species' wildlife habitat.

Specifically, the protocols describe a way to apply field-based desired forest condition metrics within Southern Open Pine Ecosystems **specifically for those managers whose primary goal is maintenance of biodiversity or enhancement of wildlife habitat for species dependent on open pine ecosystems**. The metrics in this protocols document are based directly on Nordman et al. 2016, and more exhaustive descriptions of each metric can be found there. Discussion of the concepts behind this type of assessment, which is often referred to as an ecological integrity assessment, can be found in Rocchio and Crawford (2011) and Faber-Langendoen et al. (2006, 2012, and 2014).

What is Southern Open Pine?

In the southeastern United States, there are several large-scale (or formerly large-scale) ecosystems dominated by an open canopy of pine trees that are used by a great variety of game and non-game wildlife species and plants. Due to changes in land use and lack of fire, these open pine ecosystems have undergone extensive declines over the last 100 years and continue to be threatened with further decline. These ecosystems are found from the West Gulf Coastal Plain and Ozark and Ouachita Mountains to the Southern Appalachians, Piedmont, Atlantic and East Gulf Coastal Plains, and south into the Florida Peninsula.

In the past, these ecosystems have consisted of open pine stands with a diverse ground cover composed of native warm season grasses and forbs, often with some low shrubs and only sparse tall shrubs. These open conditions were historically maintained by natural processes, including fire and grazing. Today, these ecosystems require active management to maintain or to restore the open herbaceous conditions preferred by many species of wildlife (for a fuller discussion of the wildlife targeted in this assessment, please refer to Nordman et al. 2016).

While these ecosystems occur across the southeastern United States, this current project more specifically focuses on southern open pine wildlife systems dominated by southern yellow pines, particularly longleaf pine (*Pinus palustris*) and shortleaf pine (*Pinus echinata*), which occur in the southern coastal plains and the Ozark and Ouachita mountains. We also focus on natural stands of slash pine (*Pinus elliottii*) and loblolly pine (*Pinus taeda*).

Who is the intended user for these protocols?

This protocols document can be utilized by anyone who is working within the geographic range of our project. The protocols have been specifically developed for landowners and land managers on **lands where conservation and/or restoration of open pine ecosystems and their associated wildlife is the highest priority.**

How do these protocols help users meet conservation goals?

After years of steady decline in acreage and quality, the remaining examples of southern open pine ecosystems are a patchwork of existing and restored tracts. In order to restore the function of this formerly grand ecosystem and to fully protect the species that rely on the ecosystem, we must first understand the amount of land that is currently providing high quality habitat to our target species. These protocols help us at two different scales:

- At the finest scale, these protocols give land managers with a conservation focus a powerful, efficient tool that allows them to collect data and quickly understand whether stands are in good or excellent condition (providing priority wildlife species' habitat) or not.
- At larger scales, these protocols can contribute to our understanding of the overall condition of open pine ecosystems regionally and allow us to more precisely plan for a better future for this ecosystem.

2.0 Applying Rapid Assessment Metrics in Southern Open Pine Ecosystems

Below are general guidelines for applying the desired forest condition metrics to southern open pine occurrences.

- Step 1: **Determine the assessment area, determine your target Southern Open Pine Groupings (community type(s)), and choose your sampling strategy.** Look at a map of your study area and determine the extent and size of the southern open pine occurrences or stands on your site and any stands that you wish to manage as southern open pine but that are currently other community types (for example, an old field or low quality hardwood stand that you are managing to become open pine in the future). Using the guidance in Section 2.2 below, delineate boundaries of the occurrences or stands of the different southern open pine groupings and choose a sampling strategy that best fits your needs.
- Step 2: **Conduct the field assessment and enter data collected on field datasheet.** Assess point or polygon. Assessment will consist of walking stands or visits to sets of random points within stands, and can be completed as data collection added to an ongoing natural resource inventory or timber cruise procedure. Use the sample field data sheet provided, or create your own.
- Step 3: **Complete metric assessment scores to calculate a score for the canopy, midstory, ground layer, and an overall score** using the worksheet provided in this document.
- Step 4: **Enter/upload results** into a database. Our Ecology Observation Database for open pine is currently under development, but should be available later in 2016.

2.1 Determine the Assessment Area and Determine the Target Southern Open Pine Groupings (based on Faber-Langendoen et al. 2012, Rocchio 2015).

The assessment area is “the entire area, subarea, or point of an occurrence of an ecosystem type with a relatively homogeneous ecology and condition” (Faber-Langendoen et al. 2012). In other words, it is the area where the desired forest condition metrics will be applied. There are different approaches for determining the assessment area boundaries. The approach used depends on natural resource management goals, project objectives, southern open pine ecosystem restoration targets, etc. The approaches for assessment area delineation are generally of two categories: (1) point-based and (2) polygon-based.

A single point-based approach typically defines a relatively small area (.1 hectare, for example) around a point, where the assessment is conducted. This could be a circle of a certain radius for most metrics, and basal area could be measured with a prism from the center.

A point based approach in which a fixed area is sampled around a point offers some advantages and disadvantages (Fennessy et al. 2007, Stevens and Jensen 2007):

- simple sampling design
- no mapped boundary of ecosystem type is required for assessment unit
- limited practical difficulties in the field of assessing the entire area, as the area is typically relatively small (.1-1 hectare); long-term monitoring programs often use a point-based approach because of these advantages
- Flexible so user can take one point per stand or can take multiple points per stand depending upon goals and resources available for sampling.
- For collection of multiple points, can take a large amount of sampling time as compared to the polygon approach.

A polygon approach is based on a specific southern open pine ecosystem extent or stand that is delineated to create a mapped area. The polygon approach is used when a more comprehensive assessment of ecological integrity is desired. Its advantages and disadvantages are:

- Mapping boundaries facilitates whole ecosystem and landscape interpretations
- Decision-makers and managers are often more interested in “stands” or “occurrences,” rather than points
- Involves assessing the polygon as a whole with one sample, which can speed up the process of data collection but can also lead to spurious conclusions if area sampled is not truly characteristic of polygon as a whole. In areas that turn out to be more heterogeneous than originally intended, there may still need to be some assessment of multiple distinct patches to come up with an average score for the polygon.

How to determine your assessment area (regardless of polygon or point-based approach):

1. Estimate Southern Open Pine Boundaries/assessment area: The first action needed is to map (formally or informally) the southern open pine ecosystem assessment area, if there isn't already a useable map of the area. Readily observable ecological criteria such as vegetation, soil, and hydrological characteristics can all be used to define the assessment area where it is most appropriate to apply the rapid assessment protocols (i.e. areas that are either currently in southern open pine or where managers wish to manage for a future with open pine. This map could be as simple as a hand drawing (preferably to scale) or could be a remotely sensed map with a GIS environment.

2. Classify your Southern Open Pine Observations: The Southern Open Pine Groupings themselves represent an ecosystem classification, which is an important tool in assessing the ecological integrity of the observations. Ecosystem classifications help fieldworkers to better cope with natural variability within and among types of ecosystems, and allow differences between observations with excellent, good, fair or poor condition to be more clearly recognized. Ecological classifications are also important in establishing “ecological equivalency,” for example, in providing guidance on how an impacted Mesic Longleaf Pine Flatwoods can be restored to a Mesic Longleaf Pine Flatwoods with improved condition.

Within the target assessment area mapped in action 1, determine the Southern Open Pine Grouping(s) present using the dichotomous key in **Appendix A**. Under the ideal scenario, the assessment area will only consist of one ecological “grouping” to minimize confusion in how to apply the final rapid assessment metrics (and if you encounter other open pine groupings, consider treating them as a separate assessment area). The specific place where an ecosystem type is found can be referred to as an “ecological observation”, “assessment area”, “sample point”, “field site,” or “occurrence”. The term “observation” is sometimes used as a generic, flexible term applied to any kind of place or unit where an ecosystem is identified and described (Stevens and Jensen 2007), and is increasingly used as a term for all species or ecosystem field records (Lapp et al. 2011).

3. Modify Boundaries of Observations Based on Variation in Land Use: Significant differences in management or land use can result in distinct ecological differences across an observation boundary. If such changes result in strong differences in condition, they should be considered separate stands or occurrences, rather than the same observation/assessment area. Some examples follow:

- Heavily grazed Wet Longleaf & Slash Pine Flatwoods & Savannas on one side of a fence line and ungrazed Wet Longleaf & Slash Pine Flatwoods & Savannas on the other could result in separate stands or occurrences (Figure 1).
- Altered hydrology including, ditches, water diversions, tiling, or roadbeds that substantially alter a site’s hydrology relative to adjacent areas could result in separate stands or occurrences (Figure 1).

4. Choose best sampling strategy for Assessment Areas: Occurrences of southern open pine can be very large. For such occurrences/observations, it may be necessary to sample more than one area to best capture the variability within the observed area. A random or stratified random sampling design is a useful way to accomplish this goal. The

Generalized Random Tessellation Stratified (GRTS) survey design can be used to create a spatially balanced random sample of points within the AA. This method allows for some points to be dropped while maintaining spatially balanced random sampling. The R statistics software package called *spsurvey*, can be used for GRTS survey design. Details are available online at:

<https://science.nature.nps.gov/im/datamgmt/statistics/r/advanced/grts.cfm>

<http://www.inside-r.org/packages/cran/spsurvey/docs/grts>

<https://cran.r-project.org/web/packages/spsurvey/index.html>

Alternatively, subdivide large occurrences based on ecological or practical criteria and delineate such that they provide a practical assessment area for rapid assessment application.

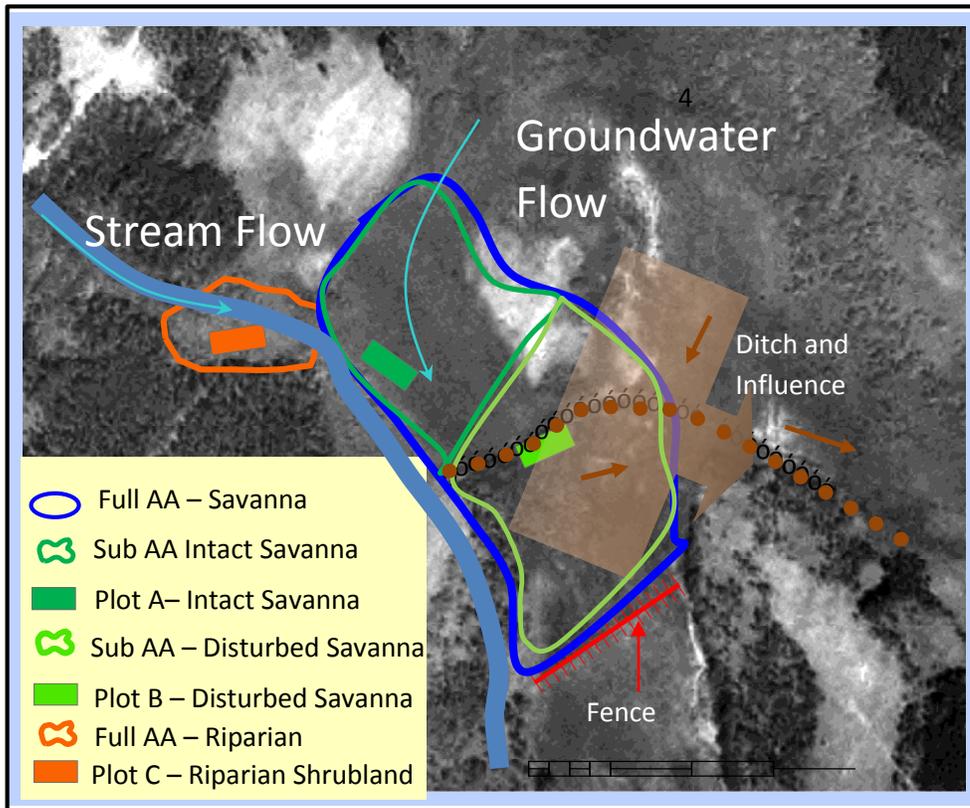


Figure 1. Example of delineated Assessment Areas (AAs). Although contiguous with each other, the savanna and riparian shrubland were delineated as distinct AAs because they were distinct wetland types (e.g., savanna vs. riparian shrubland). The savanna was divided into sub-AAs due to a human-induced disturbance (e.g., ditching) which could significantly alter a large portion of an otherwise contiguous wetland type (e.g., intact vs. disturbed savanna). A decision as to whether to formally recognize two sub assessment areas within a larger assessment area or

to simply incorporate the variation into a single evaluation depends on the observed differences in integrity and the size of the main assessment area versus sub-AAs (adapted from Rocchio 2007).

2.2 Conduct the field assessment and enter data collected on fieldsheet.

The great advantage to our methodology is that it is both fast and flexible. Users can apply the methodology as rigorously or loosely as is possible using their available resources. Similarly, users may choose to either apply all metrics or just a subset depending upon the amount of time and resources they feel they can spare.

Assessment can consist of simply walking through the stands using a polygon-based assessment, visits to sets of random points within stands using a point-based approach, or can be completed as data collection added to an ongoing natural resource inventory or timber cruise procedure. **Use the sample field data coversheet provided in Appendix B to document your entire assessment area and choose the appropriate field form from Appendix C to take specific data for each point or polygon within your assessment area.** *Since this is the first version of this document, we encourage input and feedback on these forms so that we can improve them for the next iteration of this protocols document.*

At the beginning of your project, choose the metrics that you wish to apply. Under the ideal scenario, users would collect data on all metrics suggested in the document for the open pine grouping that is applicable. If time is a major factor, at a minimum choose at least 1-2 metrics per strata (for a total of 3-6 metrics) to ensure that you have metrics representing the canopy, midstory, and ground layer.

Also for canopy layer, keep in mind that users may use the yellow pine stand density index measurement INSTEAD OF yellow pine canopy cover and yellow pine basal area. The stand density index is still in early development stages, so we are allowing users to consider this as an optional alternative where they feel comfortable applying it.

We highly recommend that users that have the resources to do so collect exact measurements in the field. In this way, we can potentially look back at the raw data to better understand how far measurements were from cutoffs between categories of excellent, good, fair, poor. However, if time is highly limited, then simply marking the excellent/good/fair/poor category on the datasheet without recording the actual specific measure is acceptable.

2.3 Complete metric assessment scores to calculate a score for the canopy, midstory, ground layer, and an overall score.

Once all data is filled in for an assessment area (see appendix C for data sheet templates), it is time to score each point or polygon assessed. If only scoring one sample, convert any raw data to a score using the metric cutoffs on the data sheet. Add up all metrics for a particular strata and follow instructions on sheet for developing a score for that strata. Finally, add up all three strata scores and divide by 3 to obtain the final total score.

Scores can be useful in two ways:

- Scores for each strata can help users better understand which strata are in good condition vs. which strata are in poor/fair condition. These results may help users understand which strata need the most “help” to improve condition in the future, thereby potentially focusing future management.
- Overall scores can help users understand how their stand is performing overall and can be rolled up and used at a large stand or regional scale to better quantify larger scale wildlife habitat and biodiversity contributions at these larger scales.

2.4 Enter/upload Results.

Enter/upload results into database. The Ecology Observation Database for open pine is not yet available, but we hope for a release in late 2016.

3.0 Definitions of key fields on data sheets

This section provides guidance on how to populate the field form. The first four sections address basic site-level data. Thereafter, protocols for each metric are described. They are organized by Rank Factor categories. The majority of protocols used for the WA wetland/riparian Level 2 EIAs are the same as outlined by Faber-Langendoen et al. (2012). We occasionally use regional language for some of the metric ratings.

Site / Assessment Area Information

Date: the date of the survey

Project: name of field data collection project

Site ID: unique ID of site

Field Crew Team Members

Leader: leader of the field team, with first and last name

Assistants: field team assistants, with first and last names

Photographer: name of the photographer

Photos of Site: descriptions of each photo (in order, separated by commas). A brief description of each photo's content should be documented in a previous image taken of the top of that field form, or (1) a field notebook or (2) file name; or (3) in the photo's metadata.

Photo filenames: filenames of photos, these ideally should have the photographer's initials and a number (e.g., fjr_001), or siteID and a number (e.g., Black_Creek_stand12_1).

Assessment Area Shape: shape of assessment area, such as circle, rectangle or polygon

Bearing: compass bearing of length of rectangle or polygon assessment area

Assessment Area Dimensions: radius of circle, or width and length of rectangle or polygon

State: State in which the assessment area occurs.

County: County in which the assessment area occurs.

Twp: Township, only for areas where TRS (Township, Range, Section) land designations are used

Range: Range, only for areas where TRS (Township, Range, Section) land designations are used

Section: Section, only for areas where TRS (Township, Range, Section) land designations are used

USGS 7.5' Quad: 7.5 Minute Quadrangle map name from US Geological Survey

Landowner/Managed Area Name:

Contact Person: name of contact person associated with the site

Stand Name: name of stand where assessment area is, could be a stand code or name.

Permit Required? Yes/No, if a permit is required the field team should always carry it in the field.

Locked Gate? Yes/No, the field team should leave locked gates as they are instructed to by contact person. If there is a series of locks, be careful to relock as found when team is done working beyond gate.

Access Difficulties? (describe): Any particular access difficulties should be clearly noted, on an extra sheet if needed. These notes will enable future visits to be efficient.

Site Description: General description of the site, provide a written description of the site's characteristics with details appropriate for project needs. Focus on the setting in which the site occurs, ecological and vegetation patterns both within and adjacent to the site, notable stressors or human activity, signs of wildlife, etc. A drawing may also be helpful.

General Drawing (Optional): A clear drawing is optional but can be useful.

Location

Assessment Area CENTRUM (check one) Original Moved (why? how far?)

GPS Unit: GPS make, model and number (if numbered)

GPS Filename: filename of saved new GPS point at assessment area

Projection: projection of GPS data

UTM Zone: UTM zone, which is the same for most project areas.

UTM X Easting: Easting of field recorded new GPS point

UTM Y Northing: Northing of field recorded new GPS point

Datum: Circle either NAD83 or WGS84, or write in other datum

LAT (decimal degree): Latitude of field recorded new GPS point

LONG (decimal degree): Longitude of field recorded new GPS point

GPS Accuracy: reported accuracy, such as from a Garmin GPS (e.g. 5 feet)

PDOP: PDOP is reported for Trimble GPS units

of Sats: number of satellites used by GPS for recorded point

Original (e.g. GRTS): original random, stratified random, or GRTS random point location which was navigated to with GPS

Post-processed: values if GPS point taken in the field was post-processed to improve accuracy

Classification

Southern Open Pine Grouping: use the key provided to determine Southern Open Pine Grouping

Other Community Classification Reference: optional other classification reference used, such as Eyre 1980 (SAF), Florida Natural Areas Inventory 2010, Edwards, Ambrose & Kirkman 2013, etc.

Name: optional name of other open pine community name following classification reference

USNVC Association (Optional): the US National Vegetation Classification Plant Association name is optional, and can be added if known.

Classification Comments: any comments on classification of assessment area

Notes: any notes, specify which field or topic they pertain to

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Appendix A. Key to Southern Open Pine Habitat Groupings

This key should help determine which southern open pine habitat grouping desired forest condition metrics are most appropriate for particular lands. A map of states and USDA Forest Service sections (Cleland et al. 2007), is provided (see Figure A-1, below). Some of the southern open pine habitat groupings occur within the range of longleaf pine (*Pinus palustris*) as defined by Little (1971). This general range is not precise in all places, so it is possible that a stand of a longleaf pine grouping could be found outside this range. In the vast majority of cases, a user should be able to place a stand in a southern open pine grouping, then chose the appropriate set of metric values for that grouping.

The key is specifically designed for use within the boundaries of the Gulf Coast Plains and Ozarks Landscape Conservation Cooperative (GCPOLCC), which includes the Missouri and Arkansas highlands of the Ozark, Boston and Ouachita mountain ranges, and the Gulf Coastal Plains, which extend from eastern Texas to the Florida panhandle. It also applies to stands dominated by Longleaf Pine (*Pinus palustris*) throughout the range of this species, but makes no attempt to accommodate other related vegetation east and north of the GCPOLCC footprint.

The key will lead a user through a series of choices (“couplets”) related to the geographic location of the area under consideration, as well as choices about stand composition and environment. At its higher levels, the key is constructed around these Forest Service regions. Further into the key, the choices related to stand composition and environment come into play. A user should read both statements and see which one best applies to the area and stands under question. If an obviously incorrect answer is obtained, it may be necessary to repeat the exercise.

Common terms rather than highly technical ones are used (wet, dry, sandy, upland, seasonally, etc.). One term that may be unfamiliar to some users is “mesic”. This is a kind of shorthand for an environment that is neither very dry nor very wet (i.e. “in the middle” of a broad ecological moisture continuum). It is most frequently applied to species-rich hardwood stands (“coves”), but in this context it would refer to stands that are not “wet”, i.e. without standing water), but have enough available soil moisture to support diverse and possibly dense herbaceous layers. Similarly “dry-mesic” refers to stands that are on the dry side of mesic, but not notably dry. These terms may roughly correlate with soil texture, in that under similar hydrological conditions, coarser-textured soils are more likely to be drier than those with finer particle size.

Following the key, a table of distributions of the open pine groupings by state and region (Table A-1), a map of the relevant USDA Forest Service Sections (Figure A-1), and a table of USDA Forest Service Provinces and Sections referred to in the key (Table A-2) are provided to assist in its use.

Key to Open Pine Groupings

- 1a. Forests and woodlands in the coastal plains (Outer Coastal Plains Mixed Forest Province 232; Southeastern Mixed Forest Province 231, southern parts of Sections 231B, 231E and 231H within the range of Longleaf Pine [*Pinus palustris*] as defined by Little [1971]), typically dominated by Longleaf Pine (*Pinus palustris*) and/or Slash Pine (*Pinus elliottii*), habitat ranging from very dry sandy uplands, mesic finer-textured soils, and seasonally wet or saturated flatwoods and savannas..... 2
- 1b. Forests and woodlands landward of the coastal plains (Southeastern Mixed Forest Province 231, Sections 231A, 231C, 231D, 231G, 231I; also Central Interior Broadleaf Forest Province 223, Section 223A; Ozark Broadleaf Forest Province M223, and Ouachita Mixed Forest-Meadow Province M231); or in the inner portions of the coastal plains landward of the range of Longleaf Pine (Southeastern Mixed Forest Province 231, most of Sections 231B, 231E, lowland parts of Section 231G, 231H) dominated by Shortleaf Pine (*Pinus echinata*) and/or Loblolly Pine (*Pinus taeda*), OR dominated by Longleaf Pine (*Pinus palustris*) and found landward of the coastal plains as mentioned above..... 3
- 2a. Longleaf Pine / Slash Pine Woodlands (wet and mesic flatwoods and savannas); the wet examples found on poorly drained, somewhat poorly drained, and seasonally saturated mineral soils with seasonally high water tables; the mesic examples found on flat sites with a spodosol soil which has a hardpan (spodic horizon) impeding drainage which can cause sites to be wet in the winter and dry in the summer 4
- 2b. Stands of longleaf pine (*Pinus palustris*) on sandy to loamy soils on upland sites ranging from gently rolling lands, broad ridgetops to steeper side slopes, and in mesic swales and terraces.. 5
- 3a. Stands with Longleaf Pine (*Pinus palustris*) in combination with Shortleaf Pine (*Pinus echinata*) and dry Oak (*Quercus*) species, found landward of the coastal plains (Southeastern Mixed Forest Province 231, Sections 231A, 231C, 231D, 231I) **“Mountain Longleaf”**
 **Dry & Mesic Highlands Pine Woodlands, in part; [part of US NVC GROUP G012]**
- 3b. Forests and woodlands dominated by Shortleaf Pine (*Pinus echinata*) and/or Loblolly Pine (*Pinus taeda*) found landward of the coastal plains (Southeastern Mixed Forest Province 231, Sections 231E, 231G); and in the inner portions of the coastal plains landward of the range of Longleaf Pine (Southeastern Mixed Forest Province 231, most of Sections 231B, 231E and 231H); also west of the Mississippi River in the Central Interior Broadleaf Forest Province 223, Section 223A; Ozark Broadleaf Forest Province M223, and Ouachita Mixed Forest-Meadow Province M231, as well as the Crowley’s Ridge Subsection 234Db) 6

4a. Mesic Longleaf Pine flatwood woodlands found on flat sites with spodic horizons (Spodosols) or some factor impeding drainage which can cause sites to be wet in the winter and dry in the summer..

.....**Mesic Longleaf Pine Flatwoods [US NVC GROUP G596]**

4b. Wet Longleaf Pine / Slash Pine flatwoods and savannas found on poorly drained, somewhat poorly drained, and seasonally saturated mineral soils with seasonally high water tables.....

.....**Wet Longleaf & Slash Pine Flatwoods & Savannas [US NVC GROUP G190]**

5a. Stands of longleaf pine (*Pinus palustris*) on deep sandy soils, in the fall-line sandhills (Subsection 232Bq) as well as on other sandy sites in the outer coastal plains, typically with scrub oaks (Turkey Oak, Bluejack Oak, Sand Post Oak) in the subcanopy

.....**Xeric Longleaf Pine Barrens [US NVC GROUP G154]**

5b. Other stands of longleaf pine (*Pinus palustris*) on sandy to loamy soils on upland sites ranging from gently rolling lands, broad ridgetops to steeper side slopes, and in mesic swales and terraces. Subcanopy oaks include White Oak, Southern Red Oak, Black Oak, Blackjack Oak

.....**Dry & Mesic Longleaf Pine Woodlands [US NVC GROUP G009]**

6a. Dry and dry-mesic forests and woodlands dominated by Shortleaf Pine (*Pinus echinata*) found west of the Mississippi River in the Central Interior Broadleaf Forest Province 223, Section 223A; Ozark Broadleaf Forest Province M223; Ouachita Mixed Forest-Meadow Province M231; Southeastern Mixed Forest Province 231, Section 231G

.....**“Shortleaf-Loblolly Woodlands”**
.....**Dry & Mesic Highlands Pine Woodlands, in part; [part of US NVC GROUP G012]**

6b. Forests and woodlands, including flatwoods, dominated by Shortleaf Pine (*Pinus echinata*) and/or Loblolly Pine (*Pinus taeda*) found in the inner portions of the coastal plains landward of the range of Longleaf Pine (Southeastern Mixed Forest Province 231, most of Sections 231B, 231E, 231H), as well as in portions of the Mississippi River Alluvial Basin Section 234A. [this Grouping would also apply to the lower/outer parts of the Piedmont (Sections 231A, 231I but this area is not within the GCPOLCC footprint]

7

7a. Dry and dry-mesic forests and woodlands dominated by Shortleaf Pine (*Pinus echinata*) and/or Loblolly Pine (*Pinus taeda*) found in the inner portions of the coastal plains landward of the range of Longleaf Pine (Southeastern Mixed Forest Province 231, most of Sections 231B, 231E, 231H), as well as the Crowley’s Ridge Subsection 234Db (Lower Mississippi Riverine Forest Province 234) [this

Grouping would also apply to the lower/outer parts of the Piedmont (Sections 231A, 231I) but this area is not within the GCPOLCC footprint].....

..... **Dry and Mesic Hilly Pine Woodlands [US NVC GROUP G013, part of G012]**

7b. Flatwoods (nonriverine wetland or seasonally wet pine-hardwood forests) in the coastal plains (Outer Coastal Plains Mixed Forest Province 232; Southeastern Mixed Forest Province 231, most of Sections 231B, 231E, 231H) and the Lower Mississippi Riverine Forest Province 234

..... **Upper Coastal Plain Flatwoods [US NVC GROUP G130]**

References

Cleland, D. T., J. A. Freeouf, J. E. Keys Jr., G. J. Nowacki, C. Carpenter, and W. H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States [1:3,500,000] [CD-ROM]. Sloan, A.M., cartog. Gen. Tech. Report WO-76. Washington, DC: U.S. Department of Agriculture, Forest Service.

Little E. L. Jr. 1971. Atlas of United States trees, volume 1, conifers and important hardwoods: U.S. Department of Agriculture Miscellaneous Publication 1146, 9 p., 200 maps, available at <http://esp.cr.usgs.gov/data/little/>. Accessed 22 Jan 2016.

States	Region	Dominant Pines	Site	Southern Open Pine Grouping
AR, MO, OK	Ozark and Ouachita Highlands	Shortleaf Pine	Dry & Mesic Uplands	Dry & Mesic Highlands Pine Woodlands
AR, LA, TX	Coastal Plain	Shortleaf Pine, Loblolly Pine	Dry & Mesic Uplands	Dry & Mesic Hilly Pine Woodlands
AR, LA, TX	Coastal Plain	Shortleaf Pine, Loblolly Pine	Wet-Mesic to Wet Flats	Upper Coastal Plain Pine Flatwoods
LA, TX	Coastal Plain	Longleaf Pine	Xeric Uplands on deep sandy soils	Xeric Longleaf Pine Barrens
LA, TX	Coastal Plain	Longleaf Pine	Dry & Mesic Uplands	Dry & Mesic Longleaf Pine Woodlands
LA, TX	Coastal Plain	Longleaf Pine	Wet Flats	Wet Longleaf & Slash Pine Flatwoods & Savannas
AL, GA, NC, SC	Appalachians and Piedmont	Longleaf Pine	Dry Uplands, on ridges and upper slopes	Dry & Mesic Highlands Pine Woodlands
AL, GA, NC, SC	Piedmont	Shortleaf Pine, Loblolly Pine	Dry & Mesic Uplands	Dry & Mesic Hilly Pine Woodlands
AL, GA, FL, MS, NC, SC	Coastal Plain	Shortleaf Pine, Loblolly Pine	Dry & Mesic Uplands	Dry & Mesic Hilly Pine Woodlands
AL, GA, MS, NC, SC	Coastal Plain	Longleaf Pine	Xeric Uplands on deep sandy soils	Xeric Longleaf Pine Barrens
AL, GA, MS, NC, SC	Coastal Plain	Longleaf Pine	Dry & Mesic Uplands	Dry & Mesic Longleaf Pine Woodlands
AL, GA, MS, NC, SC	Coastal Plain	Longleaf Pine, Slash Pine	Mesic to Wet Flats, Spodosols	Mesic Longleaf Pine Flatwoods
AL, GA, MS, NC, SC	Coastal Plain	Longleaf Pine, Slash Pine	Wet Flats	Wet Longleaf & Slash Pine Flatwoods & Savannas
FL	Coastal Plain	Longleaf Pine	Dry & Mesic Uplands	Dry & Mesic Longleaf Pine Woodlands
FL	Coastal Plain	Longleaf Pine	Xeric Uplands on deep sandy soils	Xeric Longleaf Pine Barrens
FL	Coastal Plain	Longleaf Pine, Slash Pine, South Florida Slash Pine	Mesic to Wet Flats, Spodosols	Mesic Longleaf Pine Flatwoods
FL	Coastal Plain	Longleaf Pine, Slash Pine, South Florida Slash Pine	Wet Flats	Wet Longleaf & Slash Pine Flatwoods & Savannas

Table A-1. States, Regions, and Southern Open Pine Groupings

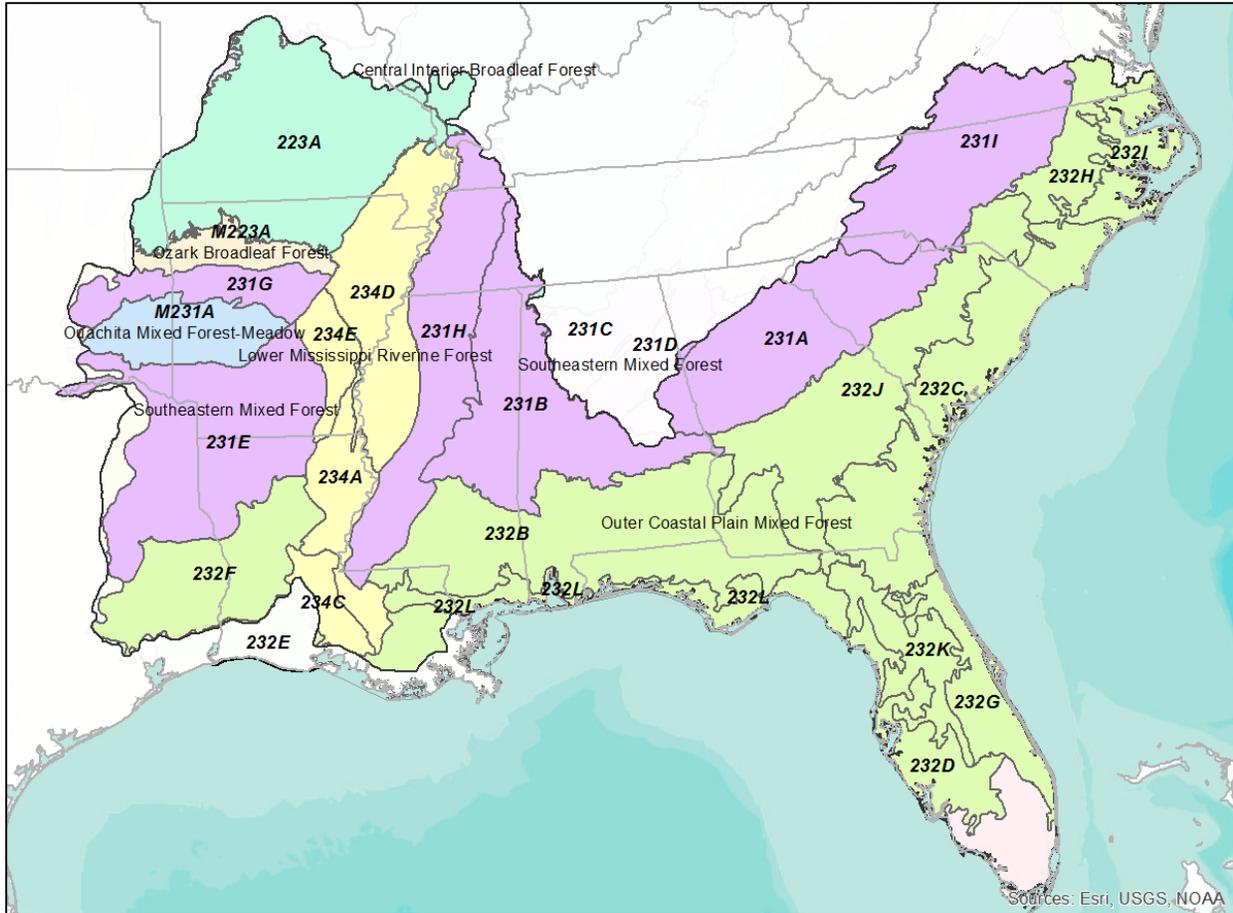


Figure A-1. USDA Forest Service Provinces and Sections (from Cleland et al. 2007)

PROVINCE /SECTION	PROVINCE/SECTION_NAME
223	Central Interior Broadleaf Forest
223A	Ozark Highlands
M223	Ozark Broadleaf Forest
M223A	Boston Mountains
231	Southeastern Mixed Forest
231A	Southern Appalachian Piedmont
231B	Coastal Plains-Middle

231C	Southern Cumberland Plateau
231D	Southern Ridge and Valley
231E	Mid Coastal Plains-Western
231G	Arkansas Valley
231H	Coastal Plains-Loess
231I	Central Appalachian Piedmont
M231	Ouachita Mixed Forest-Meadow
M231A	Ouachita Mountains
232	Outer Coastal Plain Mixed Forest
232B	Gulf Coastal Plains and Flatwoods
232C	Atlantic Coastal Flatwoods
232D	Florida Coastal Lowlands-Gulf
232F	Coastal Plains and Flatwoods-Western Gulf
232G	Florida Coastal Lowlands-Atlantic
232H	Middle Atlantic Coastal Plains and Flatwoods
232I	Northern Atlantic Coastal Flatwoods
232J	Southern Atlantic Coastal Plains and Flatwoods
232K	Florida Coastal Plains Central Highlands
232L	Gulf Coastal Lowlands
234	Lower Mississippi Riverine Forest
234A	Southern Mississippi Alluvial Plain
234C	Atchafalaya and Red River Alluvial Plains
234D	White and Black River Alluvial Plains
234E	Arkansas Alluvial Plains

Table A-2. USDA Forest Service Provinces and Sections referred to in the Key

Notes on Some Ambiguous or Confusing Habitats

There are some possible situations related to open pine habitats in the southeastern United States which are ambiguous or may present uncertainties in terms of which habitat is best managed for in a particular locale.

1. Sites found landward of the coastal plains (Southeastern Mixed Forest Province 231, Sections 231A, 231C, 231D) with Longleaf Pine as a dominant or codominant should be treated as examples of “Mountain Longleaf”. These could be proximal to, or interfingering with, stands dominated by Shortleaf Pine without Longleaf Pine. The issue here is that “Mountain Longleaf” would be evaluated with the metrics for the Dry & Mesic Highlands Pine Woodlands Grouping, and the adjacent Shortleaf Pine stands would be evaluated with the metrics for the Dry & Mesic Hilly Pine Woodlands Grouping. In this area, both of these Groupings are related to US NVC GROUP G012. A distinction may need to be made between stands dominated by Shortleaf Pine without Longleaf Pine which are landward of the coastal plain and do **not** have loblolly pine or are outside the range of loblolly pine, then their grouping would be Dry & Mesic Highlands Pine Woodlands, otherwise. Stands that are within the range of Loblolly Pine would be part of the Dry & Mesic Hilly Pine Woodlands Grouping.
2. In a portion of the inner coastal plain (Section 231B), there are quite rugged landforms found north of the black belt region and southwest of the southern end of the Ridge and Valley (this is within the ranges of both Longleaf Pine and Chestnut Oak [*Quercus prinus*]). Using our key to Open Pine Groupings, this would be part of the Dry & Mesic Longleaf Pine Woodlands, but has some characteristics of the “Mountain Longleaf” discussed above. This area includes the Oakmulgee District of the Talladega National Forest in Bibb, Hale, Perry, and Tuscaloosa counties of Alabama. It is not clear which metrics are better applied in this area.
3. The third exception or anomaly would be stands dominated by Shortleaf Pine found within the range of Longleaf Pine in the inner or outer coastal plains (Provinces 231 and 232). This type of stand would have been far less common in the outer coastal plain, and more likely in the inner coastal plain. More information is needed about this vegetation and its characteristics and environment. One example is Shortleaf Pine vegetation of the Red Hills of Florida and Georgia. In this case, the metrics for Dry & Mesic Hilly Pine Woodlands [US NVC GROUP G012] would apply.

Appendix B. Rapid Assessment Field Cover Sheet

Field Form for Rapid Assessment Metrics for Wildlife and Biodiversity in Southern Open Pine Ecosystems

Date: _____ Project: _____ Site ID: _____

Field Crew Team Members:

Leader: _____ Assistants: _____

Photographer: _____ Photos of Site: AA Centrum out: N E S W ; Buffer in: N E S W; Add'l: Y / N

Photo filenames: _____

Assessment Area Shape: Circle, Rectangle, Square, Polygon Bearing: _____

Assessment Area Dimensions: radius 18m, 40m, _____ m/ft. or rectangle _____ m/ft wide x _____ m/ft long (fill in values, units)

State: _____ County: _____ Twp: _____ Range: _____ Section: _____ USGS 7.5' Quad: _____

Landowner/Managed Area Name: _____ Contact Person: _____

Stand Name: _____ Permit Required? Locked Gate? Access Difficulties? (describe) _____

SITE DESCRIPTION:

GENERAL DRAWING (Optional): Provide a drawing of the assessment area, including its boundaries, either aerial view or transect view.

LOCATION: Assessment Area CENTRUM (check one) ORIGINAL MOVED (why? how far?)

GPS Unit:	GPS Filename:	Projection:		
UTM Zone:	Datum: NAD83 WGS84	GPS Accuracy: _____ m/ ft	PDOP:	# of Sat's:
UTM X Easting: ____ _	LAT: decimal degree	Original (GRTS):	Field:	Post-processed:
UTM Y Northing: ____ _	LONG: decimal degree			

Classification (use to select appropriate Southern Open Pine Metrics Datasheet for page 2 of field form)

Southern Open Pine Grouping: _____

Other Community Classification Reference: _____ Name: _____

USNVC Association (Optional): _____

Classification Comments:

Notes:

Appendix C. Rapid Assessment Metrics Data/Scoring Sheets (By Habitat Grouping)

Dry & Mesic Highlands Pine Woodlands (Mountain Longleaf) Metrics Data Sheet					Recorded Measured Value of Metric	Recorded Metric Score (1.0-4.0)
Canopy Metrics	If the optional Stand Density Index metric is used, then Canopy Southern Pine Basal Area and Southern Yellow Pine Canopy Cover do not need to be used as metrics					
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Canopy Southern Yellow Pine Basal Area	>35 to 75 ft ² /acre basal area of longleaf & shortleaf pine	30 to 35 or >75 to 90 ft ² /acre basal area of longleaf & shortleaf pine	10 to <30 or >90 to 110 ft ² /acre basal area of longleaf & shortleaf pine	<10 or >110 ft ² /acre basal area of longleaf & shortleaf pine	ft ² /acre BA	x0.25
Southern Yellow Pine Canopy Cover	>25 to 70% canopy cover of longleaf & shortleaf pine	20-25% or >70 to 80% canopy cover of longleaf & shortleaf	10 to <20% or >80 to 90% canopy cover of longleaf & shortleaf	<10% or >90% canopy cover of longleaf & shortleaf pine	% cover	x0.25
Southern Yellow Pine Stand Age Structure	BA ≥20 ft ² /acre of flat-top longleaf pine of any diameter and/or longleaf or shortleaf pine trees ≥14" DBH class	BA ≥10 ft ² /acre of longleaf or shortleaf pine trees ≥14" DBH class	Longleaf or shortleaf pine trees ≥14" DBH class are present, but at <10 ft ² /acre BA	No longleaf or shortleaf pine trees ≥14" DBH or flat-top longleaf pine are present	ft ² /acre BA	x0.25
Canopy Hardwood Basal Area	≤20 ft ² /acre BA of hardwood trees	>20 to 40 ft ² /acre BA of hardwood trees	>40 to 50 ft ² /acre BA of hardwood trees	>50 ft ² /acre BA of hardwood trees	ft ² /acre BA	x0.25
Stand Density Index (applies to longleaf pine)	SDI = 55 – 120 (14 - 30% of Maximum SDI of 400)	SDI = 40 – 55 or 120 - 160 (10-14% or 30-40% of Maximum SDI of 400)	SDI = 15 – 40 or 160 - 200 (4-10% or 40-50% of maximum SDI)	SDI <15 or >200 (<4% or >50%, 240 is 60% of Maximum SD of 400)	SDI value	x0.5
Midstory/Shrub Metrics					Canopy Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Midstory Fire Tolerant Hardwood Cover	<10% cover of midstory fire tolerant hardwoods	10-30% cover of midstory fire tolerant hardwoods	>30 to 40% cover of midstory fire tolerant hardwoods	>40% cover of midstory fire tolerant hardwoods	% cover	x0.25
Midstory Overall Cover	<20% cover of woody midstory	≥20 to 25% cover of woody midstory	>25 to 35% cover of woody midstory	>35% cover of woody midstory	% cover	x0.25
Short Shrub (<3 ft tall) Cover	Short shrubs average <20% cover	Short shrubs average 20- 25% cover	Short shrubs average >25 to 40% cover	Short shrubs average >40% cover	% cover	x0.25
Tall Shrub (3-10 ft) Cover	Tall shrubs average < 15% cover.	Tall shrubs average 15 - 20% cover.	Tall shrubs average >20 to 30% cover.	Tall shrubs average >30% cover.	% cover	x0.25
Ground Layer Metrics					Midstory Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Overall Native Herbaceous Ground Cover	>45 to 80% herbaceous cover	30-45% or >80% herbaceous cover	15 to <30% herbaceous cover	<15% herbaceous cover	% cover	x0.25
Longleaf Pine Regeneration	Longleaf pine regeneration cover is >1% of stand (Good and Excellent)	Longleaf pine regeneration cover is >1% of stand (Good and Excellent)	Longleaf pine regen cover is present but is <1% of stand, or no regen seen, but cone producing longleaf pine are present	Longleaf pine regen cover is apparently absent, and no cone producing longleaf pine are present in the stand	% of stand Regen? Cones?	x0.25
Native Warm Season Grass Cover	>25 to 85% foliar cover of all native warm season grasses	20-25% or >85% foliar cover of all native warm season grasses	10 to <20% foliar cover of all native warm season grasses	<10% foliar cover of all native warm season grasses	% foliar cover	x0.25
Invasive Plant Presence / Distribution	Invasive nonnative plant species absent or cover is very low (≤1% cover)	Invasive nonnative plant species in any stratum present but sporadic (1-5% cover)	Invasive nonnative plant species in any stratum uncommon (5-10% cover)	Invasive nonnative plant species in any stratum common (>10% cover)	% cover	x0.25
Final Score is : Canopy Score _____x0.33 + Midstory Score _____x0.33 + Ground Layer Score _____x0.33 = Evaluation Scale: 4.0 to 3.5 = Excellent, 3.5 to 2.5 = Good, 2.5 to 1.5 = Fair, 1.5 to 1.0 = Poor					Ground Layer Score =	

Dry & Mesic Highlands Pine Woodlands Metrics Data Sheet					Recorded Measured Value of Metric	Recorded Metric Score (1.0-4.0)
Canopy Metrics	If the optional Stand Density Index metric is used, then Canopy Southern Pine Basal Area and Southern Yellow Pine Canopy Cover do not need to be used as metrics					
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Canopy Southern Yellow Pine Basal Area	>35 to 75 ft ² /acre basal area of shortleaf pine	30 to 35 or >75 to 90 ft ² /acre basal area of shortleaf pine	10 to <30 or >90 to 110 ft ² /acre basal area of shortleaf pine	<10 or >110 ft ² /acre basal area of shortleaf pine	ft²/acre BA	x0.25
Southern Yellow Pine Canopy Cover	>25 to 70% canopy cover of shortleaf pine	20-25% or >70 to 80% canopy cover of shortleaf pine	10 to <20% or >80 to 90% canopy cover of shortleaf pine	<10% or >90% canopy cover of shortleaf pine	% cover	x0.25
Southern Yellow Pine Stand Age Structure	Basal area ≥20 ft ² /acre of shortleaf pine trees ≥14" DBH class	Basal area ≥10 ft ² /acre of shortleaf pine trees ≥14" DBH class	Shortleaf pine trees ≥14" DBH class are present, but <10 ft ² /acre basal area of those large trees	No shortleaf pine trees ≥14" DBH are present	ft²/acre BA	x0.25
Canopy Hardwood Basal Area	≤20 ft ² /acre BA of hardwood trees	>20 to 40 ft ² /acre BA of hardwood trees	>40 to 50 ft ² /acre BA of hardwood trees	>50 ft ² /acre BA of hardwood trees	ft²/acre BA	x0.25
Stand Density Index (applies to shortleaf pine)	SDI = 65 – 135 (14 - 30% of Maximum SDI of 450)	SDI = 45 – 65 or 135 - 180 (10-14% or 30-40% of Maximum SDI of 450)	SDI = 20 – 45 or 180 - 225 (4-10% or 40-50% of maximum SDI of 450)	SDI <20 or >225 (<4% or >50%, 270 is 60% of Maximum SD of 450)	SDI value	x0.5
Midstory/Shrub Metrics					Canopy Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Midstory Fire Tolerant Hardwood Cover	<10% cover of midstory fire tolerant hardwoods	10-30% cover of midstory fire tolerant hardwoods	>30 to 40% cover of midstory fire tolerant hardwoods	>40% cover of midstory fire tolerant hardwoods	% cover	x0.25
Midstory Overall Cover	<20% cover of woody midstory	20-25% cover of woody midstory	>25 to 35% cover of woody midstory	>35% cover of woody midstory	% cover	x0.25
Short Shrub (<3 ft tall) Cover	Short shrubs average <20% cover	Short shrubs average 20 - 25% cover	Short shrubs average >25 to 40% cover	Short shrubs average >40% cover	% cover	x0.25
Tall Shrub (3-10 ft tall) Cover	Tall shrubs average < 15% cover.	Tall shrubs average 15 - 20% cover.	Tall shrubs average >20 to 30% cover.	Tall shrubs average >30% cover.	% cover	x0.25
Ground Layer Metrics					Midstory Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Overall Native Herbaceous Ground Cover	>45 to 80% herbaceous cover	30-45% or >80% herbaceous cover	15 to <30% herbaceous cover	<15% herbaceous cover	% cover	x0.33
Native Warm Season Grass Cover	>25 to 85% foliar cover of all native warm season grasses	>15 to 25% or >85% foliar cover of native warm season grasses	10-15% foliar cover of all native warm season grasses	<10% foliar cover of all native warm season grasses	% foliar cover	x0.33
Invasive Plant Presence / Distribution	Invasive nonnative plant species absent or cover is very low (≤1% cover)	Invasive nonnative plant species in any stratum present but sporadic (1-5 % cover)	Invasive nonnative plant species in any stratum uncommon (5-10% cover)	Invasive nonnative plant species in any stratum common (>10% cover)	% cover	x0.33
Final Score is : Canopy Score _____ x0.33 + Midstory Score _____ x0.33 + Ground Layer Score _____ x0.33 = Evaluation Scale: 4.0 to 3.5 = Excellent, 3.5 to 2.5 = Good, 2.5 to 1.5 = Fair, 1.5 to 1.0 = Poor					Ground Layer Score =	

Dry & Mesic Hilly Pine Woodlands Metrics Data Sheet					Recorded Measured Value of Metric	Recorded Metric Score (1.0-4.0)
Canopy Metrics	If the optional Stand Density Index metric is used, then Canopy Southern Pine Basal Area and Southern Yellow Pine Canopy Cover do not need to be used as metrics					
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Canopy Southern Yellow Pine Basal Area	30-85 ft ² /acre basal area of loblolly or shortleaf pine	20 to <30 or >85 to 100 ft ² /acre basal area of loblolly or shortleaf pine	10 to <20 or >100 to 115 ft ² /acre basal area of loblolly or shortleaf pine	<10 or >115 ft ² /acre basal area of loblolly or shortleaf pine	ft ² /acre BA	x0.25
Southern Yellow Pine Canopy Cover	>25 to 75% canopy cover of loblolly or shortleaf pine	>15 to 25% canopy cover or >75 to 85% canopy cover of loblolly or shortleaf pine	10-15% canopy cover or >85 to 95% canopy cover of loblolly or shortleaf pine	<10% cover or >95% cover of loblolly or shortleaf pine	% cover	x0.25
Southern Yellow Pine Stand Age Structure	BA ≥20 ft ² /acre of loblolly and/or shortleaf pine trees ≥14" DBH class	BA ≥10 ft ² /acre of loblolly and/or shortleaf pine trees ≥14" DBH class	Loblolly and/or shortleaf pine trees ≥14" DBH class are present, but <10 ft ² /acre basal area of those large trees	No loblolly and/or shortleaf pine trees ≥14" DBH are present	ft ² /acre BA	x0.25
Canopy Hardwood Basal Area	≤20 ft ² /acre BA of hardwood trees	>20 to 30 ft ² /acre BA of hardwood trees	>30 to 50 ft ² /acre BA of hardwood trees	>50 ft ² /acre BA of hardwood trees	ft ² /acre BA	x0.25
Stand Density Index (applies to shortleaf pine)	SDI = 55 – 155 (12 - 34% of Maximum SDI of 450)	SDI = 35 – 55 or 155 - 205 (8-12% or 34-45% of Maximum SDI of 450)	SDI = 20 – 35 or 205 - 225 (4-8% or 45-50% of maximum SDI of 450)	SDI <20 or >225 (<4% or >50%, 270 is 60% of Maximum SD of 450)	SDI value	x0.5
Midstory/Shrub Metrics					Canopy Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Midstory Fire Tolerant Hardwood Cover	<10% cover of midstory fire tolerant hardwoods	10-20% cover of midstory fire tolerant hardwoods	>20 to 35% cover of midstory fire tolerant hardwoods	>35% cover of midstory fire tolerant hardwoods	% cover	x0.25
Midstory Overall Cover	<20% cover of woody midstory	≥20 to 30% cover of woody midstory	>30 to 50% cover of woody midstory	>50% cover of woody midstory	% cover	x0.25
Short Shrub (<3 ft tall) Cover	Short shrubs average <20% cover	Short shrubs average 20 - 30% cover	Short shrubs average >30 to 45% cover	Short shrubs average >45% cover	% cover	x0.25
Tall Shrub (3-10 ft tall) Cover	Tall shrubs average <15% cover.	Tall shrubs average 15 to 20% cover.	Tall shrubs average >20 to 30% cover.	Tall shrubs average >30% cover.	% cover	x0.25
Ground Layer Metrics					Midstory Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Overall Native Herbaceous Ground Cover	35-80% herbaceous cover	20 to <35% or >80% herbaceous cover	10 to <20% herbaceous cover	<10% herbaceous cover	% cover	x0.33
Native Warm Season Grass Cover	25-100% foliar cover of all native warm season grasses	>15 to <25% foliar cover of all native warm season grasses	10-15% foliar cover of all native warm season grasses	<10% foliar cover of all native warm season grasses	% foliar cover	x0.33
Invasive Plant Presence / Distribution	Invasive nonnative plant species absent or cover is very low (≤1% cover)	Invasive nonnative plant species in any stratum present but sporadic (1-5 % cover)	Invasive nonnative plant species in any stratum uncommon (5-10% cover)	Invasive nonnative plant species in any stratum common (>10% cover)	% cover	x0.33
Final Score is : Canopy Score _____ x0.33 + Midstory Score _____ x0.33 + Ground Layer Score _____ x0.33 = Evaluation Scale: 4.0 to 3.5 = Excellent, 3.5 to 2.5 = Good, 2.5 to 1.5 = Fair, 1.5 to 1.0 = Poor					Ground Layer Score =	

Dry & Mesic Longleaf Pine Woodlands Metrics Data Sheet					Recorded Measured Value of Metric	Recorded Metric Score (1.0-4.0)
Canopy Metrics	If the optional Stand Density Index metric is used, then Canopy Southern Pine Basal Area and Southern Yellow Pine Canopy Cover do not need to be used as metrics					
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Canopy Southern Yellow Pine Basal Area	30-80 ft ² /acre basal area of longleaf pine	20 to <30 or >80 to 90 ft ² /acre basal area of longleaf pine	10 to <20 or >90 to 105 ft ² /acre basal area of longleaf pine	<10 or >105 ft ² /acre basal area of longleaf pine	ft ² /acre BA	x0.25
Southern Yellow Pine Canopy Cover	30-65% canopy cover of longleaf pine	>20 to <30% or >65 to 75% canopy cover of longleaf	10-20% canopy cover or >75 to 85% canopy cover of longleaf pine	<10% cover or >85% cover of longleaf pine	% cover	x0.25
Southern Yellow Pine Stand Age Structure	BA ≥20 ft ² /acre of flat-top longleaf pine of any diameter and/or longleaf pine trees ≥14" DBH class	BA ≥10 ft ² /acre of longleaf pine trees ≥14" DBH class	Longleaf pine trees ≥ 14" DBH class are present, but at <10 ft ² /acre BA	No longleaf pine trees ≥14" DBH or flat-top longleaf pine are present	ft ² /acre BA	x0.25
Canopy Hardwood Basal Area	<20 ft ² /acre BA of hardwood trees	≥20 to 25 ft ² /acre BA of hardwood trees	>25 to 35 ft ² /acre BA of hardwood trees	>35 ft ² /acre BA of hardwood trees	ft ² /acre BA	x0.25
Stand Density Index (applies to longleaf pine)	SDI = 60 – 125 (15 - 31% of Maximum SDI of 400)	SDI = 40 – 60 or 125 - 160 (10-15% or 31-40% of Maximum SDI of 400)	SDI = 20 – 40 or 160 - 200 (5-10% or 40-50% of maximum SDI)	SDI <20 or >200 (<5% or >50%, 240 is 60% of Maximum SD of 400)	SDI value	x0.5
Midstory/Shrub Metrics					Canopy Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Midstory Fire Tolerant Hardwood Cover	<15% cover of midstory fire tolerant hardwoods	15 to <20% cover of midstory fire tolerant hardwoods	20-25% cover of midstory fire tolerant hardwoods	>25% cover of midstory fire tolerant hardwoods	% cover	x0.25
Midstory Overall Cover	<20% cover of woody midstory	20 to <30% cover of woody midstory	30-40% cover of woody midstory	>40% cover of woody midstory	% cover	x0.25
Short Shrub (<3 ft tall) Cover	Short shrubs average <30% cover	Short shrubs average 30 to 35% cover	Short shrubs average >35 to 45% cover	Short shrubs average >45% cover	% cover	x0.25
Tall Shrub (3-10 ft tall) Cover	Tall shrubs average <20% cover.	Tall shrubs average 20 to 30% cover.	Tall shrubs average >30 to 40% cover.	Tall shrubs average >40% cover.	% cover	x0.25
Ground Layer Metrics					Midstory Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Overall Native Herbaceous Ground Cover	40-98% herbaceous cover	30 to <40% or >98% herbaceous cover	20 to <30% herbaceous cover	<20% herbaceous cover	% cover	x0.25
Longleaf Pine Regeneration	Longleaf pine regeneration cover is ≥1% of stand (Good and Excellent)	Longleaf pine regeneration cover is ≥1% of stand (Good and Excellent)	Longleaf pine regen cover is present but is <1% of stand, or no regen seen, but cone producing longleaf pine are present	Longleaf pine regen cover is apparently absent, and no cone producing longleaf pine are present in the stand	% of stand Regen? Cones?	x0.25
Native Warm Season Grass Cover	>25 to 97% foliar cover of all native warm season grasses	>15 to 25% or >97% foliar cover of native warm season grasses	10-15% foliar cover of all native warm season grasses	<10% foliar cover of all native warm season grasses	% foliar cover	x0.25
Invasive Plant Presence / Distribution	Invasive nonnative plant species cover is very low (≤1% cover)	Invasive nonnative plant species in any stratum present, but sporadic (1-5% cover)	Invasive nonnative plant species in any stratum uncommon (5-10% cover)	Invasive nonnative plant species in any stratum common (>10% cover)	% cover	x0.25
Final Score is : Canopy Score _____x0.33 + Midstory Score _____x0.33 + Ground Layer Score _____x0.33 = Evaluation Scale: 4.0 to 3.5 = Excellent, 3.5 to 2.5 = Good, 2.5 to 1.5 = Fair, 1.5 to 1.0 = Poor					Ground Layer Score =	

Mesic Longleaf Pine Flatwoods Metrics Data Sheet					Recorded Measured Value of Metric	Recorded Metric Score (1.0-4.0)
Canopy Metrics	If the optional Stand Density Index metric is used, then Canopy Southern Pine Basal Area and Southern Yellow Pine Canopy Cover do not need to be used as metrics					
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Canopy Southern Yellow Pine Basal Area	30-80 ft ² /acre basal area of longleaf or slash pine	20 to <30 or >80 to 90 ft ² /acre basal area of longleaf or slash pine	10 to <20 or >90 to 105 ft ² /acre basal area of longleaf or slash pine	<10 or >105 ft ² /acre basal area of longleaf or slash pine	ft ² /acre BA	x0.25
Southern Yellow Pine Canopy Cover	30 to 65% canopy cover of longleaf or slash pine	20 to <30% canopy cover or >65 to 75% canopy cover of longleaf or slash pine	10 to <20% canopy cover or >75 to 85% canopy cover of longleaf or slash pine	<10% cover or >85% cover of longleaf or slash pine	% cover	x0.25
Southern Yellow Pine Stand Age Structure	BA ≥20 ft ² /acre of flat-top longleaf or slash pine of any diameter and/or longleaf or slash pine trees ≥14" DBH class	BA ≥10 ft ² /acre of longleaf or slash pine trees ≥ 4" DBH class	Longleaf or slash pine trees ≥14" DBH class are present, but at < 10 ft ² /acre BA	No longleaf or slash pine trees ≥14" DBH or flat-top slash or longleaf pine	ft ² /acre BA	x0.25
Canopy Hardwood Basal Area	<20 ft ² /acre BA of hardwood trees	≥20 to 25 ft ² /acre BA of hardwood trees	>25 to 35 ft ² /acre BA of hardwood trees	>35 ft ² /acre BA of hardwood trees	ft ² /acre BA	x0.25
Stand Density Index (applies to longleaf pine)	SDI = 60 – 125 (15 - 31% of Maximum SDI of 400)	SDI = 40 – 60 or 125 - 160 (10-15% or 31-40% of Maximum SDI of 400)	SDI = 20 – 40 or 160 - 190 (5-10% or 40-48% of maximum SDI)	SDI <20 or >190 (<5% or >48%, 240 is 60% of Maximum SD of 400)	SDI value	x0.5
Midstory/Shrub Metrics					Canopy Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Midstory Fire Tolerant Hardwood Cover	<10% cover of midstory fire tolerant hardwoods	10 to <20% cover of midstory fire tolerant hardwoods	20 to 25% cover of midstory fire tolerant hardwoods	>25% cover of midstory fire tolerant hardwoods	% cover	x0.25
Midstory Overall Cover	<20% cover of woody midstory	20 to <30% cover of woody midstory	30-40% cover of woody midstory	>40% cover of woody midstory	% cover	x0.25
Short Shrub (<3 ft tall) Cover	Short shrubs average <30% cover	Short shrubs average 30 to <40% cover	Short shrubs average 40-45% cover	Short shrubs average >45% cover	% cover	x0.25
Tall Shrub (3-10 ft) Cover	Tall shrubs average <20% cover.	Tall shrubs average 20 to <30% cover.	Tall shrubs average 30-35% cover.	Tall shrubs average >35% cover.	% cover	x0.25
Ground Layer Metrics					Midstory Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Overall Native Herbaceous Ground Cover	40-98% herbaceous cover	30 to <40% or >98% herbaceous cover	20 to <30% herbaceous cover	<20% herbaceous cover	% cover	x0.25
Longleaf Pine Regeneration	Longleaf pine regeneration cover is ≥1% of stand (Good and Excellent)	Longleaf pine regeneration cover is ≥1% of stand (Good and Excellent)	Longleaf pine regen cover is present but is <1% of stand, or no regen seen, but cone producing longleaf pine are present	Longleaf pine regen cover is apparently absent, and no cone producing longleaf pine are present in the stand	% of stand Regen? Cones?	x0.25
Native Warm Season Grass Cover	>25 to 97% foliar cover of all native warm season grasses	>15 to 25% or >97% foliar cover of native warm season grasses	10-15% foliar cover of all native warm season grasses	<10% foliar cover of all native warm season grasses	% foliar cover	x0.25
Invasive Plant Presence / Distribution	Invasive nonnative plant species absent or cover is very low (≤1% cover)	Invasive nonnative plant species in any stratum present but sporadic (1-5% cover)	Invasive nonnative plant species in any stratum uncommon (5-10% cover)	Invasive nonnative plant species in any stratum common (>10% cover)	% cover	x0.25
Final Score is : Canopy Score _____ x0.33 + Midstory Score _____ x0.33 + Ground Layer Score _____ x0.33 = Evaluation Scale: 4.0 to 3.5 = Excellent, 3.5 to 2.5 = Good, 2.5 to 1.5 = Fair, 1.5 to 1.0 = Poor					Ground Layer Score =	

Upper Coastal Plain Pine Flatwoods Metrics Data Sheet					Recorded Measured Value of Metric	Recorded Metric Score (1.0-4.0)
Canopy Metrics	If the optional Stand Density Index metric is used, then Canopy Southern Pine Basal Area and Southern Yellow Pine Canopy Cover do not need to be used as metrics					
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Canopy Southern Yellow Pine Basal Area	30-80 ft ² /acre basal area of loblolly or shortleaf pine	20 to <30 or >80 to 90 ft ² /acre basal area of loblolly or shortleaf pine	10 to <20 or >90 to 110 ft ² /acre basal area of loblolly or shortleaf pine	<10 or >110 ft ² /acre basal area of loblolly or shortleaf pine	ft ² /acre BA	x0.25
Southern Yellow Pine Canopy Cover	>25 to 70% canopy cover of loblolly or shortleaf pine	>15 to 25% canopy cover or >70 to 80% canopy cover of loblolly or shortleaf pine	10-15% canopy cover or >80 to 90% canopy cover of loblolly or shortleaf pine	<10% cover or >90% cover of loblolly or shortleaf pine	% cover	x0.25
Southern Yellow Pine Stand Age Structure	BA ≥20 ft ² /acre of loblolly and/or shortleaf pine trees ≥14" DBH class	BA ≥10 ft ² /acre of loblolly and/or shortleaf pine trees ≥14" DBH class	Loblolly and/or shortleaf pine trees ≥14" DBH class are present, but <10 ft ² /acre basal area of those large trees	No loblolly and/or shortleaf pine trees ≥14" DBH are present	ft ² /acre BA	x0.25
Canopy Hardwood Basal Area	≤20 ft ² /acre BA of hardwood trees	>20 to 30 ft ² /acre BA of hardwood trees	>30 to 50 ft ² /acre BA of hardwood trees	>50 ft ² /acre BA of hardwood trees	ft ² /acre BA	x0.25
Stand Density Index (applies to shortleaf pine)	SDI = 55 – 145 (12 - 32% of Maximum SDI of 450)	SDI = 35 – 55 or 145 - 180 (8-12% or 32-40% of Maximum SDI of 450)	SDI = 20 – 35 or 180 - 225 (4-8% or 40-50% of maximum SDI of 450)	SDI <20 or >225 (<4% or >50%, 270 is 60% of Maximum SD of 450)	SDI value	x0.5
Midstory/Shrub Metrics					Canopy Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Midstory Fire Tolerant Hardwood Cover	<10% cover of midstory fire tolerant hardwoods	10 to 20% cover of midstory fire tolerant hardwoods	>20 to 35% cover of midstory fire tolerant hardwoods	>35% cover of midstory fire tolerant hardwoods	% cover	x0.25
Midstory Overall Cover	<20% cover of woody midstory	20-30% cover of woody midstory	>30 to 50% cover of woody midstory	>50% cover of woody midstory	% cover	x0.25
Short Shrub (<3 ft tall) Cover	Short shrubs average <20% cover	Short shrubs average 20 to 30% cover	Short shrubs average >30 to 45% cover	Short shrubs average >45% cover	% cover	x0.25
Tall Shrub (3-10 ft tall) Cover	Tall shrubs average <15% cover.	Tall shrubs average 15 - 20% cover.	Tall shrubs average >20 to 30% cover.	Tall shrubs average >30% cover.	% cover	x0.25
Ground Layer Metrics					Midstory Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Overall Native Herbaceous Ground Cover	35-80% herbaceous cover	20 to <35% or >80% herbaceous cover	10 to <20% herbaceous cover	<10% herbaceous cover	% cover	x0.33
Native Warm Season Grass Cover	>25% foliar cover of all native warm season grasses	20-25% foliar cover of all native warm season grasses	10 to <20% foliar cover of all native warm season grasses	<10% foliar cover of all native warm season grasses	% foliar cover	x0.33
Invasive Plant Presence / Distribution	Invasive nonnative plant species absent or cover is very low (≤1% cover)	Invasive nonnative plant species in any stratum present but sporadic (1-5 % cover)	Invasive nonnative plant species in any stratum uncommon (5-10% cover)	Invasive nonnative plant species in any stratum common (>10% cover)	% cover	x0.33
Final Score is : Canopy Score _____ x0.33 + Midstory Score _____ x0.33 + Ground Layer Score _____ x0.33 = Evaluation Scale: 4.0 to 3.5 = Excellent, 3.5 to 2.5 = Good, 2.5 to 1.5 = Fair, 1.5 to 1.0 = Poor					Ground Layer Score =	

Wet Longleaf & Slash Pine Flatwoods & Savannas Metrics Data Sheet					Recorded Measured Value of Metric	Recorded Metric Score (1.0-4.0)
Canopy Metrics	If the optional Stand Density Index metric is used, then Canopy Southern Pine Basal Area and Southern Yellow Pine Canopy Cover do not need to be used as metrics					
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Canopy Southern Yellow Pine Basal Area	20-80 ft ² /acre basal area of longleaf or slash pine	10 to <20 or >80 to <90 ft ² /acre basal area of longleaf or slash pine	5 to <10 or 90 to <100 ft ² /acre basal area of longleaf or slash pine	<5 or ≥100 ft ² /acre basal area of longleaf or slash pine	ft ² /acre BA	x0.25
Southern Yellow Pine Canopy Cover	20-65% canopy cover of longleaf or slash pine	15 to <20% canopy cover or >65-75% canopy cover of longleaf or slash pine	10 to <15% canopy cover or >75-85% canopy cover of longleaf or slash pine	<10% cover or >85% cover of longleaf or slash pine	% cover	x0.25
Southern Yellow Pine Stand Age Structure	BA ≥20 ft ² /acre of flat-top longleaf or slash pine of any diameter and/or longleaf or slash pine trees ≥14" DBH class	BA ≥10 ft ² /acre of longleaf or slash pine trees ≥14" DBH class	Longleaf or slash pine trees ≥14" DBH class present, but at <10 ft ² /acre BA	No longleaf or slash pine trees ≥14" DBH or with flat-top slash or longleaf pine	ft ² /acre BA	x0.25
Canopy Hardwood Basal Area	<20 ft ² /acre BA of hardwood trees	≥20 to 25 ft ² /acre BA of hardwood trees	>25 to 35 ft ² /acre BA of hardwood trees	>35 ft ² /acre BA of hardwood trees	ft ² /acre BA	x0.25
Stand Density Index (applies to longleaf pine)	SDI = 35 – 120 (9 - 30% of Maximum SDI of 400)	SDI = 20 – 35 or 120 - 155 (5-9% or 30-39% of Maximum SDI of 400)	SDI = 10 – 20 or 155 - 180 (2.5-5% or 39-45% of maximum SDI)	SDI <10 or >180 (<2.5% or > 45%, 240 is 60% of Maximum SD of 400)	SDI value	x0.5
Midstory/Shrub Metrics					Canopy Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Midstory Fire Tolerant Hardwood Cover	<10% cover of midstory fire tolerant hardwoods	10-15% cover of midstory fire tolerant hardwoods	>15 to 25% cover of midstory fire tolerant hardwoods	>25% cover of midstory fire tolerant hardwoods	% cover	x0.25
Midstory Overall Cover	<20% cover of woody midstory	20-30% cover of woody midstory	>30 to 40% cover of woody midstory	>40% cover of woody midstory	% cover	x0.25
Short Shrub (<3 ft tall) Cover	Short shrubs average <30% cover	Short shrubs average 30 to <40% cover	Short shrubs average 40-45% cover	Short shrubs average >45% cover	% cover	x0.25
Tall Shrub (3-10 ft) Cover	Tall shrubs average < 15% cover.	Tall shrubs average 15 to <25% cover.	Tall shrubs average 25-35% cover.	Tall shrubs average >35% cover.	% cover	x0.25
Ground Layer Metrics					Midstory Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Overall Native Herbaceous Ground Cover	40-100% herbaceous cover	30 to <40% herbaceous cover	20 to <30% herbaceous cover	<20% herbaceous cover	% cover	x0.25
Longleaf Pine Regeneration	Longleaf pine regeneration cover is ≥1% of stand (Good and Excellent)	Longleaf pine regeneration cover is ≥1% of stand (Good and Excellent)	Longleaf pine regen cover is present but is <1% of stand, or no regen seen, but cone producing longleaf pine are present	Longleaf pine regen cover is apparently absent, and no cone producing longleaf pine are present in the stand	% of stand Regen? Cones?	x0.25
Native Warm Season Grass Cover	25-97% foliar cover of all native warm season grasses	>15 to <25% or >97% foliar cover of native warm season grasses	10-15% foliar cover of all native warm season grasses	<10% foliar cover of all native warm season grasses	% foliar cover	x0.25
Invasive Plant Presence / Distribution	Invasive nonnative plant species absent or cover is very low (≤1% cover)	Invasive nonnative plant species in any stratum present but sporadic (1-5% cover)	Invasive nonnative plant species in any stratum uncommon (5-10% cover)	Invasive nonnative plant species in any stratum common (>10% cover)	% cover	x0.25
Final Score is : Canopy Score _____ x0.33 + Midstory Score _____ x0.33 + Ground Layer Score _____ x0.33 = Evaluation Scale: 4.0 to 3.5 = Excellent, 3.5 to 2.5 = Good, 2.5 to 1.5 = Fair, 1.5 to 1.0 = Poor					Ground Layer Score =	

Xeric Longleaf Pine Barrens Metrics Data Sheet					Recorded Measured Value of Metric	Recorded Metric Score (1.0-4.0)
Canopy Metrics	If the optional Stand Density Index metric is used, then Canopy Southern Pine Basal Area and Southern Yellow Pine Canopy Cover do not need to be used as metrics					
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Canopy Southern Yellow Pine Basal Area	25-80 ft ² /acre basal area of longleaf pine	>15 to <25 or >80 to 90 ft ² /acre basal area of longleaf pine	10 to 15 or >90 to <100 ft ² /acre basal area of longleaf pine	<10 or ≥100 ft ² /acre basal area of longleaf pine	ft ² /acre BA	x0.25
Southern Yellow Pine Canopy Cover	>20 to 55% canopy cover of longleaf pine	>15 to 20% canopy cover or >55 to 70% canopy cover of longleaf pine	5-15% canopy cover or >70 to 80% canopy cover of longleaf pine	<5% cover or >80% cover of longleaf pine	% cover	x0.25
Southern Yellow Pine Stand Age Structure	BA ≥20 ft ² /acre of flat-top longleaf pine of any diameter and/or longleaf pine trees ≥12" DBH class	BA ≥10 ft ² /acre of longleaf pine trees ≥12" DBH class	Longleaf pine trees ≥12" DBH class are present, but at <10 ft ² /acre BA	No longleaf pine trees ≥12" DBH or flat-top longleaf pine are present	ft ² /acre BA	x0.25
Canopy Hardwood Basal Area	<20 ft ² /acre BA of hardwood trees	≥20 to 25 ft ² /acre BA of hardwood trees	>25 to 35 ft ² /acre BA of hardwood trees	>35 ft ² /acre BA of hardwood trees	ft ² /acre BA	x0.25
Stand Density Index (applies to longleaf pine)	SDI = 50 – 120 (13 - 30% of Maximum SDI of 400)	SDI = 30 – 50 or 120 - 160 (8-13% or 30-40% of Maximum SDI of 400)	SDI = 20 – 30 or 160 - 180 (5-8% or 40-45% of maximum SDI)	SDI <20 or >180 (<5% or >45%, 240 is 60% of Maximum SD of 400)	SDI value	x0.5
Midstory/Shrub Metrics					Canopy Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Midstory Fire Tolerant Hardwood Cover	<10% cover of midstory fire tolerant hardwoods	10-20% cover of midstory fire tolerant hardwoods	>20 to 25% cover of midstory fire tolerant hardwoods	>25% cover of midstory fire tolerant hardwoods	% cover	x0.25
Midstory Overall Cover	<20% cover of woody midstory	20 to <30% cover of woody midstory	30-40% cover of woody midstory	>40% cover of woody midstory	% cover	x0.25
Short Shrub (<3 ft tall) Cover	Short shrubs average <25% cover	Short shrubs average 25 - 35% cover	Short shrubs average >35 to 45% cover	Short shrubs average >45% cover	% cover	x0.25
Tall Shrub (3-10 ft) Cover	Tall shrubs average <15% cover.	Tall shrubs average 15 to <25% cover.	Tall shrubs average 25-30% cover.	Tall shrubs average >30% cover.	% cover	x0.25
Ground Layer Metrics					Midstory Score=	
	Excellent = 4.0	Good = 3.0	Fair = 2.0	Poor = 1.0		
Overall Native Herbaceous Ground Cover	40-100% herbaceous cover	>25 to <40% herbaceous cover	>15 to 25% herbaceous cover	0-15% herbaceous cover	% cover	x0.25
Longleaf Pine Regeneration	Longleaf pine regeneration cover is ≥1% of stand (Good and Excellent)	Longleaf pine regeneration cover is ≥1% of stand (Good and Excellent)	Longleaf pine regen cover is present but is <1% of stand, or no regen seen, but cone producing longleaf pine are present	Longleaf pine regen cover is apparently absent, and no cone producing longleaf pine are present in the stand	% of stand Regen? Cones?	x0.25
Native Warm Season Grass Cover	25-95% foliar cover of all native warm season grasses	15 to <25% or >95% foliar cover of native warm season grasses	10 to <15% foliar cover of all native warm season grasses	<10% foliar cover of all native warm season grasses	% foliar cover	x0.25
Invasive Plant Presence / Distribution	Invasive nonnative plant species absent or cover is very low (≤1% cover)	Invasive nonnative plant species in any stratum present but sporadic (1-5% cover)	Invasive nonnative plant species in any stratum uncommon (5-10% cover)	Invasive nonnative plant species in any stratum common (>10% cover)	% cover	x0.25
Final Score is : Canopy Score _____ x0.33 + Midstory Score _____ x0.33 + Ground Layer Score _____ x0.33 = Evaluation Scale: 4.0 to 3.5 = Excellent, 3.5 to 2.5 = Good, 2.5 to 1.5 = Fair, 1.5 to 1.0 = Poor					Ground Layer Score =	

