



Using GIS To Map Longleaf Pine Restoration at Big Thicket National Preserve

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Abstract

IA

- The Longleaf Pine (*Pinus palustris*) was once a dominant tree populating the southeastern area of the United States ranging from Southeast Virginia to Florida and as far West into East Texas.
- The Longleaf Pine historically covered 90,000,000 million acres.
 - After years of logging, various diseases, natural disasters and being replaced with faster growing trees like the Loblolly and Slash Pine, there is estimated to be less than 3% of that left (6).
- Longleaf Pine restoration has been the focus all across the southeastern United States with various government agencies and nonprofits that are committed to restoring the habitat the Longleaf Pine once dominated.



Introduction

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- With less than 3% of Longleaf Pine remaining of the 90,000,000 acres, the restoration of the Longleaf Pine has come to the forefront of Southeast U.S. Various government agencies and nonprofit organizations that have developed programs to restore and promote the habitat of the Longleaf Pine (6).
 - Even less than the 3% remaining in the U.S. is found in East Texas where Big Thicket National Preserve is (3).
- Big Thicket has been working on restoring Longleaf Pine for more than 15 years without a map of where the Longleaf Pine is located and where the potential Longleaf Pine can be restored.
- The objective of my Project is to create a map using the trends of where Longleaf Pine is located and known to be growing in the preserve and where it historically once grew.
- Using ArcGIS10.2.2 and layers provided by Big Thicket National Preserve, SSURGO soil maps, LIDAR, topography, and elevation; a map will be created with polygon layers defining potential Longleaf Pine restoration sites, historical Longleaf Pine habitat and where the Big Thicket is currently at in the restoration progress.



Methods

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- ArcMap 10.2.2 and 10.3 were used to study the trends where the Longleaf Pine is known to be growing at.
- A de-trended surface was created to get rid of unwanted noise with the LIDAR.
 - The LIDAR raster was resampled to 30m before analyzing trend surface in Spatial Analyst using the 5th order.
 - By subtracting the trend surface from the resample 30m raster with minus tool in 3d Analyst the de-trended layer was created.
 - The soil layers provided by USDA Soil Survey Geographic (SSURGO) also helped in determining the best suitable habitat. Big Thicket National Preserve provided topography, LIDAR, restoration stands, and virgin longleaf map layers.
- Data provided in soil attribute table included: hydrologic group dominant conditions (hydgrpdc): A, B, C, D, or A/D, B/D, C/D, flooding conditions, frequency of flooding, soil drainage class for the wettest component, the available water storage, runoff potential of the soil, geometry of the soil survey.
- Other factors analyzed including elevation and slope angle in determining the hillside boundaries. The Historic Longleaf layer provided a good trend to analyze surrounding areas, creating the Potential Longleaf Pine Restoration layer.



Terms of Use

- drclassdcd: dominant drainage class, hydgrpdc: Hydrologic group; soils having similar runoff potential under similar storm and cover conditions, drclasswet: the wettest drainage class is equal to 15% or more, aws###wta: where the # is equal to the available water storage, Runoff: potential runoff ranging low to high, geomdesc: describes the geometry of the soil polygon.
- Soil Type A: Soils having high infiltration rate with low runoff and are usually gravel and sand mixtures, Soil Type B: Soils having moderate infiltration rates and are fine to somewhat coarse, Soil type C: having slow infiltration rate and having a high runoff potential, they are usually very fine loamy soils, Soil Type D: All clay and coarse soils. Longleaf Pine (LLP).



Longleaf Pine History and Life Cycle

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- After years of logging, various diseases and natural disasters, the Longleaf Pine was replaced with faster growing trees like the Loblolly and Slash Pine.
- It is adapted to various types of sandy soils, elevations, terrains, weather, climate and other factors that affect the life cycle of the Longleaf Pine.
- Big Thicket area contains over 40 species per square meter(4), of various insects and vegetation having biotic relationships with Longleaf Pine and some of which are endangered species including:
 - The Red-cockaded Wood Pecker, Texas Trailing Phlox, Bachman Sparrow, and the Louisiana Pine Snake.
- The Longleaf Pine depends on seasonal fires for its survivability. Fire keeps underbrush down, reduces competition, maintains a rich nutrient soil.
 - After a good fire Longleaf Pine will release seeds from the cones where it will take 80-100 hundred years to reach maturity.



Biotic Relationships With The Longleaf Pine

Texas Trailing Phlox (*Phlox nivalis* subspecies *texensis*)

Red-Cockaded Wood Pecker (*Picoides borealis*)



Source: Personal Photos

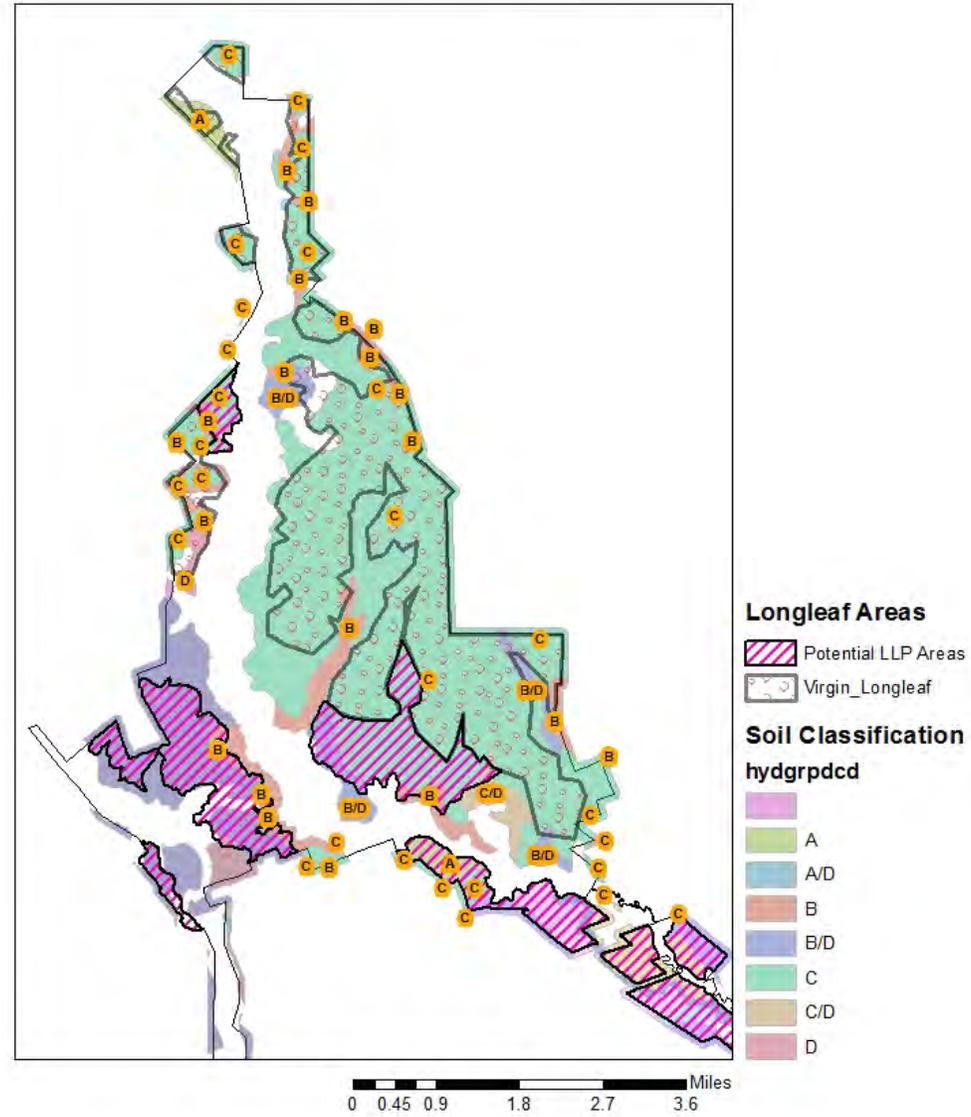
Source: <http://www.fws.gov/rcwrecovery/rcw.html>



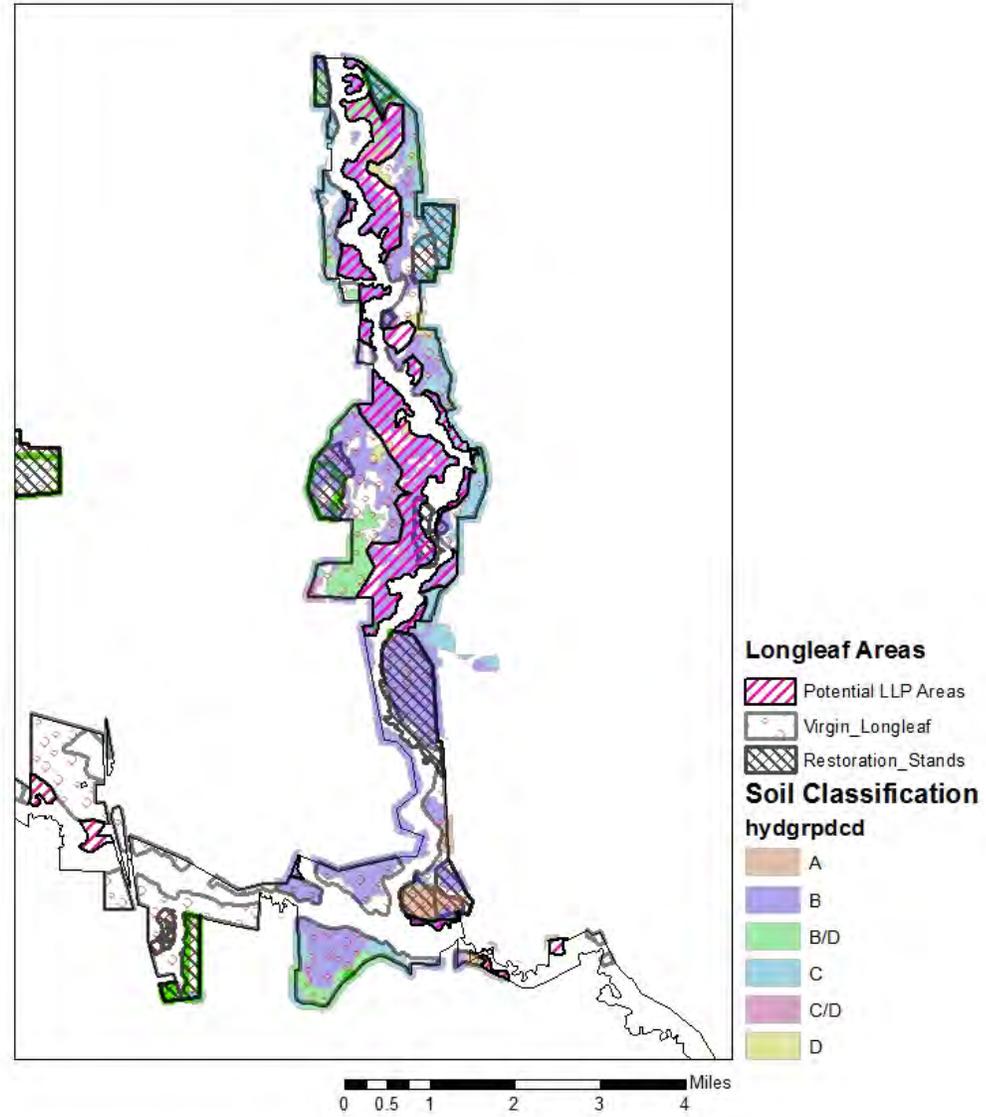
Longleaf Pine Soil Preferences

- Soil Survey Information (found in the attribute tables) is important for a lot of things. Soils are the foundations for all plant communities and they impose what can grow.
 - Soil depth, organic matter, texture, and parent material can affect regeneration and growth. As time passes geological parent material breaks down and turns into soil.
- The Longleaf Pine prefers dry sandy soils
 - It has the grows best in Soil Types A and B but has the potential to grow in C
 - Soil A & B provide high infiltration of water with high run off and low flooding potential
 - Soil C has moderate infiltration of water with moderate run off and rare flooding potential
 - Soil D has low infiltration of water with no run off and high flooding potential
- It has the ability to grow in a variety soils from fine to coarse sand (Type B & C Soil) and sand mixed with small pebble sized rocks (Type A).
- The Big Sandy Creek Unit shows the Longleaf Pine growing on hilltops in fine soil classified as soil type C.
- The Lower Turkey Creek Unit near the sand hill loop trail shows the Longleaf Pine growing on flats with soil type A, a pebble sand mixture.

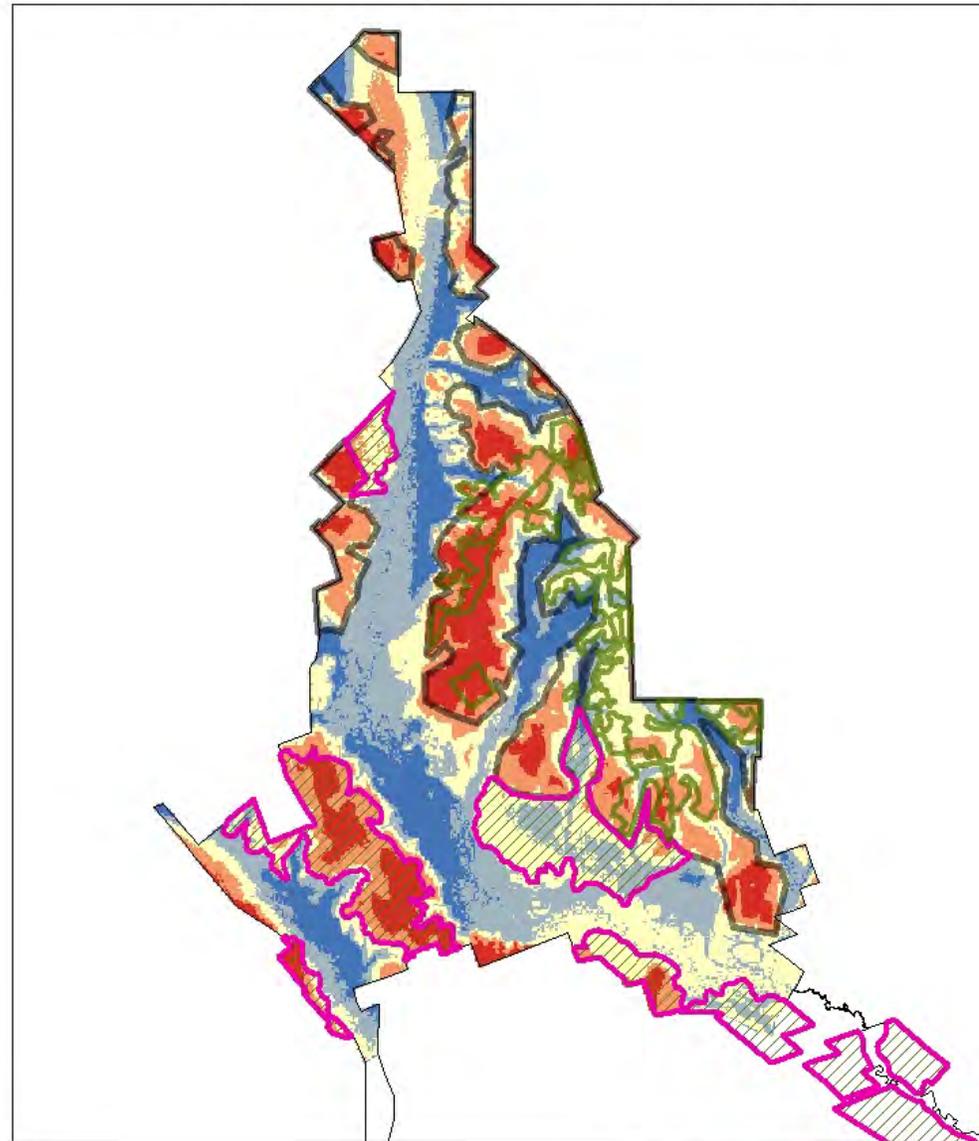
Big Sandy Creek Unit Soil Map



Turkey Creek Soil Map



LIDAR Resample 30m Subtract Trend

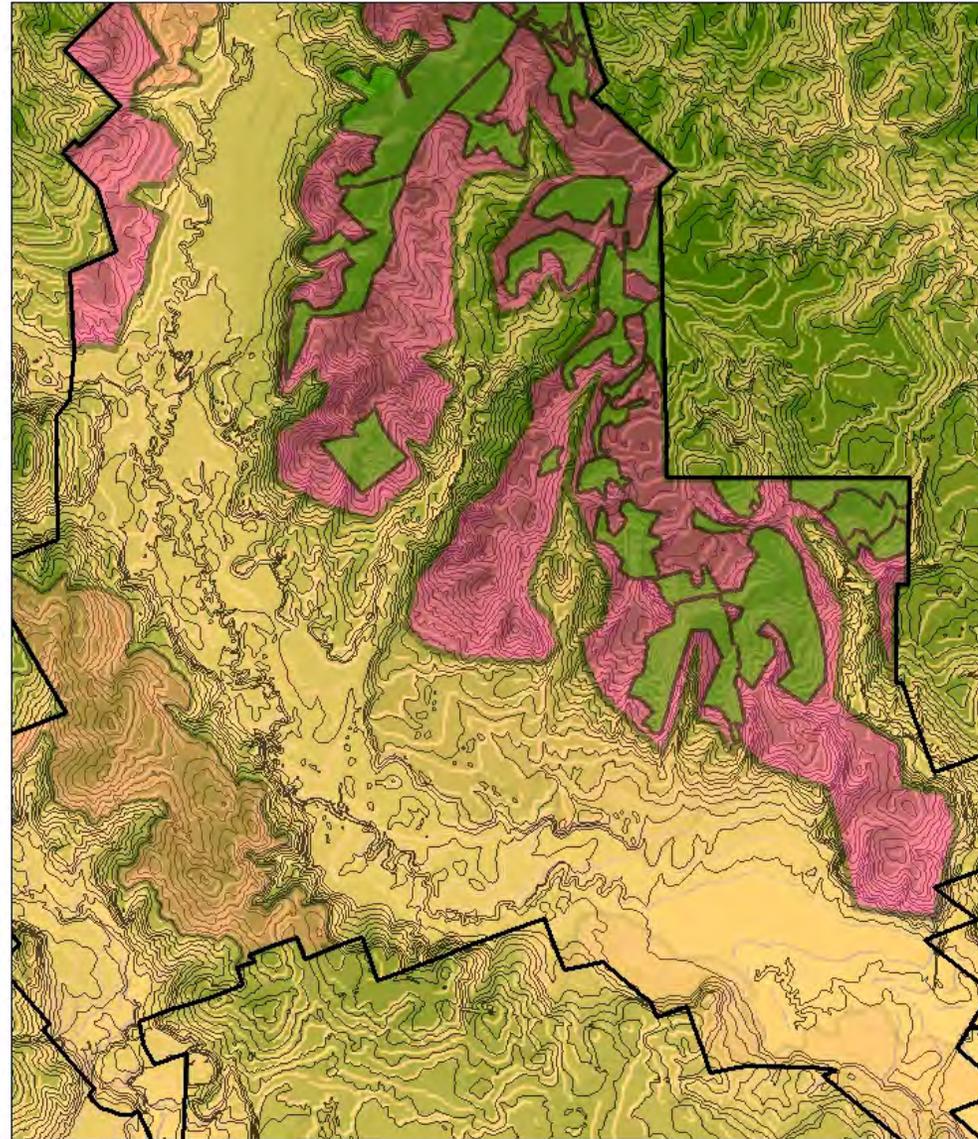


0 0.4 0.8 1.6 2.4 3.2 Miles

LongLeaf Areas

- Restoration_Stands
- Potential LLP Areas
- Virgin_Longleaf

Use of Topography to Indicate LLP Areas



0 0.2 0.4 0.8 1.2 1.6 Miles

Restoration Areas

- Restoration_Stands
- Historic Range
- Potential LLP Areas



Creating Restoration Areas

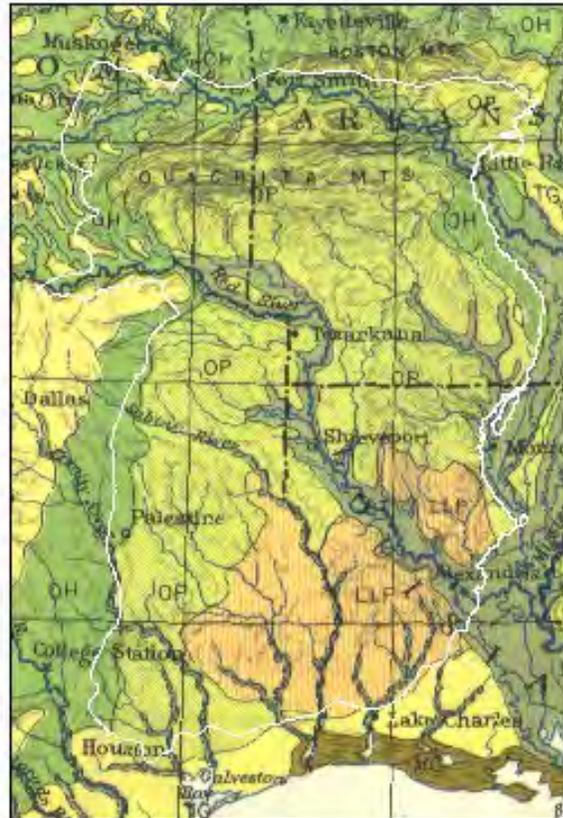
- Topography and Elevation were used to trace out polygons on soil type A, B and C and avoiding steep hillside forested areas where the forest has the potential to be dominated by hardwood forests such as oak.
- Combining the topography layer, elevation layer, LIDAR layer, soils layer map and excluding the frequently flooded areas and poor drainage areas in the soils map a trend followed the virgin Longleaf Pine polygon.
- Using this trend with the soil types as long as they were not frequently flooded or poorly drained a new layer was created for potential Longleaf Pine areas outside the historic area.

Wallenberg Historic LLP Map

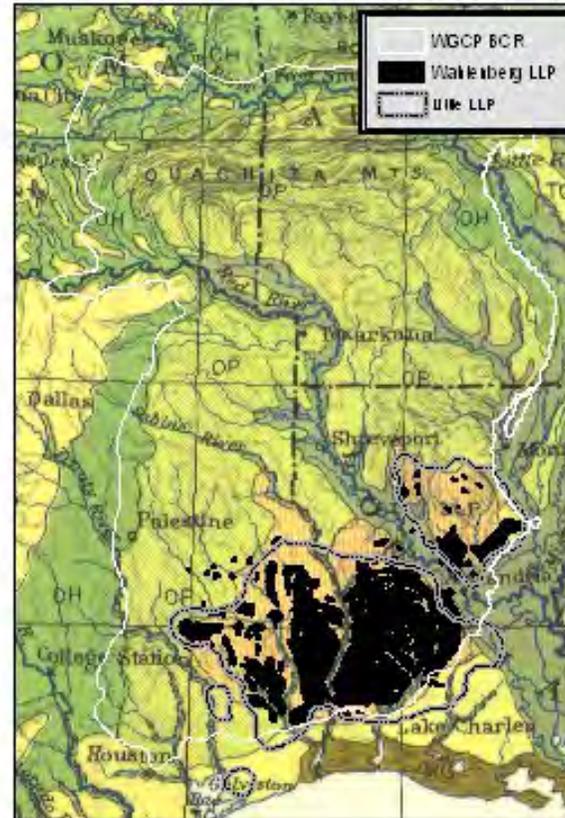
(8)

A Comparison of Historic Longleaf Pine Maps

Shantz and Zon Map



Shantz and Zon with Others Overlay Map

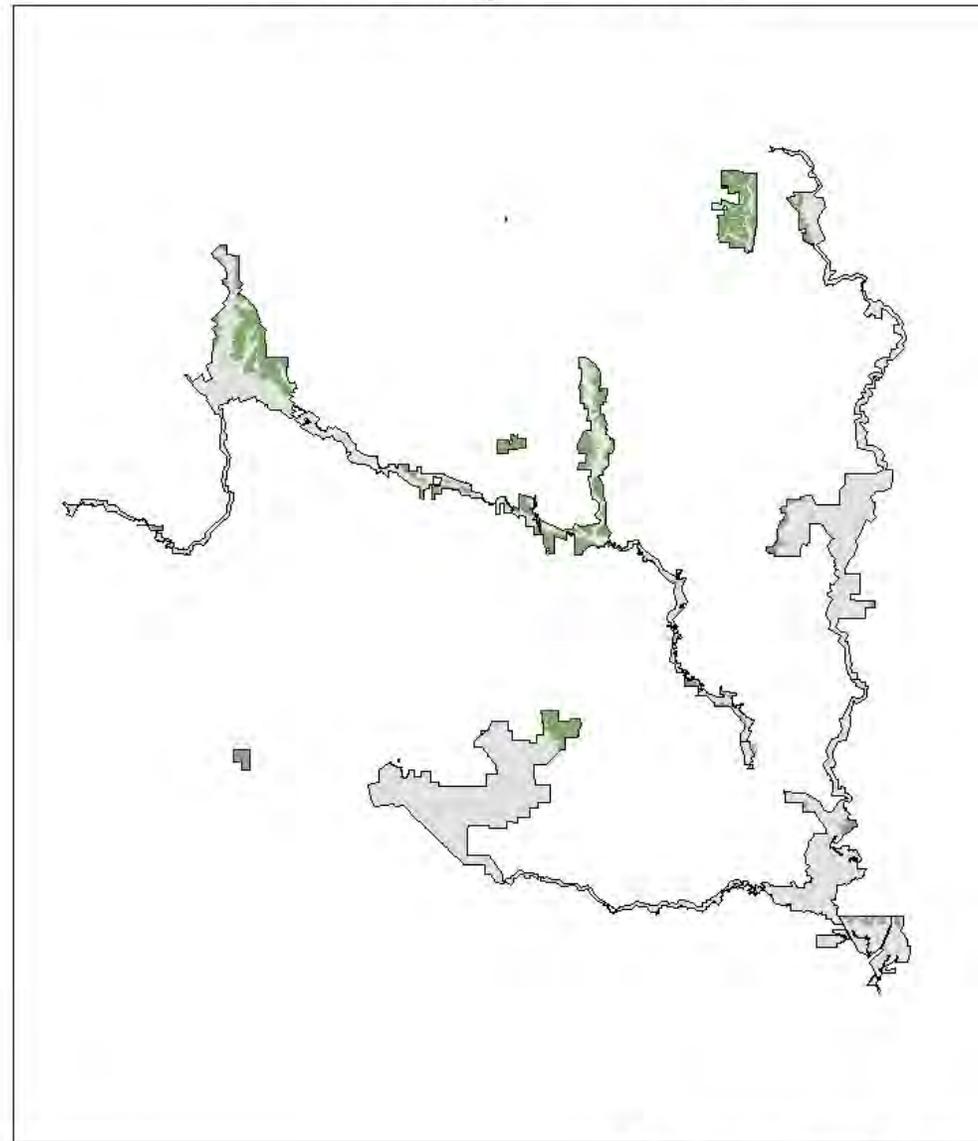


Historical Longleaf Pine Areas



Historic Range

Historically
Throughout Big
Thicket there is a total
of 21,500 acres where
Longleaf Pine used to
be.



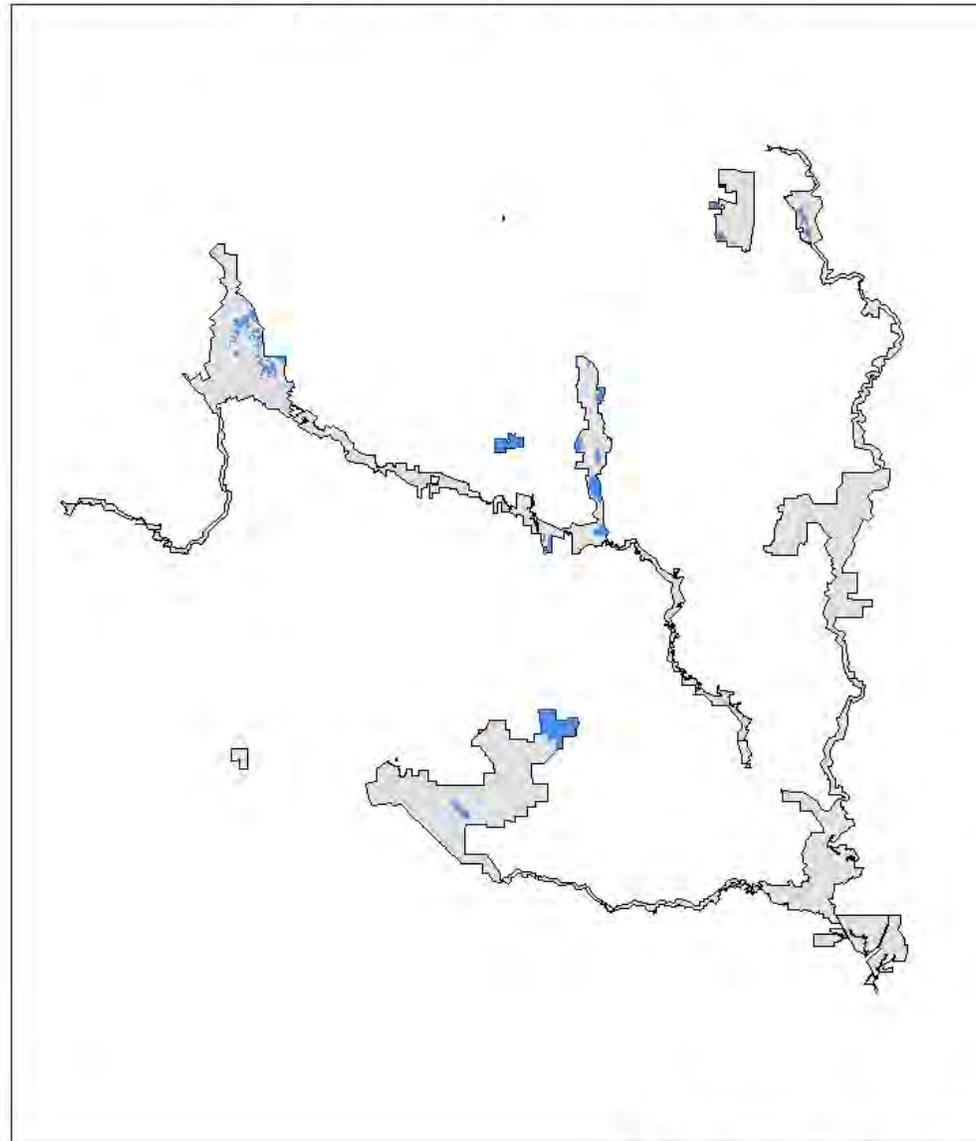
Restoration Areas

Virgin_Longleaf

Current Longleaf Pine Stands

Currently there just over 2,000 acres of restoration stands .

Restoration Longleaf Pine Stands



0 2.25 4.5 9 13.5 18 Miles

Restoration Areas

Restoration_Stands

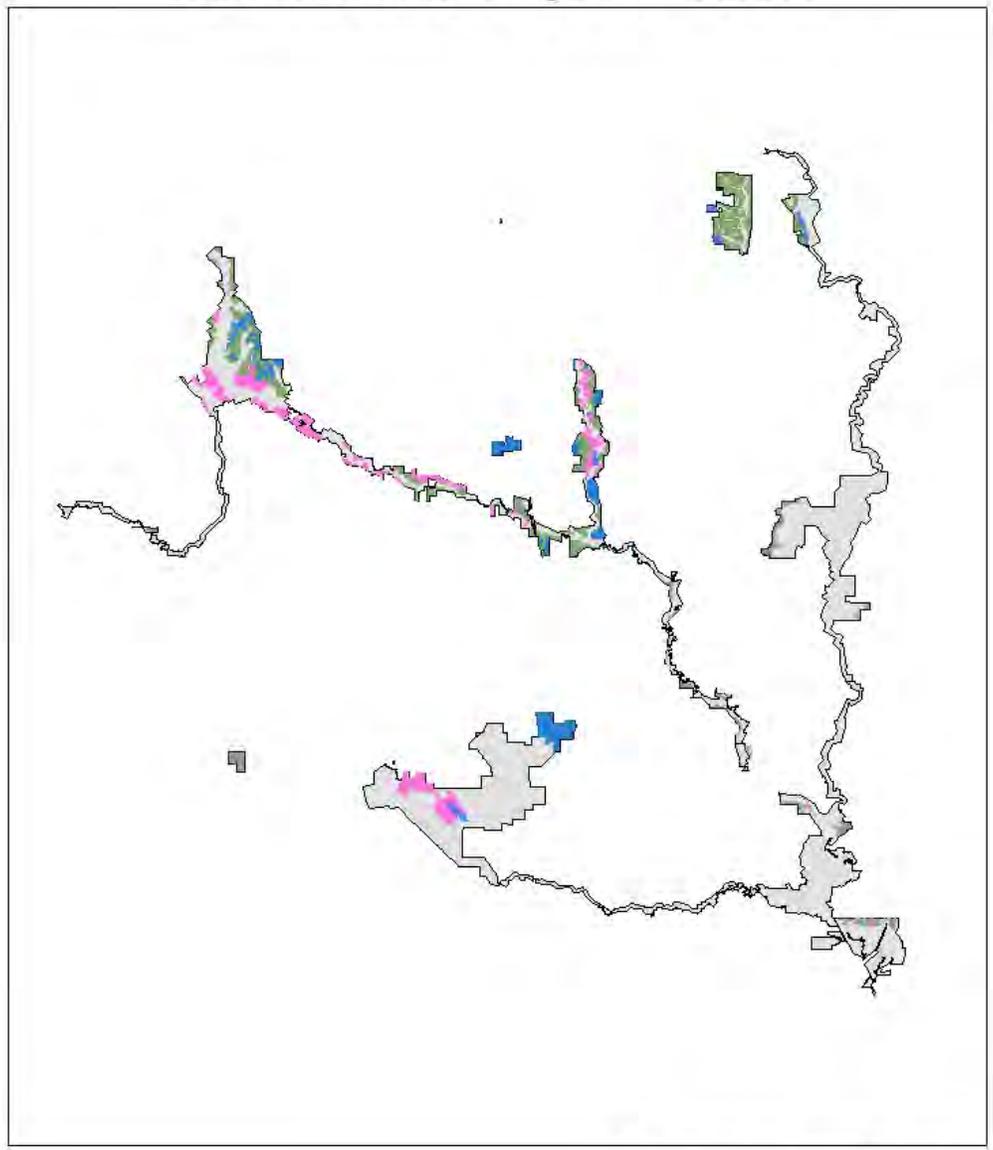


Future Longleaf Pine areas

There are a total of 24,800 acres of potential Longleaf Pine habitat.



Potential Suitable Longleaf Pine Areas



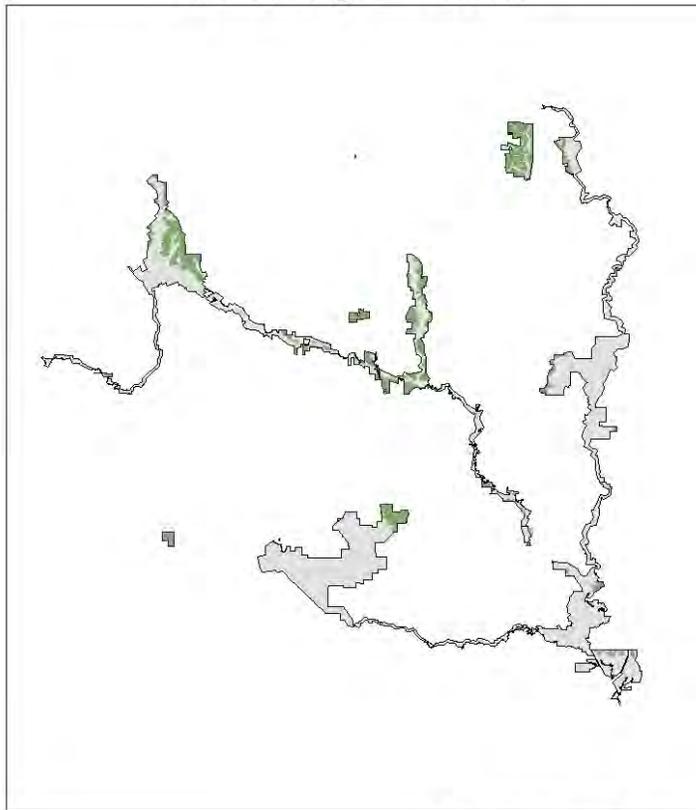
0 2.25 4.5 9 13.5 18 Miles

Restoration Areas

- Restoration_Stands
- Potential LLP Areas
- Virgin_Longleaf

Restoration Progress Maps

Historical Longleaf Pine Areas

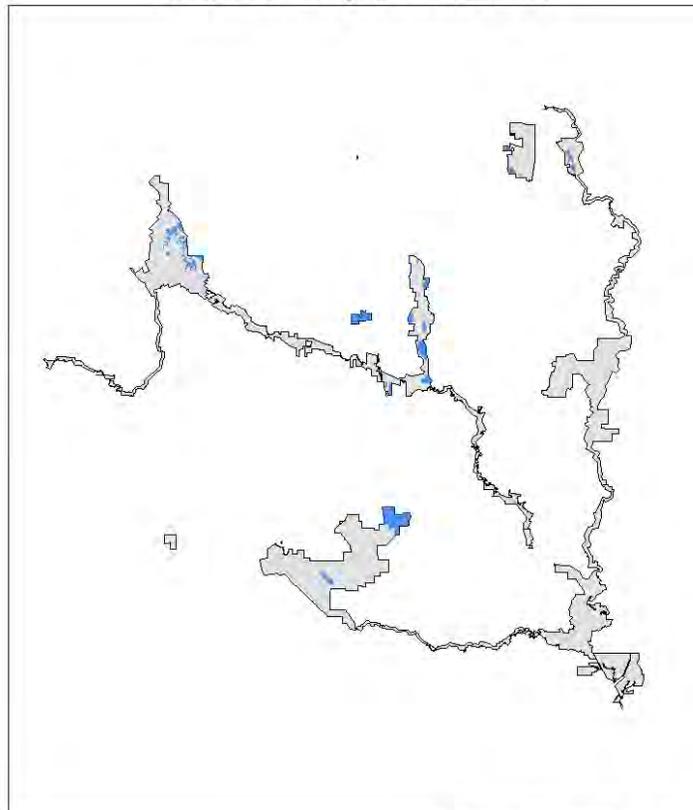


0 2.25 4.5 9 13.5 18 Miles

Restoration Areas

Virgin_Longleaf

Restoration Longleaf Pine Stands

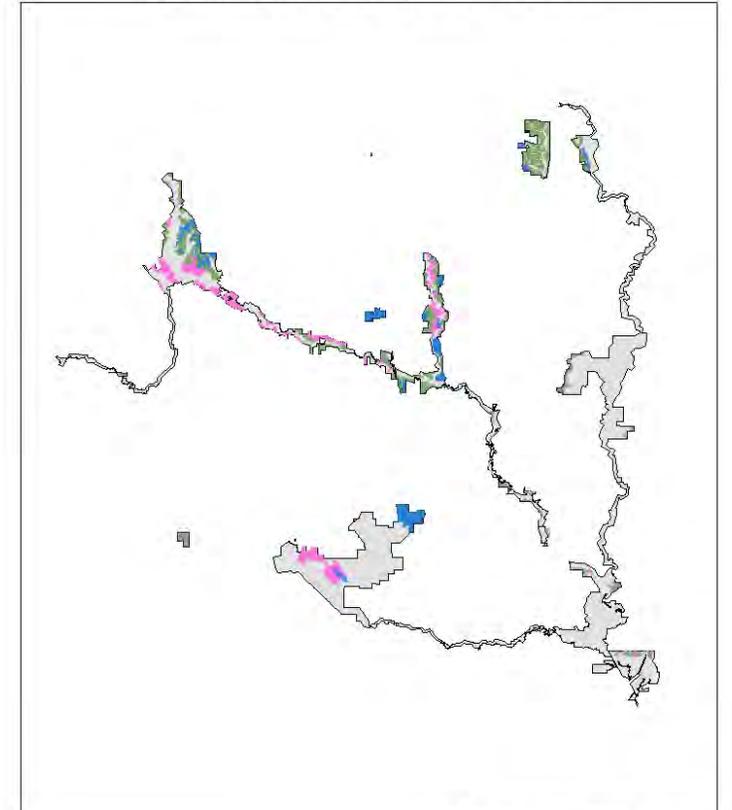


0 2.25 4.5 9 13.5 18 Miles

Restoration Areas

Restoration_Stands

Potential Suitable Longleaf Pine Areas



0 2.25 4.5 9 13.5 18 Miles

Restoration Areas

Restoration_Stands

Potential LLP Areas

Virgin_Longleaf



Progress on Restoration

- Topography and Elevation were used to trace out polygons to avoid steep hillside forested areas. Combining the topography layer, elevation layer, LIDAR layer, with the soils layer map and excluding the frequently flooded areas and poor drainage areas in the soils map a trend followed the virgin Longleaf Pine polygon.
- Big Sandy Creek, Turkey Creek, Lance Rosier and Beech Creek Unit all provide the largest acreage for Longleaf Pine habitat
- With a total of 24,800 acres for potential Longleaf Pine growth there are a total of 2,470 acres being treated for Longleaf Pine restoration
- 1,373 acres are treated by Mastication alone.
- 413 acres are treated by a combination of Herbicide and Mastication.
- 328 acres are treated by Herbicide alone.
- And 356 acres are treated by other prescriptions.





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Questions?

