



# FLORIDA'S LONGLEAF PINE ECOSYSTEM, EVALUATING A HALF CENTURY OF CHANGE AND ITS RECOVERY STATUS.

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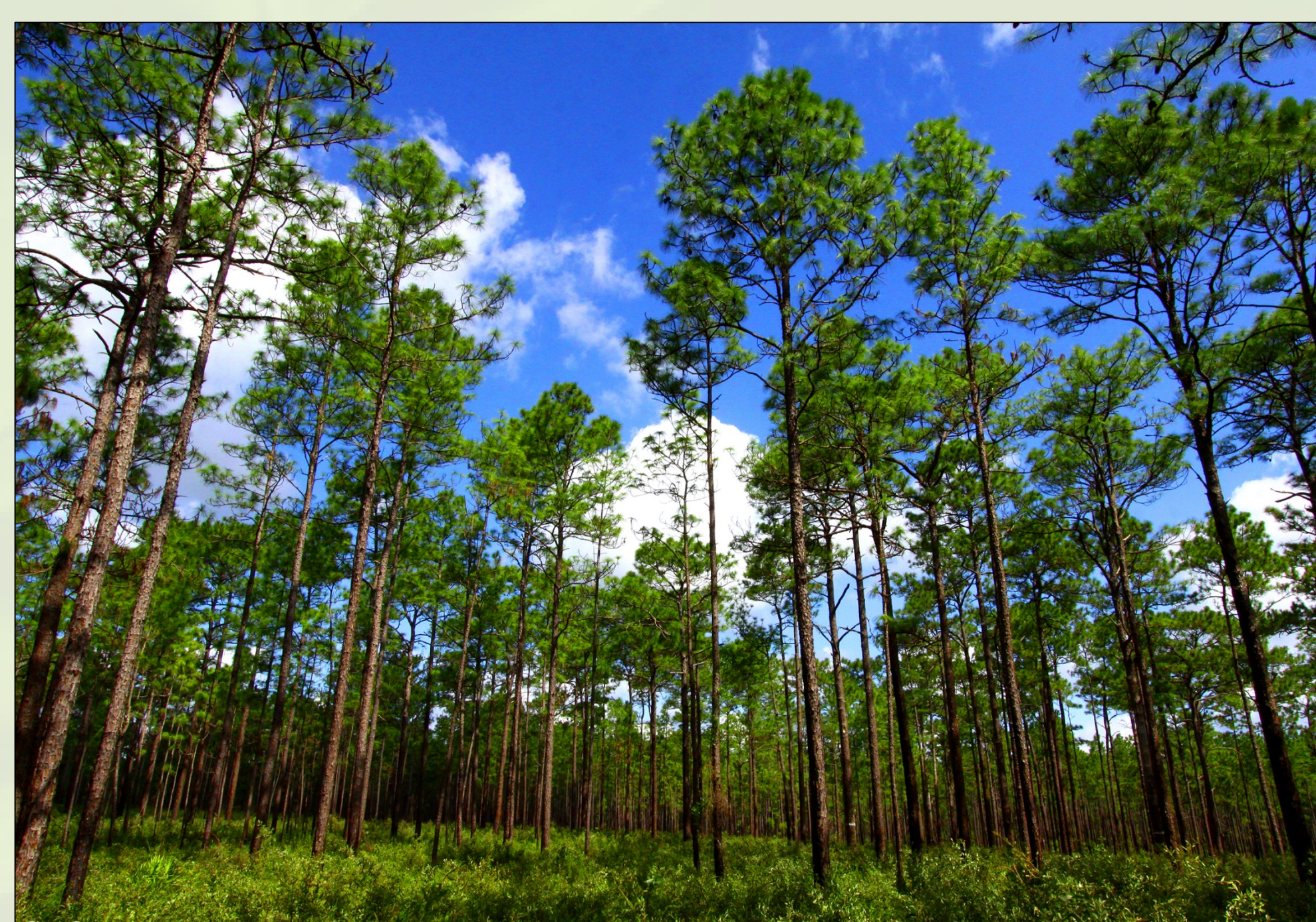
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## Introduction

Longleaf pine is an important keystone species in the unique longleaf pine ecosystem which covered 10.2 million acres, or 47 percent, of Florida's forests in the State's first forest survey of 1936. These surveys are conducted by the USDA Forest Service Forest Inventory and Analysis (FIA) program. FIA surveys provide important forest condition data valuable to assessment and management decisions. By the middle of the 20<sup>th</sup> century, longleaf pine ecosystems had dwindled to 7.3 million acres in Florida. A decade later, its area was reduced to 4.2 million acres, and by 1970 it was down to 1.3 million acres. The severity of decline slowed during the early part of the next half century to a low of 0.9 million acres in 1987 where the focus of efforts aimed at restoring this unique and valuable ecosystem became more urgent. From the 1987 low, Florida's longleaf pine ultimately recovered to more than 1.2 million acres by 2012 due to restoration efforts. However, by 2015 the area of longleaf pine accretion in Florida had slowed or plateaued at less than 1.2 million acres. Further indication of this "slow down" was Florida's population of longleaf pine trees at least 1-inch in diameter at breast height that rose from a low of 171 million trees in 1987 to 221 million trees by 2012, only to decrease to 214 million trees by 2015. This paper investigates reasons behind the recovery pause, and it evaluates changes since 1970 regarding catalysts of loss, effectiveness of alternative restoration methods, and degrees of progress achieved based on parameters of ownership category, regeneration method, tree size population, and biomass (volume) estimates.

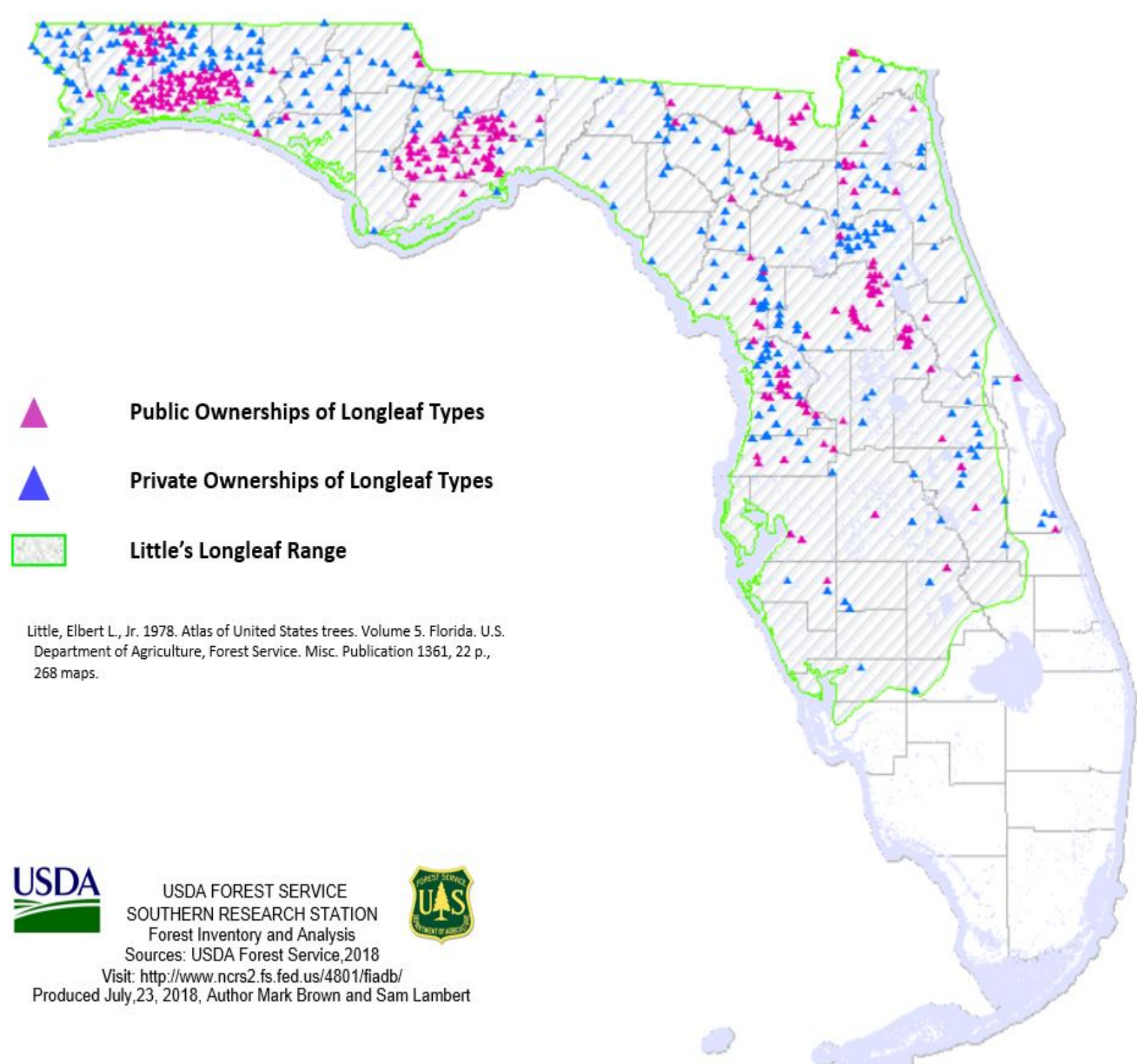


## Methods

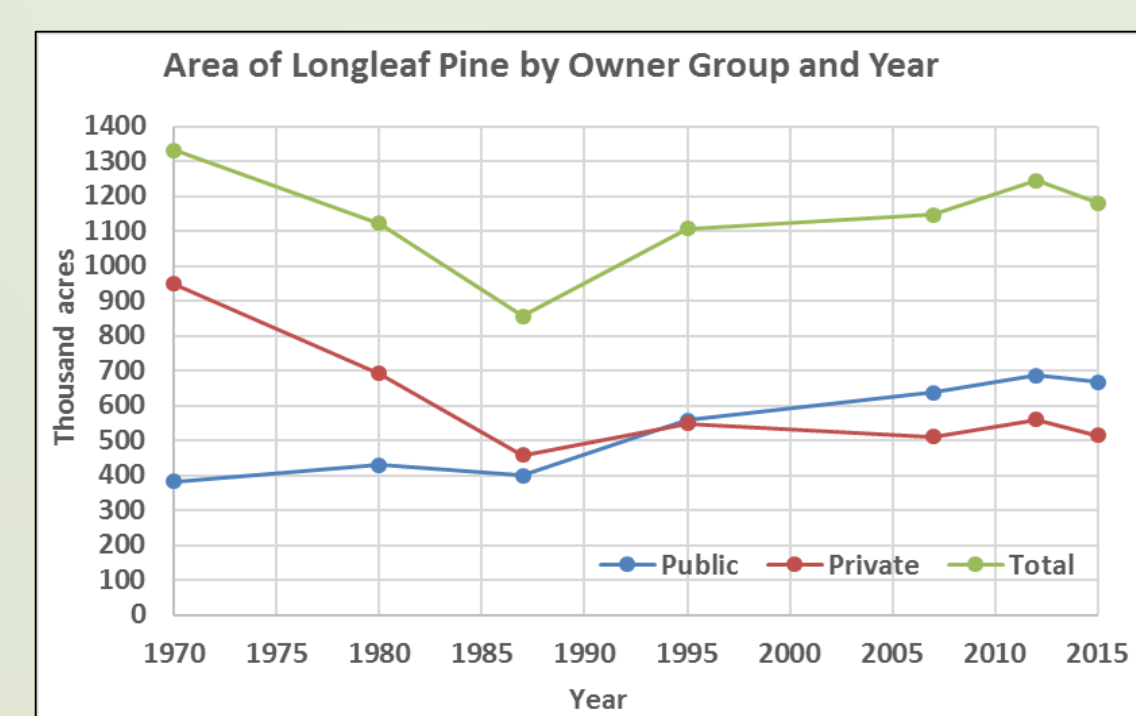
The data presented in this study were extracted from the FIA database (FIADB) through the EVALIDator tool <http://apps.fs.fed.us/Evalidator/evalidator.jsp> on February 2, 2018. The data were collected by FIA forest surveys conducted across the nearly 50 year period of 1968 to 2016. The evolution of inventory procedures employed during this time span involved two sampling designs and two data acquisition methods. Prior to 2000, FIA utilized a variable radius sample design with a 10-point cluster of plots systematically distributed on an acre, at which measurements were taken using a 37.5 basal area factor prism. Trees <5.0 inches, but >1.0 inch in diameter at breast height (d.b.h.) were tallied on 6.8-foot fixed radius plots around the point centers. Surveys were conducted periodically and data was acquired by compartmental unit progressively across the State until completed. Post 2000, FIA has used a fixed radius sample design consisting of 4 subplots. From a central subplot, the other three lay 120 feet from it at azimuths of 0, 120, and 240 degrees. Each point is the center of a circular subplot with a fixed radius of 24 feet. Plot sample area equaled 0.166 acre. Trees <5.0 inches, but > 1.0 inch d.b.h. were measured on 6.8-foot fixed radius microplots 12 feet and 90 degrees east from each subplot center. Surveys have been conducted annually, with approximately 20 percent of all samples acquired each year in State-wide panels. Further information about methods used in FIA forest surveys can be found in the U.S. Forest Service Field Guides for Standard (Phase 2) Measurements. The latest version is located at [https://www.fs.usda.gov/srsfia/data\\_acquisition/July%20SRS%20FINAL%200%20LEGAL%20reading%20version.pdf](https://www.fs.usda.gov/srsfia/data_acquisition/July%20SRS%20FINAL%200%20LEGAL%20reading%20version.pdf).

## Findings

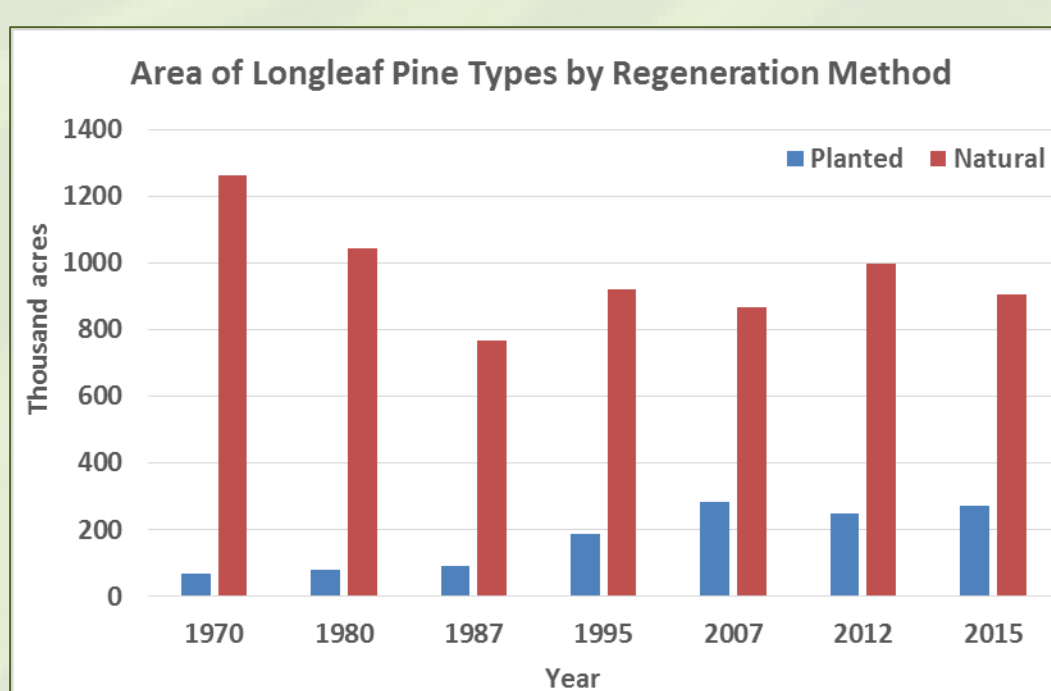
### Longleaf Pine Forest Type Plots by Public and Private Ownership, Florida 2015



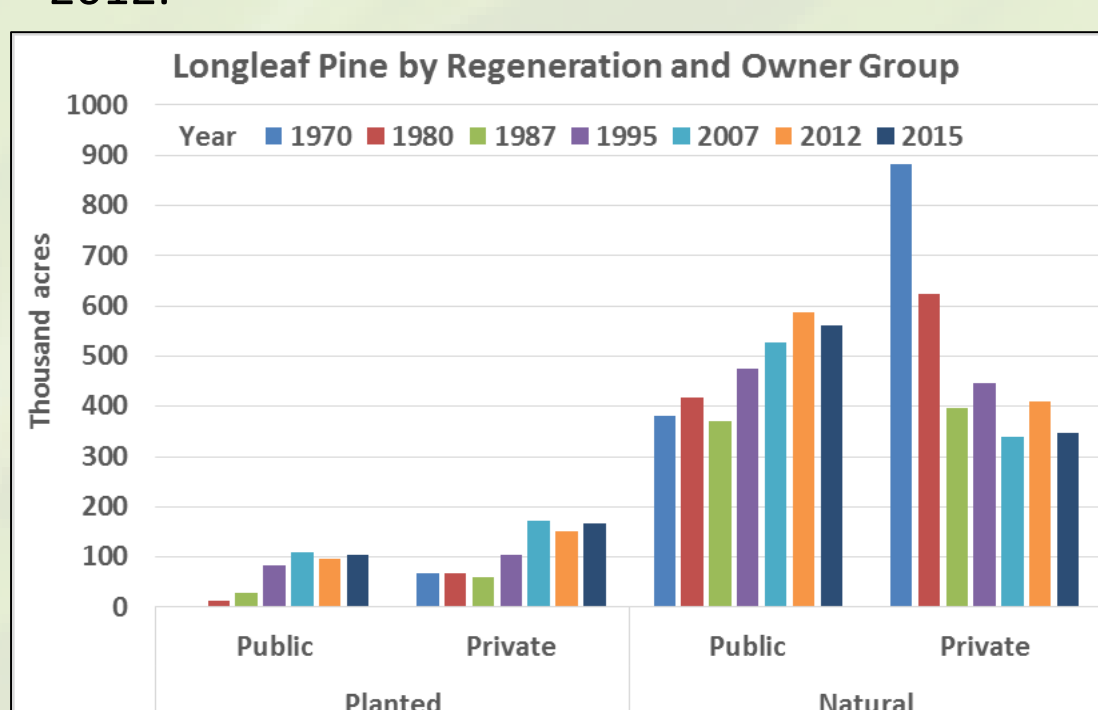
- Statewide distribution of Florida's longleaf pine sample locations in 2015.
- More than one half (54 percent) of the State's longleaf pine forest types are concentrated in the Northwest Florida panhandle.
- Public ownerships control 62 percent of the longleaf pine area in the Northwest Florida panhandle.
- Private ownerships control 56 percent of the longleaf pine area in the remaining peninsula of the State.



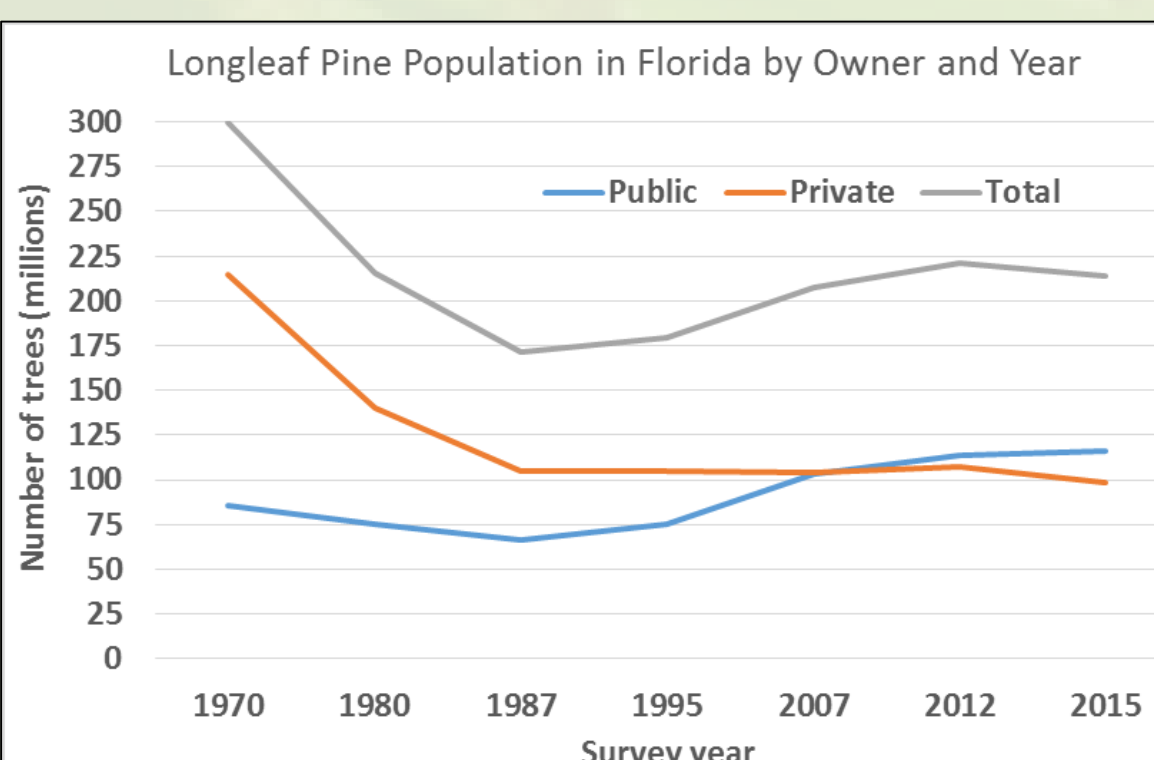
- Area of longleaf pine forest types (both longleaf and longleaf/hardwood) reached a low of <0.9 million acres in 1987.
- Most of the long term decline in area of Florida's longleaf pine happened on private lands.
- A variety of recovery efforts restored Florida's longleaf pine area to >1.2 million acres by 2012.
- Although some of the recovery took place on private lands, most of the increase occurred on public lands.
- The longleaf recovery trend paused by 2015 where it dropped slightly to <1.2 million acres.
- Since 1995, more of Florida's longleaf pine forest type area is under public ownership.



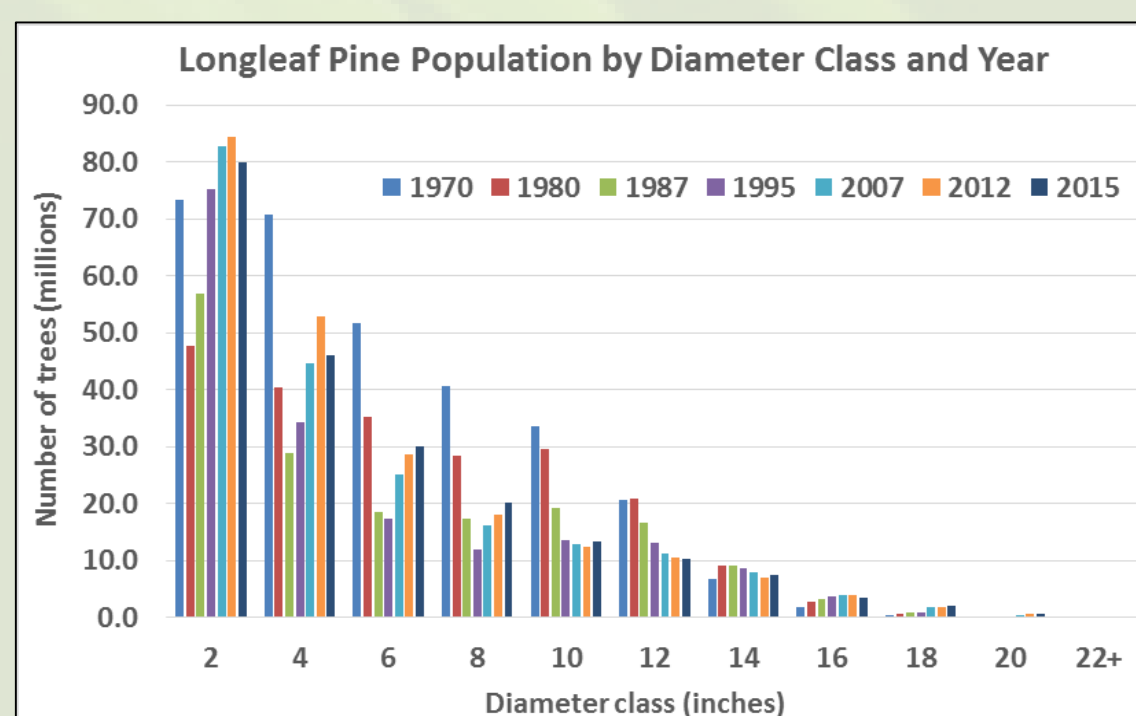
- Planting of longleaf pine began increasing in the 1980s and 1990s due to restoration efforts.
- Area of planted longleaf pine peaked in 2007 where it accounted for 25 percent of all longleaf pine in the State, but has leveled off since.
- Natural methods continue to account for most of the longleaf pine regeneration.
- After a low in 1987, natural regeneration increased until 1995 and again from 2007 to 2012.



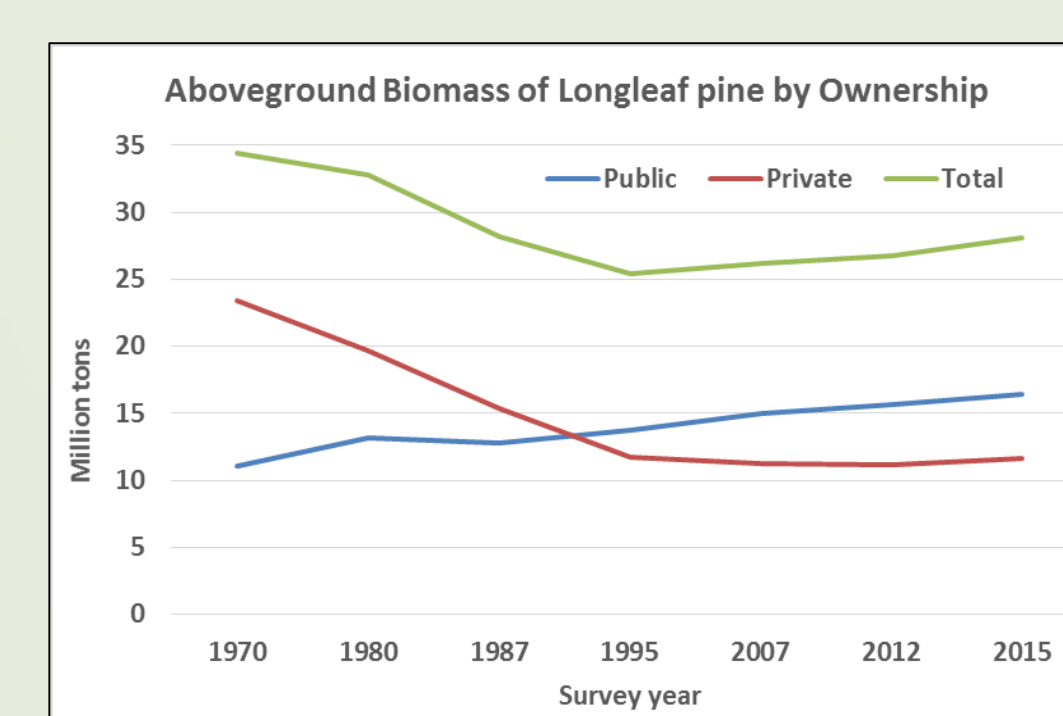
- Most of the planted longleaf pine continued to be under private ownerships, 62 percent in 2015.
- Both public and private ownerships increased their planting of longleaf pine from the early 1990s through 2007 after which the increase has halted.
- Overall, natural regeneration continued to decrease on private ownerships with lows in 2007 and again in 2015.
- In contrast to private ownerships, natural regeneration on public ownerships generally continued to increase with a low in 1987 and reduction in 2015.



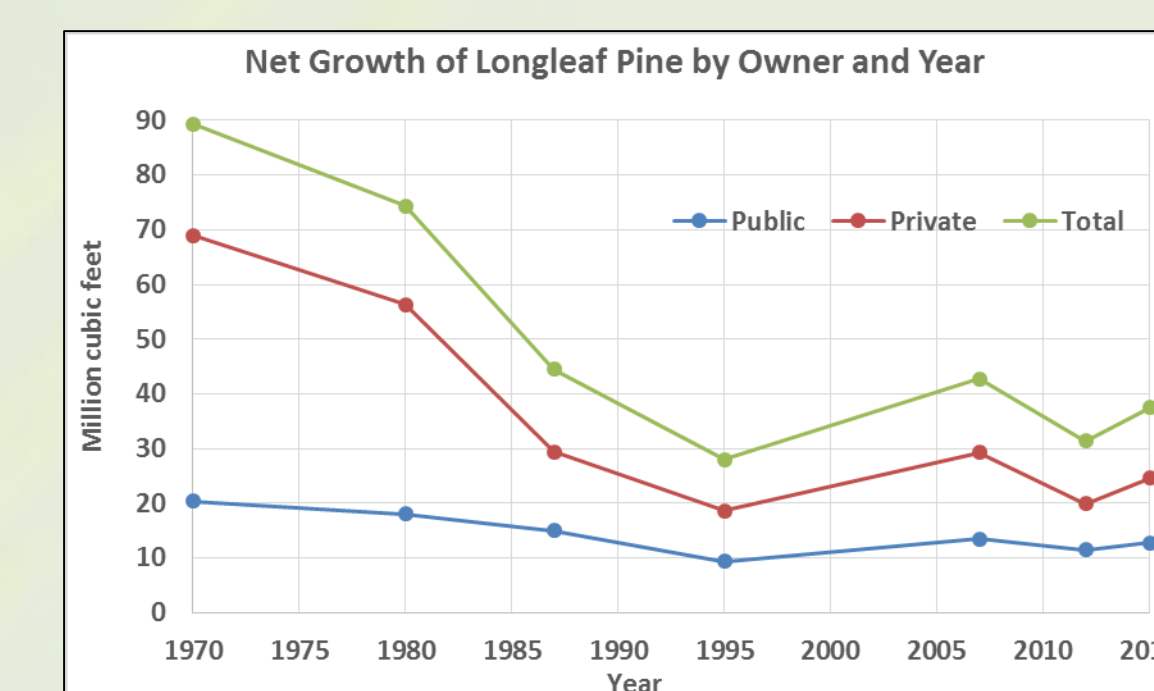
- The population of longleaf pine trees in Florida reached a low of 171 million trees in 1987.
- Most of the decline in number of longleaf pine trees occurred on private ownerships.
- Since 1987, the longleaf pine population increased through 2012 to 221 million trees, after which the increase stopped.
- After 2012, the number of longleaf pine trees continued a gradual increase on public lands while declining slightly on private lands.
- Since 2007, public ownerships have surpassed private ownerships in number of longleaf trees.



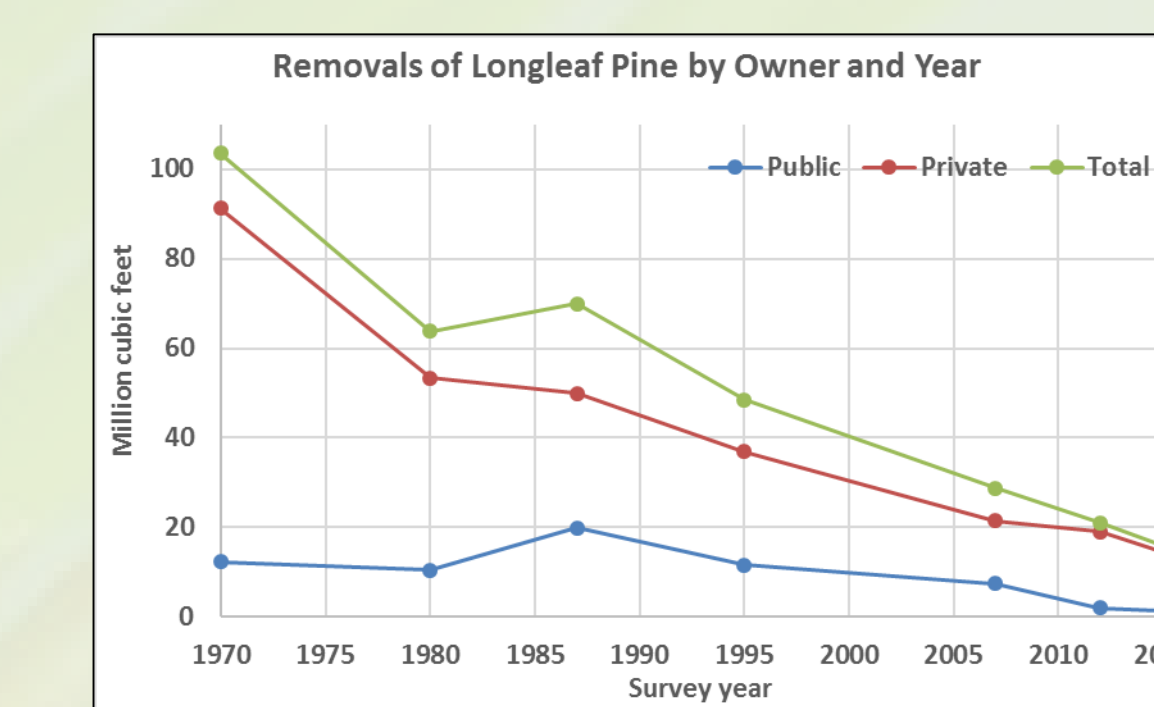
- The large number of longleaf pine trees between the 4- and 10-inch diameter classes in 1970 rapidly disappeared by 1987.
- Between 1987 and 1995, losses of tree numbers continued in the 8- through 12-inch diameters.
- Since 1987, most gains in tree numbers have been in the 2- through 6-inch diameter classes.
- Since 1995, the 8-inch diameter class has increased in tree numbers, but no change in the 10-inch class, and nominal decline in the 12- and 14-inch classes.
- Overall, the number of 16-inch and larger diameter class longleaf pine trees have remained similar or even increased slightly during the time span.



- Biomass of longleaf pine steadily decreased to a low of 25 million tons in 1995, and has gradually increased since.
- Most of the decline in longleaf pine biomass was driven by private ownerships, which has only slightly increased since 2012.
- In contrast, biomass of longleaf pine on public ownership has steadily increased since 1970, with only a slight pause in 1987.
- Since the 1990s, longleaf pine biomass on public lands has exceeded that on private lands.



- Average annual net growth of longleaf pine plummeted from near 90 million cubic feet in 1970 to a low of 28 million cubic feet in 1995.
- Average annual net growth was down on both public and private lands until 1995. However, the rate of decline was more severe on private lands.
- Since 1995, recovery efforts have produced increased net growth in both ownership categories until 2007, where it declined again through 2012.
- In 2015, average annual net growth of longleaf pine appears to be on the increase again in both ownership categories.



- Average annual removals (i.e. harvests, land clearing, etc.) of longleaf pine fell steeply from 103 million cubic feet in 1970 to just 16 million cubic feet in 2015, only 1987 increased.
- Private ownerships were behind the reduction in average annual removals of longleaf pine.
- Public ownerships were behind most of the longleaf pine removal increase in 1987.
- Levels of longleaf pine removals from public lands remained fairly consistent across the time span until 2007, after which longleaf pine removals on public lands were reduced sharply.



## Conclusions

After decades of reductions, area of all longleaf pine forest types (both longleaf pine and longleaf/hardwood type groups) in Florida reached a low of <0.9 million acres in 1987. In response to the decline, a variety of public and private sponsored recovery efforts including artificial regeneration and forest management to enhance natural regeneration succeeded in restoring the area to >1.2 million acres by 2012. The population of longleaf pine trees reflected the area gained from these efforts as well, and rose from a low of 171 million trees in 1987 to 221 million trees by 2012. Gains in the number of small 2-, 4-, and even 6-inch diameter class longleaf pine trees after 1987 corroborate the effectiveness of recovery efforts. However, after 2012 the rate of recovery showed evidence of a slowdown based on a 2015 decline in area of longleaf pine forest type gained and in numbers of longleaf pine trees present. This is particularly evident by the slight drop in area of longleaf pine forest type and decreased numbers of 2- and 4-inch diameter class longleaf pine trees after 2012. In addition, the increased rate of area planted to longleaf pine that began after 1987 has halted by 2012 after peaking in 2007, providing further evidence of a recovery pause. Compared to earlier decades, the paucity of landowner cost share incentives for tree planting could be a limiting factor, particularly since in general, more of the artificial regeneration occurred on private lands and more of the natural regeneration took place on public lands. Biomass has continued to increase slowly, but that is largely due to the minimal changes in the numbers of large diameter class (> 14-inches d.b.h.) longleaf pine trees and not as good an indicator of restoration status. Changes in net growth has paralleled aforementioned area and population trends and correlates with changes after 2007. The steep drop in removals of longleaf pine has benefited the recovery effort, but could be related to supply or availability issues. The fact that public ownerships have reduced longleaf pine removals bodes well for recovery efforts, especially now that more longleaf pine exists on public ownerships than private ownerships. Many other factors are involved in the recovery pause, but most importantly the residual effects from the economic downturn which began around 2007 appear to have impacted the longleaf pine recovery pace and are reflected in the data by 2012.

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Photos courtesy of The Florida Forest Service