# Shortleaf Pine: A Resurgence Opportunity in a Changing Climate

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## Introduction

Shortleaf pine, blessed with fire and drought tolerance, is one of the South's most resilient pine species. Facing a warmer, drier south and eastern landscape, shortleaf pine may offer the best hope of matching ownership objectives and risk–avoidance. Shortleaf pine is already dominant in xeric, water-stressed, and rocky sites, thereby yielding a competitive advantage over other ecosystem cohorts. Its willingness to grow on many different site and soil types may provide an additional advantage under projected temperature increases and irregular rainfall patterns, which loom as the chief threats facing southern forests. In combination, temperature and precipitation will likely cause unprecedented drought and wildfire activity, some of which may lead to increase mortality and loss in currently dominant forest species. Should hot and dry conditions dominate the future climate, managing for shortleaf pine offers a resilient solution for these extreme conditions because of its fire and drought tolerance. This poster highlights expected climate effects and possible areas where expanding shortleaf utility can be beneficial and successful.

Oklahoma Forestry Service


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## Shortleaf Decline and Resilience

Shortleaf pine dominated many southern and eastern forests at the close of the 19th Century. Selective pine logging drastically reduced seed sources which favored competitive hardwoods and other species. As a result, nearly all natural stand populations have declined over the last 150 years. In the Missouri Ozarks, for example, shortleaf pine abundance is down between 20 and 50 percent. To add further insult, fire prevention and disruption of fire frequency limit the conditions essential for shortleaf pine development. Despite a grim past, there may be an opportunity for a shortleaf resurgence under the harsh and irregular temperature and rainfall conditions being projected, as it is one of the more resilient species in southern and eastern forests.

- **Insulating bark**
- **Resistance to rot**
- **Longer available growing season**
- **Resilience to/after fire and wind events**
- **High tolerance to drought conditions**
- **A lifespan of up to 250 years or more**
- **Tolerance to a wide variety of soil types and site conditions**
- **Largest range of any southern pine species**

## How Will Climate Change Affect Temperature?

Our sample of climate projections combines and averages twenty global climate models to compare past climate to time periods in the near future. Results from temperature projections back the consensus views that if business as usual continues, temperature is expected to increase in every part of the southeast in the near-future *(Figure 1)*. Fortunately, in the case of shortleaf pine, most of the native range is expected to see comparatively limited temperature increases; however, increased temperature across the region is still likely to impact pine and soil health, productivity, and extent. For example, while warmer temperatures can lead to an expansion of shortleaf range, they may also increase evaporation rates and decrease water availability making conditions dry and prone to wildfire.

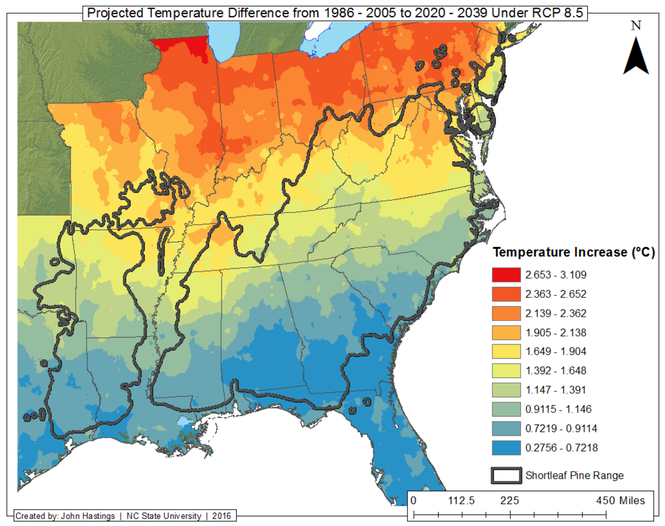


Figure 1

## How Will Climate Change Affect Precipitation?

Although deducing site-specific risk is challenging, we can confidently conclude that summers in the southeast are expected to receive less rainfall, causing longer droughts, while winters in the southeast are expected to see a higher number of rainfall events *(Figure 2)*. Depending on the the degree of variability in relation to the mean rainfall totals, rainfall may become more or less irregular. Our models project more variability with each sequential time period, thus more irregular rainfall. These patterns will likely produce similar rainfall totals across the region, but rather than the consistent daily rainfall, the projections tell us periodic drought followed by heavy rainfall events will become the norm. Especially in the winter, these patterns may further stress soils to compact, runoff, and erode. Additionally, drought-stressed trees may also shift carbon usage to defense, reduce their carbon uptake to nearly zero, and are at a higher risk of internal damage making them prone to wildfire[3].

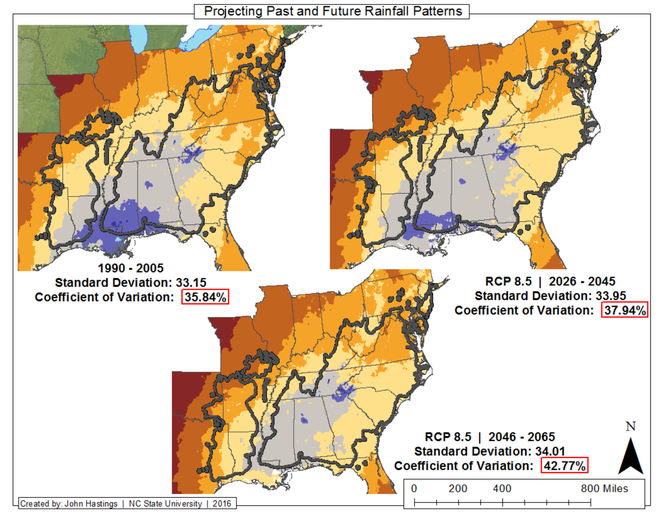


Figure 2

## Why Manage For Shortleaf Pine?

Managing for shortleaf pine may be a resilient solution for the extreme conditions brought on by climate change. For example, a higher likelihood of wildfire events may benefit shortleaf, as features like the basal crook, which is likely sub-surface in nature to protect the bud from fire, are attributes that rival species such as loblolly pine do not possess. It may also be wise to promote shortleaf pine in fire-threatened areas, as the species fire resilience may be a way to mitigate loses in a fire-prone future.

Warmer, wetter winters and drier summers are conditions that may give the species an additional competitive advantage, as shortleaf pine is more adapted to withstand drought than many other species. Shortleaf pine is already dominant in xeric, water-stressed, and rocky sites. Should hot and dry conditions materialize in the future, shortleaf evapotranspiration rates may outcompete other species in locations that express drought-like growing conditions.

Although many neighborhood factors influence shortleaf pine establishment success, more intensive forest management will likely become the norm across all forest types; thus, initial management intensity should not discourage the planting of and managing for shortleaf pine. Techniques like thinning, prescribed burning, reducing competition, and others are inexpensive methods for transforming mixed stands and promoting shortleaf. In the future, climate-driven events such as drought and wildfire may promote shortleaf pine's resilient characteristics and site preferences, and may eventually lead to its resurgence.

Multivariate Adaptive Constructed Analogs(MACA) Statistical Downscaling Method

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