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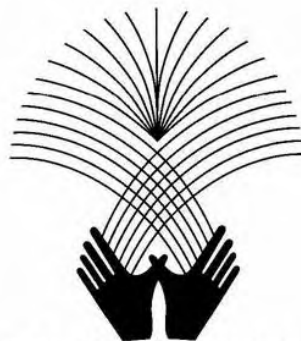


## Longleaf Pine: *Making Dollar\$ and Sense*



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THE LONGLEAF ALLIANCE

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## LAND USE LEGACIES AND UPLAND FOREST OVERSTORY STRUCTURAL CHANGE IN SOUTHWEST GEORGIA

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**Abstract:** This project proposes to elucidate historical land use effects on hardwood succession in longleaf pine woodlands on the J.W. Jones Ecological Research Center at Ichauway in southwest Georgia. Land use legacies will be documented from historical documents, historical maps, and aerial photograph series. Aerial photograph series will be used to analyze the spatial and temporal patterns of canopy change. Age class distributions will be used to verify stand histories and document successional trajectories. These generalizations will provide useful data to land managers and conservationists working to restore longleaf pine ecosystems and maintain multiple use longleaf pine woodlands.

### INTRODUCTION AND BACKGROUND

Forest overstory structure is determined by geomorphology, existing vegetation, disturbance, and species response to disturbance (Myers 1990). Fire drastically shapes the structural characteristics of longleaf pine (*Pinus palustris*) forests. While frequency and intensity of fires are important factors, the spatial and temporal extent and structure of fire patches also play a dominant role at the sub-landscape level (Glitzenstein et al 1995). In today's human impacted landscape, fire suppression and habitat fragmentation associated with land use legacies have caused many of the remaining longleaf pine woodlands to follow hardwood successional trajectories (Robbins and Myers 1992).

Quail hunting plantations provide a valuable but complex venue in which to study longleaf pine. Many of the remaining old growth and well conditioned longleaf stands occupy former and current quail management lands (Landers et al 1995). Prior to 1989, Ichauway was managed as a bobwhite quail hunting plantation. A generalized timeline for historic Ichauway Plantation and southwest Georgia is presented in Table 1.

The use of fire on quail plantations to maintain habitat and open the woodlands for easy access helped maintain these ecosystems from completely succeeding into mixed or southern hardwood forests. However, the common practice of annual burning also precluded effective longleaf pine regeneration and winter burning may have failed to control invading hardwoods (Jacqmain 1999). On Ichauway, decades of presumed cool season or annual fire regimes and woodland fragmentation have led to areas with extensive hardwood succession that is now undergoing mechanical removal. It is important to understand how land use legacies influence hardwood succession in order to make decisions about restoration and future management.

### OBJECTIVES

The main objective of this research is to examine the effects of historical land use legacies on the spatial and temporal patterns of hardwood succession in upland longleaf pine ecosystems. Successional patterns will be examined through reconstruction of stand histories using historical aerial photographs and age class distributions.

Hypotheses presented are not mutually exclusive. These hypotheses cover a wide range of spatial and temporal patterns and it is likely that more than one will be applicable depending on the scale of inquiry. Use of these hypothetical models provides testable straw-man scenarios, or multiple working hypotheses, against which patterns that are revealed can be compared.

#### Hypothesis 1 – Diffuse Model

Hardwoods encroached (diffused) evenly across space and time, causing gradual successional changes due to temporal and spatial variability in fire frequency and extent in conjunction with land use legacies such as historical timber removal and turpentineing.

#### Hypothesis 2 – Event Punctuated Model

Hardwood encroachment was event punctuated with periods of widespread hardwood recruitment and little to no pine regeneration. Historical pine timber removal combined with annual burning provided broad-scale opportunities for hardwood recruitment, while precluding broad-scale longleaf pine stand recruitment and establishment.

**Hypothesis 3 – Nucleation Model**

Land use activities created distinct features that served as spatial foci for hardwood encroachment. Fragmentation of longleaf pine woodlands by fields, food plots, timber removal, and homesites resulted in loss of fuel continuity that led to spatial heterogeneity of burned areas and expanded dominance of hardwoods.

**METHODS**

Land use and canopy change will be analyzed for the period of ~1930 to ~1994 using historical documents, historical aerial photograph series, and age class distributions derived from counting rings from hardwood stumps and increment bores from hardwoods and longleaf pines. Inferences about land use effects on longleaf pine woodlands will be drawn based on landscape analysis of the spatial distribution of hardwood successional areas and the temporal scale of those changes. Patterns found will be compared to the hypothetical models presented in order to make generalizations about the effects of land use legacies on succession in longleaf pine woodlands. Table 2 shows the three hypothetical models and criteria for validation.

**LITERATURE CITED**

Glitzenstein, J. S., W. J. Platt, and D. R. Streng. 1995. Effects of fire regime and habitat on tree dynamics in north Florida Longleaf pine savannas. *Ecological Monographs*. 65(4):441-476.

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Myers, R. L. 1990. Scrub and high pine. In *Ecosystems of Florida*, R. L. Myers and J. J. Ewel, eds. University of Central Florida Press. Orlando, Florida. Pages 150-193.

Robbins, L.E., and R.L. Myers. 1992. Seasonal effects of prescribed burning in Florida: a review. Tall Timbers Research, Inc. Miscellaneous Publ. 8. 96 pp.

**Table 1. Generalized timeline for Ichauway Plantation and southwest Georgia**

<b>Time</b>	<b>Land Use</b>
Mid to late 1800s	*Widespread timber harvest * Widespread turpentine * Some settlement and agriculture
~1900 to ~1920	* Widespread timber harvest * Most of oldgrowth longleaf pine removed * Widespread turpentine * Livestock production * Increasing settlement and agriculture
~1920 to ~1940	* Acquisition of properties to form Ichauway Plantation * Quail management * Timber harvest * Turpentine * Livestock production *Dry-land agriculture *Some fire suppression
~1940 to ~1960	* Quail management * Timber harvest * Turpentine trees removed in timber harvest * Dry-land agriculture * Livestock production
~1960 to ~1990	* Quail management * Timber harvest * Dry-land agriculture * Decreasing livestock production * J.W. Jones Ecological Research Center created in 1991

**Table 2. Hypothetical models, measurements, and hypothesis validation.**

<b>Measurement</b>	<b>Hypothesis 1 Diffuse</b>	<b>Hypothesis 2 Event Punctuated</b>	<b>Hypothesis 3 Nucleation</b>
<b>Age Class Distribution (ACD) – Stand History and Successional Trajectory</b>	<ul style="list-style-type: none"> <li>*Longleaf ACD generally peaked towards center of distribution or older age classes</li> <li>*HW age classes fairly even</li> <li>*Pine and HW age classes distributed evenly or randomly across patches and landscape (not clustered or clumped)</li> </ul>	<ul style="list-style-type: none"> <li>*Peaks in HW ACD – correlating with known management events and release of hardwood succession</li> <li>*Gaps in longleaf ACD correlating with timber removal or peaks correlating with regeneration</li> </ul>	<ul style="list-style-type: none"> <li>*Decreasing hardwood age with distance from fragmentation feature</li> <li>*Overall increase in longleaf ages with distance from fragmentation feature</li> </ul>
<b>Cover Type Patches From Historical Aerial Photo Series– Overstory Structure and Change</b>	<ul style="list-style-type: none"> <li>*Long time-scale disturbance such as change in fire regime and/or continual conifer removal</li> <li>*High probability of change from pine to mixed cover types for all patches regardless of proximity to fragmentation features</li> <li>*Examination of intermediate photos shows gradual cover change: pine to mixed to hardwood</li> </ul>	<ul style="list-style-type: none"> <li>*High probability of pine patches to change to hardwood patches, especially in patches with decreases in pine cover</li> <li>*Examination of intermediate photos shows no intermediate successional step</li> </ul>	<ul style="list-style-type: none"> <li>*Decrease in pine patch extent and frequency</li> <li>*Individual hardwood patches increasing in size through time</li> <li>*High probability of pine patch transition to hardwood patch with increasing probability of change closer to fragmentation feature</li> </ul>