Chapter 1: Introduction and Statement of Purpose

1.1 Introduction

The Coastal Plain region of the southeast, prior to European settlement, was dominated by pure or mixed stands of *Pinus palustris* Mill. (longleaf pine) maintained by periodic fire. In pure stands, it shared an association with wiregrass (*Aristidia stricta* Michaux) and other grasses forming *Pinus palustris*-grass communities that topographically dominated the landscape from xeric uplands to flatwoods and shrub swamps (Bridges & Orzell 1989; Noss 1989; Carter et al. 1999). These communities once composed the matrix in the vegetation mosaic of the southeast forming a regional vegetation landscape (Noss 1989; Noss et al. 1995). During pre-settlement times, the *Pinus palustris* ecosystem dominated 36 million hectares within the states of Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas, and Virginia. *Pinus palustris* is also found within the ecoregions of the Coastal Plain and Plains of the Southeast, the Piedmont, the Ridge and Valley, the Southwestern Appalachians, and the Mississippi Alluvial Loess Plain (Figures 1.1, 1.2; Little 1971; Noss 1989; Walker 1991; Frost 1993; Landers et al. 1995; Woods et al. 1999; Smith et al. 2000). Over the past four centuries, intense anthropogenic activities in the form of the naval store industry, silvicultural practices, fire suppression, and conversion of stands to agricultural fields and suburban areas have disrupted the presettlement fire regime and reduced this ecosystem from 40.4% of the southeastern landscape to 0.7% (647,000 ha of its former range) (Farrar 1998; Frost 1993; Noss 1989; Outcalt 2000; Smith et al. 2000).

Fire is thought to have sculpted the vegetation landscape in the coastal plain prior to European settlement, with less than 5% of the landscape protected from fire by natural breaks in the landscape (Frost 1993). Depending on the habitat type, fire occurred in frequencies of two to ten year intervals ignited by lightning during the spring and summer season and by Native Americans during winter (Frost 1993; Smith et al. 2000). Since European colonization, trends and practices in the naval store and forest industry and landscape fragmentation resulting from urban growth and agriculture have resulted in fire suppression. In the absence of fire, the succession of *Pinus taeda* (loblolly pine) and hardwood species has flourished, herbaceous ground cover has been eliminated, and the range of presettlement flora and fauna has collapsed in many areas (Outcalt 2000; Smith et al. 2000). Examples of fauna that have declined from their presettlement range are the endangered *Picoides borealis* (red-cockaded woodpecker) and the threatened *Gopherus polyphemus* (gopher tortoise), both keystone species, just like *Pinus palustris*, for this ecosystem (Auffenburg 1982; USFWS 2003). This collapse has also resulted in the loss of many other organisms that have come to rely on these keystone species, causing them to be listed as "threatened" or "endangered." If left unchecked, current land use practices could result in the extinction of many species that have adapted to the *Pinus palustris* ecosystem throughout the southeast.

1.2 Statement of Purpose

Human activities have had major impacts on the *Pinus palustris* ecosystem throughout its range, especially in Virginia, where *Pinus palustris* reaches its

northernmost limit. It is estimated that only 81 ha of *Pinus palustris* remain of the original 607,000 ha that existed in Virginia, prior to European settlement (Sheridan et al. 1999; Frost 1993). Further studies on *Pinus palustris* in this part of its range are warranted due to its past abundance on the landscape in southeastern Virginia (Figure 1.2), its unique species assemblage, and its value as a timber species. The purpose of this research is to add to the knowledge of the ecology of *Pinus palustris* in this state, specifically the dendroecology. This research incorporates methods in dendroecology to determine the disturbance history as indicated by the variability of annual ring growth. Because *Pinus palustris* in this area is at the northern extent of its range and is situated in *Pinus taeda* (loblolly pine) dominated stands, I hypothesized that annual ring growth of *Pinus palustris* would exhibit growth releases in response to canopy gaps created by natural or human disturbance. I reconstructed the disturbance history of *Pinus palustris* by using Black and Abrams (2003) boundary line method to determine if growth releases could be detected from *Pinus palustris* at a decadal scale. This research will be the first published study to focus on the dendroecological disturbance history of *Pinus palustris* and to apply the boundary line technique to this species. The results of this work will contribute to the understanding, restoration, and management of the *Pinus palustris* ecosystem in Virginia, and to the dendroecological knowledge of this species.

This thesis has two additional chapters. Chapter 2 provides a detailed review of the ecology and natural history of *Pinus palustris* and of the relevant dendrochronological research. Chapter 3 focuses on the study of the dendroecology of remnant *Pinus palustris* in southeastern Virginia and is written in preparation for submission to the Journal of Vegetation Science.

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Chapter 1 Figures

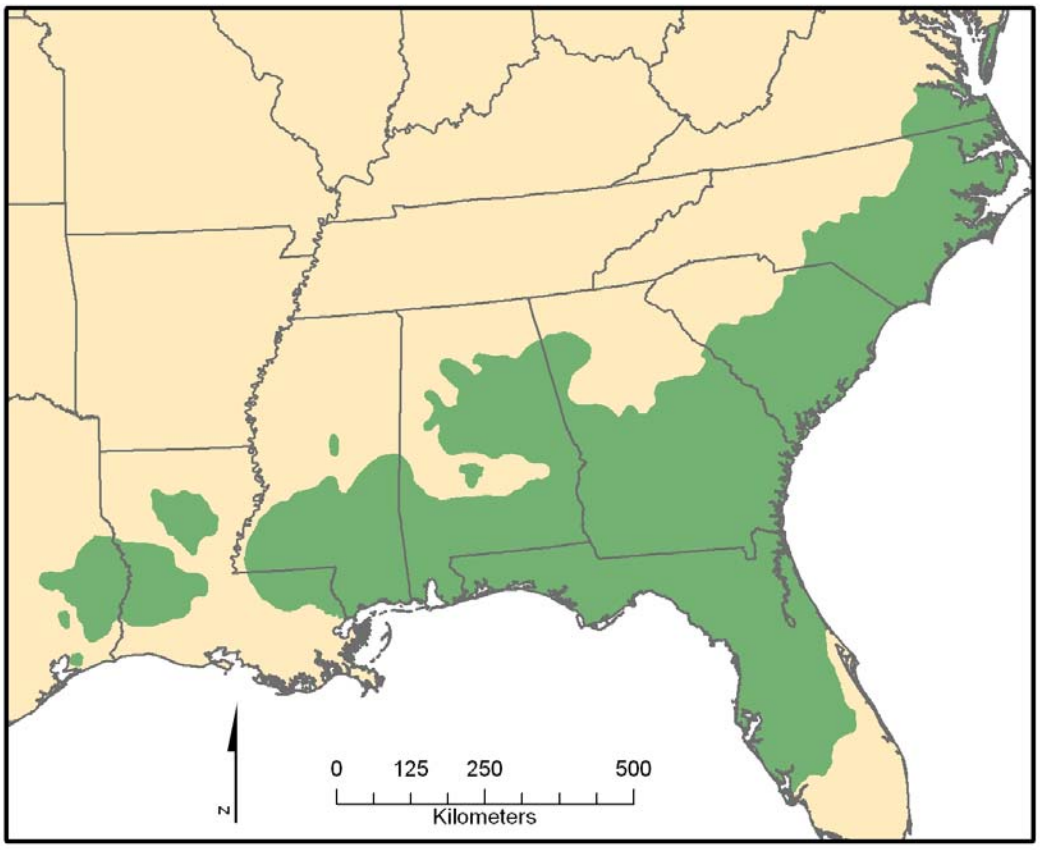

Figure 1.1. Distribution of the *Pinus palustris* ecosystem throughout the southeastern United States (modeled after Little 1971; Frost 1993; Sheridan et al. 1999).

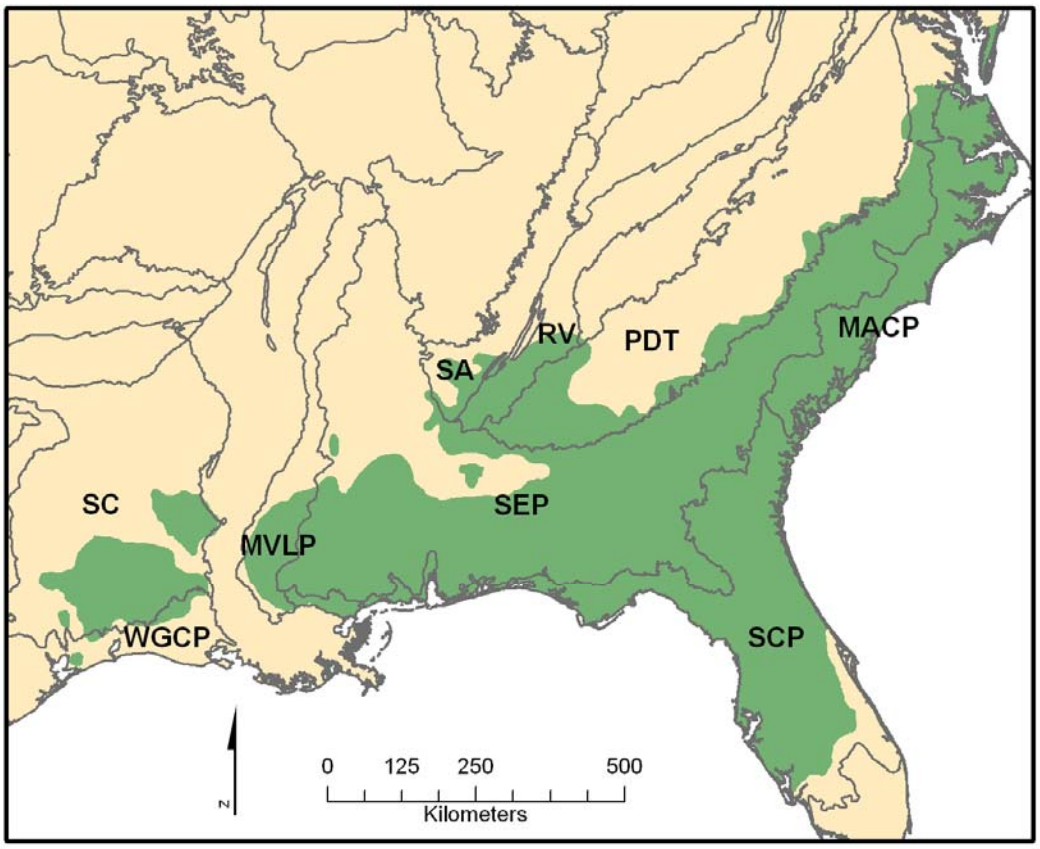

Figure 1.2. Distribution of the *Pinus palustris* ecosystem throughout the ecoregions of the southeastern United States (Woods et al. 1999; modeled after Little 1971; Frost 1993; Sheridan et al. 1999). MACP = Middle Atlantic Coastal Plain; MVLP = Mississippi Valley Loess Plain; PDT = Piedmont; RV = Ridge and Valley; SA = Southwestern Appalachians; SC = South Central Plain; SCP = Southern Coastal Plain; SEP = Southeastern Plain; WGCP = Western Gulf Coastal Plain.