LANDOWNER PERCEPTIONS AND MANAGEMENT OF FLORIDA'S HARDWOOD FORESTS

By

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To my wife, Amanda and son, Asah, for providing support and motivation through this long process

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LIST OF ABBREVIATIONS

FIA	Forest inventory and analysis
NAICS	North American Industry Classification System
NIPF	Non-industrial private forest
OSB	Oriented strand board
TDM	Tailored design method
TPO	Timber products output
TSI	Timber stand improvement
USDA	United States Department of Agriculture

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Predicted increases in population and decreases in wood supply raise concern about the sustainability of the hardwood resource in Florida. Private forest landowners are important to improved hardwood management since they hold 2.2 million acres of hardwood forest types. These forests are largely unmanaged and silvicultural practices may improve productivity. Even though hardwoods are in abundance and occur on a wide variety of sites, the application of silvicultural practices may be difficult since the knowledge base in Florida is with pine silviculture. Also, the current markets for hardwood are limited (most hardwood volume utilized is low quality for pulp and paper) and the value of shipments is declining for hardwood-using industries. An analysis of hardwood supply and production using USDA Forest Service Forest Inventory and Analysis data finds that pulp and paper overshadows other high value timber products, e.g. saw logs and veneer logs, which are utilized in significant amounts in this state. Further, high-value timber species such as yellow poplar (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), and white ash (*Fraxinus americana*) occur in noteworthy volumes in Florida's forests.

Higher stumpage prices may motivate some landowners to manage for hardwoods. In a mail-out survey using Dillman's Tailored Design Method (TDM), 26% of respondents indicated they would change to hardwood management from pine management if stumpage price were above pine. The survey also indicated that landowners can improve stumpage values through better access to market price information. Of respondents who sold timber in the 5 years preceding 2005, 23% had accessed price information and received greater than $9.00 per ton, while none received greater than $9.00 per ton if they did not receive price information.

A change in perceptions is also needed to improve hardwood management. Most respondents would not change from pine management to hardwood management even if the value were above pine. Most respondents who had sold hardwood were unwilling to harvest hardwood for timber. Further, most respondents lacked a written management plan which could improve hardwood management even if timber is not an objective. Aesthetic beauty, environmental benefits, and wildlife values are all reasons to manage hardwood forests. Results show that hardwood forestry in Florida has potential, and advancement lies with improved stumpage prices for private forest landowners, a willingness to perform multiple use management, the use of alternative markets, and an improved knowledge base of hardwood forestry.

CHAPTER 1
FLORIDA HARDWOOD MARKETS, A LITERATURE REVIEW

Introduction

The recent increase in the value of hardwoods in the South's timber markets may be an important indication that possible changes in hardwood management may be practical (Bates 2003). Southern pines have traditionally been favored in Florida for economic gain. In the past, the slow growth and poor form of hardwoods received low stumpage value if any at all. If hardwood values are increasing, timber stand management focused on the improvement of the quality of hardwoods may be economically beneficial. Opportunities may exist for landowners to increase hardwood value through hardwood management. Here, hardwood management refers to applying silvicultural systems such that the quality and volume of hardwood growing stock is increased for use as a commercial timber product. Hardwood management can still be performed even if landowner objectives are solely for non-timber products, recreation, and environmental services so long as the commercial value will be increased.

In the early 1990s researchers noted an increasing demand for hardwoods across the South (Abt et. al. 1994). Related to this increase, hardwoods began to match pine prices for certain products (Pelkki and Ringe 1994). Although Florida has many native hardwood species, forest management has focused on pines. Hardwoods have only been allowed to grow on sites where pines are not promoted. Hardwoods in Florida are usually considered a weed in pine plantations and most silvicultural practices discourage growth of hardwoods in those stands, or seek to eradicate them (Cain and Yaussy 1984). Since control of hardwoods increases pine production and financial returns for landowners (Williston 1987) much research effort and expense has been allocated to reducing competing hardwoods in pine plantations. However, hardwoods, while

unwanted, have continued to thrive on southern pine sites and the recent changes in timber markets should increase their value (Abt et. al. 1994).

Even so, more information about Florida hardwood forestry is needed to sustain the use of this resource. In this paper, a review of the pertinent forest economic research explores supply, demand and market information issues with Florida's hardwood market. While the factors of supply and demand are important to stumpage prices, so is market information. Landowner access to market information is a key focus of this research. Survey research methods can provide information about landowners' access of market information and their management practices.

The results of this survey research could determine the opportunities and limitations of hardwood management improvement by the forest landowner, as well as provide a test of the hypothesis that landowners who obtain current market information are more likely to receive higher stumpage prices than landowners who do not.

Supply and Timber Value

Supply trends have an important effect on timber value. A shortage of timber supply may negatively impact consumers by inflating lumber prices, increase imports, and promote deforestation (in third world countries) but it should increase stumpage prices. A timber surplus may negatively impact the landowner by reducing stumpage prices and their profits. Since standing timber supply cannot be readily increased in a short period of time, society will benefit from timber management that keeps supply steady.

Currently, Florida's potential hardwood supply exceeds demand, but that may change in the near future. All of Florida's forest inventory and analysis (FIA) survey units are expected to lose private timberland (Prestemon and Abt 2002). Hardwood growth is expected to stay ahead of removals only until the mid-2020s. The falling hardwood inventories are due to conversion of

natural areas to pine plantation and urban development (Prestemon and Abt 2002). The increase in population associated with urban development may increase demand for hardwoods, and simultaneously reduce supply by taking land out of timber production. This indicates the need for Florida landowners to adopt management practices that improve hardwood quality and intensively manage for higher production. If stumpage price remains high enough to provide motivation for the landowner to do so, then society will receive a desirable level of hardwood supply (Callahan 1980).

Demand for Products that Use Hardwoods

The demand for hardwoods has been increasing worldwide due to increasing world population and the development of third world countries. The increased hardwood demand in the Southeast is for white paper, engineered wood products and fine furniture. With these changes the U.S. has gone from a net exporter of wood pulp to a net importer (Harris et. al. 2003).

In Florida, the pulp and paper industry uses about 74% of the harvested hardwoods (Bentley et. al 2002). They are most frequently used in printing paper, writing paper and in tissue paper. Hardwood pulp is added to softwood pulp in the paper making process to improve certain paper properties such as opacity and surface characteristics of white paper (Koch 1985).

Engineered wood products (EWP) have also contributed to increased demand for hardwoods, although at a much lower level than for pulp. Of particular interest is oriented strand board (OSB). Florida previously exported 14% of its roundwood hardwoods for OSB production in adjacent states (Bentley et. al 2002). The bulk of this material went to a mill near Valdosta, Georgia. Also an OSB mill recently opened in Hosford, FL. However, both of these mills currently use pine as a primary wood source.

Market Price Information

Stumpage value is an important factor in forest management as it provides a source of motivation to the landowner. The money received provides the resources to hire workers and perform various silvicultural practices. It also provides money to pay property taxes, purchase equipment to perform various other land management functions, and meet other financial needs. It is also an investment opportunity to increase individual wealth. Therefore, improved stumpage value provides incentives to improve hardwood forest management.

Many factors affect stumpage value, such as timber size and quality, ability to access with logging equipment, distance to mill, etc. Improved landowner access to market price information for hardwood timber may increase the cash value of a landowner's standing hardwood. Many small landowners perform very few timber sales so their inexperience may place them at a disadvantage for getting the best sale prices. While this may improve the welfare of the timber buyer, it hurts the welfare of the landowner, and the benefits and motivations to manage a forest for timber products are diminished.

Researchers try to determine whether or not prices match publicly available information for timber. By doing this they can determine if the markets are efficient (Fama 1970). In theory, timber markets could fail if they are inefficient (Klemperer 1996). The existence of informational inefficiency in stumpage markets has been debated in the literature (Washburn and Binkley 1990, Hultkrantz 1993, Yin and Newman 1996). However, it is still widely accepted that small landowners need improved access to timber market information to optimize sale values.

Market price information for hardwood stumpage is readily available for Florida landowners. Sources that are free include but are not limited to local county extension agents, county foresters, and quarterly Timber Mart-South reports that are summarized in the Florida

Forest Steward newsletter. However, these sources may have only generalized information that does not account for other factors (i.e. distance to mill, site conditions, etc.) that can strongly influence sale prices. Other sources that are available (e.g. forestry consultants and timber market price reporting companies like F2M and Timber-Mart South) may have an associated cost. Even with these available resources, few landowners seek market information or management advice (Rosen 1989, Butler and Leatherberry 2004).

Research suggests landowner access to market price information may affect stumpage price. In Ohio, stumpage prices for hardwood sawtimber did not decrease as much as lumber prices during severe recession due to price expectations of landowners (Luppold et. al. 1998). Forestry consultants brought higher bid prices to timber sales in North Carolina and Florida than were received without consultant assistance (Hubbard and Abt 1989, Munn and Rucker 1994). Therefore, more widely disseminated timber market price information may increase stumpage price for the private landowner.

Landowners and Hardwood Management

In Florida the non-industrial private forest (NIPF) landowner is the largest single class of landowner (Brown 1996). NIPF landowners hold 1.5 million acres of upland hardwood forest and 0.8 million acres of oak-pine forest (Thompson 1999). Therefore, the management of 2.2 million acres of hardwood forest is dependent on the decisions of private forest landowners.

The viewpoint of the landowner may also have a major impact on the decision to manage hardwoods. Many landowners in Florida have the pre-conceived notion that hardwoods are an impediment to pine production and offer little or no cash value. Others may feel that hardwoods provide such aesthetic beauty and benefits to wildlife that they would never dream of cutting them down even if the monetary rewards are large. The spectrum of attitude, perception, and emotion represents a challenge to improving hardwood timber management in Florida.

Hardwoods are often viewed as a problem for many forest landowners in Florida. In the past, pine received considerably higher stumpage price than hardwood. Hardwood control in the past has been shown to increase pine production and financial returns (Williston 1987). Some hardwoods, such as water oak (*Quercus nigra*) are alternate hosts for fusiform rust disease in pines (Hollis and Schmidt 1977). For these reasons, hardwoods are often perceived as undesirable and management efforts focus on reducing their abundance. Allowing hardwoods to grow near or in pine plantations could be reconsidered since the price margin between hardwood and pine has narrowed considerably in recent years, at least for pulpwood and OSB logs.

Landowners may benefit from increased information about management practices that can increase the value of hardwoods. In the south central United States it has been shown that naturally regenerating mixed loblolly pine-hardwood stands is a sound financial investment (Ruanikar et. al. 2000). Three low cost methods of regenerating pine-hardwood stands in southern Alabama were shown to be effective (Jones et. al. 2000). The methods included seedtree, clearcut-and-plant, and fell-burn-and-plant, and were applied to mature mixed loblolly pine (*Pinus taeda*) –upland hardwood stands. Results of these and similar studies can be disseminated to help landowners manage for hardwoods in ways that increase their value and total stand value.

Other than effects on pine growth, hardwoods are often thought to impact land value positively. Timber products, non-market timber products, recreation, and other land uses may have cash values tied to the hardwood resource. Additionally non-cash value may be added by the landowner because of aesthetics, wildlife benefits, and enjoyment of the land.

Since hardwoods have not traditionally been grown for profit in Florida the literature regarding hardwood management is limited. Landowners need information regarding specific

management practices for Florida that will maximize their profit from growing hardwoods. Similar information is available for the South but its applicability to Florida is limited (Hicks, et. al. 2004; Moorhead and Coder 1994).

Conclusion

Predicted increases in population and decreases in supply signal the need for improved hardwood management in Florida. The key to improved hardwood management lies with the NIPF landowners because they hold 2.2 million acres of hardwood forest types. Improved stumpage price is a keystone to providing the motivation and resources for improvement of their hardwood forest. It is hypothesized that increased stumpage price could be achieved through improved market price information. Even so, pre-conceived notions and lack of knowledge about hardwood forestry may impede their decisions to actively manage the hardwood resource in Florida. Therefore, the goal of improving the hardwood resource in Florida is likely to be disregarded by many landowners.

However, improvement of hardwood forestry in Florida is a goal of great importance with need for much information and research. Landowners need information on forest type and silviculture which is explored in Chapter 2. Hardwood market potential is largely unknown and publicly available data is examined in Chapter 3. Landowner interests and potential for improving hardwood management are researched in Chapter 4 through data from a mail-out survey. Also, hardwood field trials are needed for future research and chapter 5 presents preliminary data from an establishment trial at Austin Cary Memorial Forest. This collection of information and research will show areas of potential improvement for hardwood forestry in the state of Florida.

CHAPTER 2
FLORIDA'S HARDWOOD FORESTS

Florida's climate and environment supports a diverse array of hardwood species that have the potential to serve as a valuable resource for both wildlife and timber (Table 2-1). Hardwood forestry is often overlooked as pine silvicultural systems take precedence. Even so, Florida has many types of hardwood forest stands that would benefit from silvicultural practices.

Florida's Hardwood Forest Types

Florida hardwood forest stands are often described by the terms xeric, mesic, and hydric in reference to their soil water conditions of dry, moderate, and wet, respectively. The composition of the dominant tree species changes along the soil water gradient because flooding, drought, and nutrient availability limit the respective sites to trees adapted to those conditions. Geographic location is also important, though differences are more subtle. Species composition changes are observed with latitude, proximity to the coast, and from east to west across the northern portion of the state. Variations in both geographical location and soil water conditions are important considerations for accomplishing hardwood forestry practices.

Most xeric sites are dry because they are well drained with deep sands allowing rainfall to rapidly percolate below the root zone. They are typically dominated by longleaf pine (*Pinus palustris*) and turkey oak (*Quercus laevis*) when maintained by prescribed fire. In the absence of fire, hardwoods become dominant through the process of succession. Important hardwood species include pignut and mockernut hickory (*Carya glabra* and *tomentosa*), southern magnolia (*Magnolia grandiflora*), southern red oak (*Quercus falcata*), *redbay* (*Persea borbonia*), and black cherry (*Prunus serotina*). The infertility of xeric sites offers limited potential for intensive hardwood management (McEvoy 1995).

Mesic forest soils are moist, fertile, and biologically diverse (Monk 1965). Often they are transitional areas between xeric and hydric stands. They may be considered hammocks, uplands, or flatwoods. Important timber species are not limited to but include basswood (*Tilia americana*), southern magnolia, American beech (*Fagus grandifolia*), white oak (*Quercus alba*), pignut hickory, and sweetgum (*Liquidambar styraciflua*). Mesic forests offer much potential for management because the relatively fertile soils support a variety of hardwoods as well as harvesting equipment.

Hydric stands are flooded for at least part of the year. In Florida they may be considered bottomland hardwood forests, hydric hammocks, bay swamps, and cypress swamps. They are not well drained and are usually in low topographic position. These forests cover the flood plains around Florida's numerous streams, ponds, lakes, and rivers as well as depressions in pine dominated flatwood forests. These hardwood forests support valuable timber species such as cypress (*Taxodium* sp.), sweetgum, tupelo (*Nyssa* sp.), red maple (*Acer rubrum*), swamp chestnut oak (*Quercus michauxii*), and other oaks. However, management may be difficult because soil conditions may limit access by harvesting equipment and environmental regulations may restrict activities on certain sites (FDACS 2003). These forests are also very important to wildlife (Harris 1984).

The terms described above are best for delineating the type of hardwood stand for timber management. These types occur across the entire state of Florida. However, there are variations in dominant tree species and vegetation, which are important for wildlife conservation, ecological diversity and ecosystem management (Myers 1990, Odum, et. al. 1998, Monk 1965, FNAI 1990). Many hardwood forestry practitioners will want to take advantage of these associated non-timber values. Since soil-water conditions define the dominant tree species and

therefore stand boundaries, xeric, mesic, and hydric are appropriate descriptions for silvicultural prescriptions.

Hardwood Silviculture

Hardwoods, in general, are not emphasized in silvicultural practices in Florida. Pines are preferred for planting and harvesting for economic return. Meanwhile, hardwoods are harvested as by-products of pine production or eliminated to make improvements in health and production of pine forests. Generally, pine trees in plantations grow fast and straight, whereas hardwoods in natural stands grow slow and are poorly formed (there are, of course, exceptions to this rule). Because of this, hardwood receives little emphasis in many Florida forestry operations.

With proper emphasis, hardwood timber value may be increased through silvicultural practices. These practices improve the quantity, quality and ultimately the financial value of the timber (Jones, et. al. 2000; Ruanikar, et. al. 2000; Mercker, et. al. 2003; and Hicks, et. al. 2004). Some silvicultural practices common to pine plantations include fertilization, thinning, mechanical removal of weed competition, and tree planting. Similar practices could be performed for hardwood management. However, hardwood silviculture can also be substantially different from pine silviculture.

Cultural practices need to be tailored to the hardwood situation by the landowner. Since their experience with southern pines may not equate closely to knowing how to grow hardwoods (Schuler and Robison 2004, Hansbrough 1970) landowner attempts to favor hardwoods may face difficulty. Hardwoods have different requirements and often multiple species are managed on the same site.

A key advantage to hardwood silviculture is the ability to regenerate by coppice. This eliminates the need and expense for site prep and re-planting that is necessary in most pine silviculture systems. However, if planting is necessary to initially establish a hardwood forest,

there are barriers to consider. First, the cost of bareroot seedlings is considerably higher at approximately 25¢ each versus about 7.5¢ each for pine. Also, the leaves of many hardwoods provide tender forage for whitetail deer (*Odocoileus virginianus*). Seedling establishment may require additional planting and deer exclusion devices in areas of high deer population.

Especially when establishing hardwoods on sites that previously had pine, soil conditions should be examined through soil lab analysis. Nutrients and pH are important concerns when making soil amendment decisions (Kidder 1989). For example, on old pine sites the soil is often more acidic than optimum for hardwood growth. This may necessitate liming the soil. Even though hardwoods will survive on a wide range of pH levels growth may be limited without correct soil conditions.

Growth may also be constrained by competing vegetation. Control may be necessary when establishing a stand, but herbicides are often non-selective and kill most broadleaf vegetation including hardwoods. However, if planting hardwoods, herbicides could be used prior to planting (Schuler, et. al. 2004). Mechanical control such as mowing or bedding is also an option. Manual pre-commercial thinning may also be applied by landowners (Mercker 2003).

Shade tolerance of individual species is important to consider in hardwood regeneration. Single tree and group selection systems require shade tolerant species. Even though it is reported that none of the commercially viable shade tolerant hardwoods provide management opportunities in the South (Hicks, et. al. 2004), species like maple and basswood may do well with group selection, especially in developing good form. Further research in this area is needed.

Proper timber stand improvement (TSI) and thinning in hardwood stands is integral to quality hardwood management. It is often thought that the best TSI for Florida's hardwoods is to

clearcut. This may be true in stands that have been high graded in order to get high quality hardwoods growing. A TSI plan that leaves the best trees until final harvest is the best way to produce high quality logs and leave good genetic stock for continued production of high quality hardwood timber.

Conclusion

The potential for hardwood forestry in Florida is great. Hardwoods occur on a variety of sites from wet to dry across Florida and they are important to wildlife. However, silvicultural principles and practices need to be adjusted to achieve good quality and growth of timber species. Since pine silvicultural practices are widely known and performed, landowners and foresters alike must be wary of trying to apply the same cultural techniques to hardwoods. Regeneration methods, soil nutrient management, competition control, and TSI must be evaluated and applied to hardwood management. Knowing just how to grow pines may be an impediment to desirable growth and quality of Florida's hardwood timber, but their importance to wildlife may provide landowners with enough motivation to manage their hardwoods.

Table 2-1. Florida hardwood species with potential commercial value.

Common Name	Genus	Species	Forest Type *	Industrial products and uses**
Red Maple	*Acer*	*rubrum*	HH, BH, SH	Pulpwood, composite, lumber
River Birch	*Betula*	*nigra*	BH	Inexpensive furniture, pulpwood
Pignut Hickory	*Carya*	*glabra*	MU, MM, XU	Fuelwood , lumber, pulpwood, charcoal, and other fuelwood products. veneer, tool handles, furniture, and pallets
Mockernut Hickory	*Carya*	*tomentosa*	MU, MM	Fuelwood, lumber, pulpwood, charcoal, and other fuelwood products. veneer, tool handles, furniture, pallets, blocks, a preferred wood for smoking meats
Persimmon	*Diospyros*	*virginiana*	XU	Turnery, plane stocks, shuttles, medicine from the inner bark and unripe fruit, permanent ink from fruit
American Beech	*Fagus*	*grandifolia*	BH, MU, MM	Flooring, furniture, turned products and novelties, veneer, plywood, railroad ties, pulpwood, charcoal, and lumber
White Ash	*Fraxinus*	*americana*	MU	Handles, oars, lumber and baseball bats
Black Walnut	*Juglans*	*nigra*	MU	Solid furniture and gunstocks, veneer, nuts for food
Sweetgum	*Liquidambar*	*styraciflua*	HH, BH, MU	Lumber, veneer, plywood, railroad ties, fuel, and pulpwood
Yellow Poplar	*Liriodendron*	*tulipifera*	MU	Lumber for furniture parts, pulpwood, and tuliptree honey.
Southern Magnolia	*Magnolia*	*grandiflora*	HH, MU, MM	Furniture, pallets, and veneer.
Water Tupelo	*Nyssa*	*aquatica*	BH	Boxes, pallets, crates, baskets, furniture, pulpwood, and corks (from roots).
Blackgum	*Nyssa*	*sylvatica var. sylvatica*	BH	Plywood and veneer, boxboards, crossties, pulpwood.
Swamp Tupelo	*Nyssa*	*sylvatica var. biflora*	BH	Tupelo honey, lumber
Sycamore	*Platanus*	*occidentalis*	BH	Boxes, crates, butcher's blocks, pulp
Black Cherry	*Prunus*	*serotina*	MU, XU	Veneer and lumber; jelly and wine are made from the fruit.
White Oak	*Quercus*	*alba*	MU, MM	Lumber
So. Red Oak	*Quercus*	*falcata var. falcata*	MM	General construction, furniture, flooring, lumber, fuel, flooring.
Cherrybark Oak	*Quercus*	*falcata var. pagodaefolia*	MM	Furniture and interior finish (larger and better formed than southern red oak).
Swamp Chestnut Oak	*Quercus*	*michauxii*	BH	Lumber in all kinds of construction, fence posts, and fuel.
Laurel Oak	*Quercus*	*laurifolia*	MU, MH, MM, XU	Fuelwood, blocks
Live oak	*Quercus*	*virginiana*	MH, MM, XU	Fuelwood

* HH- hydric hammock, BH- bottomland hardwood, SH- swamp hardwood, MU- mesic upland, MH, mesic hammock, MM- mesic mixed, XU- xeric upland
** Sources: Harrar, E.S., and J.G. Harrar. 1964. Guide to Southern Trees. Dover Publications, Inc., New York, NY. 709p. Harlow, W.M., E.S. Harrar, J.W. Hardin, and F.M. White. 1991. Textbook of Dendrology. McGraw-Hill Publishers, New York, NY. 501p.

CHAPTER 3
MARKET ASSESSMENT OF FLORIDA'S HARDWOODS

Florida's hardwood species provide a variety of goods and services depending on their market use. Hardwood markets are classified into four categories: timber products, non-timber products, recreation, and environmental services (Table 3-1). Because they are tangible, timber and non-timber products are easier to track and value than recreation and environmental services, which are less tangible and therefore not easily valued. The true value of a hardwood forest may be hard to assess, but timber value is its foundation.

Hardwood timber values are realized at harvest, when trees are cut into logs, and sold to a mill for further processing. The quality of logs produced by the tree is important in determining the mill product and ultimately the stumpage value. Logs that are utilized for pulp and paper or Oriented Strand Board (OSB) are generally low value. They are chipped as an early step in processing, so defects, small size, and poor form in the log are not very important. The higher value logs used for lumber and veneer are sawn or peeled, respectively. The process of sawing boards or peeling thin sheets requires straight logs with few defects and thus these qualities increase the value of hardwood logs.

But even standing, down, and decaying hardwoods have a value. They are all used for non-timber products and environmental services. The value of these trees may be difficult to assess depending on whether or not fees are collected. Hunting leases are an example of a non-timber hardwood product where hardwoods may influence monetary value because they provide food and shelter for many game species. Wildlife viewing and hiking have certain intrinsic values that are not monetary and may be difficult to assess if no access fees are collected. Mushrooms are another example of a non-timber product where hardwoods are needed for shade and decay. However, markets for these products are small and not available in any public data.

Much data is made available by U.S. government agencies to assess hardwood markets in Florida. The USDA Forest Service through its Forest Inventory and Analysis (FIA) program reports forest inventory and timber products output (TPO) on the world wide web. Data is collected by many individuals across the United States and reveals how much wood supply is standing in the forest and how much volume is used by industry. Industrial trends can also be examined from data published by the U.S. Economic Census. The following analysis of these data reveals the potential for hardwood forestry in Florida.

Hardwood Usage for Timber Products

The volume of wood harvested for timber products in Florida is categorized into product uses for: saw logs, pulpwood, veneer logs, composite panels, other industrial products, and by-products. These data provide valuable insight into wood-use trends and they can be analyzed separately for softwoods and hardwoods. The most recent data for Florida is from 2005.

In 2005, Florida produced 28.3 million ft^3 of hardwoods. This is a 50% decline in production from 1999 to 2005 (Figure 3-1). This trend is tied to declines in pulpwood production and masks trends that occurred with other products. Hardwood pulpwood accounts for 20 to 40 million cubic feet annually making it the largest single industrial use of hardwood in the state.

With the massive pulpwood volume excluded, trends in small-volume products are revealed (Figure 3-2). Composite panels increased dramatically after 1995, but fell off equally as much by 2005. Saw and veneer log production changed little from 1993 to 2005, with annual production about 4.5 and 1.5 million ft^3, respectively. Other industrial products remained steady, but below 1 million ft^3. These other products (composite, saw log, veneer log, and other industrial) totaled 8.2 million ft^3, 29% of the total hardwood production.

Total hardwood volume illustrates the substantial size of the hardwood market, while the product class breakdown reveals that most is for low quality use in large volume by pulp and paper mills. This was the largest sector of the market, and it declined between 1999 and 2005. However, smaller markets that use high quality logs, e.g. saw and veneer logs, still used significant volumes of hardwood timber and their production remained steady.

Standing Volume of Hardwoods

Hardwoods have sustained significant volume, growth rate, and acreage in Florida. According to FIA data, 2006, hardwoods accounted for 5.7 billion ft^3 of standing timber, occupied 6.7 million acres, and their growth rates exceeded harvest by 111 million ft^3 (USFS 2008). These data show Florida ably sustained hardwood timber growth.

However, sustainability is in question. Harvests are expected to exceed growth by 2025 (Prestemon and Abt 2002). This is evident in a historical graph of growing stock volume (Figure 3-3). From 1953 to 1997 volume increased at a decreasing rate and may have reached a peak. Decreased volumes would indicate a disappearing hardwood forest. This would be a loss to both industry and society because of the expansive acreage devoted to hardwood forest types (Table 3-2). Significant forest types include 1.8 million acres of mixed upland hardwoods, 1.1 million acres of baldcypress/swamp tupelo, and 1.5 million acres of sweetbay/swamp tupelo/red maple, across both private and public ownerships.

Forest type gives information about harvestability through inference about the wetness or dryness of their soils. Wet sites are potentially difficult to harvest because equipment may get stuck or create ruts. From this inference 2.6 million acres (baldcypress/swamp tupelo and sweetbay/swamp tupelo/red maple forest types) may have limited access by tree harvest equipment.

If the land is dry and accessible by harvesting equipment it may be on the unproductive sandhills. In fact, Florida land in low productivity classes is seemingly reserved for hardwoods (Figure 3-4). In the lowest forestland productivity class (20-49 ft^3/ac/yr) hardwood exceeds pine by 1 million acres. Pine outnumbers hardwood in all other productivity classes.

High-value hardwoods often require highly productive sites for good growth but will survive on a variety of soil conditions. These species, such as ash, sweetgum, yellow-poplar, black cherry, and white and red oaks, do well on rich soils. These species also had noteworthy standing volumes in Florida (Figure 3-5). However, the species most prevalent in Florida are tupelo, black gum, and oaks which make up 56% of the total volume (Figure 3-6). Even though the high-value species are small in volume, relative to the total, these data suggest that high-value hardwoods are adapted to Florida's timberlands.

One important factor influencing high-value hardwoods is bole quality, which is partially a function of diameter at breast height, DBH. According to FIA data, most of the standing volume of hardwoods is in 7.0 to 14.9 inches DBH trees (Figure 3-7). These tree sizes are large enough to use for pulpwood or saw logs but other measures of log quality are not included in the data and thus the potential to be saw timber is unknown. In summary, the FIA data do not provide a good indication of product class they only infer that much of the volume of hardwoods is large enough to be used by some sector of the wood products industry.

Industry Trends for Hardwoods

The U.S. economic census publishes industrial production data every five years. Industries are categorized according to a hierarchical code, called the North American Industry Classification System (NAICS). Data is published for geographical areas, including counties metropolitan areas, and states. Data on the value of shipments and the number of firms for select hardwood using industries are provided in Table 3-3. The values are adjusted for inflation and

are not necessarily the value of hardwood products because pine is also used by many of these industries.

The value of shipments decreased in all categories from 1997 to 2002. The number of firms also decreased slightly, except pulp, paper and paperboard mills, and hardwood veneer and plywood which increased by 60 and 33 percent, respectively. From these data the hardwood using industry generally decreased in value from 1997 to 2002.

Also in a similar timeframe a downward trend is observed in the interstate commerce of Florida hardwood. Total importation and exportation of hardwood roundwood went down by 22% and 40%, respectively. However, the large volume of pulpwood overshadows the smaller volumes of saw logs and veneer logs, which increased in the same time period (Table 3-4).

Market Prices

Timber sale dynamics have important effects on stumpage and market prices. Hardwood roundwood will generally go through two transactions before being processed. First, the landowner sells his timber to a wood buyer for a 'stumpage' price. Gate, mill, or delivered prices are paid to the logger or timber broker when logs arrive at the mill. The mill then processes the timber and sells its product for profit. Some products are finished at the mill, while others may be sold to other mills for further processing. The ultimate driver of stumpage price may be demand for the finished product, but harvesting and transport costs are included, and the dynamics of all these are important to determining price in a hardwood market.

The stumpage prices when adjusted for inflation reveal that outside of the cyclical up and down trends hardwood remained almost constant. Trend lines for oak sawtimber prices show slightly increased value between 1994 and 2007 (Figure 3-8). Hardwood pulpwood stumpage value had a flat trend line. The trend line for mixed hardwood sawtimber stumpage prices slightly decreased during the same time period.

Market Potential

The hardwood market in Florida is small, but has potential to improve in volume and value. Low value, low quality trees are easily marketed through pulp and paper and OSB industries. Pricing is favorable since oak saw timber and pulpwood stumpage value stayed ahead of inflation from 1993 to 2005. Even with favorable stumpage price trends, the hardwood land base may present a challenge to management and harvesting activities. Much of 6.7 million acres of hardwoods and 5.7 billion ft^3 of inventory is located on sites with low productivity and/or poor conditions for conducting forest operations. However, large diameter and high value species on the mesic and bottomland sites show promise. High value species exist in noteworthy volumes. Most of the volume is in trees with DBH 7.0 to 14.9 inches. Improvement of log quality through management practices with current standing trees may be a key to maximizing hardwood forest potential. By marketing low value hardwoods when thinning as part of a management plan aimed toward producing high quality, high value saw logs landowners could unlock this potential. Thus, hardwood forestry in Florida can be supported through timber markets.

Table 3-1. Traditional and non-traditional hardwood forest products and services.

Timber	Non-timber	Recreation	Environmental
Pulp/paper	Mushrooms	Hunting	Mine site reclamation
OSB	Earthworms	Wildlife viewing	Riparian buffer
Plywood	Honey	Hiking	Water supply catchment
Firewood	Crafts	Camping	Nutrient cycling
Crates	Fruits/nuts		Gas exchange
Lumber	Extractives		Pollution abatement
Poles/posts			Carbon sequestration
Veneer			Wildlife habitat
Logging Mats			
Biomass			

Table 3-2. Area of timberland by forest type, Florida, 2006

Forest Type	Acres
Other tropical (989)	258
Eastern redcedar (181)	1,882
Yellow-poplar (511)	5,483
Cottonwood / willow (709)	5,615
Spruce pine (168)	7,487
Swamp chestnut oak / cherrybark oak (601)	7,487
River birch / sycamore (702)	9,488
Cherry / ash / yellow-poplar (803)	10,172
Overcup oak / water hickory (605)	10,309
Sycamore / pecan / American elm (705)	12,706
Yellow-poplar / white oak / northern red oak (506)	13,102
Sugarberry / hackberry / elm / green ash (706)	14,370
Hard maple / basswood (805)	15,109
Eastern redcedar / hardwood (402)	15,566
Eucalyptus (993)	22,766
Shortleaf pine (162)	24,808
Mangrove (982)	26,606
Atlantic white-cedar (606)	26,777
Red maple / lowland (708)	29,131
White oak / red oak / hickory (503)	29,456
Red maple / oak (519)	32,847
Willow (704)	38,394
Post oak / blackjack oak (501)	48,703
Sassafras / persimmon (507)	61,329
Melaluca (992)	67,222
Pond pine (166)	94,528
Sweetgum / yellow-poplar (508)	102,424
Other pine / hardwood (409)	127,122
Loblolly pine / hardwood (406)	275,336
Longleaf pine / oak (403)	336,930
Sable palm (981)	444,444
Sand pine (164)	545,879
Nonstocked (999)	563,461
Sweetgum / Nuttall oak / willow oak (602)	587,538
Slash pine / hardwood (407)	751,684
Southern scrub oak (514)	797,725
Longleaf pine (141)	817,807
Loblolly pine (161)	875,781
Baldcypress / swamp tupelo (607)	1,086,576
Sweetbay / swamp tupelo / red maple (608)	1,497,433
Mixed upland hardwoods (520)	1,765,375
Slash pine (142)	4,750,749
Total pine-hardwood forest types	1,491,072
Total Hardwood forest types	6,742,068
Total Forest	15,957,866

Source: USDA Forest Service, Forest Inventory and Analysis (FIA) National Program, via Forest Inventory Data Online (FIDO II, ver: 0.3.0r1) available at http://fia.fs.fed.us last accessed on April 24, 2008.

Table 3-3. Value of shipments of selected hardwood using industries in Florida by North American Industry Classification, 1997 and 2002, constant dollars, Gross Domestic Product Implicit Price Deflator, 2000 = 100.

		Value of Shipments (million $)			Number of Firms		
NAICS Code	Industry	1997	2002	% change	1997	2002	% change
322	Paper mfg	3989	3344	-16	166	163	-2
3221	Pulp, paper, and paperboard mills	2519	1979	-21	10	16	60
321	Wood product mfg	2368	2288	-3	524	528	1
32113	Sawmills	424	327	-23	53	44	-17
321211	Hardwood veneer and plywood	-	42	-	9	12	33
32192	Pallets	121	95	-21	61	59	-3

Source: U.S. Census Bureau. 2005. Florida: 2002 Economic Census, Manufacturing. Geographic Area Series.

Table 3-4. Imports and exports of hardwoods between Florida and other U.S. states, thousand cubic feet.

	Imports			**Exports**		
Product	1999	2003	% change	1999	2003	% change
Sawlogs	566	147	-74	272	689	153
Veneer logs	0	0	N/A	321	606	89
Pulpwood	25398	21544	-15	10256	4505	-56
Composite Panels	0	0	N/A	7380	6400	-13
Other Industrial	0	0	N/A	0	0	N/A
Total	27963	21691	-22	20228	12200	-40

Source: Bentley, J.W., M. Howell, and T.G. Johnson. 2006. Florida's timber industry- an assessment of timber market product output and use, 2003. USDA For. Serv. Res. Bull. SRS-110. 40p.

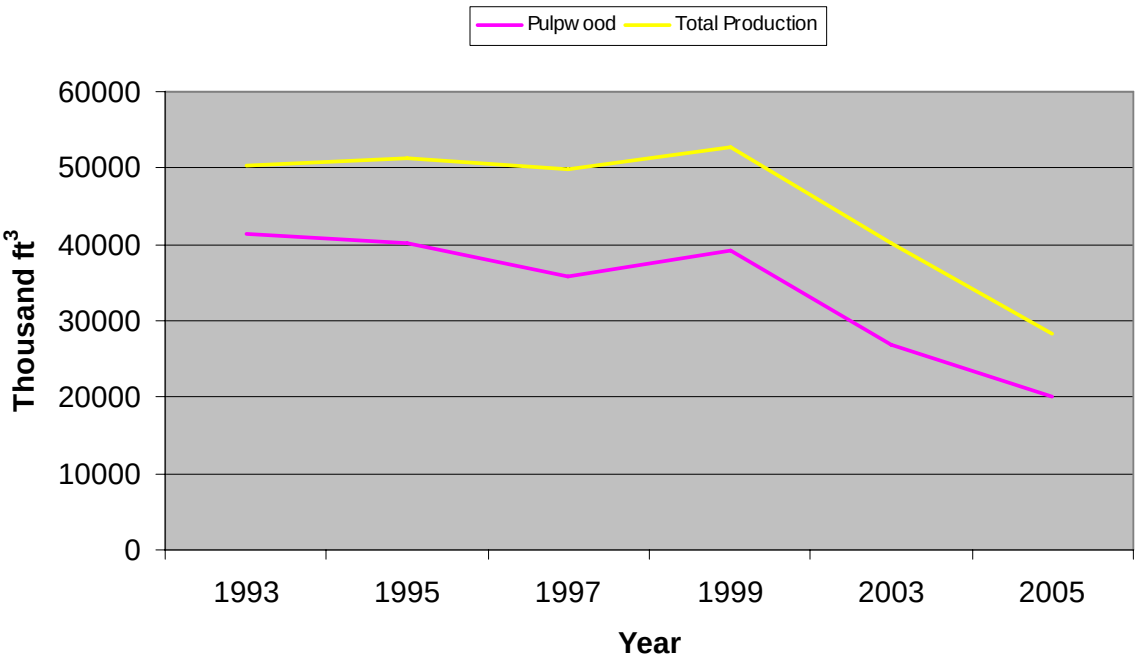


Figure 3-1. Hardwood pulpwood and total hardwood roundwood production, Florida, 1993-2005. Source: Forest Inventory and Analysis, Southern Research Station, USDA Forest Service, http://srsfia2.fs.fed.us/php/tpo2/tpo.php, last accessed May 5, 2008.

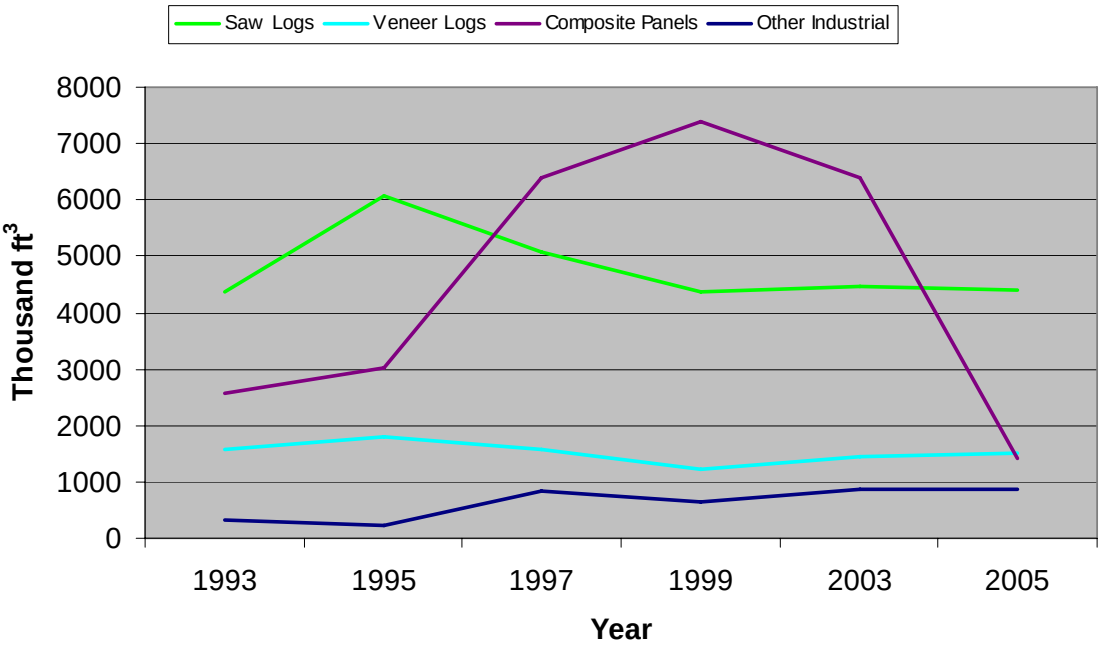


Figure 3-2. Hardwood production for saw logs, veneer logs, composite panels, and other industrial uses, Florida, 2005. Source: Forest Inventory and Analysis, Southern Research Station, USDA Forest Service, http://srsfia2.fs.fed.us/php/tpo2/tpo.php, last accessed May 5, 2008.

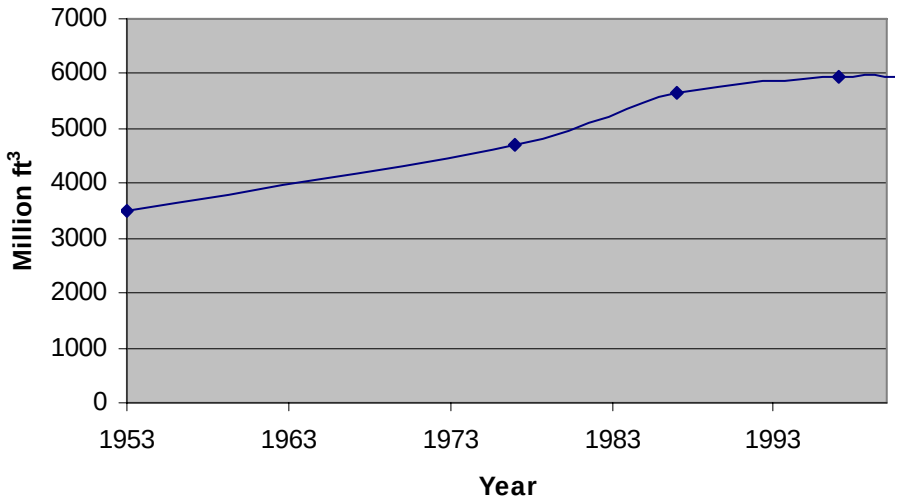


Figure 3-3. Net volume of hardwood growing stock, Florida, 1953, 1977, 1987, 1997 and 2002. Source: Smith, W.B., P.D. Miles, J.S. Vissage, and S.A. Pugh. 2004. Forest Resources of the United States, 2002. USDA For. Serv. Gen. Tech. Rep. NC-241. 137p.

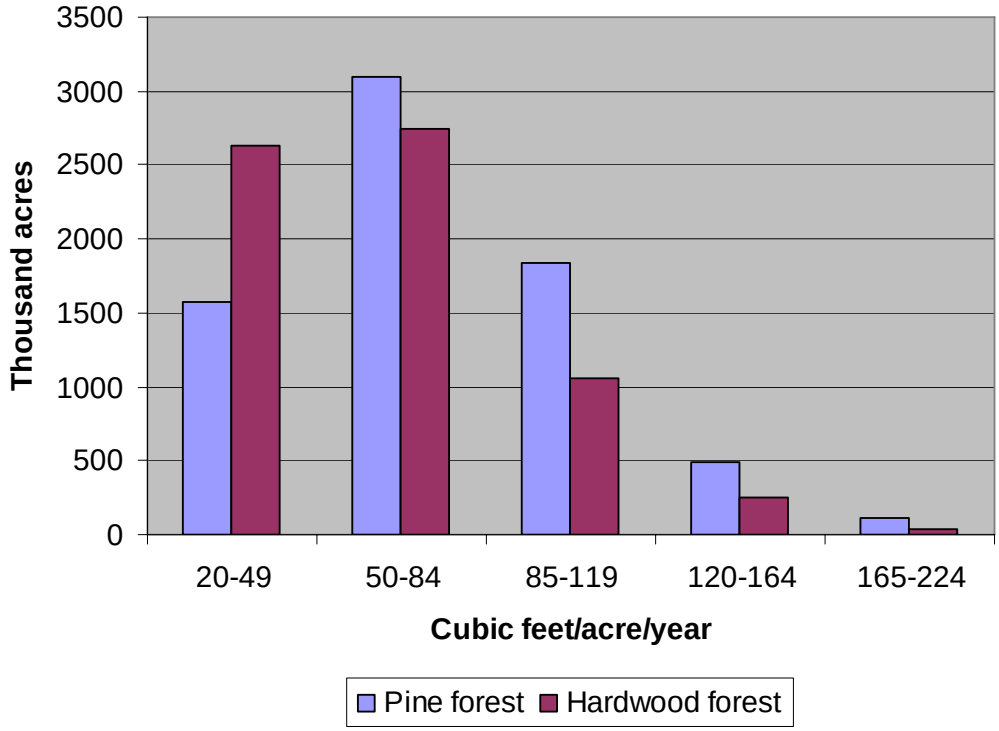


Figure 3-4. Area of timberland by forestland productivity class, pine and hardwood, Florida, 2006. Source: USDA Forest Service, Forest Inventory and Analysis (FIA) National Program, via Forest Inventory Data Online (FIDO II, ver: 0.3.0r1) available at http://fia.fs.fed.us last accessed on May 2, 2008.

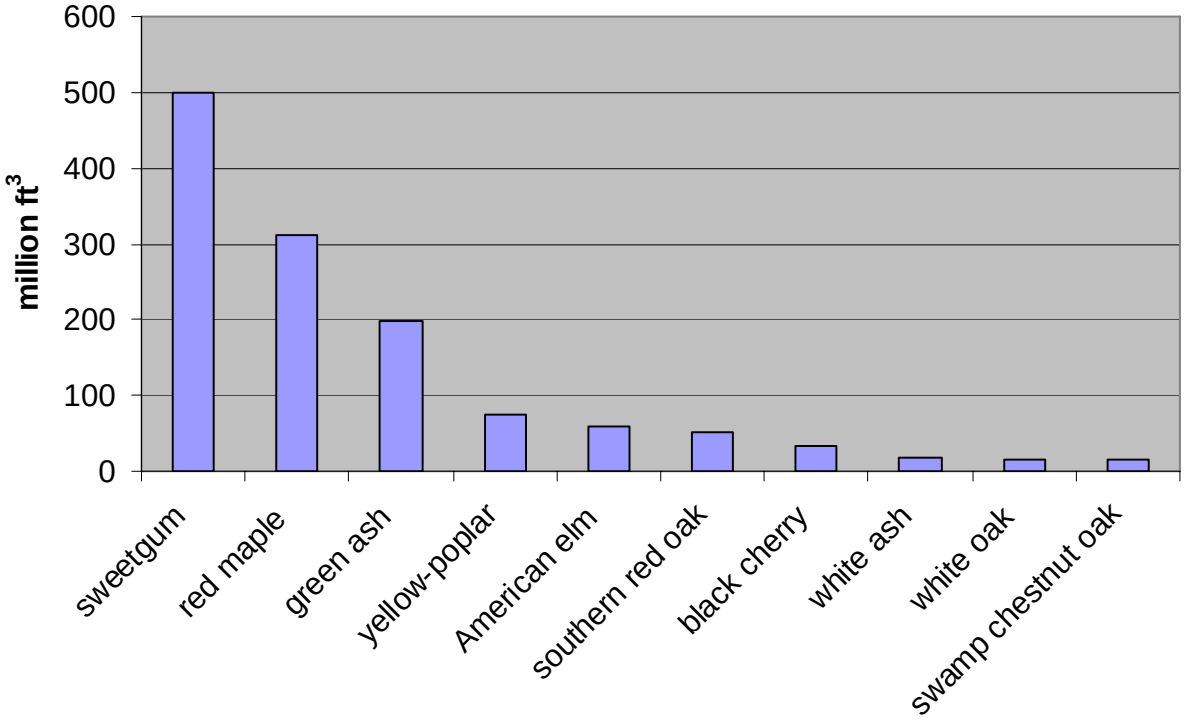


Figure 3-5. Net volume of potentially high-value hardwood species in Florida, 2006. Source: USDA Forest Service, Forest Inventory and Analysis (FIA) National Program, via Forest Inventory Data Online (FIDO II, ver: 0.3.0r1) available at http://fia.fs.fed.us last accessed on April 24, 2008.

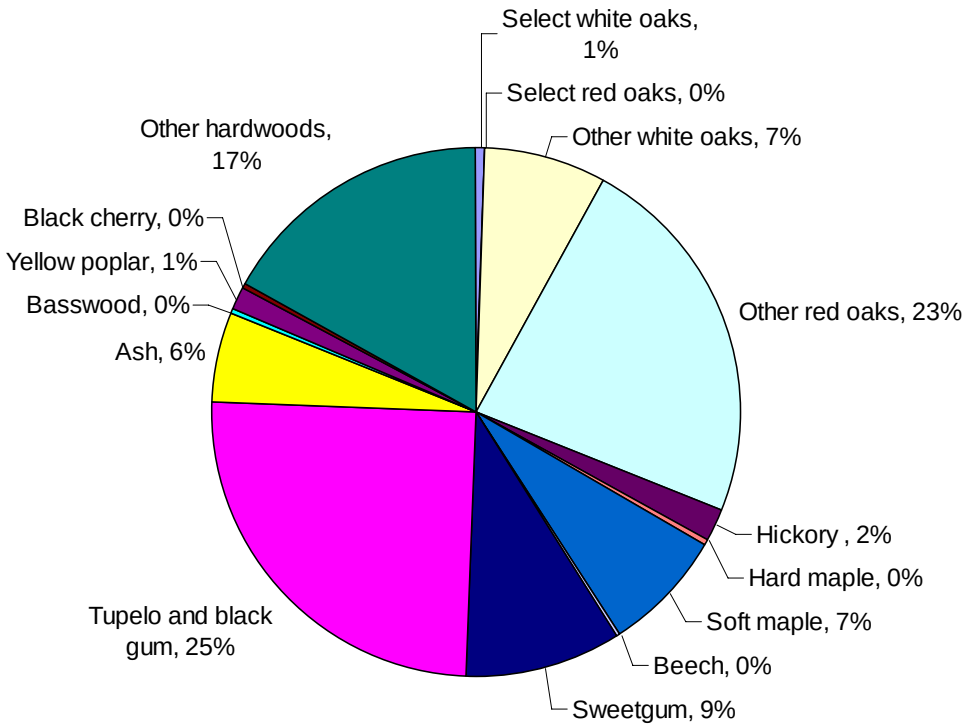


Figure 3-6. Percent net volume of hardwood growing stock by species, Florida. Source: Smith, W.B., P.D. Miles, J.S. Vissage, and S.A. Pugh. 2004. Forest Resources of the United States, 2002. USDA For. Serv. Gen. Tech. Rep. NC-241. 137p.

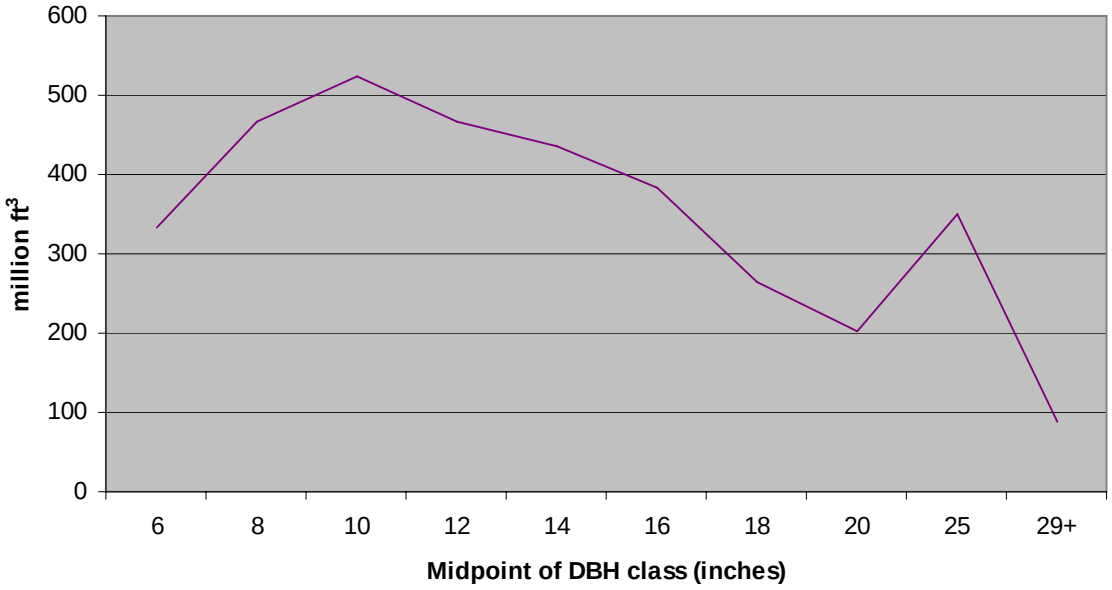


Figure 3-7. Diameter at breast height (DBH) size class distribution of hardwoods, Florida, 2006. Source: USDA Forest Service, Forest Inventory and Analysis (FIA) National Program, via Forest Inventory Data Online (FIDO II, ver: 0.3.0r1) available at http://fia.fs.fed.us last accessed on April 24, 2008.

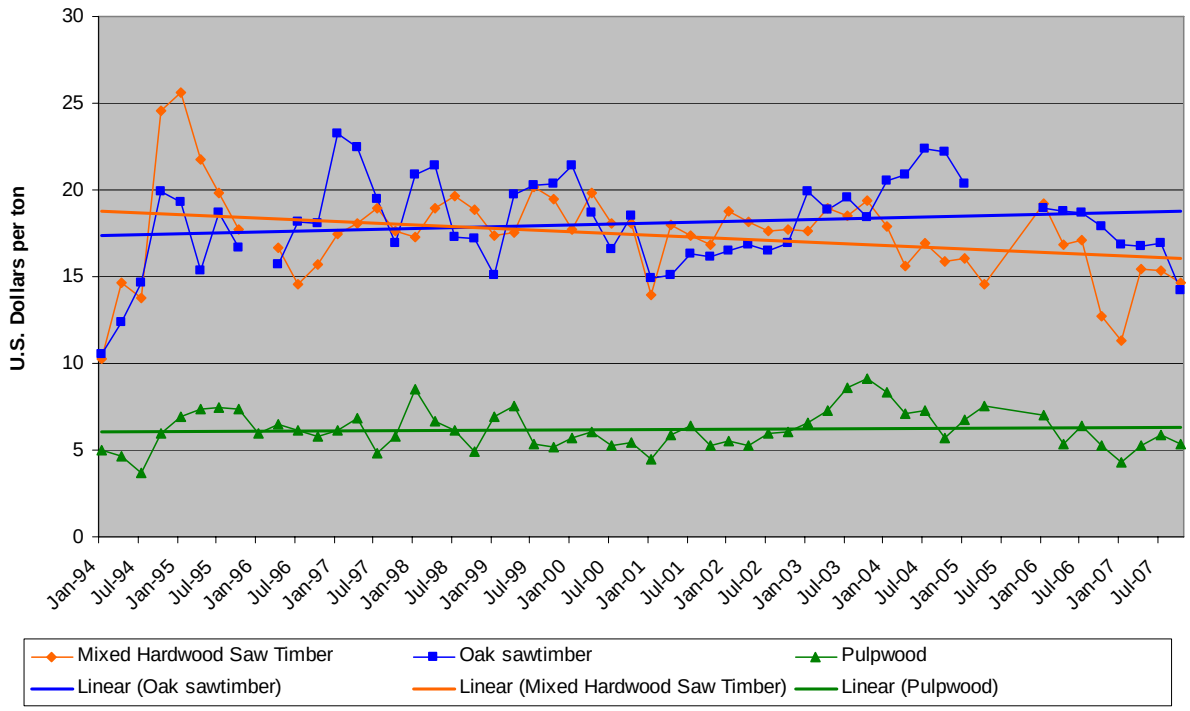


Figure 3-8. Average stumpage prices for mixed saw timber, oak saw timber and pulpwood, Florida, 1994 to 2007 constant dollars, Gross Domestic Product Implicit Price Deflator, 2007 = 100, linear trend line added by Microsoft Excel. Source: Baldwin S., and C. Melton. Timber Mart-South. 1990-2007. Tom Harris. Daniel B. Warnell School of Forest Resources. The University of Georgia: Athens Georgia.

CHAPTER 4
LANDOWNER SURVEY

Introduction

An information campaign could improve hardwood management in Florida. Such a campaign should aim to improve landowners' awareness of hardwood markets, teach silvicultural practices, and increase stumpage value. However, data are needed to assess current landowner knowledge and perceptions about hardwoods. A mail-out survey was developed to provide this information about landowners.

Objectives

The overall goal of our survey was to provide information that will paint a picture of current and future hardwood forestry practices in Florida. Prior to designing the survey four objectives were established:

1. determine the scope of hardwood management being practiced by private landowners,
2. determine if landowners access market information and if they know what forest products come from their hardwood timber,
3. determine if the hardwood stumpage price landowners receive is higher for landowners who obtain market price information than for those who do not, and
4. determine if any small non-timber markets are in existence or developing.

Further, the survey and subsequent analysis needed to answer the following key questions to meet our objectives:

- What management practices are currently being performed with regards to hardwoods?
- Do landowners know what products are produced from their hardwood logs?
- What stumpage price are landowners receiving or willing to receive for their hardwoods?
- Do landowners have access to market price information?
- At what price will landowners change from pine management to hardwood management?
- Are there any current or developing specialty markets for hardwoods?

- Can stumpage price be improved through increased access to market information?

These questions formed the basis of the survey content.

The survey questions and analysis focused on landowners' knowledge of the forest on their property. It asked about their knowledge of timber products and prices, as well as management and recreation activities that occur on their property. The results were used to describe a picture of hardwood forestry in Florida. Statistical analysis helped to form inferences about the relationship between market information and stumpage price as well as to test the hypothesis that landowners who obtain current market information receive higher stumpage prices than landowners who do not obtain market information. Finally the results are discussed to determine potential areas of improvement for Florida hardwood forestry.

Methods

Survey Research

A mail-out survey can be an effective and inexpensive method to determine landowner interests in hardwood management. Surveys have been performed to assess landowners' use of forestry services, hunting leases, and overall characteristics of forest landowners in the South (Measells et. al. 2005, Jones, et. al. 2001, Birch 1997). The Tailored Design Method (TDM) is a survey procedure to increase response rates, thus effectively obtaining data needed from landowners (Dillman 2000). Mail-out surveys are cheaper than telephone or personal interview survey methods because only the cost of designing, printing, and mailing the survey are involved. A properly designed and executed mail-out survey may be an effective and inexpensive way to assess the current state of knowledge, attitude, and perception of hardwood forests in Florida.

A mail-out survey has many advantages over other survey methods because they are low cost, can be collected on a large number of people over a wide geographic area, uniform because everyone receives the same questions in the same manner, and less intrusive as a face-to-face or telephone interview. Mail-out surveys also have the advantage of being able to control for the four types of error common to all survey methods. 1) Sampling error results from surveying a percentage of the population. 2) Coverage error results from using a sample from an incomplete list of the population. 3) Measurement error results from the respondent giving inaccurate answers. These types of error can be overcome to produce reliable data. Sampling error is the precision of the survey and is calculated as a confidence interval. A complete list is necessary to know the size of the population and calculate confidence intervals, or margin of error. Coverage error can be overcome with accurate lists of the population such as tax rolls. Mail-out surveys can overcome measurement error with proper wording and uniformity. 4) Non-response error is the result of failure to respond and is the biggest challenge in a mail-out survey.

Non response occurs in every survey and is particularly a challenge in a mail-out survey. In any survey, the reasons for non-response may be lack of interest in the study, mistrust in releasing personal information, forgetfulness, costs of participation greater than rewards, or misplacement of questionnaire in the home. The problem with non-response is that it invokes a bias on the results of the data analysis. Usually, the extent of non-response biases cannot be known since reliable data for non-respondents is lacking, unless a follow-up of non-respondents can entice them to respond. Non-respondents tend to be a select group. The best way to deal with non-response is to minimize it to the greatest extent possible. One such method is TDM (Dillman 2000).

A key feature of TDM surveys is "the development of survey procedures that create respondent trust and perceptions of increased rewards and reduced costs for being a respondent, that take into account features of the survey situation, and that have as their goal the overall reduction of survey error" (Dillman 2000). The TDM criteria, when properly utilized, result in high-quality and high-response surveys. Social exchange theory explains how and why TDM works.

Social exchange is a theory of human behavior used to explain human interaction. The theory says that actions of individuals are motivated by the return the action brings to the individual. The criteria used to explain social exchange are rewards, costs, and trust placed on the participant. Rewards are the return that the participant expects to receive. Costs are the time it takes to fill out the survey and put it in the mail. Trust is the expectation that long-term rewards outweigh the cost of filling out the survey and providing confidential information. The TDM method aims to provide rewards, reduce costs, and establish trust through a clearly articulated survey instrument that may be mailed multiple times to potential respondents. The two fundamental assumptions of a survey design based on TDM are response to a self-administered questionnaire involves not only cognition, but also motivation, and that multiple attempts are essential to achieving satisfactory response rates to self-administered surveys.

The mail-out survey satisfies the need to collect data from large groups over a wide geographic area in a cost effective manner. Properly done, the four types of survey error are reduced. The most challenging part, non-response bias, is at least partially overcome through Dillman's TDM.

Survey Selection Process

A survey was mailed to a random sample of 1999 forest landowners utilizing the Tailored Design Method (Dillman 2000). The landowners were selected from a mailing list of all North

Florida forest landowners provided by the Florida Department of Transportation (Figure 4-1). The list, after removing duplicates, contained 24,440 names and addresses. A random number was generated for each person on the list. The selections were made randomly with the random number function in Microsoft Excel computer program. The list was sorted from lowest to highest based on the random number. The first 1,999 people on the list were mailed surveys, representing approximately an 8% sample of the landowner population.

Each landowner received an introductory letter announcing the arrival of the survey in about a week. A week later they received the survey package which included a survey booklet (Appendix A) and a name and address card to be filled out so their name could be removed from our mailing list in the event of further attempts to collect data. A week after the survey was mailed a reminder post card was sent to thank those who had filled out the survey as well as to encourage those who had not yet responded. A total of 476 surveys were returned to give a response rate of 23.8%. All were analyzed regardless of whether they had been completed in full. Some surveys were returned undelivered due to insufficient mailing address.

Data Analysis

The information from each survey was entered into a worksheet in a Microsoft Excel database. The surveys were numbered so each would have a unique identifier. Most answers were categorical, so these answers were coded with a non-zero positive number. The handwritten comments were typed into the database.

The answers to each survey question were then copied into separate worksheets to allow data manipulation while preserving the integrity of the original dataset. The results are reported as a percent of the total respondents to each question. Some data were needed for further statistical analysis and hypothesis testing. These data were formatted for importation by the software program SAS 9.1.

SAS 9.1 was used to perform Fisher's exact test to determine if associations existed between stumpage price and market information. Even though sample size was small this test is valid since the exact distribution is calculated, rather than approximated which would require large sample sizes (Freeman and Halton 1951, Agresti 1990).

For these analyses, Fisher's exact test gives the p-value of the contingency table created from two survey questions (SAS Institute 2004). The p-value is the probability of obtaining the results randomly. A low p-value is a low probability and is significant because the event is not random.

Results

Demographics

The demographics collected in our survey are presented in Table 4-1. The average length of ownership was 24 years (n=432), and the average land holding was 265 acres (n=436). Most owners (61%) described their land ownership as family, 32% as sole proprietor, 3% as partnership, and no response came from Timber Management Investment Organizations (TIMOs) or timber companies (n=441). Timber income was minimal; 75% said that none of their income came from timber and only 2% derived more than 1/3 of their income from timber (n=436). The annual income of 64% of our respondents was above $55,000 (n=362). Most were male (77%), and most (70%) had received college training or above (n=463). The average size household was 2.4 persons (n=465). Most (88%) resided primarily in Florida (n=472). The average age was 61 (n=460). Few (17%) were members of a conservation organization (n=457).

Scope of Hardwood Management

Hardwood forests had a small but important component of the forest land covered by our survey (Figure 4-2). Planted pines occupied about 61% of the respondents' forested area. The three hardwood forest types combined made up about 29% of the area. However, a much higher

percentage of landowners (79%) indicated having an oak-pine forest type somewhere on their property (Table 4-2). The landowners who had hardwood hammock or hardwood swamp made up 42% and 39%, respectively, of the total who answered the question. Although hardwood forests may not be a dominant cover type in terms of acreage, most landowners had hardwood forests on their property.

The most identifiable hardwoods for landowners were sweetgum, white oaks, red oaks, and southern magnolia which were identified as being on the property of 56%, 51%, 47%, and 47%, respectively, of landowners (Figure 4-3). The least identifiable to landowners were basswood, elm, and black walnut at 3%, 6%, and 7%, respectively. High value hardwoods such as ash and yellow poplar tended not to be familiar to landowners, quite possibly because these hardwoods were not found on their property. These figures are also very similar to the percentage of the volume hardwood growing stock found in Florida presented in chapter 3 (Figure 3-6).

Primary purposes for owning forest land tended to be timber production and financial investment (Table 4-3). Timber production was listed as the primary purpose by 43% of landowners whereas financial investment accounted for 18%. However, only 14% had a written management plan for their forest (Table 4-4).

In terms of active management, pine certainly was favored over hardwoods (Table 4-5). In our survey, 94% of respondents indicated they performed at least one management activity aimed at improving pine. Hardwood was still receiving some attention, but only 46% of respondents reported at least one management activity for hardwoods (Table 4-5). The top activities being performed on or near hardwoods were thinning, harrowing or mowing. Even though pine received more attention for improvement, efforts to reduce hardwoods were minimal. Most landowners (79%) spent no money on hardwood reduction (Table 4-6).

However, 21% reported at least $1 per acre spent to control hardwoods (Table 4-6). Note that prescribed burning in pines is considered a method of hardwood control.

General hardwood management strategy was classified into one of three categories (Table 4-7). "Control hardwoods" indicated the landowner was trying to reduce or eliminate hardwood growth. "No management" indicates the landowner was not concerned with or doing anything with hardwoods. In the third category the landowner is doing very little about hardwoods but does want the added value of hardwoods. In our survey, most answers fell into either no management strategy (48%) or a passive strategy of allowing hardwoods to grow (41%). Few landowners (16%) indicated a management strategy of controlling the hardwood growth. Only 11% indicated no hardwoods found on their property. The answers were not mutually exclusive and some landowners checked more than one answer.

Stumpage Price

Landowners who sold timber within the past five years were asked to give an indication of the stumpage price they received. Eight price categories were listed in the survey, along with two other options to write in an exact amount, or to respond "don't know". Of those who had sold hardwood timber at least 40% received a cash value for their hardwoods, 27% received no money, and 31% did not know how much they received (Table 4-8). The rest were distributed through the price categories from $0.01 to over $18.00 per ton, but were slightly skewed to the lower price categories. Only one respondent indicated an exact amount.

Landowners who had not sold hardwoods were given the opportunity to indicate the expected value of their hardwoods via the stumpage price at which they would be willing to cut hardwoods. The majority of those who did not sell hardwood timber were not willing to cut hardwoods. Those who indicated a willingness price are evenly distributed through the price categories (Table 4-8).

Market Information and Product Knowledge

Most landowners do not obtain current market price information (Table 4-9). Only 31% indicated that they utilized current price information sources for hardwoods. The most popular source of market price information was local loggers (Table 4-9). Consulting foresters were used by 13% of our forest landowners. Other sources were used by 5% or less of the landowners. Of these who obtain market information, 35% used more than one source.

The landowners who obtained market information were somewhat different from the average landowner in our survey. Most (64%) had management plans, had longer average length of ownership (27 years), and their average landholding larger (710 acres) (Table 4-10). These landowners were more motivated to ensure the best value from their timber because they had more experience with land, more land acreage, and clear goals and objectives through their management plans.

A list of the common products derived from hardwoods in Florida was presented in the survey. While most respondents (58%) reported that their hardwoods were not used for timber products, 18% indicated that they don't know how hardwoods are processed (Tables 4-11 and 4-12). The largest use of hardwoods in Florida, pulp and paper, was among the top two products reported by landowners. The top product in our survey was firewood. The survey did not ask if the firewood was for personal use (Table 4-11). The other products were reported by much smaller percentages which was to be expected considering Florida's output of these products was much less as discussed in chapter 3.

Market Information and Stumpage Price Association

A contingency table revealed the association between the stumpage price received and access to market information (Table 4-13). The table was created by combining the results of the stumpage price question into two price categories to increase sample size for the analysis

since most respondents did not sell timber in that time span. The midpoint of the price range given was $9.00 per ton so the answers were grouped into those less than or equal to $9.00 and those greater than $9.00 per ton. The midpoint also corresponded to four price categories above and below that value. Those who cut but received $0.00 per ton for hardwoods were grouped into the less than $9.00 per ton category. The proportion of landowners who received greater than $9.00 per ton for their hardwood timber was significantly greater for those who obtained at least one source of current stumpage price information than for landowners who had not utilized such information (21.3% versus 0%). Using Fisher's Exact test in SAS 9.1 the probability (p-value) of obtaining a table with this difference was 2.977E-04 (two sided p-value). The low two-sided p-value gives support to the hypothesis that landowners who obtain current market information receive higher stumpage prices than landowners who do not obtain market information.

Price expectations were also greater for those who obtain market information (Table 4-14). The contingency table indicated a higher likelihood of expecting greater than $9.00 per ton if the respondent obtained market information than if he had not obtained market information. But also note that most landowners who answered this question were unwilling to cut their hardwoods for timber.

Willingness to Change to Hardwood Management

The survey asked a question about how much more valuable hardwoods would need to be than pines before landowners would start managing hardwoods. The options 10%, 25%, and 50% more valuable were given as well as, "none of the above", or "I already favor hardwoods" as options. The majority (54%) of landowners said "none of the above" (Table 4-15) and only 26% indicated a willingness to change if hardwoods were more valuable than pine. Only 22% of the landowners said that hardwoods were less valuable than pines, but a 10%, 25%, or 50% price

increase above pines would cause them to switch from pine management to hardwood management (Table 4-16).

Our results indicated a very small proportion (6%) of landowners felt hardwoods decrease land value, while 62% believed that hardwood was worth less than pine. Some 19% believed hardwood is worth more than pine and many (47%) felt that hardwoods increased land value (see questions 11 and 12 in appendix B). These results mean the hardwood resource was seemingly low value compared to pine but still added value to the land in the perspective of many forest landowners.

Alternative Hardwood Markets

There was a small but significant portion of landowners who used hardwoods for non-market purposes (Table 4-17). The uses were diverse (Table 4-18). Things such as photography, woodworking, grub worms, and down trees for horse jumps are uncommon uses of hardwoods that landowners listed in our survey. Uses such as these may potentially fill the financial gap for enterprising landowners instead of a once-in-a-lifetime timber harvest of hardwoods.

Hunting leases could also potentially fill the financial gap since wildlife is important. Many landowners listed wildlife as an objective of their management plan (see summary of management objectives in appendix B). The most popular recreational activity according to the survey was hunting. Hunting leases are known to provide income to the landowner without harvesting the timber.

Discussion

There is potential for the advancement of hardwood forestry in Florida, but there are many challenges. Hardwoods are on the majority of forest lands in Florida, even on lands dominated by pines, and many landowners are making no effort to manage hardwoods. Most landowners do not have a written timber management plan nor do they have a management strategy with

regards to hardwoods. Even though pine receives the focus when it comes to silviculture, few listed controlling hardwood growth as a strategy. For this resource to be improved, landowners will have to change their interest and outlook considerably.

Increased stumpage prices are needed to motivate some landowners to manage for hardwoods. Low stumpage prices may be the result of poor market research and lack of timber sale experience by the landowner. Most landowners had not performed a sale in the past five years, but of those who did, 45% had not researched market prices for hardwood stumpage, and consequently received a lower price for their hardwood timber.

Another challenge is one of perception. Most landowners feel hardwoods are worth less than pine and most would not change to hardwood management even if hardwoods were 10%, 25%, or 50% greater in value than pine. Changing perceptions about hardwood management could be a goal of an education program aimed at teaching Florida landowners about hardwood forestry. There is a select group of landowners who feel that hardwoods are less valuable than pines, but if stumpage prices were greater for hardwoods than pines they would change to hardwood management. This minority of landowners could be a target audience for a hardwood education program.

Educators could also target landowners who are unwilling to sell their hardwoods for timber. Aesthetic beauty, environmental benefits, and wildlife values are all reasons to reserve hardwood trees. These uses could all be included as part of a written multiple use timber management plan which most landowners do not have, without sacrificing these benefits. In fact, a written management plan will help landowners to meet these objectives.

Alternative hardwood markets may provide income to enterprising Florida forest landowners. Things such as photography, woodworking, grub worms, and down trees for horse

jumps were listed by survey participants. Hunting is also important to the landowner. These products may provide income without harvesting trees for traditional timber products.

Conclusion

The advancement of hardwood forestry in Florida requires increased stumpage prices, a change in perception by the landowner, written timber management plans, and enterprising landowners to take advantage of alternative markets for hardwood products. Knowledgeable and perceptive resource professionals and educators can potentially help landowners unlock the potential in hardwood production. Beginning with an education program based on accurate and authoritative information on Florida hardwood forestry, the state can reach its full potential in hardwood forest management.

However, given the current state of hardwood markets and the scope of hardwood management, extensive change in the hardwood resource would likely take a lifetime. Further, more research is needed on the proper application of silvicultural prescriptions in Florida's unique climate and environment.

Table 4-1. Demographics of the north Florida forest landowners surveyed.

	n	mean	minimum	maximum	median
Household size	465	2.4 persons	1	9	3
Age	460	61 yrs.	25	92	20
Length of ownership	433	23.1 yrs.	1	100	20
Landholding size	436	265 ac.	3	30000	2
Ownership class	n	percent			
Family	268	61			
Sole proprietor	141	32			
Partnership	13	3			
TIMO	0	0			
Timber company	0	0			
Other	3	0			
Percent income from timber					
0	328	75			
1 – 33	86	20			
34 – 66	3	1			
67 – 100	3	1			
Annual income (2004)					
Below 15,000	18	6			
15,001-25,000	33	11			
25,001-35,000	39	13			
35,001-45,000	29	10			
45,001-55,000	38	13			
55,001-65,000	39	13			
65,001-75,000	23	8			
75,001-85,000	23	8			
85,001-95,000	19	6			
Above 95,000	87	29			
Gender					
Male	358	77			
Female	105	23			
Education Level					
Elementary School	4	1			
Junior High	9	2			
High School	124	27			
College or Technical School	215	46			
Graduate or Professional School	111	24			
Residence					
Florida	417	88			
Not Florida	55	12			
Conservation Organization					
Yes	79	17			
No	378	83			

Table 4-2. Percentage of landowners who owned each forest type.

Forest Type	Landowners (n)	Percent Respondents
Hardwood Swamp	100	39
Cypress Swamp	100	39
Hardwood Hammock	109	42
Natural Pine	121	47
Oak-pine mixture	191	74
Planted Pines	211	82

Table 4-3. Primary purpose landowners identified for their forest land (n=257)*.

Purpose of forest	Percent Landowners
Urban development	1
Cattle grazing	4
Recreation	16
Other	16
Financial investment	18
Timber	43

* Percent does not add to 100 due to rounding.

Table 4-4. Percentage of landowners who have a written management plan (n=428).

Management Plan	Percent Landowners
Yes	14
No	86

Table 4-5. Management practices performed by landowners, based on whether the practice was targeted to improve the pine resource or hardwood resource (n=267).

	Pine (percent)	Hardwood (percent)
Fertilization	12	5
Herbicide treatment	16	7
Other mechanical site prep.	20	7
Prescribed burning	34	11
Discing/harrowing or mowing	41	20
Tree planting	51	10
Thinning	52	20
At least one of the above	94	46

Table 4-6. Landowner expenditures on treatments to reduce hardwood growth per acre of area treated between 1995 and 2005 (n=357).

Amount spent on treatments to reduce hardwoods (U.S. dollars)	Percent landowners
>100	3
76-100	3
51-75	1
26-50	4
1-25	10
0	79

Table 4-7. Management practices of landowners relative to hardwoods on their land (n=422).*

Management Strategy	Percent Landowners
Other	<1
No hardwoods on land	11
Control hardwoods	16
Allow hardwood growth for timber or non-timber value	41
No management of hardwoods	48

*Note: percentages are greater than 100% due to answers not being mutually exclusive.

Table 4-8. Percentage of respondents who indicated a stumpage price that they received or would be willing to receive for their hardwoods.

Price (dollars per ton)	Received Price, n=55 (percent)	Willing to receive price, n=187 (percent)
0.00	27	2
0.01- 3.00	7	0
3.01 - 6.00	9	0
6.01 - 9.00	11	2
9.01 - 12.00	2	3
12.01 - 15.00	2	2
15.01- 18.00	4	3
Greater than 18.00 ton	5	5
Don't know	31	-
not willing to cut trees	n/a	65
cannot cut trees due to SMZs	n/a	1
No hardwoods to cut	n/a	17

Table 4-9. Market information sources utilized by landowners (n=402)*.

Information source	Percent Respondents
Forest2Market	1
Other	1
Internet	2
Timber Mart-South	3
County forester	3
Newsletters	5
Consulting forester	13
Local logger	17
Did not obtain	69

*Percentages do not add to one-hundred. More than one source of price information can be used so answers are not mutually exclusive.

Table 4-10. Summary of the landowners who obtain timber market price information from outside sources, n=128.

Info Getters (percent)	
One source	65
Multi-source	35
Management Plan (percent)	
yes	64
no	27
no-response	9
Demographics	
Length of ownership	27 yrs.
Landholding size	710 ac.
Age	61 yrs.

Table 4-11. Product conversions for hardwoods sold or utilized by respondents (n= 390).

Product	Percent Landowners
OSB	2
Other	2
Crates	3
Poles and/or Posts	3
Plywood	4
Veneer	4
Lumber	9
Firewood	17
Don't Know	18
Pulp/paper	19
Not used for timber products	58

Table 4-12. Market knowledge of landowners.

Market knowledge	Yes (percent)	No (percent)	Responses (n)
Know the products of their hardwoods	24	18	390
Obtain market information from an outside source	31	69	402

Table 4-13. Association between stumpage price received and landowner access to market information (n=54).

	Total, n (percent)	Stumpage price $0.00 to $9.00/ton, n (percent)	Stumpage price greater than $9.00/ton, n (percent)	Do not know price received, n (percent)
Obtained Market Information	30 (100)	19 (63.3)	7 (23.3)	4 (13.3)
Did not Obtain Market Information	24 (100)	10 (41.7)	0 (0)	14 (58.3)
Table p-value	4.370E-05			
Two-sided p-value	2.977E-04			

Table 4-14. Association between a landowner's expectation of stumpage price and their access to market information, table p-value 2.977E-06, two-sided p-value 3.822E-04 (n=188).

	Total, n (percent)	Willingness to sell stumpage price $0.00 to $9.00/ton	Willingness to sell stumpage price greater than $9.00/ton	Not willing to cut	No cuttable hardwood
Obtained Market Information	40 (100)	1(2.5)	14 (35)	20 (50)	5 (12.5)
Did not Obtain Market Information	148 (100)	5 (3.4)	11 (7.4)	107 (72.3)	25 (16.9)

Table 4-15. Respondents willingness to change management to favor hardwoods (n = 387).

Change in value	Percent
Hardwood becomes 10 percent more valuable than pine	5
Hardwood becomes 25 percent more valuable than pine	7
Hardwood becomes 50 percent more valuable than pine	14
I already favor hardwood	20
None of the above	54

Table 4-16. Cross tabulation of landowner perceptions about the relative values of hardwoods and their willingness to change from pine management to hardwood management, n=329 (percent).

	Willing to change	Not willing to change	Already favor hardwoods	Total
Hardwoods equal pine	3	9	5	18
Hardwoods are greater than pine	2	8	10	20
Hardwoods are less than pine	22	36	4	62
Total	27	53	20	100

Table 4-17. Percent of landowners who use their hardwoods for uncommon markets (n=397).

	Yes	No
Alternative hardwood markets	22	78

Table 4-18. Non-market use of hardwoods.

Shade for livestock
Firewood
Arts and crafts
Fruits and nuts
Future development
Recreation
Down trees for horse jumps
Wildlife food
Mushrooms
Hunting
Woodworking
Photography
Grub worms

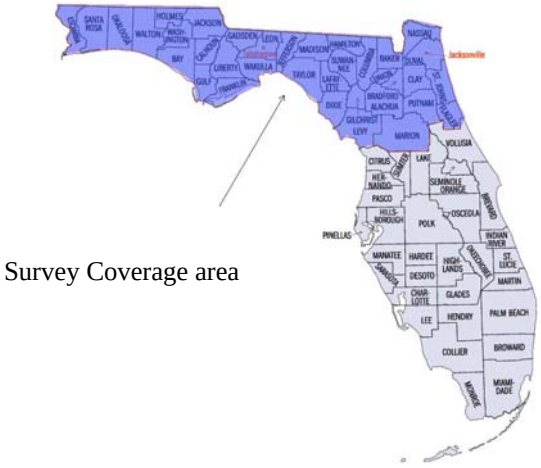


Figure 4-1. The North Florida landowners selected in the mail-out survey owned land in the blue shaded area.

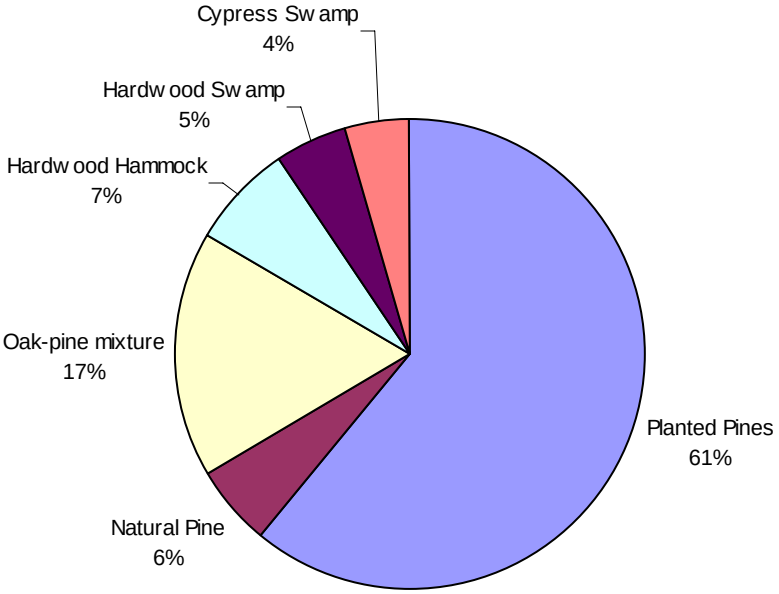


Figure 4-2. Forest types as percent of acreage owned by survey respondents (n=307).

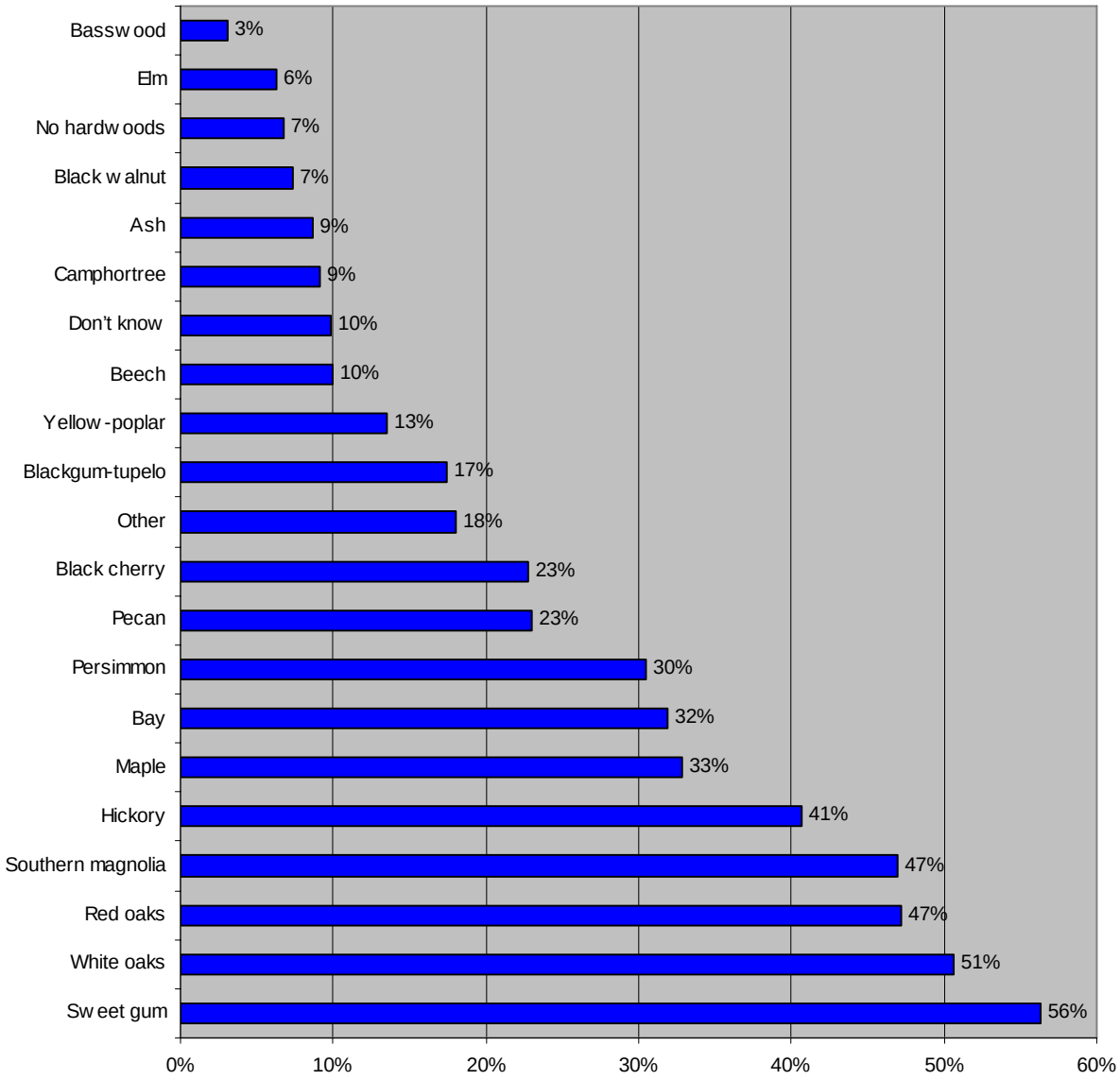


Figure 4-3. Percentage of landowners who identified having each hardwood species on their land (n= 460).

CHAPTER 5
HARDWOOD ESTABLISHMENT TRIAL AT AUSTIN CARY MEMORIAL FOREST

In February of 2005, approximately 4 acres of hardwoods were planted on two different sites at Austin Cary Memorial Forest (ACMF). Nine species were hand-planted by undergraduate students in the Forestry Club at the School of Forest Resources and Conservation at the University of Florida. Two types of deer barrier were used to determine efficacy.

The two sites were old fields. The first site was an old field that had been in grass cover for over 20 years. It was mowed regularly and burned periodically until establishment of the research plots. The second site was a food plot that had been maintained by grass cover and is surrounded by slash and longleaf pines. Both sites have sandy flatwoods soils, with scattered cypress ponds and a fairly shallow water table.

Hardwoods were planted at ACMF to determine how well they would grow under plantation conditions in north central Florida. Nine species were chosen for their potential to grow high quality and high value wood (Table 5-1).

Two methods were tested to protect the trees from deer browse. The first was a 7' high plastic deer fence around one-third of the planted area. The second involved 36-inch mesh plastic seedling protector tubes that fit over one-third of the individual seedlings. The tube was held in place with a 4 foot bamboo stake driven into the ground. Additionally, one-third of the planted seedlings were left unprotected. The efficacy of these methods as well as a cost-benefit analysis should result from these experiments.

The overall management objective was to produce high-quality hardwood saw timber while providing much needed research information on regeneration, growth, and yield rates for hardwood plantation systems in Florida. Final harvest was expected in 40 to 50 years. The trees were densely planted at 700-800 trees per acre. This encourages straight bole growth, and may

also allow for a thinning at 10 to 20 years. Depending on development rate pruning may be done between age 10 and 25 to improve potential log value. After the final harvest, regeneration methods will include coppice and planting unless improved regeneration methods are available at that time.

The local bare-root hardwoods cost $0.25 per seedling. The seedling protector tube with bamboo stake cost $0.625 each. The labor for planting the whole project was $400. Funding was received from the Hardwood Forestry Fund for this project.

Preliminary results from the first two growing seasons show very high mortality rates for trees with no protection from deer browsing, with the exception of persimmon which is naturally abundant in the local forest (Table 5-2). Black walnut was very susceptible to mortality in all treatments. Persimmon actually gained seedlings in the fenced area, probably from outside seed sources. White ash and sycamore achieved a height advantage over the rest of the hardwoods especially inside the fenced area (Table 5-3). The remaining hardwood species had height differences of 30 cm (about 1 foot) or less.

Table 5-1. The nine hardwood species selected for research at ACMF.

Common Name	Scientific name
Black cherry	*Prunus serotina*
Yellow poplar	*Liriodendron tulipifera*
Persimmon	*Diospyros virginiana*
Black walnut	*Juglans nigra*
Southern red oak	*Quercus falcata* var. *falcata*
Cherrybark red oak	*Quercus falcata* var. *pagodifolia*
Swamp chestnut oak	*Quercus michauxii*
White ash	*Fraxinus americana*
Sycamore	*Platanus occidentalis*

Table 5-2. Percent seedling mortality from 2005-2006.

	Deer protection treatments		
Species	Open	Fenced	seedling protector tubes
Black cherry	100	23	0
Black walnut	100	66	79
Cherrybark red oak	96	27	16
Persimmon	14	-5	0
Southern red oak	97	32	12
Swamp chestnut oak	100	24	13
Sycamore	92	22	0
White ash	100	22	17
Yellow poplar	100	51	17

Table 5-3. Average seedling height 2006, centimeters.

	Deer protection treatments		
Species	control	fence	seedling protector tube
Yellow poplar	*	37	46
Southern red oak	18	41	30
Black walnut	*	47	46
Swamp chestnut oak	*	52	47
Cherrybark red oak	13	54	52
Black cherry	*	55	63
Persimmon	40	65	67
White ash	*	110	78
Sycamore	20	220	140

* no data

APPENDIX A
MAIL-OUT SURVEY QUESTIONS

1. What percentage of your forested land is in the following forest types?

_____% Planted pines
_____% Natural pines
_____% Mixture of oak and pines
_____% Hardwood hammock
_____% Hardwood swamps
_____% Cypress swamps or ponds

2. Indicate the hardwoods you know to be found on your property by checking the box next to it.

☐ Black cherry
☐ Red oaks
☐ White oaks
☐ Hickory
☐ Maple
☐ Sweet gum
☐ Persimmon
☐ Basswood
☐ Beech
☐ Yellow-poplar
☐ Ash
☐ Blackgum-tupelo
☐ Elm
☐ Pecan
☐ Black walnut
☐ Bay
☐ Camphortree
☐ Southern magnolia
☐ Other: _____
☐ Don't know
☐ No hardwoods found on my land

3. What types of recreational activities occur on your land? (Check all that apply)

- ☐ Hunting
- ☐ Canoeing
- ☐ Hiking
- ☐ Camping
- ☐ Fishing
- ☐ Wildlife viewing
- ☐ Others _____

4. What types of soils does your forest land have? Check all that apply.

- ☐ Red, loamy soil (typical of panhandle)
- ☐ Red clay soil (typical of panhandle)
- ☐ Well-drained, sandy soil (throughout Florida)
- ☐ Poorly drained, sandy soil (typical of flatwoods)
- ☐ Don't know

5. For what purpose do you own your forest land? (Check the most appropriate)

- ☐ Cattle grazing
- ☐ Timber
- ☐ Recreation (hunting, camping, etc.)
- ☐ Urban development
- ☐ Financial investment
- ☐ Other: (please specify) _____

6. Do you have a written management plan and objective for your forest land?

- ☐ No
- ☐ Yes (please provide objective)

_____

_____

7. How do you manage the hardwoods on your land. (Please check all that apply.)

- ☐ Control hardwood growth through herbicide or mechanical treatment (examples include spraying, mowing, chopping, hand clearing, prescribed burning, girdling, etc.)
- ☐ No management strategy with regards to hardwoods
- ☐ Allow hardwood growth for timber and/or wildlife value
- ☐ Other: (please explain) _____
- ☐ I have no hardwoods in my forest (go to page 7 and answer questions 19-30)

8. How much have you spent on treatments to reduce hardwood growth within the last ten years?

- ☐ $0 per acre of area treated
- ☐ $ 1 – 25 per acre of area treated
- ☐ $ 26 – 50 per acre of area treated
- ☐ $ 51 – 75 per acre of area treated
- ☐ $ 76 – 100 per acre of area treated
- ☐ Greater than $100 per acre of area treated

9. Which management activities occur on your land? Indicate if the activity is aimed at <u>improving</u> pine or hardwood timber value by checking the box under that heading.

Pine	**Hardwood**	
☐	☐	Prescribed burning
☐	☐	Fertilization
☐	☐	Thinning
☐	☐	Herbicide treatment
☐	☐	Discing/harrowing or mowing
☐	☐	Tree planting
☐	☐	Other mechanical site prep.

10. How long have you actively managed your land? (Mark '0' if you do not actively manage your land.)

_____ Years

11. Which best describes the effects hardwoods have on your land value?

- ☐ Hardwoods increase my land value
- ☐ Hardwoods decrease my land value
- ☐ Hardwoods have no effect on my land value

12. Which best describes the value of hardwoods and pines?

- ☐ Hardwoods are worth more money than pine trees
- ☐ Hardwoods are worth about the same amount of money as pine trees
- ☐ Hardwoods are worth less money than pine trees

13. Do you use hardwoods on your land for reasons other than wood production or recreation, such as, growing mushrooms, fruits, nuts, personal firewood, arts and crafts, etc.?

- ☐ No
- ☐ Yes

If 'yes', for what reasons?

_____

_____

14. Which of the following statements would cause you to change your management to favor hardwoods rather than pines?

- ☐ Hardwood timber becomes 10% more valuable than pine timber
- ☐ Hardwood timber becomes 25% more valuable than pine timber
- ☐ Hardwood timber becomes 50% more valuable than pine timber
- ☐ None of the statements would affect how I manage the trees on my land
- ☐ I already favor hardwoods on my land

15. How have you obtained current market prices for hardwood timber? (Please check all that apply.)

- ☐ Internet
- ☐ Timber-Mart South
- ☐ Forest2Market
- ☐ County forester
- ☐ Consulting forester
- ☐ Local logger
- ☐ Newsletters
- ☐ Other: _____
- ☐ I haven't obtained market prices for hardwoods

16. Which of the following are products produced from hardwoods grown on your land? (Check all that apply.)

- ☐ Pulp/paper
- ☐ Oriented-strand board (OSB)
- ☐ Plywood
- ☐ Firewood
- ☐ Crates
- ☐ Lumber
- ☐ Poles and/or posts
- ☐ Veneer
- ☐ Other (please specify) _____
- ☐ Don't Know
- ☐ My hardwoods are not used for timber products

Please answer <u>one</u> of the following two questions.

17. If you sold hardwood timber in the past 5 years, what stumpage price did you receive?

- ☐ $0.00
- ☐ $0.01 - $3.00/ ton ($0.01 – $9.00/cord)
- ☐ $3.01 - $6.00/ton ($9.01-$17.00/cord)
- ☐ $6.01 - $9.00/ton ($17.01-$26.00/cord)
- ☐ $9.01 - $12.00/ton ($26.01-$35.00/cord)
- ☐ $12.01 - $15.00/ton ($35.01-$44.00/cord)
- ☐ $15.01-$18.00/ton (44.01-52.00/cord)
- ☐ Greater than $18.00/ton ($52.00/cord)
- ☐ Don't know
- ☐ _____ (If you know exactly, please write here)

18. If you haven't sold hardwoods, at what price per ton (or cord) would you be willing to sell your hardwoods for timber?

- ☐ $0.00
- ☐ $0.01 - $3.00/ ton ($0.01 – $9.00/cord)
- ☐ $3.01 - $6.00/ton ($9.01-$17.00/cord)
- ☐ $6.01 - $9.00/ton ($17.01-$26.00/cord)
- ☐ $9.01 - $12.00/ton ($26.01-$35.00/cord)
- ☐ $12.01 - $15.00/ton ($35.01-$44.00/cord)
- ☐ $15.01-$18.00/ton (44.01-52.00/cord)
- ☐ greater than $18.00/ton ($52.00/cord)
- ☐ not willing to cut trees
- ☐ cannot cut trees due to special management zones
- ☐ Other: $_____/ton or $_____/cord
- ☐ I do not have any hardwoods to cut

19. How long have you owned your forest land?
_____ Years

20. Approximately how much forest land do you own in Florida?
_____ Acres

21. What is the zip code or section-township-range (STR) of your forest land?

☐☐☐☐☐ or ___ ___ ___
zip code S T R

22. Which best describes the ownership of your land?

☐ Family
☐ Sole proprietor
☐ Partnership
☐ Timber Investment Management Organization (TIMO)
☐ Timber company
☐ Other: (please specify) _____

23. What percentage of your total income is from timber?

☐ 0 %
☐ 1 – 33%
☐ 34 – 66%
☐ 67 – 100%

24. Please indicate the range of your personal 2004 annual gross income?

☐ Below $15,000
☐ $15,001-25,000
☐ $25,001-35,000
☐ $35,001-45,000
☐ $45,001-55,000
☐ $55,001-65,000
☐ $65,001-75,000
☐ $75,001-85,000
☐ $85,001-95,000
☐ Above $95,000

25. What is your gender?

☐ Male
☐ Female

26. Please circle your highest education level:

Elementary School	Junior High	High School	College or Technical School	Graduate or Professional School

27. How many people live in your household?

_____ Persons

28. Is your primary residence in Florida?

☐ Yes
☐ No

29. What year were you born?

19__

30. Are you a member of any conservation organization?

☐ No
☐ Yes Please list: _____

APPENDIX B
LANDOWNER SURVEY RESULTS

1. What percentage of your forested land is in the following forest types?

Forest Type	Number Respondents	Forest Land Owned (acres)	Percent Respondents
Planted Pines	211	56928	82
Natural Pine	121	5249	47
Oak-pine mixture	191	15667	74
Hardwood Hammock	109	6848	42
Hardwood Swamp	100	4751	39
Cypress Swamp	100	4047	39
Total Forest Land (Acres)		93489	
Responses (n)		307	
Average Forest Land Holding (acres)		305	

2. Indicate the hardwoods you know to be found on your property by checking the box next to it.

Type of Hardwood	Number Respondents	Percent Respondents
Black cherry	105	23
Red oaks	217	47
White oaks	233	51
Hickory	187	41
Maple	151	33
Sweet gum	259	56
Persimmon	140	30
Basswood	14	3
Beech	46	10
Yellow-poplar	62	13
Ash	40	9
Blackgum-tupelo	80	17
Elm	29	6
Pecan	106	23
Black walnut	34	7
Bay	147	32
Camphortree	42	9
Southern magnolia	216	47
Other	83	18
Don't know	45	10
No hardwoods	31	7
Responses (n)	460	

3. What types of recreational activities occur on your land? (Check all that apply)

Activity	Number Respondents	Percent Respondents
Hunting	263	76
Canoeing	17	5
Hiking	90	26
Camping	66	19
Fishing	117	34
Wildlife viewing	201	58
Others	24	7
Responses (n)	345	

4. What types of soils does your forest land have? Check all that apply.

Soil Type	Number Respondents	Percent Respondents
Red, loamy	87	21
Red, clay	85	20
Well drained	287	68
Poorly drained	138	33
Don't know	33	8
Responses (n)	420	

5. For what purpose do you own your forest land? (Check the most appropriate)

Purpose of forest	Number Respondents	Percent Respondents
Cattle grazing	11	4
Timber	110	43
Recreation	42	16
Urban development	3	1
Financial investment	47	18
Other	42	16
Responses (n)	257	

6. Do you have a written management plan and objective for your forest land?

Management Plan	Number Respondents	Percent Respondents
Yes	62	14
No	366	86
Responses (n)	428	

7. How do you manage the hardwoods on your land. (Please check all that apply.)

Management Strategy	Number Respondents	Percent Respondents
Control Hardwoods	69	16
No Mgt.	201	48
Allow growth for timber or non-timber value	171	41
Other	2	0
No Hardwoods on land	48	11
Responses (n)	422	

8. How much have you spent on treatments to reduce hardwood growth within the last ten years?

Amount spent on treatments (per acre)	Number Respondents	Percent Respondents
$0	282	79.0
$1-25	37	10.4
$26-50	14	3.9
$51-75	5	1.4
$76-100	9	2.5
>$100	10	2.8
Responses (n)	357	

9. Which management activities occur on your land? Indicate if the activity is aimed at improving pine or
hardwood timber value by checking the box under that heading.

	Pine		Hardwood	
	Number Respondents	Percent Respondents	Number Respondents	Percent Respondents
Prescribed burning	90	34	29	11
Fertilization	31	12	13	5
Thinning	140	52	53	20
Herbicide treatment	42	16	18	7
Discing/harrowing or mowing	110	41	54	20
Tree planting	136	51	28	10
Other mechanical site prep.	53	20	18	7
Responses (n)	267			

10. How long have you actively managed your land? (Mark '0' if you do not actively manage your land.)

Average Active Management (years)	10.8
Responses (n)	402

11. Which best describes the effects hardwoods have on your land value?

	Number Respondents	Percent Respondents
Hwd. inc. land value	184	47
Hwd. dec. land value	24	6
Hwd. no effect	185	47
Responses (n)	393	

12. Which best describes the value of hardwoods and pines?

	Number Respondents	Percent Respondents
Hwd>pine	67	20
Hwd=pine	63	18
Hwd<pine	212	62
Responses (n)	342	

13. Do you use hardwoods on your land for reasons other than wood production or recreation, such as, growing mushrooms, fruits, nuts, personal firewood, arts and crafts, etc.?

	Number Respondents	Percent Respondents
Yes	89	22
No	308	78
Responses (n)	397	

14. Which of the following statements would cause you to change your management to favor hardwoods rather than pines?

Change in value	Number Respondents	Percent Landowners (n=387)
Hardwood becomes 10% more valuable than pine	20	5
Hardwood becomes 25% more valuable than pine	28	7
Hardwood becomes 50% more valuable than pine	54	14
None of the above	209	54
I already favor hardwood	76	20
Responses (n)	387	

15. How have you obtained current market prices for hardwood timber? (Please check all that apply.)

Information source	Number Respondents	Percent Respondents
Internet	8	2
T-Mart South	14	3
F2M	3	1
County forester	14	3
Consulting forester	54	13
Local logger	70	17
Newsletters	19	5
Other	5	1
Not obtained Info.	278	69
Responses (n)	402	

16. Which of the following are products produced from hardwoods grown on your land? (Check all that apply.)

Product	Number Respondents	Percent Respondents
Pulp/paper	63	19
OSB	8	2
Plywood	16	5
Firewood	65	20
Other	8	2
Crates	11	3
Lumber	37	11
Poles and/or Posts	10	3
Veneer	14	4
Don't Know	69	21
Not used for timber products	225	69
Responses (n)	390	

17. If you sold hardwood timber in the past 5 years, what stumpage price did you receive?

Price	Total each response (question 17)	Percent each response
$0.00	15	27
$0.01-$3.00/ ton	4	7
$3.01 - $6.00/ton	5	9
$6.01 - $9.00/ton	6	11
$9.01 - $12.00/ton	1	2
$12.01 - $15.00/ton	1	2
$15.01-$18.00/ton	2	4
>$18.00/ton	3	5
Don’t Know	17	31
Know exact amount	1	2
Responses (n)	55	

18. If you haven't sold hardwoods, at what price per ton (or cord) would you be willing to sell your hardwoods for timber?

Price	Total each response (question 18)	Percent each response
$0.00	3	2
$0.01-$3.00/ ton	0	0
$3.01 - $6.00/ton	0	0
$6.01 - $9.00/ton	3	2
$9.01 - $12.00/ton	6	3
$12.01 - $15.00/ton	4	2
$15.01-$18.00/ton	5	3
>$18.00/ton	10	5
not willing to cut trees	122	65
cannot cut trees due to SMZs	1	1
Other	1	1
No hardwoods to cut	32	17
Responses (n)	187	

19. How long have you owned your forest land?

Average Length of Ownership	24
Responses (n)	432

20. Approximately how much forest land do you own in Florida?

Total Forest Land (acres)	115363
Average Forest Land Owned (acres)	265
Responses (n)	436

21. What is the zip code or section-township-range (STR) of your forest land?

County	No. Respondents	Percent Respondents
Alachua	28	7
Baker	1	0
Bay	5	1
Bradford	8	2
Calhoun	11	3
Clay	2	1
Columbia	9	2
Dixie	8	2
Duval	8	2
Escambia	3	1
Flagler	1	0
Gadsden	27	7
Gilchrist	6	2
Hamilton	8	2
Holmes	28	7
Jackson	30	8
Jefferson	14	4
Lafayette	8	2
Leon	1	0
Levy	13	3
Liberty	7	2
Madison	27	7
Marion	20	5
Nassau	10	3
Okaloosa	9	2
St. Johns	3	1
Suwannee	12	3
Taylor	9	2
Union	7	2
Volusia	1	0
Wakulla	15	4
Walton	18	5
Washington	33	8
Responses (n)	392	100

22. Which best describes the ownership of your land?

Ownership	Number Respondents	Percent Respondents
Family	268	61
Sole proprietor	141	32
Partnership	13	3
TIMO	0	0
Timber company	0	0
Other	3	1
Responses (n)	441	

23. What percentage of your total income is from timber?

Percentage income	Number Respondents	Percent Respondents
0	328	75
1 to 33	86	20
34 to 66	3	1
67 to 100	3	1
Responses (n)	436	

24. Please indicate the range of your personal 2004 annual gross income?

2004 income	Number Respondents	Percent Respondents
Below $15,000	18	6
$15,001-25,000	33	11
$25,001-35,000	39	13
$35,001-45,000	29	10
$45,001-55,000	38	13
$55,001-65,000	39	13
$65,001-75,000	23	8
$75,001-85,000	23	8
$85,001-95,000	19	6
Above $95,000	87	29
Responses (n)	362	

25. What is your gender?

Gender	Number Respondents	Percent Respondents
Male	358	77
Female	105	23
Responses (n)	463	

26. Please circle your highest education level:

Education Level	Number Respondents	Percent Respondents
Elementary School	4	1
Junior High	9	2
High School	124	27
College or Technical School	215	46
Graduate or Professional School	111	24
Responses (n)	463	

27. How many people live in your household?

Average Household (persons)	2.4
Responses (n)	465

28. Is your primary residence in Florida?

	Number Respondents	Percent Respondents
Primary residence in Florida	417	88
Primary residence not in Florida	55	12
Responses (n)	472	

29. What year were you born?

Responses (n)	460
Average Age (at end of 2004)	61

30. Are you a member of any conservation organization?

	Number Respondents	Percent Respondents
Yes	79	17
No	378	83
Responses (n)	457	

Summary of Management Objectives (Question 6)

Timber production/ financial investment

Clear cut on a 20 year rotation
Grow trees to maturity and harvest.
Harvest pines in 10 years and re-plant
Income
Investment
Long term investment- income, appreciation, for future
Manage timber for optimal profit
Maximize NPV
Maximize return on investment
Sell timber in 10years and replant
Timber for investment, provide for hunting, encourage wildlife
Timber production
To let it reforest itself after logging and land purchase in 1995

Wildlife/game, recreation

In progress from our game Biologist
Enhance forest wildlife
Game animals
Improving wildlife habitat
Maintain strong wildlife habitat

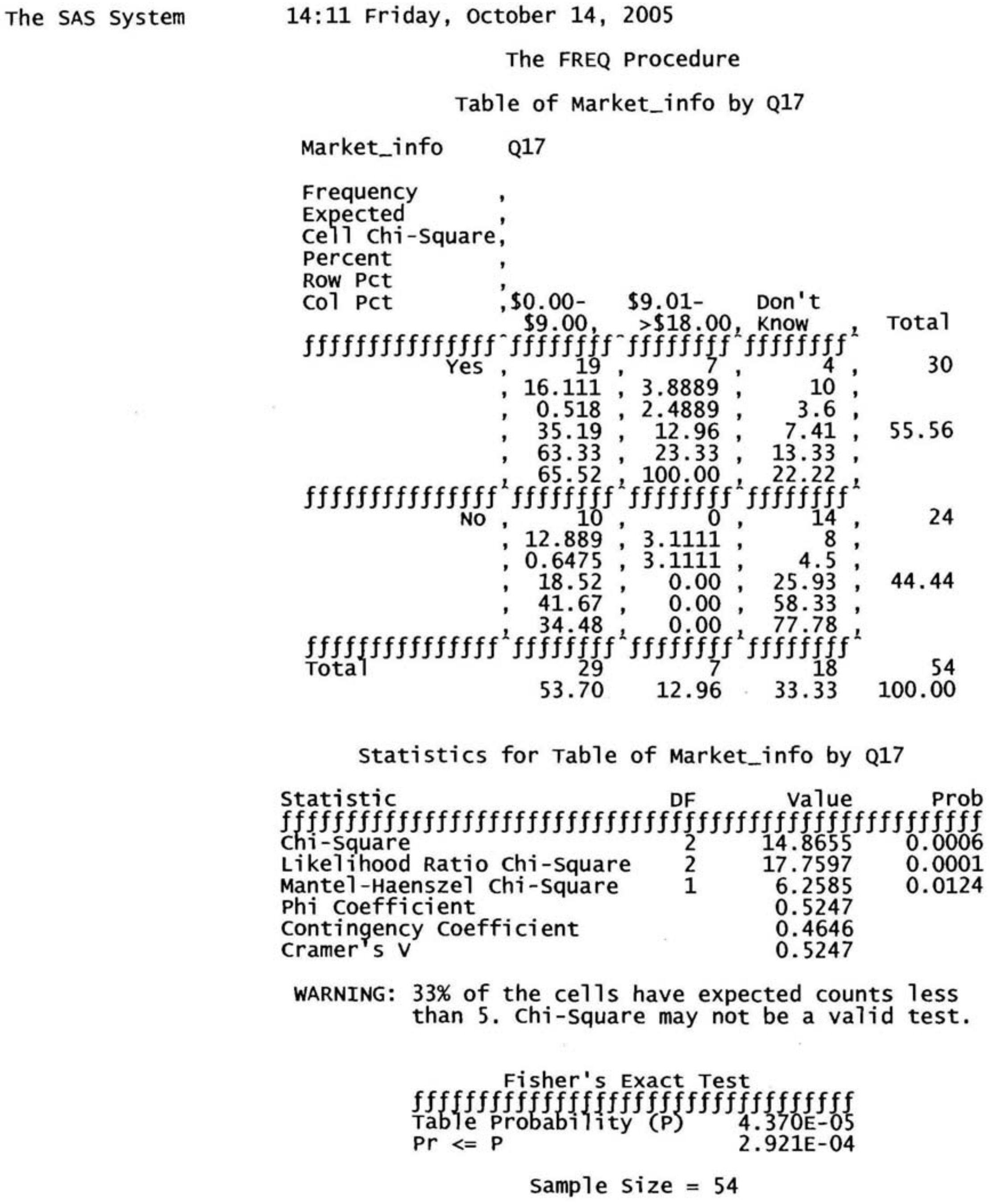
Multiple Use

Financial timber management, along with wildlife enhancement
Maximize investment return, recreation, and aesthics
Provide income and wildlife
Provide optimal combination between revenue producing timber and wildlife enhancement for recreational use.
Provide optimum timber production and promote wildlife growth.
Restore native ecosystems, timber income, and hunting.
Silviculture, hunting
Thin underbrush, timber trees. Only shoot 6 point or larger. Cull does as needed
Timber and wildlife
Timber growth and any other legitimate activity
Timber harvest pine and wildlife habitat
Timber management, wildlife, recreation (hunting)
Timber production and aesthetics and enjoyment of forest
Timber production and Wildlife Management. Financial Investment.
Timber value, straw, wildlife, keeping the land undeveloped
Timber, cattle, wildlife
Return on investment and recreation

Conservation, preservation, aesthetics

Conservation, preservation of rare and endangered species; replanting of LL pine and wiregrass
It is my hope that the land will be forever preserved, for future generations with no alterations, so that my future family and friends can enjoy and admire nature as it was meant to be.
Maintain the natural beauty and hardwood preservation
Preservation of natural Florida
To maintain the land and forest as is for wildlife and to protect.

APPENDIX C
SAS OUTPUT



```
The SAS System         14:11 Friday, October 14, 2005

                                 The FREQ Procedure

                              Table of Market_info by Q17

                       Market_info     Q17

                       Frequency      ‚
                       Expected       ‚
                       Cell Chi-Square‚
                       Percent        ‚
                       Row Pct        ‚
                       Col Pct        ‚$0.00-    $9.01-    Don't
                                      ‚ $9.00‚   >$18.00‚ Know    ‚  Total
                       ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒˆƒƒƒƒƒƒƒƒˆƒƒƒƒƒƒƒƒˆƒƒƒƒƒƒƒƒˆ
                                   Yes ‚     19 ‚      7 ‚      4 ‚     30
                                       ‚ 16.111 ‚ 3.8889 ‚     10 ‚
                                       ‚  0.518 ‚ 2.4889 ‚    3.6 ‚
                                       ‚  35.19 ‚  12.96 ‚   7.41 ‚  55.56
                                       ‚  63.33 ‚  23.33 ‚  13.33 ‚
                                       ‚  65.52 ‚ 100.00 ‚  22.22 ‚
                       ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ‰ƒƒƒƒƒƒƒƒ‰ƒƒƒƒƒƒƒƒ‰ƒƒƒƒƒƒƒƒ‰
                                    No ‚     10 ‚      0 ‚     14 ‚     24
                                       ‚ 12.889 ‚ 3.1111 ‚      8 ‚
                                       ‚ 0.6475 ‚ 3.1111 ‚    4.5 ‚
                                       ‚  18.52 ‚   0.00 ‚  25.93 ‚  44.44
                                       ‚  41.67 ‚   0.00 ‚  58.33 ‚
                                       ‚  34.48 ‚   0.00 ‚  77.78 ‚
                       ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ‰ƒƒƒƒƒƒƒƒ‰ƒƒƒƒƒƒƒƒ‰ƒƒƒƒƒƒƒƒ‰
                       Total                 29        7       18       54
                                          53.70    12.96    33.33   100.00


                         Statistics for Table of Market_info by Q17

                      Statistic                     DF       Value      Prob
                      ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
                      Chi-Square                     2     14.8655    0.0006
                      Likelihood Ratio Chi-Square    2     17.7597    0.0001
                      Mantel-Haenszel Chi-Square     1      6.2585    0.0124
                      Phi Coefficient                       0.5247
                      Contingency Coefficient               0.4646
                      Cramer's V                            0.5247

                       WARNING: 33% of the cells have expected counts less
                                than 5. Chi-Square may not be a valid test.


                                    Fisher's Exact Test
                          ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
                          Table Probability (P)     4.370E-05
                          Pr <= P                   2.921E-04

                                     Sample Size = 54
```

The FREQ Procedure

Table of Info by Q18

Info	Q18				
Frequency Expected Cell Chi-Square Percent Row Pct Col Pct	$0.00- $9.00,	$9.01- >$18.00,	Not willing,	No Hwd	Total
Yes	1 1.2766 0.0599 0.53 2.50 16.67	14 5.3191 14.167 7.45 35.00 56.00	20 27.021 1.8244 10.64 50.00 15.75	5 6.383 0.2996 2.66 12.50 16.67	40 21.28
No	5 4.7234 0.0162 2.66 3.38 83.33	11 19.681 3.829 5.85 7.43 44.00	107 99.979 0.4931 56.91 72.30 84.25	25 23.617 0.081 13.30 16.89 83.33	148 78.72
Total	6 3.19	25 13.30	127 67.55	30 15.96	188 100.00

Statistics for Table of Info by Q18

Statistic	DF	Value	Prob
Chi-Square	3	20.7704	0.0001
Likelihood Ratio Chi-Square	3	17.2712	0.0006
Mantel-Haenszel Chi-Square	1	6.0387	0.0140
Phi Coefficient		0.3324	
Contingency Coefficient		0.3154	
Cramer's V		0.3324	

WARNING: 25% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

Fisher's Exact Test

Table Probability (P)	2.977E-06
Pr <= P	3.822E-04

Sample Size = 188

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BIOGRAPHICAL SKETCH

Brian Hinton was born and raised in Gainesville, FL. He received his Bachelor of Science degree in agricultural operations management from the University of Florida in May 2001. He has worked as a forest ranger for the Florida Division of Forestry and a project coordinator for the Southern Centers for Urban and Interface Forestry. Currently he resides in Jacksonville, FL where he is a forestry technician for the Department of the Navy.