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FOR337

Timber Production in a Working Forest Context[1]

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"Working forests" are private forests managed not just for timber production, but for other important ecosystem services as well (see Alavalapati and Zarin 2004). Timber production is an essential ecosystem good or service (e.g., saw timber, pulp, biomass for energy, etc.) that supports a number of important industries and provides jobs in Florida. Forest products have a total economic impact of $16.5 in Florida (Florida Department of Agriculture and Consumer Services, Florida Forest Service, 2006). Because timber resources are a well-known commodity with readily available market prices (deGroot et al. 2010) and are widely produced on Florida forest properties (Stein et al. forthcoming), they are a useful gauge of ecosystem service values from these lands. One recent study found that 61% of non-industrial private forest landowners in the state were likely to manage their land for timber, and 71% consider timber an important ecosystem service (Stein et al. 2014).

The Florida Forest Stewardship Program (FSP) encourages multiple-use forest stewardship practices on private lands (http://www.sfrc.ufl.edu/Extension/florida_forestry_information/additional_pages/forest_stewardship_program.html). Multiple-use includes managing for more than one objective, such as timber, recreation, wildlife, watershed, and other simultaneous objectives. Of the approximately 835 properties enrolled in the FSP in Florida in 2010, 80% have timber production defined as a primary or secondary objective in their forest management plans (Figures 1 and 2).

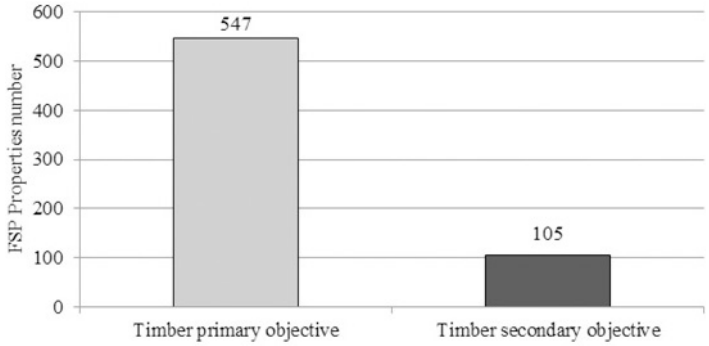

Figure 1. Forest Stewardship Properties with available spatial data and have timber production as an objective.
Credits: Escobedo et al. (2012)

Given the critical role that Florida's working forests play in providing highly valuable ecosystem services (Hodges et al. 2005), it is important to understand how timber is prioritized on different types of non-industrial private forests (NIPF). In this fact sheet, we focus on the production of timber as an ecosystem service, and using actual and modeled timber data, we compare timber output on two types of land: 1) FSP properties, and 2) non-FSP properties that are within one mile of each FSP property. Results from this study can be used to assess the positive impacts of multiple-use management on both timber production and other ecosystem services.

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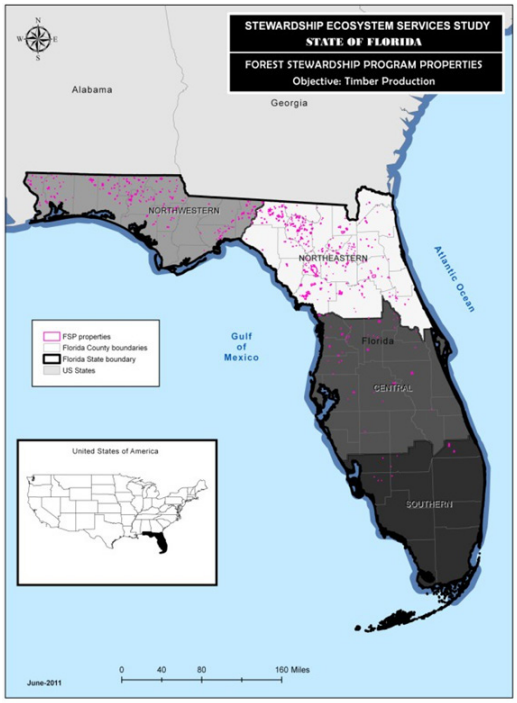

Figure 2. Forest Stewardship Program (FSP) properties that manage for timber production objectives in the four FIA units. The FSP properties shown are those with available spatial data.
Credits: Escobedo et al. (2012)

FIA Data Analysis

Plot-level timber resource data from the USDA Forest Service's Florida Forest Inventory and Analysis (FIA) program were used to study current timber-production characteristics of forests in the state of Florida. The data were analyzed according to the four Florida FIA regions: northeastern, northwestern, central, and southern Florida (Figure 2). Geo-referenced plot-level FIA data from both FSP and non-FSP forests were used to analyze key timber production indicators from 2002 to 2007. Three indicators, or categories, used by FIA to estimate regional and state-wide timber production were included in this analysis:

- *Volume:* Net cubic-meters timber volume.
- *Net annual merchantable growth*: Net annual merchantable growth in cubic-meters of growing-stock trees on timberland. This is the net change in cubic-meter volume per year for a tree.
- *Volume of growing-stock for removable purposes*: Cubic-meter volume of a growing-stock tree on timberland for removal purposes. Represents the cubic-meter volume of the tree at time of removal.

These categories provided data on individual trees (cubic meter/tree), which was converted into per-hectare estimates. For detailed methods, see Escobedo et al. (2012) pages 79 to 92.

Method: InVEST Model Scenarios

The Integrated Valuation of Environmental Services and Tradeoffs (InVEST) timber production model (managed timber production ecosystem service valuation model, http://www.naturalcapitalproject.org/InVEST.html) was used to simulate timber production as an ecosystem service on properties that manage for FSP and non-FSP program objectives. Specifically, the InVEST timber production model analyzed the volume of legally harvested timber from natural pine forests and managed plantations. The economic value of timber as an ecosystem service was also modeled using timber amounts and volume. This estimation was based on market prices, harvest and management costs, and discount rates (Tallis et al. 2011).

Since every forest property's stand characteristics are different, as are individual landowner's management activities, two different simplified scenarios that prioritize timber production as a management objective were simulated on Florida FSP and adjacent lands. A representative set of current FSP properties and their available geographic information system (GIS) and forest management plan data were used to develop the model.

There were 242 properties selected based on whether:

1. Timber harvesting was defined as a specific objective in the property's forest management plan, and

2. The forested area dominated by pine for the FSP property was greater than or equal to 25 hectares

The two scenarios, one emphasizing FSP management criteria and the other conventional timber-management activities, were analyzed for a total of 76,000 hectares across all four FIA regions.

The first scenario (FSP scenario) was based on the assumption that FSP properties are managed for multiple uses following FSP criteria. This FSP criteria assumes that thinning, or reducing the density of a stand to improve the growth of remaining trees (Williams et al. 2011), is applied at the rate of 1–3 times per rotation for landowners that manage for multiple uses (M. Humphrey, Florida Forest Service, personal communication). The FSP scenario assumed the thinning treatment was a 30% removal of total biomass per hectare.

The second scenario (non-FSP scenario) was based on the assumption that non-FSP properties manage for timber production as their primary management objective and do

not follow FSP criteria. This scenario assumed no thinning treatments.

For both scenarios, the primary timber harvest management objective was the use of clear-cuts. The secondary timber harvest management objective was the use of selective harvesting methods (i.e., harvesting a portion of trees in the stand). Results of the timber production scenarios will be used in a study assessing the tradeoffs among different ecosystem-services objectives such as carbon, timber, and water yield.

Results of FIA Data Analysis

The average net volume, average net merchantable growth, and average net volume of growing-stock for removal purposes on FSP and non-FSP properties in the four FIA regions are shown in Tables 1 through 4 and Figures 3 through 6 (from Escobedo et al. 2012). Although sample sizes for FSP properties in the central and southern FIA regions were too small for statistical analysis, but most importantly, differences in the three categories for FSP and non-FSP properties in the northeastern and northwestern Florida regions were not statistically significant.

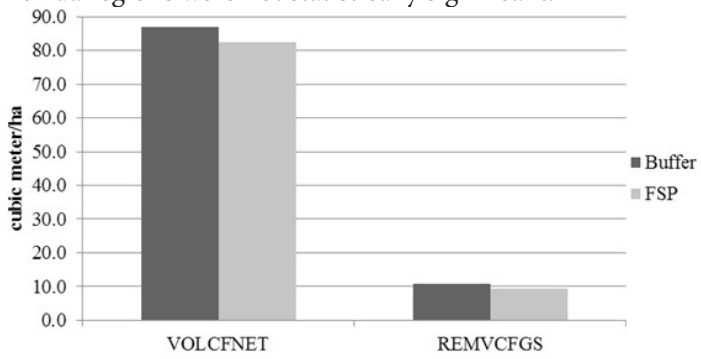

Figure 3. Timber net volume (VOLCFNET) and removal (REMVCFGS) for Forest Stewardship Program (FSP) properties and non-FSP properties (buffers) in northeastern Florida.
Credits: Escobedo et al. (2012)

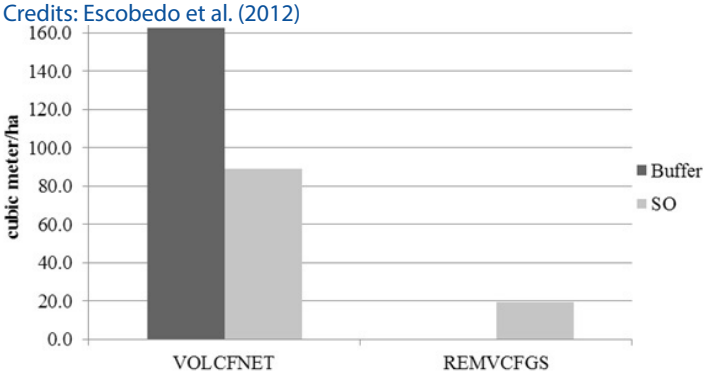

Figure 4. Timber volume (VOLCFNET) and removal (REMVCFGS) for Forest Stewardship Program properties (FSP; SO) and non-FSP (Buffer) in northwestern Florida.
Credits: Escobedo et al. (2012)

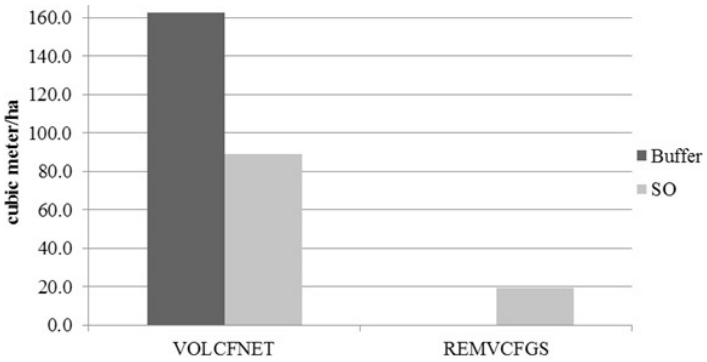

Figure 5. Timber net volume (VOLCFNET), and removal (REMVCFGS) for Forest Stewardship Properties (FSP; SO) and non-FSPs (buffer) in central Florida.
Credits: Escobedo et al. (2012)

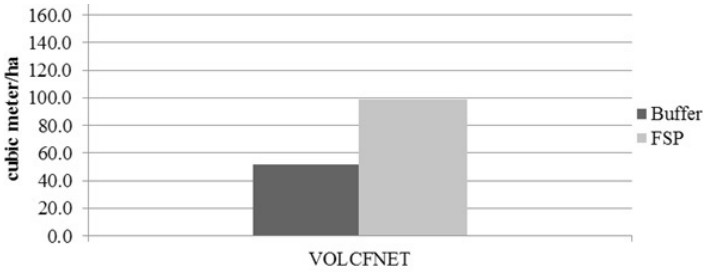

Figure 6. Timber net volume (VOLCFNET) for Forest Stewardship Program (FSP) properties and non-FSP properties (buffers) in southern Florida.
Credits: Escobedo et al. (2012)

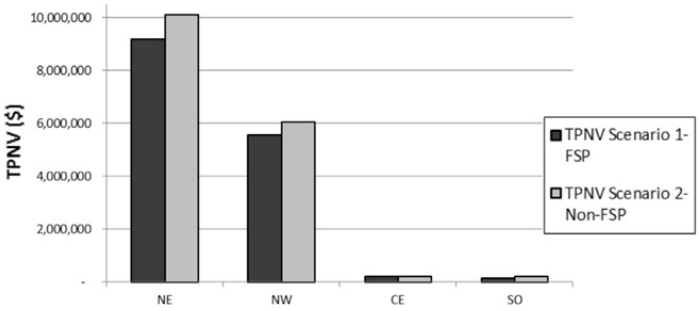

Figure 7. Total Net Present Economic Value (TPNV) of timber for northeastern (NE), northwestern (NW), central (CE) and southern (SO) FIA units.

Results of the InVEST Model Scenarios

A total of 145 timber plots were analyzed in the northeastern region. The timber harvest area was 12,214 hectares. The total present net economic value was higher in the non-FSP scenario ($10,100,545, or $826 per hectare; Figure 7). In the northwestern region, 114 timber parcels were analyzed. The timber harvest area was 7,021.8 hectares. Again, the total present net economic value was higher for the non-FSP scenario ($6,063,369 or $863 per hectare). Three timber parcels were analyzed in the southern region. The timber harvest area was 378.7 hectares, and the total present net economic value was higher in the non-FSP scenario ($200,801 or $530 per hectare).

Key Implications

Timber production is a versatile and valuable ecosystem service. Understanding how multiple-use management affects both timber production and other ecosystem services is important for informing forest landowners and other stakeholders. As expected, we found that timber volumes were higher overall in non-FSP properties or those that prioritize timber. However, in the northwestern and southern Florida FIA regions, FSP properties had higher timber volume than did non-FSP properties. The net annual merchantable growth was also greater for FSP properties in northeastern and southern Florida. The volume of growing-stock for removal purposes was greater for FSP properties in central Florida, and higher for non-FSP properties in northeastern and northwestern Florida. This indicates that timber production and growing-stock might be more closely related to factors not included in this analysis.

Our modeling analysis shows that timber volume in the FSP scenario and the non-FSP scenario were the same across the four FIA regions. Since one of the assumptions of the non-FSP scenario was no thinning treatments, this result does not correspond with the common management practice of thinning to increase growth. However, there was no evidence that thinned and unthinned plots resulted in changes in tree size as measured by basal area, a measure of stand density (Demers, Long, and Nowak 2005).

The InVEST model results should be considered very conservative estimates of timber production and value that are based on typical conditions and simplified assumptions of forest management activities (see Escobedo et al. 2012 for specific methods, assumption, and information sources). But, as expected, the largest revenue was in the non-FSP scenario. This result is likely due to the type of management objective that results in a greater amount of timber being available for final harvest at a higher price. Further results are provided in Escobedo et al. (2012), pages 79 to 92. According to this study, there were no differences between the FSP and non-FSP model scenarios in terms of timber production. But the use of forest thinning practices was assumed to be the only difference in management between these scenarios.

Although few to no differences were found between FSP and non-FSP properties, the Florida Forest Stewardship Program promotes multiple-use forest management that adds value for society. As a result, a typical FSP Forest Management Plan promotes, in addition to timber production, conservation of soil and water, protection of wildlife habitats and wetlands, livestock grazing, recreation, and beauty (Duryea et al. 1992). This means that FSP management approaches support multiple ecosystem services and associated values. When considering just water, carbon, and wildlife, together with timber, we estimated that the value of the typical FSP acre was $5,030 per acre (see Escobedo et al. 2012:11). However, we caution that without a mechanism to capture that value, it remains very difficult to motivate landowners to manage for multiple ecosystem services (rather than solely timber) when doing so is good for the environment, sustaining Florida forests, mitigating climate change, etc. but does not provide positive financial impacts. This highlights the need for educational and incentive programs that help bridge the gap between the social and private value generated from these lands.

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Table 1. Timber Volume, Growth, and Removal for Forest Stewardship Program (FSP) Properties and non-FSP Properties in Northeastern Florida.

Categories	Units	FSP Properties			Non-FSP Properties		
		Min	*Mean*	*Max*	*Min*	*Mean*	*Max*
Timber volume	m^3/ha	1.0	82.4	328.7	0.2	87.0	378.3
Timber growth	m^3/ha/year	0.2	6.0	26.4	-6.3	3.3	18.4
Timber removal	m^3/ha	0.6	9.5	20.9	0.8	10.8	32.1

Note: m^3/ha =meters cubed per hectare; m^3/ha/year=meters cubed per hectare per year; Min=Minimum, Max=Maximum
Credits: Escobedo et al. (2012)

Table 2. Timber Volume, Growth, and Removal for Forest Stewardship Program (FSP) Properties and non-FSP Properties in Northwestern Florida.

Categories	Units	FSP Properties			Non-FSP Properties		
		Min	*Mean*	*Max*	*Min*	*Mean*	*Max*
Timber volume	m^3/ha	20.4	103.6	231.0	0.6	89.9	335.9
Timber growth	m^3/ha/year	-4.6	1.4	6.1	-4.4	3.9	21.4
Timber removal	m^3/ha	3.3	4.3	6.7	1.2	10.4	34.7

Note: m^3/ha=meters cubed per hectare; m^3/ha/year=meters cubed per hectare per year; Min=Minimum, Max=Maximum
Credits: Escobedo et al. (2012)

Table 3. Timber Volume, Growth, and Removal for Forest Stewardship Program (FSP) Properties and non-FSP Properties in Central Florida.

Categories	Units	FSP Properties			Non-FSP Properties		
		Min	*Mean*	*Max*	*Min*	*Mean*	*Max*
Timber volume	m^3/ha	6.6	89.0	171.4	0.6	162.5	390.0
Timber growth	m^3/ha/year	1.2	1.8	2.3	17.2	25.5	33.8
Timber removal	m^3/ha	19.3	19.3	19.3	0.0	0.0	0.0

Note: m^3/ha=meters cubed per hectare; m^3/ha/year=meters cubed per hectare per year; Min=Minimum, Max=Maximum
Credits: Escobedo et al. (2012)

Table 4. Timber Volume, Growth, and Removal for Forest Stewardship Program (FSP) Properties and non-FSP Properties in Southern Florida.

Categories	Units	FSP Properties			Non-FSP Properties		
		Min	*Mean*	*Max*	*Min*	*Mean*	*Max*
Timber volume	m^3/ha	98.7	98.7	98.7	3.7	51.6	99.5
Timber growth	m^3/ha/year	3.2	3.2	3.2	0.9	0.9	0.9
Timber removal	m^3/ha	0.0	0.0	0.0	0.0	0.0	0.0

Note: m^3/ha=meters cubed per hectare; m^3/ha/year=meters cubed per hectare per year; Min=Minimum, Max=Maximum
Credits: Escobedo et al. (2012)