

## **Timber Theft: Financial Impacts and Prevention in the U.S. South**

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### **Abstract**

Timber theft is a rarely studied subject with anecdotal evidence most often driving perceptions of its impact on the timber industry. This study utilized a mixed-mode survey of consulting foresters from 11 states in the U.S. South to evaluate the magnitude of timber theft and identify which prevention techniques are most commonly employed. The survey population was identified from publicly available sources with an effective response rate of 37% out of 1,159 foresters contacted. Participants were asked to report the number of incidents encountered, financial losses/recoveries, theft methods, resolution approaches and prevention techniques. Responding foresters reported administering a total of 11,114 timber sales in 2016 and encountering 500 incidents of timber theft between 2014-2016. Firms from mountain regions encountered an average of 2.31 incidents of timber theft in the past three years, significantly more than the Piedmont (1.21) and Coastal Plain (1.07) ( $p \leq 0.02$ ). Firms reported total financial losses over the past three years ranging from \$0 to \$300,000. Average three-year timber theft financial losses among the three physiographic regions examined were not statistically different, and the median loss was \$0 with the lower 95% of reported losses averaging \$5,546 per forester across all regions. The most common method of theft reported was cutting across property boundaries with 24% of firms reporting this as an occasional or frequent problem. Most discovered incidents were resolved internally between the parties involved. This study suggests that timber theft is a relatively infrequent, though ubiquitous occurrence with the potential to significantly impact individual landowners.

### **Introduction**

Private landowners in the U.S. South represent a significant source of timber in the region and ensuring their satisfaction is important to the future of the timber industry. Studying timber theft on private sales is often problematic due to difficulty in contacting large numbers of individuals and their reluctance to discuss the sensitive topic. In one example, a telephone survey of private/individual timberland owners in Appalachia attained a response rate of only 16% (Baker 2003). A survey in New York state, where 85% of land is privately owned, determined that timber theft occurs primarily on private lands (Canham and Pedersen 2007). One-third of timber theft cases in this study occurred on land not permanently occupied by the owners.

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The U.S. South is dominated by private owners with Georgia's timberland ownership alone consisting of over 90% private entities (Brandeis et al. 2014). Developing a more complete understanding of the impact and modes of timber theft is especially pertinent in the U.S. South given its land ownership.

Determining the methods by which timber theft is perpetrated and the relative threat that each represents is key to prevention. A recent analysis in Kentucky concluded that as much as 91% of unauthorized timber harvest incidents were related to property line infringements, either intentional or not (Stringer et al 2016). Other reports suggest that timber sale boundaries are often clearly marked making unintentional harvest of timber logically unlikely (Canham and Pedersen 2007). Making the distinction between intentional theft and civil disputes is often difficult, however the net effect of lost revenue to landowners is the same.

There have been few studies attempting to estimate the scale of timber theft. Often, small samples and secondary sources have informed these estimates. An analysis of a 20-county region in the Appalachian Mountains estimated anywhere from 131 to 1527 incidents of theft from private individuals annually. The same study found that 61 instances of timber theft reported by industrial landowners resulted in \$304,000 of timber lost, an average of \$4,984 per incident (Baker 2003). In Kentucky, a survey of consulting foresters found an average of \$4,904 of timber value lost per incident state-wide and \$7,875 per incident in Eastern Kentucky. In both cases, the total estimate of timber value lost amounted to less than 0.5% of the annual harvest revenue in the area of interest (Stringer et. al. 2016). However, nearly \$5,000 of lost revenue to a single landowner could be considered substantial.

## **Methods**

We conducted a survey of forestry consulting firms in the U.S. South in order to gather information on timber sale practices and experiences with timber theft. Survey questions asked foresters about theft incident frequency, financial impacts, theft methods, prevention techniques, perception of risk and resolution methods.

Foresters were identified by utilizing state published lists of registered foresters and the Association of Consulting Foresters (ACF) member list. One forester at each firm's office location was randomly selected to be included in the survey. Dillman's (2009) Tailored Design Method utilizing multiple contacts was followed. Each forester selected was sent a cover letter inviting them to participate in the survey and to confirm the email address to which the electronic survey would be sent. Following the cover letter, an email containing a link to the online questionnaire was sent on three consecutive Tuesday mornings.

Participants were asked to report information for all foresters employed at their firm's location. Questions related to timber theft/trespass asked participants to report information on the past 3 years. A series of Likert Scale questions asked participants to respond to a statement regarding payment types and marketing methods. Response choices included "strongly disagree", "disagree", "neither", "agree" and "strongly agree" with corresponding continuous values including -2, -1, 0, 1 and 2. Some questions were asked respondents to select a category

containing a range of percentages. For these questions, the midpoint was used to calculate means.

Statistical analysis was performed using JMP to produce distributions of data collected. Tukey's HSD test of statistical significance was used to compare results among physiographic regions and among categories.

## Results and Discussion

A total of 1,159 emails containing the survey were deliverable and 522 firms from 11 states completed the survey for a gross response rate of 45%. The first question asked if the individual was a consulting forester who offered timber sale set-up/administration services for a fee, and 92 indicated that they did not fit this criterion resulting in a net response rate of 37% consisting of 430 responses. Four respondents completed at least parts of the survey but did not indicate the state in which they worked (Figure 1).

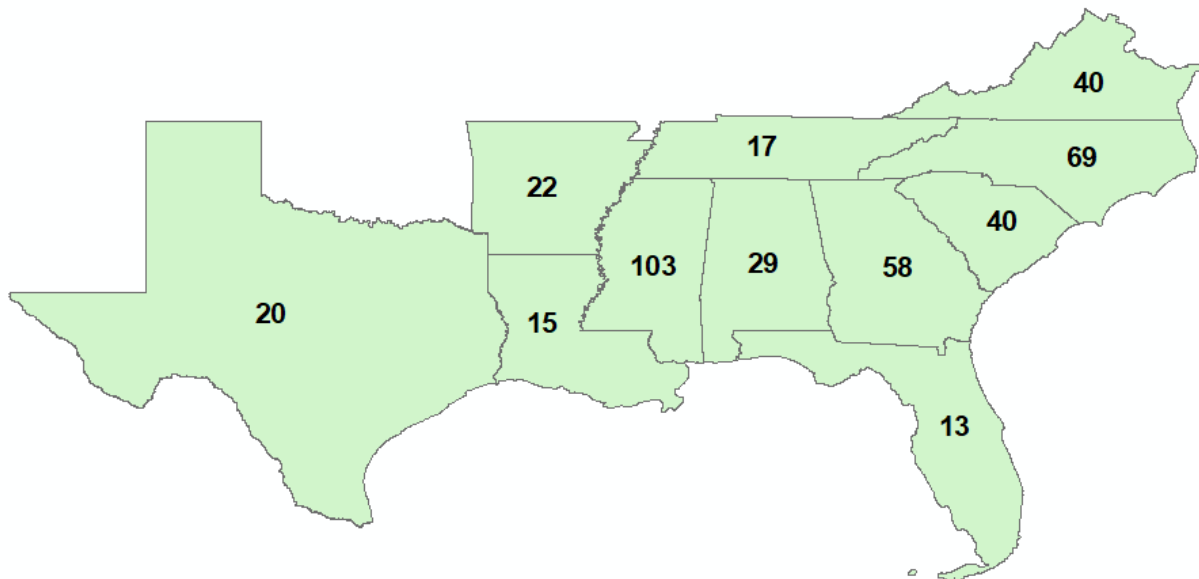


Figure 1: Survey responses by state (4 responses with no state indicated).

### Theft Incident Frequency

South-wide, foresters reported a total of 500 theft incidents resulting in an average of 1.28 incidents of timber theft per firm over the last 3 years. A total of 11,114 timber sales were administered by responding firms in 2016, suggesting a maximum of 1.5% of sales were victimized by theft. Because firms were also asked to report on incidents from other sales that they were asked to investigate, the actual percentage of sales victimized by timber theft is probably somewhat lower. Firms operating primarily in the Mountains reported significantly more cases of theft (2.31) compared to the Coastal Plain (1.07) and the Piedmont (1.21) ( $p < 0.05$ ) (Table 1). Nearly half of respondents (47%) reported having encountered at least 1 case of timber theft in the past 3 years.

### Financial Losses/Recoveries

Total financial losses resulting from timber theft over the past three years amounted to \$3,391,572, or \$6,783 per incident. Recoveries over the 3-year period totaled \$3,844,237, or \$7,688 per incident. This amounted to a south-wide average of \$8,385 of losses and \$9,539 of recoveries per responding firm for the 3-year period.

It should be noted that there were a few significant cases of firms reporting large 3-year losses and recoveries. In the most extreme case, a firm reported 3-year losses of \$250,000 and recoveries of \$750,000. The lower 95% of 3-year financial losses and recoveries averaged \$5,546 and \$4,871 per firm, respectively. The reversal of recoveries exceeding losses observed in the lower 95% of cases can probably be explained by the likely possibility that relatively large cases of theft are more frequently pursued to a resolution.

The Piedmont has the largest average loss per incident at \$8,464.63. The Coastal Plain is the only region in which average recoveries exceeded average losses with recoveries amounting to nearly 1.8 times the losses (Table 1). Losses and recoveries among regions were not statistically different from one another. This survey's Mountain region average loss per incident of \$4,601.85 is comparable to Baker's (2003) finding of \$4,984 lost per incident in the Appalachians.

Table 1: Average incidents encountered per firm, losses and recoveries per incident by region.

<b>Physiographic Region</b>	<b>Incidents per firm</b>	<b>Average loss</b>	<b>Average recovery</b>
Piedmont	1.07 <sup>a</sup>	\$8,464.63 <sup>a</sup>	\$7,593.27 <sup>a</sup>
Mountains	2.31 <sup>b</sup>	\$4,601.85 <sup>a</sup>	\$3,394.44 <sup>a</sup>
Coastal Plain	1.21 <sup>a</sup>	\$5,579.88 <sup>a</sup>	\$9,939.72 <sup>a</sup>

<sup>a,b</sup>Values in columns not connected by the same letter are statistically different at  $\alpha=0.05$

### Theft Methods

Survey participants were asked to report how often they encountered six methods of timber theft in the past 3 years. All theft methods were overwhelmingly reported to be infrequent occurrences. South-wide, the method of theft most commonly reported to occur "occasionally" or "often" is cutting across property boundaries during a legitimate sale. The method most commonly reported to occur "never" or "rarely" is theft of decked logs/unattended trailers (Figure 2). Differences among physiographic regions were not observed to be statistically significant ( $p>0.05$ ).

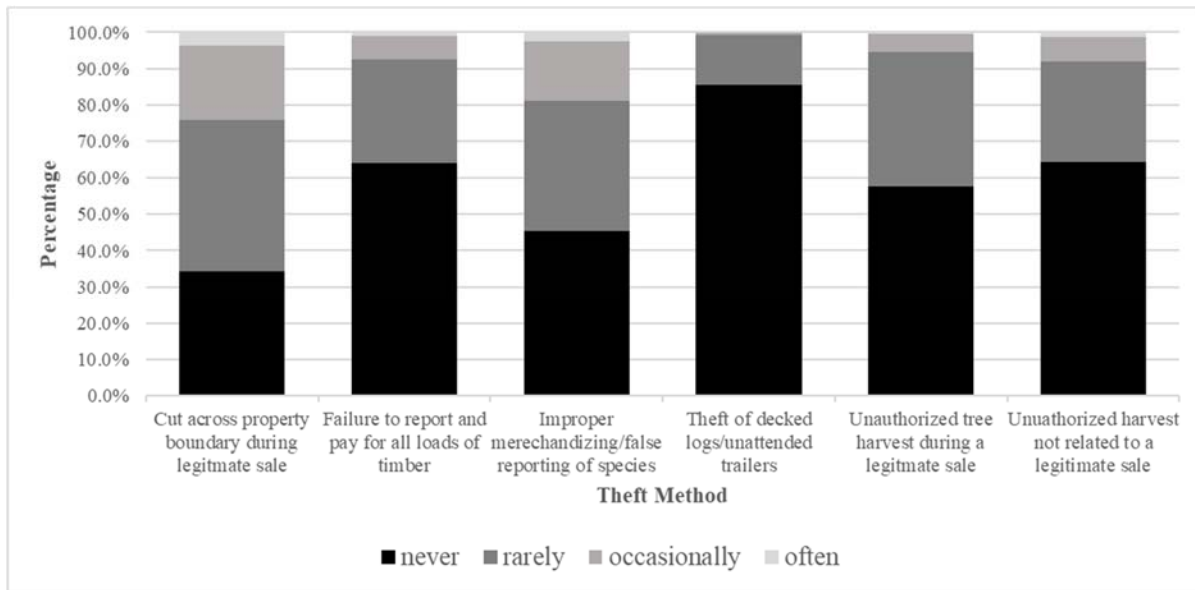


Figure 2: Reported relative frequencies of 6 methods of timber theft.

### Prevention Techniques

Each firm was asked to report if their foresters regularly employed any of six timber theft prevention techniques. The most commonly used technique is property line marking with 93.3% of firms reporting regular usage. The least commonly used method is electronic surveillance with only 29.5% reporting regular usage (Figure 3).

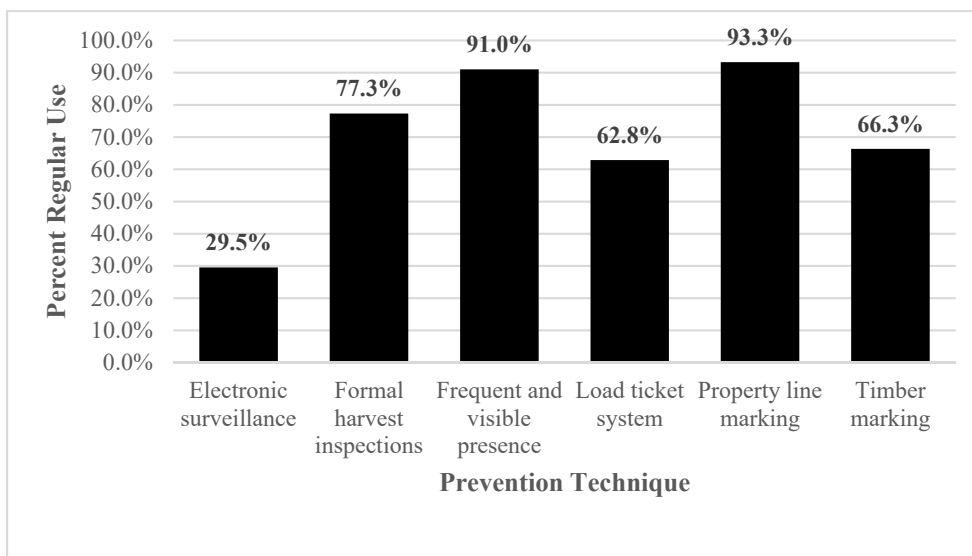


Figure 3: Frequency of regular use of 6 risk management techniques.

Regular usage of each timber theft prevention method was compared to reports of how many theft incidents firms had encountered in the past 3 years. Electronic surveillance, formal harvest inspections and timber marking were all associated with higher rates of theft detection (Table 2). Firms reporting regular use of a frequent and visible presence, load ticket systems, and property line marking did not detect statistically more theft incidents in comparison to those not regularly employing those tactics.

Table 2: Comparison of use of prevention techniques to number of theft incidents detected per firm.

<b>Prevention Technique</b>	<b>Regular Usage</b>	<b>Theft incidents encountered</b>
Electronic surveillance	Yes	1.70 <sup>a</sup>
	No	1.12 <sup>b</sup>
Formal harvest inspections	Yes	1.42 <sup>a</sup>
	No	0.82 <sup>b</sup>
Frequent and visible presence	Yes	1.29 <sup>a</sup>
	No	1.29 <sup>a</sup>
Load ticket system	Yes	1.36 <sup>a</sup>
	No	1.16 <sup>a</sup>
Property line marking	Yes	1.30 <sup>a</sup>
	No	1.15 <sup>a</sup>
Timber marking	Yes	1.43 <sup>a</sup>
	No	1.01 <sup>b</sup>

<sup>a,b</sup>Values in columns not connected by the same letter are statistically significant at  $\alpha=0.05$

These results suggest that frequent visits to timber sales are not necessarily a deterrent to timber theft unless formal harvest inspections are also incorporated. The insignificance of property line marking could be explained by the possibility that legal property boundaries may be unclear, especially on properties surveyed by metes and bounds. Legally ambiguous boundaries could lend themselves to accusations of timber theft, regardless of whether or not they were marked. Load ticket systems may be an insignificant factor in theft detection because it deters theft attempts from the outset.

### Perceptions of Risk

Analysis suggests that consulting firms clearly favor one payment method over the other for each statement. Lump sum sales are perceived to pose a lower risk for timber theft, encourage proper merchandizing, maximize competition for sales and incentive tract utilization compared to pay-as-cut sales. Pay-as-cut is not reported to significantly favor, nor discourage tract utilization, however lump sum is still perceived to be superior in this category (Table 3).

Despite foresters' clear preference for lump sum sales, TimberMart-South (TMS) reports that use of this payment method has declined by 5% over the last 10 years (Hood et. al. 2016). This trend could be explained by logging firms' reluctance or inability to tie up large amounts of capital in

stumpage. Regardless of the reasons, the trend towards pay-as-cut sales is troubling given the increased risk associated with this payment method.

Table 3: Firms' Likert Scale level of agreement with statements pertaining to pay-as-cut and lump sum payment methods.

Statement	Payment Type	Mean
Present a high risk for timber theft/contract disputes	Lump sum	-1.10 <sup>*a</sup>
	Pay-as-cut	0.61 <sup>*b</sup>
Encourage proper merchandizing according to product specifications	Lump sum	1.10 <sup>*a</sup>
	Pay-as-cut	0.48 <sup>*b</sup>
Maximize competition for timber sales	Lump sum	1.10 <sup>*a</sup>
	Pay-as-cut	0.54 <sup>*b</sup>
Fail to incentivize tract utilization as prescribed by the harvest plan	Lump sum	0.41 <sup>*a</sup>
	Pay-as-cut	-0.06 <sup>b</sup>

\*values are statistically different from 0 at  $\alpha=0.05$

<sup>a,b</sup>Values for each statement not connected by same letter are statistically different from each other at  $\alpha=0.05$

Firms mildly disagree with the notion that either bidding or negotiation strategies are vulnerable to collusion. Neither bidding nor negotiation is alleged to be more or less vulnerable. Bidding is perceived to outperform negotiation in maximizing stumpage prices for sales primarily consisting of high-value products, while negotiation is perceived to be superior for sales with mostly low-value products (Table 4).

Table 4: Firms' Likert Scale level of agreement with statements pertaining to bidding and negotiation marketing techniques.

Statement	Marketing Strategy	Mean
Are vulnerable to collusion among buyers	Bidding	-0.22 <sup>*a</sup>
	Negotiation	0.17 <sup>*a</sup>
Maximize stumpage prices on sales with large proportions of high-value products	Bidding	1.30 <sup>*a</sup>
	Negotiation	0.40 <sup>*b</sup>
Maximize stumpage prices on sales with large proportions of low-value products	Bidding	0.37 <sup>*a</sup>
	Negotiation	0.56 <sup>*b</sup>

\*values are statistically different from 0 at  $\alpha=0.05$

<sup>a,b</sup>Values for each statement not connected by same letter are statistically different from each other at  $\alpha=0.05$

Foresters' perception that bidding tends to maximize stumpage prices on high-value sales generally corroborates TimberMart-South's findings that stumpage prices for chip-n-saw and sawtimber are higher on bid sales compared to negotiated sales (Hood et. al. 2016). TMS found that bidding is generates only marginally higher stumpage prices on pulpwood products, making foresters' perception from this survey that negotiation is superior plausible. Over the last 10

years, the proportion of timber sales that are negotiated has increased by approximately 15% according to TMS, signaling another concerning trend, at least for high-value timber sales.

### Resolution Methods

Firms were asked to report the percentage of timber theft incidents resolved through five categories of resolution methods. South-wide, the most common method used to resolve discovered cases of timber theft is to negotiate a solution internally, between the parties involved. The second most commonly used method is civil litigation, followed by referral to local law enforcement or the state’s natural resource agency. The least common method of resolution is contract arbitration (Table 5).

Table 5: Percentage use of 5 categories of timber theft resolution methods.

<b>Resolution Method</b>	<b>mean</b>
Civil litigation	13.3%
Contract arbitration	5.6%
Local law enforcement	6.5%
State natural resource agency	6.5%
Resolved internally	34.1%

Firms from the Mountains use civil litigation to resolve timber theft cases significantly more frequently (31.0%) than their counterparts in the Piedmont (9.1%) and Coastal Plain (12.4%). Other methods of theft resolution are used at similar rates across regions with internal resolution being the most common (Figure 4).



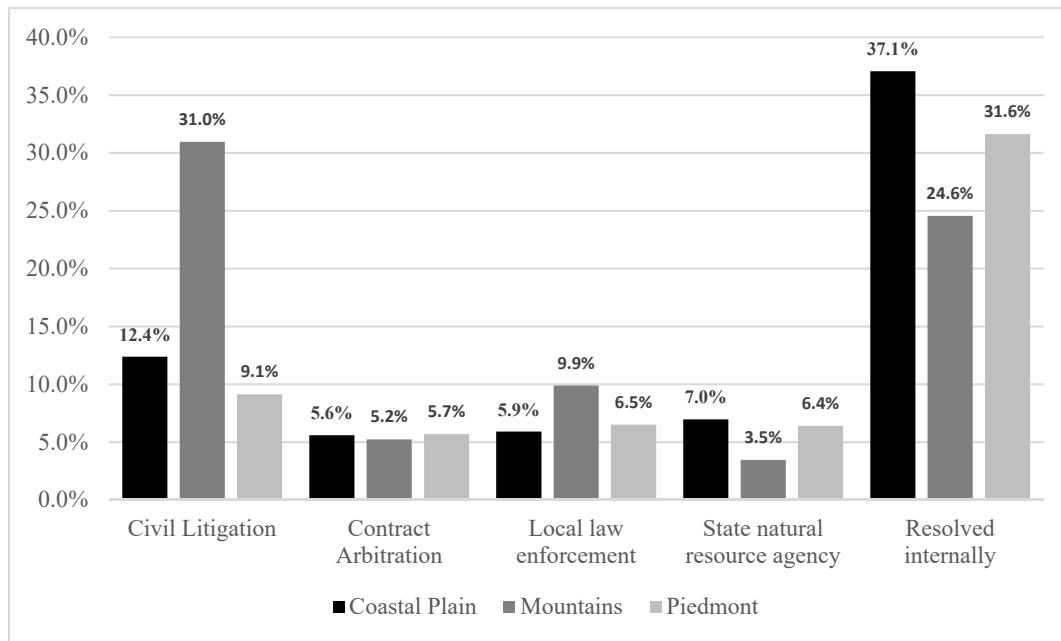


Figure 4: Regional percentage use of 5 timber theft resolution methods (means generated from categorical midpoints).

## Conclusion

Timber theft is reportedly present in all regions of the U.S. South, but the mountains report markedly more frequent incidents. The most severe cases of timber theft are commonly resolved with recoveries including punitive damages exceeding the original losses. Despite near universal use of property line marking, infringement of these boundaries is the most common timber sale dispute. Certain prevention techniques are associated with higher rates of theft detection, with load ticket systems being a notable exception. Lump sum payments are perceived to be superior to pay-as-cut in key categories of timber security and landowner compensation. Bidding is perceived to maximize stumpage prices on high-value product sales and negotiation is perceived to maximize prices on low-value product sales. Neither bidding nor negotiation is thought to be more effective at preventing collusion among buyers, though both methods are reported to be relatively unsusceptible. Discovered methods of theft are most commonly resolved internally without involving state agencies or law enforcement. Smaller, family timberland ownerships may be substantially impacted by an average timber theft incident loss of \$6,783 despite relatively insignificant aggregate theft losses in comparison to total timber sale receipts.

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