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Family Forest Owners Satisfaction with Timber Transactions

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Family Forest Owners Satisfaction with Timber Transactions

Jeffrey M. Lee

Thesis submitted to the
Davis College of Agriculture, Natural Resources, and Design
at West Virginia University

In partial fulfillment of the requirements for the degree of

Masters of Science in Forestry

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Abstract

Family Forest Owners Satisfaction with Timber Transactions

Jeff Lee

Forest industries in the eastern U.S. rely heavily on family forest owners to supply fiber needs for their mills. As of 2017, 79 percent of West Virginia is classified as forestland and of this roughly 86.5 percent is privately owned. With such a heavy reliance on wood from private forest lands, family forest owner satisfaction is extremely important if companies want to continue harvesting or working with these landowners in the future.

Timber transactions are complex. No two timber transactions are exactly the same. They often involve many different parties apart from the landowner. Site conditions, land cover, and landowner goals all are major factors that influence the outcome of a timber harvest. A timber harvest can leave a property completely transformed. For better or worse the property will not be the same as before the harvest. Timber harvests are common in West Virginia many lack the use of a forester. Without a forester, landowners are likely at a competitive disadvantage when negotiating timber contracts and accomplishing their goals and future of their properties.

The goal of this study was to explore ways to alleviate common pitfalls that lead to legal or financial issues that are associated with timber transactions. We carried out a mail-based survey to landowners who had recently harvested timber from their West Virginia properties. In this paper, we explore the relationships between landowner satisfaction with a harvest, their property attributes, management goals, and the types of professional assistance they received during their timber transaction.

Many attributes selected to represent conditions and events during timber transactions were found to be significantly related to the overall satisfaction of landowners following timbering operations. The adequacy of several of the attributes were used as indicators of landowners' perception of service quality. Having a forestry professional assist with the timber sale enhanced the likelihood that landowners would be satisfied with timbering outcomes.

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Chapter I: Introduction

Timber harvesting is a fundamental part of most wood supply chains. Wood processing companies rely on a continuous supply of timber from diverse sources. One of the largest sources of timber comes from family forest owners (FFO). FFOs are considered families, individuals, trusts, estates, family partnerships and other unincorporated groups or individuals that own at least an acre of woodland or forestland (Butler 2004, Butler 2008). In 2002, more than 60% of timber harvests nationwide were performed on FFO lands while only 3% of harvests were from national forest lands, representing an all-time low (Adams et al. 2006).

FFOs face important land management decisions that have long-term impacts on their property. Some of these decisions include whether to harvest timber, lease their property, or sell part or all of their property for added income (Ma et al. 2011). To complicate matters, when an FFO decides to harvest timber other parties become involved in the future conditions of the property. The timber sale may include loggers, consulting foresters, procurement foresters, state foresters, and others. All of these parties have a role to play in the success of the sale and future of the land (Rickenbach 2018, Hoover et al. 2002, Bowers et al. 2007, Grotta 2014).

While not a primary objective for owning timberland (Butler et al. 2016), selling timber for harvest can happen suddenly and oftentimes is full of difficult decisions and situations that FFOs need to respond to (Butler et al. 2011, Ma et al. 2011, Kendra et al. 2005). As in any type of transaction, participants want to be satisfied and want to have their expectations met (Hernandez-Espallardo 2011). But satisfaction itself is complex because a consumer can be satisfied with the service that was given but the quality of work can still be poor (Parasuraman et al. 1988). For agencies and organizations that advise landowners on how to sell timber,

understanding the complexity timber transactions is important because FFOs do not always grasp these intricacies.

Research on FFO's characteristics and behavior ranges from management activities (e.g. Howel et al. 2010, Greene et al. 2006, Joshi et al. 2009, Ma et al. 2011), outreach program participation (Korhonen et al. 2012, Butler et al. 2011, Davis et al. 2015, Butler 2014, Best 2001), harvesting behavior (Zhang et al. 2001, McGill et al. 2006, Favada et al. 2007), and demographics (e.g. Mehmood et al 2005, Sauliner et al. 2017, Walkingstick et al. 2001). However, there has been very little research of FFO's satisfaction with their overall timber sale.

Differences such as who and what are involved, species composition, payment method, and even the lay of the land itself all contribute to how complex a timber sale can be for an FFO (McGill et al. 2006, Heiligmann et al. 1986, Grotta 2014, Grushecky et al. 2012, Bower et al. 2007). All of these variables can have an impact on how satisfied an FFO is with their timber sale. Whether an FFO hires a forester, has knowledge of the harvest, or trusts the associated parties involved in the timber sale can have either a positive or negative impact on their experience (Heiligmann et al. 1986, Bowers et al. 2007, Moss et al. 2013, Grotta 2014 Rickenbach 2018). FFOs who used a contract and were aware of the steps involved in completing a timber harvest were found to have a positive experience when selling timber (Maltempie 2017).

Despite the fact that there is little research on FFO satisfaction, university extension programs have tried to educate FFOs about forest management since the Clarke-McNary Act of 1924 (Barden et al. 1996). The act was meant to strengthen forestry extension in the United States to help FFOs plan and implement timber management activities. Yet even with this with

this effort over the years, more than half of the FFOs of West Virginia who harvested in 2000-2001, did so without the help of a professional forester (McGill 2006).

In order to add to our understanding of FFO satisfaction with their timber transactions, a questionnaire was designed to investigate recent timber sales in West Virginia. The primary research concern was to determine how overall FFO satisfaction is influenced by events and conditions that occur during a timber transaction. Specifically, research questions included:

Q1. What attributes of a timber sale are indicators of overall FFO satisfaction with their timber sale?

Q2. How important are these attributes to an FFO and how well they are being performed during a timber sale?

Chapter II: Literature Review

Private Landowners

American private forest owners have existed and have made management decisions for their properties even before the Revolutionary War. The newly formed United States federal government distributed land to veterans or families through the Homestead Act of 1862 (12 Stat. 392) to settle the land gained from the Louisiana Purchase of 1803 and lands ceded to the United States at the conclusion of the Mexican American War in 1846. In a way, the Louisiana purchase and private land ownership set the stage for the further growth of the United States (Joy 2003).

Between 1781 to 1940 the United States federal government transferred land to individuals to encourage settlement of the western United States (Poschman 2014). Currently 69% of western forestland is publicly owned and 31% is privately owned. Public landowners include federal, state and local governmental agencies (Butler 2016). In contrast, private landowners control up to 81% of the forestland in the eastern US (Nelson et al. 2010). Private forest ownership makes up the greatest proportion of ownership types in the eastern United States. Changing policies for public lands has caused a shift from harvesting predominantly public lands in the western half of the United States to almost exclusively harvesting the private lands of the eastern United States (Oswalt et al. 2014).

Private landowners are individuals, organizations or corporations who own land. This includes private individuals, business corporations, tribal nations, and other nongovernmental conservation or natural resource organizations (Butler 2016). Private landownership is usually categorized as either industrial or non-industrial. Industrial private landowners own the mills to process timber growing on their property whereas non-industrial forest ownership includes

anyone or any corporation that does not rely upon the processing of the forest materials for their main income source (Bliss 2010).

Non-industrial private forest owners include family forest owners (FFOs).

Approximately 10.7 million FFOs possess roughly 290 million acres of forest or 36% of all forest land in the United States (Butler et al. 2016). FFOs include families, individuals, trusts, estates, family partnerships and other unincorporated groups or individuals that own forest land (Butler 2008). To be considered an FFO, one must own at least one acre of land that is at least 10% stocked with trees (Butler et al. 2004). FFOs may have received their forests through inheritance, direct purchase, or by possessing abandoned or overgrown agricultural land (Zhang et al. 2005).

FFOs have increased 11% from 1990 to 2000 (Zhang et al. 2005). These numbers may be increasing as a result of parcelization. Parcelization is breaking up large tracts of land and selling them as smaller fragments (Mehmood et al. 2001). This increase in FFO numbers was mostly in smaller acreage properties, specifically owners who owned less than 50 acres (Zhang et al. 2005). It is in the interest of government agencies, university extension programs, and even forestry professionals to understand landowner goals for their woodlands. Working with FFOs is important because collectively they affect local and regional economic health (Bengston et al. 2010)

More than half of the timberland in West Virginia—the focal area for this study—is owned by private individuals. Families and individuals own 52%, corporations own 34% and other private entities own 1%. Only 14% of the forestland in West Virginia is owned by public entities. The US Forest Service manages 9%, the state of West Virginia owns 3% and other public entities own 2% of forestland (Morin et al. 2017).

FFO goals

FFOs are strongly attached and have a strong desire to “do right” by their land and view their properties as a reflection of their lifestyle instead of a means for financial gain (Greene et al. 2006). Three-fourths of Virginia FFOs purchased forest land to “preserve nature” instead of uses for financial gain such as harvesting timber (Kendra and Hull 2005). When forestry professionals are called upon, landowners are frequently asking for help with other goals such as increasing amenity values for their property instead of timber harvesting (Butler et al. 2016).

FFOs commonly own their property for aesthetic and recreation values (Butler et al. 2011) and are not opposed to performing management (Snyder 2018). Studies of South Carolina’s FFO’s perceptions on chemical methods for controlling privet find that owners who participate in extension or other stewardship programs are likely to have different views and preconceptions about treatments (Howle et al. 2010). Silvicultural activities and property management in West Virginia were found to be commonly performed activities (Joshi et al. 2009). Fifty-nine percent of West Virginia FFOs have performed some sort of management activities on their land (Joshi et al. 2009). FFO concerns may affect how they maintain and use their property.

Understanding FFO behavior can be problematic. Not all FFOs speak or understand the technical jargon or management activities that forestry professionals are accustomed too. Non-participating landowners have been described as under-involved in managing their lands but, when resurveyed by phone some owner’s responses differ from written surveys and show that

they do manage their property but are unfamiliar with the jargon used by professionals (Davis et al. 2010).

Decision to Sell

FFOs sell timber for a variety of reasons such as emergency needs, change of land use, or even to fulfill management goals (Ma et al. 2011). Some FFO attributes have been associated with a predisposition to harvesting timber or managing property such as; how the property was obtained, interests, employment, tenure of ownership, land size, age, and even gender (Joshi et al. 2009, Sauliner et al. 2017). Studies have shown that education has a positive correlation with willingness to harvest (Sauliner et al. 2017). Employment such as being a farmer affects willingness to harvest. This may be due to the farmer's ability to access resources such as stewardship programs or extension agents and their familiarity with equipment that is needed to manage their stands (Joshi et al. 2009).

FFO studies in West Virginia have determined that income is a common reason to harvest. Other reasons to harvest included the stand needed to be thinned, timber was considered mature, or harvesting was part of a management plan (McGill et al. 2006). Amount of owned acreage may also be part of the decision to harvest. FFOs in Virginia who owned larger tracts of were more likely to harvest timber than those with smaller tracts, possibly because a harvested area gets lost in larger tract of land (Sauliner et al. 2017). However, items such as tract size, distance, and timber quality are all part of a logging company's decision to bid or harvest timber (Kittredege et al. 1996). These factors can influence what companies bid on the harvest.

More than half (64.3%) of FFOs in Virginia have not had assistance of any kind from forestry professionals (Sauliner et al. 2017). Similarly, in West Virginia roughly half of FFOs

who harvested between 2000-2001 did not have any assistance from a professional forester (McGill et al. 2006). Wetzel county West Virginia FFO's demonstrate their largest landowner concern was damage to their property, followed by items such as loss of control of their land, liens against the property, or being cheated when creating a long-term timber contract (McGill 2008). FFOs in Indiana are interested in performing a harvest but choose not to due to concerns of how trustworthy a logger could be (Ruseva et al. 2014). Data like this helps support the idea FFOs harbor trust issues with industry professionals.

The timber sale

The reality for many West Virginia FFOs is that they are at a disadvantage when negotiating the sale of their timber. These landowners may not only under value their timber but may also cause changes to their timber stands (McGill et al. 2006). Timber is usually sold either as stumpage or by logs (Bowers et al. 2007). Which means that there will be removal of materials from the FFO's property and it will cause noticeable changes that the landowner will have to accept. Negative economic conditions, poor trees, low value species can add to the difficulty or frustration of finding a logging company (Moss et al. 2013).

Figure 1 explains the complexity of a timber harvest in West Virginia through a four-party timber transaction that includes a professional forester, logging company, the West Virginia Division of Forestry (WVDOP), Logger and finally the FFO. The first phase is conceptualization where a catalyst causes the FFO to decide to sell timber. The next phase is timber sale preparation where contact is made with a professional forester or in a 3 party scenario the logger. The forester will help the FFO plan and start the sale by writing up a contract, determining boundaries, and performing a prospectus. The next phase is the timber

harvesting stage. The logger notifies the West Virginia Department of Forestry (WVDOF) of a harvest that is to be performed and the WVDOF sends a state forester.

The WVDOF is involved in the harvest due to requirements associated with the Logging Sediment Control Act (LSCA). The LSCA was passed by the West Virginia Legislature in 1992 in response to section 208 of the Federal Water Pollution Control Act of 1972 (Spong 2013). The Federal Water Control Act of 1972 requires regulatory agencies such as the WVDOF to regulate locations that have an impact on water quality (U.S. Environmental Protection Agency 1972). All of these parties may or may not exist as a part of a sale and can have an impact on how the sale concludes.

Figure 1. Four party Scenario Timber Transaction Process. Figure Courtesy of D. McGill, West Virginia University Extension Service.

During all of these phases, extension literature attempts to address and give guidance to FFO's about certain activities that occur and need to be managed during the timber sale. As far back as the Clarke-McNary Act of 1924 University Extension programs added forestry into its educational programs (Barden et al. 1996). Much of this information was meant to help

landowners to plan and implement management activities. This literature suggests FFOs determine property and harvest boundaries, visit the site and communicate with parties who are involved, create a written contract with involved parties, hire a forester or at least communicate with other professionals for guidance (Heiligmann et al. 1986, Grotta 2014, Grushecky et al. 2012, Bowers 2007).

Before a harvest should even begin, it is recommended that FFOs establish goals and a management plan for their property. Goals must account for time, money, site, and equipment constraints when they are being created (Grotta et al. 2014). A forest management plan describes the property, lists goals, and roughly defines how the FFO plans to accomplish these goals (Grotta et al. 2014). A study of FFO satisfaction in West Virginia found that 79% of landowners did not have a forest management plan. However, on a positive note most of the FFOs did have objectives and goals for their property (McGill et al. 2006).

Foresters, whether state, procurement, or private consultants can be a wealth of information and a connection to other professionals Heiligmann et al. 1986, Bowers 2007, Grotta 2014 Rickenbach 2018). FFOs are encouraged to regularly visit the harvest site and communicate with the operators and having a forester can help the FFO understand what is happening and help answer questions and concerns (Heiligmann et al. 1986, Bowers 2007, Grotta 2014 Rickenbach 2018). Consulting foresters are highly recommended due to their propensity to harvest trees that are considered a high value species or timber that will become the future saw timber of the stand (Moss et al. 2013). Consulting foresters are hired and to represent and protect the FFO and their property

Logging companies can have a diverse structure, equipment types and availability to harvest and complete FFO goals. For example, the typical crew can range from 2 to 9 employees

and can be independent contractors, contract or company logging crews (Grushecky et al. 2012). Transactions can vary depending on who and what are involved, landowner goals, and the lay of the land. Equipment used for the harvest can affect the landowner's satisfaction with the harvest as well. Sounds, damage to residual trees, mess, speed of the harvest and a host of other issues can positively or negatively affect a harvest. A longer than expected harvest can affect the amount income received due to fluctuations of the market (Bower et al. 2007).

Satisfaction

Satisfaction is considered a non-financial measurement of a company's performance. It can be said that it is a reliable indicator of a company's future (Chen et al. 2009). Perceived quality is the client's judgement of how well the company performed (Parasuraman et al. 1988). Service quality is judged by a sense of standards or ideal services, whereas satisfaction is judged by experiences (Lee et al. 2014). Satisfaction is a mental state that results from confirmation or disconfirmation of expectations and prior feelings about experiences with a service (Parasuraman et al. 1988). Harvesting out of bounds, damage to residual trees, harvesting unmarked trees, and other issues can all cause a deviation from FFO expectations resulting in dissatisfaction. Negative reviews or experiences cause a consumer to avoid a product or service (Weiner 2000). Determining issues and going the extra mile to correct them as best as possible gives the client a sense of gratitude and may cause them to recommend those involved (Weiner 2000).

Purpose:

Previous research has shown that five themes emerge from interviews with West Virginia FFOs who had recently harvested timber. Items such as hiring a forester, previous knowledge of what occurs during a harvest, trusting the parties that were involved in the harvest all impacted the outcome of the harvest. Hiring a forester or being prepared for the sale could

positively impact a timber sale, whereas not trusting the forester or the logging company would negatively impact the outcome of the timber sale (Maltempie 2017).

FFOs and forestry professionals could both benefit by knowing how the various attributes timber transactions interact with and impact satisfaction. Knowing this, they could then focus on poor performing but essential attributes to improve the quality of future timber sales.

The goal of this research is to determine important aspects of a successful timber transaction. Specifically, research questions included:

Q1. What attributes of a timber sale are indicators of overall FFO satisfaction with their timber sale?

Q2. How important are these attributes to an FFO and how well they are being performed during a timber sale?

Chapter III: Methods

A survey of West Virginia FFOs formed the basis of this study designed to explore how overall FFO satisfaction is influenced by events and conditions that occur during a timber transaction. A mailed questionnaire provided a representative sample of FFO experiences with their recent timber sales.

FFO selection process

A list of FFOs who had recently harvested timber from their properties was obtained from the West Virginia Logging Operations Notification Inspection and Enforcement system (LONIE). The system is maintained by the West Virginia University Appalachian Hardwoods Center and the West Virginia Division of Forestry (WVDOF). LONIE was developed as a tool for the WVDOF to comply with the WV Logging Sediment Control Act (LSCA) by creating a registry of logging operations and inspection findings. Logging operators are required to send a notification to LONIE within three days of beginning a harvest. The LONIE database includes data such as harvesting location, parties involved, loggers license number, client contact information, and when and where the harvest would occur (Spong 2013).

LONIE contains statewide records of both FFOs and other landowner types that have filed timbering notifications. Landowners selected to participate in this survey were required to be an FFO and have filed a timber notification form between November of 2012 and November of 2019. At the time of this study, LONIE contained a total of 13,009 entries. Landowner classes were sorted to remove non-FFOs. Duplicates were removed if the FFO's owned multiple properties or had performed multiple harvests within the time period of interest. Keywords such as trusts, company, corporation, limited or limited liability company were used to find and remove possible non-FFO entries in the LONIE database. The LONIE file contained entries that

went back as far as 2012. The entries were sorted by ending date to eliminate harvests that had not been completed.

Memory and the amount of time that passes following an event could be considered a problematic issue with the accuracy of FFO responses. However, it was assumed that harvesting can be considered a “significant alteration” that acts as a reminder and inhibits forgetting (Sudman et al 1973). We also used notification date as an explanatory variable to account for this time since harvesting consideration.

After filtering for FFOs, there were 4,331 properties with notification forms making up the sampling frame. To obtain a 95% confidence and a margin of error of 0.05 for our questionnaire items, 354 FFO responses were needed from the population (Krejcie et al. 1970). Based upon previous questionnaire response rates 25 percent was commonly achieved, 1,349 FFOs were randomly chosen as participants.

Data Collection

The questionnaire contained sections related to the elements of timber sales based on peer-reviewed and extension-based technical publications. These publications contain recommendations for FFOs interested in harvesting timber or otherwise managing their properties. Some of the recommendations include the type of forestry professionals to contact, professionals who can administer timber sales from start to finish. Details of items related to the planning, layout, and logging are found in many helpful extension documents (Bowers et al. 2007, VDOF 2014, Grotta et al. 2014, Rickenbach et al. 2018) and give landowners some idea about what to expect in a prospectus, on a contract, during the timbering, and following reclamation.

The questionnaire (Appendix A) was organized around six different sections: 1) property management, 2) decision to sell timber, 3) planning the timber harvest, 4) logging operations, 5) post-harvest results, and 6) demographics. Generally, items that would be used as response variables in our analyses were taken from section 5, post-harvest results (Table 1). These are questions that are related to landowner satisfaction with their timber transaction. Items in the questionnaire that would serve as explanatory variables—descriptors of the property, planning, timbering, and demographics of each timbering transaction—are in the other five sections (Table 2). Explanatory variable types included ordinal variables derived from Likert scales and importance/performance items, opened-ended questions, categorical, and continuous variables.

Table 1. Post-harvest satisfaction attributes serving as response variables.

<i>Variable</i>	<i>Description</i>
satrevrec	Satisfied with the amount of revenue. 1= very dissatisfied, 4= very satisfied
sattimbersale	Satisfied with the entirety of the timber sale. 1= very dissatisfied, 4= very satisfied
satcontract	Satisfied with contract. 1= very dissatisfied, 4= very satisfied
satgoals	Satisfied with how well goals were accomplished. 1= very dissatisfied, 4= very satisfied
satcond	Satisfied with the condition of the property after harvest. 1= very dissatisfied, 4= very satisfied
satharvprac	Satisfied with information received about harvesting practices. 1= very dissatisfied, 4= very satisfied
satisbi	Overall mean satisfaction variable.

Table 2. Timber transaction attributes serving as explanatory variables.

Variable	Definition
residence	FFO residence. 1=current residence, 0=not currently residing
Intotac	Natural Log of FFO owned acreage
firstharv	FFO's first harvest. 1=first harvest 0=multiple harvest (veteran)
ownertype	Type of family owner split into unique owner (individual) or famunit (joint with spouse and family).
incenttax	Participation in farm or managed timberland tax. 0=yes timberland, agriculture or both 1=no
forester	Forester data from LONIE, contains Consultant, Procurement, and State forester. 1= there was a forester associated with sale, 0=no forester associated with sale
noteyear	Year the harvest was accomplished. Continuous variable.
plan	FFO management plan for property 1=plan 0 no plan
guidance	FFO's receive guidance or advice on the best way to harvest no=0 yes=1
events	FFO decision to sell timber 0=I was asked to sell, 1=I first decided to sell
Decisionbi	Q10 combination of reasons why the FFO decided to sell their timber 0= disagree 1= agree
Knewbi	Q12 combination of variables involving landowner previous knowledge related to land management 0= disagree 1=agree
Discussbi	Q12 combination of variables involving landowner communication with family and neighbors for harvest 0= disagree 1=agree
adeqparty	I-P=D When I and P are the same or P is higher than the party's involvement were adequate, if I was less than P, there was a lack of satisfaction.
adeqplan	I-P=D When I and P are the same or P is higher than the planning of the harvest was adequate, if I was less than P, there was a lack of satisfaction.
adeqcomm	I-P=D When I and P are the same or P is higher than the communications between parties were adequate, if I was less than P, there was a lack of satisfaction.
adeqoperations	I-P=D When I and P are the same or P is higher than the operations were adequate, if I was less than P, there was a lack of satisfaction.
adeqindex	Performance adequacy index of adeqparty, adeqplan, adeqcomm, adeqoperations
selltype	type of timber sale 1=Sealed bid, 2=negotiated sale, 3 paid on shares
Again	Landowner decision to sell timber again in the future. 0=no 1=yes
Addact	FFO have to perform or have logging company perform additional work after the harvest 0=no 1=yes
Gender	Gender of respondents
Age	Age in years of respondents
College	Education level of FFOs. 0=Some high school/high school
Satisbi	Response variable of overall mean of satisfaction.

Two additional variables were extracted from the LONIE data that were not included in the questionnaire. *Noteyear* was a variable designating the year that the FFO or logging company notified the WVDOF of their intention to begin logging. *Forester* was the second variable confirming that either a procurement or consulting forester was associated with the timbering operation (Table 2).

Each of these attribute sections were designed to serve as a part of a model to explore satisfaction as a function of the attributes that occur during each phase of a timber harvest. The generalized model was:

Satisfaction= f (Management of your property + Deciding to sell timber + Planning the timber harvest + The logging operations + Demographics).

Deployment

Once completed the questionnaire was submitted for review to three West Virginia University forestry faculty members and to the West Virginia Division of Forestry Assistant State Forester for Logging Compliance. Updates were made based upon comments and suggestions made during this first review. The updated questionnaire was then mailed to three FFOs known by the research team and who had recently harvested timber. Using feedback from reviewers, modifications were made to streamline and simplify the questionnaire.

The questionnaire was submitted to the West Virginia University Internal Review Board and was approved for an expedited research exemption. Deployment was based on a modified protocol recommended by Dillman (2000). An initial mailing of the questionnaire occurred on January 10, 2020. FFOs who had not responded received a follow-up reminder via postcard on January 27, 2020, with a second mailing of the questionnaire sent on February 24, 2020.

Data Analysis

Coding process

Open ended questions were used in the questionnaire to elicit responses from FFOs that may have otherwise not been revealed within the confines of the questionnaire. FFO responses were coded based on themes or patterns emerged from each question. Emergent categories were determined by reading through the responses to find themes or issues that recurred within the data. Categories were then defined after the data had been read (Renner et al. 2003). Relative importance of the themes was used to bolster or to understand the quantitative questions in the analysis process.

Importance Performance Analysis

Importance-performance analysis (IPA) was used to determine what attributes of a transaction are important to a customer—here, the landowner— and how adequately they are being performed. The difference between the importance of a transaction attribute and the performance or delivery of that attribute serves as an indicator of the adequacy of the attribute. The IPA sections in this questionnaire were 1) parties involved in the sale, 2) planning the sale, 3) FFO communication, and 4) harvest operations. Each of these sections had a set of items representing various timber sale attributes. For each attribute, the respondent was asked to rank both the importance of the attribute and the performance adequacy of the attribute. Again, many of these attributes were created from information contained in various extension and research publications that were developed to promote landowner education about timber sales. In this way, the IPA was geared to identify high and low performing elements that occur in timber transactions.

Following methodology suggested by Deng et al. (2018), importance-performance values for the attributes in each section were scaled with respect to the attributes within the respective section. Restated, the overall means of each section's importance and performance values were subtracted from each individual attribute's mean importance and performance values. The results were then plotted using performance as the domain (x-axis) and importance along the range (y-axis) (Figure 1) (Ennew et al. 1993, Deng et al. 2018).

A desirable feature of IPA is that the attributes are be plotted and given a visual display in graphical form (Martilla et al. 1977, Oh 2000). The IPA graph is divided into four quadrants, each with a different interpretation: quadrant 1-- important with good performance, quadrant 2-- possible overkill, quadrant 3--low priority, and quadrant 4-- important with poor performance (Figure 2) (Oh 2000).

Figure 2. Importance-Performance Analysis grid (adapted Martilla et al. 1977 and Oh 2000).

Alternatively, instead of viewing the attribute only by looking at the quadrant it is in, the adequacy of the attribute can be assessed by its location in relation to the iso-rating line. The iso-rating line is the line where importance equals performance (Abalo et al. 2007, Deng et al 2018), that is, it is the location where the customer finds the transaction perfectly adequate. In this format, the quadrants still exist but they have been re-arranged (Figure 3). Attributes found above the iso-rating line where importance is greater than performance are considered inadequate. Everything below the iso-rating line where performance is greater than importance is considered to be low priority, possible overkill, or keep up the good work.

Figure 3. Importance-Performance Analysis grid (adapted from Abalo et al. 2007)

Gap Analysis

A “gap” analysis was performed as a secondary method to quantify which attributes were being performed adequately and which inadequately. The mean of each importance-performance attribute was used to determine the “gap”. The mean importance rating for each attribute was

subtracted from the corresponding mean performance rating. If the difference was positive, then the attribute of the timber sale was considered to have been performed adequately, that is, performance was greater than importance. If the outcome was negative, the item was performed inadequately and would need to be addressed in the future (Chaudhary et al. 2016). A paired *t*-test was conducted for each of the IPA's importance-performance attributes to determine if there was a significant gap.

Variable Reduction

The questionnaire contained a total of 61 explanatory variables and 6 response variables. Principle components analysis (PCA) was used to examine the underlying correlation structure of Likert and IPA questions for opportunities to reduce the number of variables used in the analysis. This was done for both response (Table 1) and explanatory variables (Table 2). The ultimate objective of the PCA is to reduce the number of variables while preserving as much information in the data as possible (Jolliffe et al. 2016).

The fundamental idea for PCA was to examine whether each attribute (or questionnaire item) in a section was correlated with any or all of the others. If a high degree of correlation existed, there was no need to use all of the variables to represent the section theme. Protocol for PCA required section attributes to be subjected to multiple tests, beginning with Spearman Rank Correlation tests to determine the degree of correlation among attributes within a section. If the test suggests correlation exists, then some redundancy is present in the section's attributes and thus steps can be taken to condense the number of attributes in the section. If variables are uncorrelated, then each item can be thought to represent a separate idea and PCA does not need to continue. Bartlett's test of sphericity was used to test the correlations with the null hypothesis that there are no common factors. Rejecting the null hypothesis suggests that some of the

section's attributes are correlated. If the null hypothesis is rejected, we then subjected the section's attributes to Kaiser's measure of sample adequacy.

Kaiser's measure of sample adequacy (MSA) was used to quantify correlation between variables. When MSA is greater than 0.5, some correlation exists within the selected variables. When MSA equals 1.0, each variable is a predictor of other variables and the section of variables can be condensed. If MSA is below 0.5 then PCA is performed.

PCA was then used to check the internal consistency and evaluate the opportunity to reduce the number of variables within a section. Parallel analysis lent evidence as to the number of significant components in the section by comparing eigenvalues of randomly generated data with data from a section of timber transaction attributes (O'Conner 2000). Finally, Cronbach's α was used to test for internal consistency of any set of summated variables.

Variable Reduction Results

There was a high degree of correlation in all variables of the questionnaire. Few instances were found to indicate the sections of the questionnaire had any underlying variables that might describe variation within the section. This led to the decision to create composite variables made up of the mean of all items for each section. However, attributes within the section on prior knowledge about timber harvesting were split into the two separate composite variables *Discuss* and *Knew* (Table 3, Table 4). *Knew* consisted of attributes eliciting responses on previous knowledge such as minimizing logging erosion and having goals for my property. *Discuss* consisted of attributes eliciting responses on logging discussions held with family and neighbors.

Table 3. Details of “Knew and Discuss” attribute list from Question 12 of the survey

12. Please read the following statements and mark how strongly you *agree* or *disagree*.

<i>Before I sold timber I...</i>	Strongly Disagree	Disagree	Agree	Strongly Agree
...knew about ways to minimize logging erosion.	1	2	3	4
...was able to identify invasive plant species.	1	2	3	4
...knew that a contract was important.	1	2	3	4
...had a clear set of goals established for my property.	1	2	3	4
...discussed selling timber with my <u>neighbors</u> .	1	2	3	4
...discussed selling timber with my <u>family</u> .	1	2	3	4
...was aware of my potential liability to logging and logging related injuries.	1	2	3	4

As mentioned, PCA using Varimax rotation provided evidence for two separate components from the section on prior knowledge (Table 4). Parallel analysis (Figure 4) confirmed that the prior knowledge section could be split into two factors. Two other attributes, previous knowledge and discussion variables were able to stand as separate variables (Table 4). By looking at factor 1 and 2 we used a 0.5/0.2 rule to determine which variables stood out and could be separated into composite variables (Matsunga 2011).

The first component *knew* included the items: knew about ways to minimize logging erosion; was able to identify invasive plant species; knew that a contract was important; had a clear set of goals for my property; was aware of my potential liability to logging and logging related injuries (Table 3). The second component *discuss* included: discussed selling timber with my neighbors; discussed selling timber with my family (Table 3). Each of these components were made into composite variables.

Table 4. Factor Structure for PCA related to variables Discuss and Knew

Variable	PC	PC Name	Factor 1	Factor 2	Cronbach's α
Discussed selling timber with neighbors	1	Discuss		0.75446	0.43
Discussed selling timber with family	1	Discuss		0.69173	
Knew of ways to minimize erosion	2	Knew	0.75264		0.70
Able to identify Invasive plants	2	Knew	0.74688		
Knew importance of a contract	2	Knew	0.48975		
Clear set of goals	2	Knew	0.6288		
Aware of liability to logging related injuries	2	Knew	0.69221

Figure 4. Parallel analysis with Eigen values generated from attributes of question 12 Management knowledge.

Univariate logistic regression

Univariate logistic regression was used to assess the correlation and strength of relationships between timber transaction attributes (explanatory variables) and the measure of overall satisfaction with the timber transaction. Each variable was regressed on the binary

satisfaction metric *satisbi*. PROC Logistic was used to generate odds ratio and p-values for each univariate model.

Adequacy Index

PCA and initial univariate logistic regressions found significant correlation within IPA sections of planning (*adeqplan*), communications (*adeqcomm*), and operations (*adeqoperations*) and strong correlation with the overall satisfaction response variable, *satisbi* (Table 2). Because of the significant and ubiquitous amount of correlation among the explanatory variables (timber transaction attributes), an adequacy index was created as a representation of all IPA attributes that occur during a transaction.

The adequacy index was created by computing each section's mean gap (performance – importance) then converting it into a binary variable. If the mean was greater than or equal to 0 then section was deemed adequate and rated 1. If the section mean was less than 0 then the section was deemed inadequate and rated 0. The adequacy index is a summation of the binary variables from the planning, communications, and operations sections. Hence, the adequacy index ranged from 0, meaning there were no sections that were deemed adequate to 3 with means that all three sections were adequate.

Modeling satisfaction as a function of landowner and timber sale attributes

The Akaike Information Criterion (AIC) was used to establish which and the number of the explanatory variables that best account for the variation in a landowner's overall post-harvest satisfaction. The AIC can identify the most parsimonious models that provide the least amount of information loss (Mazerolle 2006). Stepwise logistic regression retained explanatory variables

with a significance level of 0.99 and removed variables with a significance level 0.95. This allowed all variables to be tested in this variable selection process. At each step of the variable selection process, the AIC was calculated. The optimal number of explanatory variables to generate the most parsimonious model was the model with the lowest AIC value. The regression process and corresponding AIC values suggested a two-covariate model.

A best subsets logistic regression was then used to determine the best combination of explanatory covariates based upon the outcome of the AIC selection (King 2003). All explanatory variables (Table 2) were included in the best subsets logistic regression. The best model was chosen based on the highest chi-square values for a model of a given number of covariates.

Variables dealing with *willingness to harvest again* and *parties involved* were removed from the model. *Willingness to harvest again* was removed due to the majority of coded responses lacking a satisfaction-based reason as to why or why not they planned to harvest again, that is, many simply were too old or didn't have any timber left. *Parties involved* was removed from the adequacy index of planning, communication and operations due to a low number of responses. The rest of the variables were allowed to remain in the best subsets logistic regression.

Goodness of fit for the logistic regression models was assessed using deviance goodness-of-fit statistics and Receiver Operator Characteristic curve statistics. Deviance compares the results of the best subsets logistic regression to a saturated model that includes all covariates. In the deviance test, the null hypothesis is that the fitted model is correct.

Chapter IV: Results

In total, 1349 questionnaires were sent to West Virginia FFOs with 257 completing the questionnaire. This resulted in a 19% response rate. The cooperation rate - the number of questionnaires filled out divided by the number returned (that include some refusals and blanks) - was 75% (AAPOR 2016). Ninety-four questionnaires were returned blank, 177 questionnaires were returned due to bad addresses and 34 were deemed ineligible due to either being not considered an FFO or the FFO was deceased (Wiseman 2003).

Demographics

Eighty percent (80%) of the respondents were male (Table 5) . The plurality of respondents was aged 65-74 (35%) and 35% had completed high school. Twenty four percent had an income of \$25,000-\$49,000 per year (Table 5). Most respondents (58%) were enrolled in either the Managed Timberland or Farmland incentive tax programs.

Table 5. FFO Demographic Characteristics by number (n) and proportion (%) of respondents.

Variable	<i>n</i>	%
Gender		
Male	213	80
Female	52	20
Age		
18-24	1	0.4
23-34	2	0.8
35-44	19	7
45-54	27	10
55-64	59	22
65-74	92	35
75-84	48	18
84 or greater	17	6
Gross Income		
\$15,000-\$24,999	25	12
\$25,000-\$49,999	52	24
\$50,000-\$74,999	49	23
\$75,000-\$99,000	36	17
\$100,000-\$199,999	37	17
\$200,000 or more	15	7
Education		
Some High school	7	3
High school	92	35
Associate's degree	17	7
Bachelor's degree	51	20
Master's degree	53	20
Ph.D. or higher	13	5
Trade school	25	10
Prefer not to say	2	0.8

Respondents owned a mean of 153.3 total acres and the majority described their most recent harvest as their first harvest (61%). The majority of respondents lived on their property (48%) and did not lease any part of their property (76%). However, of the 24% that did lease their land, most did so for agricultural purposes like pasture and hayfields. Similarly, most reported their property was taxed as farmland (43%) and 3.4 % of respondents were taxed for

both farmland and managed timberland. When asked about written plans for their property, 69% did not have a written plan.

When planning their harvest, the majority of FFOs received some form of guidance (52%), mostly from foresters or other industry professionals. Two primary concerns that respondents had for their harvest included the condition of their property (23%) after their harvest and financial issues (21%). Respondents visited the logging site either daily (29%) or weekly (28%). However, 11% of respondents never visited the site.

Out of 250 respondents, 50% plan to harvest again and 50% do not plan to harvest in the near future. Of those who do not plan to harvest again, 24% stated their age would not permit them to harvest and 22% did not have enough timber to harvest again. However, 16% of respondents said they would not harvest due to a bad experience. Seventy-five percent of FFO's did not have any additional work done to their property after the harvest. Of those FFOs that did have additional work performed, the majority (31%) had road work performed, followed by reseeded (30%).

The majority of respondents expressed that the best part of their harvest was the income from the harvest (32%), followed by property management (16%), and finally, the honesty and professionalism of parties involved (13%). Thirty-one percent of respondents stated there were no negative aspects to their harvest. However, 21% stated that poor reclamation was the most negative aspect of their sale.

Gap Analysis

Many significant differences were found in the paired-sample *t*-tests used in the gap analysis (Table 6). The overall mean values for performance and importance were 3.04 and 3.33 respectively. Harvesting in agreed upon areas had the highest rating for importance (3.77)

and how the FFO would receive payment was rated highest in performance (3.55). Notification of WVD OF visits and findings was rated the lowest in both importance (2.64) and performance (2.13).

Table 6. Evaluation of performance (P) and importance (I) for parties involved in timber sales.

	Mean				
Item	P	I	gap (I-P)	<i>t</i>	<i>p</i>
Parties					
Consulting Forester	3.19	3.31	0.12	-2.68	0.008
Procurement Forester	2.80	3.08	0.28	-3.44	0.001
State Forester	2.72	2.94	0.22	-2.21	0.028
Logger	2.97	3.52	0.55	-6.72	<0.000
Planning					
Treessold	3.30	3.61	0.31	-4.87	<0.000
Boundaries	3.48	3.67	0.19	-3.41	<0.001
Offlimits	3.28	3.45	0.17	-2.77	0.006
Equipment	3.02	2.80	-0.22	-8.08	<0.000
Roads	3.07	3.23	0.16	-2.24	0.026
Goals	2.90	3.27	0.37	-5.22	<0.000
Taxes	2.90	3.02	0.12	-1.78	0.076
BMPS	2.85	3.15	0.3	-4.49	<0.000
Payment	3.55	3.63	0.08	-2.12	0.035
Communication					
Welcome	3.29	3.33	0.04	-0.26	0.796
Concerns	3.29	3.51	0.22	-3.47	0.001
Loads	2.47	2.71	0.24	-2.76	0.006
Problems	2.58	3.04	0.46	-5.90	<0.000
WVD OF	2.13	2.64	0.51	-5.41	<0.000
Prices	2.33	2.76	0.43	-5.20	<0.000
Logging Operations					
Agreedtrees	3.43	3.72	0.29	-5.06	<0.000
Areas	3.52	3.77	0.25	-4.53	<0.000
Gates and Roads	3.52	3.66	0.14	-2.88	0.004
BMPSfoll	3.16	3.58	0.42	-6.13	<0.000
Ruts	3.00	3.53	0.53	-7.34	<0.000
Mulched	2.91	3.48	0.57	-7.44	<0.000
Residtrees	3.05	3.62	0.57	-7.19	<0.000
Smoothed	3.08	3.60	0.52	-7.15	<0.000
Follcont	3.26	3.70	0.44	-6.58	<0.000
Mean	3.04	3.33			

Paired *t*-tests showed that 26 out of 28 pairs were significantly different with only equipment types (-0.22) being significantly lower in performance than in importance. All of the other

attributes were rated significantly higher in performance than in importance.

Importance-performance analysis

Figure 5 displays attributes from parties involved in the harvest. Judging by the quadrant, the logging company and consulting forester are both located in the “Keep up the good work” quadrant. The Logger has the highest level of importance. However, State and

Procurement foresters are both in the “Low Priority” quadrant along with Other Party.

Figure 5. Importance-Performance Analysis of Parties involved

Alternatively, if evaluated with respect to the iso-rating line, all parties except the logger fall below the iso line and perform well. The Logger lies above the iso-rating line and shows a need for improvement.

Attributes dealing with planning the harvest have a high degree of variability (Figure 6). Attributes found in the “Keep up the good work” quadrant were determining boundaries,

payments, trees to be sold, and areas that are off-limits. However, planning how taxes would be paid, Best Management Practices (BMPs), equipment, goals, and roads as were described as “Low Priority”.

Alternatively, the attributes goals, trees to be sold, boundaries, and BMPs are all found above the iso-rating line. This suggests there is room for improvement and should be focused upon. Payment, taxes, and equipment types are found below the iso-rating line suggesting they are being performed adequately. Off-limits areas and planned roads are considered adequate, their performance matches the FFO’s importance.

Figure 6. Importance-Performance Analysis of Planning the harvest

Communication attributes that occur during the harvest (Figure 7) show mixed positive and negative results. Attributes found in the “Keep up the good work” quadrant were discussion

of concerns and being welcomed to the site. However, changing prices, loads and WVDOF visits were rated as “Low Priority”. FFOs find that being notified of problems or issues encountered during harvest operations as important but not being accomplished well, hence it is found in the “Concentrate here” quadrant.

Alternatively, welcome to the site, concerns, loads are all found below the iso-rating line suggesting they are being accomplished adequately. Notification of problems, changing prices, WVDOF visits are all found above the iso-rating line suggesting they are not being performed adequately.

Figure 7. Importance-Performance Analysis of Communication

Harvesting operations attributes (Figure 8) show mostly positive results. Attributes found in the “Keep up the good work” quadrant were, used designated gates and roads, operated in

designated areas, harvested agreed upon trees, followed the contract are in the “Keep up the good work” quadrant. However, following BMPs, smoothing trails and landing, residual tree condition, filling in ruts and were rated as “Low Priority

Alternatively, the attributes designated gates and roads, operated in designated areas, harvested agreed upon trees are all found below the iso-rating line suggesting they are being accomplished inadequately. Following the contract, following BMPs, smoothing trails and landing, residual tree condition, filling in ruts are all found above the iso-rating line suggesting they are being performed adequately.

Figure 8. Importance-Performance Analysis of Harvesting Operations

Univariate logistic regression

Univariate logistic regression analysis found FFO satisfaction with the harvest was significantly related to attributes of forester involvement, guidance, management knowledge, planning, communication, operations, overall adequacy of planning, communication and harvest operations, and FFO willingness to harvest again (Table 7). FFO's who had a forester were found to be twice as likely to be satisfied than those who did not use a forester. FFO's who received guidance on performing their timber sale were also twice as likely to be satisfied with their timber sale.

FFO's were 13 times more likely to be satisfied with their sale when they adequately planned the sale. Adequate communication with parties involved in the sale with the landowner increased the likelihood that an FFO would be 6.7 times more satisfied with their sale. If the FFO found the adequacy of work done during operations acceptable, they were 16.4 times more likely to be satisfied with their timber sale. If the FFO was satisfied with planning, communication, and operations, they were 3.4 times more likely to be satisfied with their timber harvest. FFOs who planned to harvest again were found to only be 30% more likely to be satisfied with their timber sale.

Table 7. Univariate logistic regression of reduced explanatory variables with overall level of satisfaction of timber sale.

Variable	N	Odds Ratio	95% Confidence Limits		p-value
residence	258	0.754	0.503	1.131	0.172
Lntotac	250	1.010	0.766	1.332	0.945
firstharv	252	0.781	0.414	1.475	0.446
ownertype	258	1.158	0.924	1.451	0.203
incenttax	255	1.114	0.61	2.036	0.725
plan	255	1.190	0.582	2.435	0.633
guidance	254	2.164	1.165	4.018	0.015
events	255	1.000	1.00	1.00	0.803
Decision	258	1.013	0.537	1.91	0.969
Knew	258	2.095	1.118	3.926	0.021
Discuss	258	1.43	0.741	2.774	0.28
adeqparty	231	1.000	1.00	1.00	0.316
adeqplan	239	13.204	3.972	43.983	<0.000
adeqcomm	231	6.694	3.139	14.274	<0.000
adeqoperations	240	16.361	5.663	47.269	<0.000
adeqindex	249	3.372	2.387	4.764	<0.000
selltype	252	0.769	0.531	1.113	0.163
Again	246	0.299	0.152	0.587	0.001
Addact	250	0.681	0.347	1.337	0.243
Gender	256	0.902	0.426	1.912	0.789
Age	256	1.243	0.99	1.562	0.061
College	248	0.879	0.464	1.664	0.691
forester	258	2.012	0.998	4.057	0.051
noteyear	258	1.009	0.851	1.198	0.914

Factors affecting satisfaction

Variables produced from the reduction process (Table 2) were evaluated for their explanatory effects with overall satisfaction with the timber harvest (Table 1) using a logistic regression model. The results show that the adequacy index (adeqindex), and the presence of a forester were significant explanatory variables. The two-covariate model had the strongest values for the goodness-of-fit tests, the deviance ($p=0.656$) and Receiver Operating Characteristic (0.85) (Table 8).

Table 8. Logistic regression of two covariates on landowner's overall satisfaction.

Covariate	2 Covariates p-value	Odds Ratio
adeqindex	<0.000	4.273
forester	0.026	2.530
Goodness of fit		
Deviance (p-value)	0.656	
Receiver Operating Curve	0.850	

The adequacy index (adeqindex) that combined the attributes from the planning, communication and operations sections of the questionnaire was statistically related to overall satisfaction. For every additional attribute section deemed adequate by the landowner, the FFO was 4.3 times more likely to state they were satisfied with their timber sale. Inclusion of a forester, regardless of whether they were a procurement, state or consulting forester, led to the FFO being 2.6 times more likely to be satisfied with their timber sale (Table 9).

Table 9. Univariate analysis for variables involved in Best Subsets regression

Variable	N	Odds Ratio	95% Confidence Limits		p-value
adeqindex	246	5.123	3.153	8.325	<.0001
forester		2.62	1.096	6.264	0.0304

Chapter 5: Discussion

Of the 258 responses for overall satisfaction 55 respondents or 21 percent were not satisfied with their timber sale. Furthermore, 12 out of 28 or 43 percent of IPA attributes fell above the iso-rating line. For these attributes, importance exceeded performance which means that the performance of these attributes is not living up to the FFO's expectations. These results show that the attributes of a timber sale can be improved upon, not everyone was satisfied with their timber sale. Regardless of industry, measuring customer satisfaction is an important part of improving quality of work and retaining customers (Cengiz 2010). Satisfaction is considered an indicator of a company's future (Chen et al 2009).

We evaluated many attributes and the only IPA attribute found above the iso-rating line and in the "concentrate here" quadrant was notification of problems encountered during the harvest. This is alarming since the majority of respondents stated that they visited the site daily or weekly. Heiligmann et al. (1986) highly recommends that FFO's communicate with loggers and other forestry professionals. The communication IPA section was a broad section but it does show that communication is important to the FFO. Notification of problems occurring during the harvest did not ask specifically about the types of problems that could occur. The results of this question suggest that there is a communication disconnect between the FFO and forestry professionals about problems that occur on the site. Further research on the communication attributes of a timber sale could allow forestry professionals an improved understanding of how to communicate and disseminate information to FFOs.

Of all 23 attributes evaluated in this study to describe the attributes of a timber transaction (Table 2), the adequacy index composite variable, and forester participation based on LONIE records, were found to best the best determinants of FFO satisfaction (Table 8).

The composite variable adeqindex, which contained the performance adequacy of planning, communications, and harvesting operations attributes were found to be significant in the logistic model regardless of the suggested number of covariates. All of the attributes are suggested to be performed by extension literature and the adequacy index shows that if there is an issue with one of the attributes then the respondent's overall satisfaction with their timber sale is likely to suffer. However, this index does not tell us which individual attribute caused the overall satisfaction to suffer. Further research should be done on attributes to determine how to improve adequacy of performance. If an attribute can be improved then the FFO's overall satisfaction with the harvest would possibly improve as well.

Forester involvement was also significant. Most extension publications that give guidance to landowners concerning timber sales (Heiligmann et al. 1986, Bowers 2007, Grotta 2014 Rickenbach 2018) all highly recommend having a forester involved in all phases of the timber sale. Moss et al. (2013) suggests including a consulting forester will benefit the FFO due to the forester representing and protecting the FFO and their land.

Foresters are considered experts and can guide FFOs in planning the harvest, explain to the FFO about specific operations, and help answer questions and concerns that the FFO may have throughout any part of the timber sale process (Rickenbach 2018). Previous research by Maltempie (2017) also corroborates that a forester is important to a positive timber sale. FFOs who failed to hire a forester were likely to have a negative experience with their harvest (Maltempie 2017).

Studies of FFOs have found that if the FFO is a member of a stewardship program they are more likely to have different preconceptions of how to manage their property compared to those who were not a member of a stewardship program (Howle et al 2010). Similarly, is it

possible that a forester can impact an FFO's preconceptions about harvesting? Future research could attempt to elicit a response of how a forester's involvement interacts with the adequacy of the attributes of a timber sale.

Demographic variables gender, age, and education level were all found to be insignificant in this study. Age, education level and gender contradict studies by Joshi and Arano (2009) and Sauliner et al. (2017) who found that age and education can be a predictor of willingness to harvest or manage their property. However, these demographic attributes did not seem to impact the respondent's overall satisfaction with their harvest in this study. This suggests that willingness to harvest may not impact this group of respondents due to them possibly having attributes similar to FFOs who are willing to harvest. Many of the respondents mentioned that they lease their properties for agricultural uses, or just under half of the respondents were using agricultural tax incentives. Other studies have found that farmers are more likely to harvest or manage their property compared to others (Joshi and Arano 2009).

The composite variable *decision* was found to be insignificant. McGill et al. (2006) had found that the majority of FFOs harvested for income or because the stand was mature. However, in this study, the reason to harvest did not seem to impact overall satisfaction. Similarly, most variables representing the background of the FFO such as where the FFO resides, how many acres the FFO owns, type of ownership, and use of incentive taxation were all found to be insignificant. Joshi and Arano (2009) found that FFOs who had management plans were likely to be engaged in management activities on their properties. However, FFO management plans did not impact overall satisfaction with a timber sale for this group of respondents.

The method used to sell timber was also insignificant. Extension literature overwhelmingly recommends selling timber by soliciting sealed bids (Heiligmann et al. 1986,

Bowers 2007, Grotta 2014 Rickenbach 2018). The literature suggests that there are advantages to using sealed bids for selling timber. However, the type of timber sale did not impact overall satisfaction for this group of West Virginia landowners. Other research by Kittredge et al. (1996) found that attributes such as tract size, distance and quality of timber can impact the company's interest in placing a bid. Logging companies can be diverse in structure, size, and ability (Moss et al. 2003). Maltempie 2017 found that interviewees with small logging companies did not trust their logging company. Sale type in this study was broadly worded and only asked about the type of the sale, it did not specify information related to the structure of the logging company the FFO used.

This research shows that FFO views of satisfaction are as complex as the timber sale itself. The measure of overall satisfaction was a composite response variable, suggesting that all attributes representing satisfaction were related and impacted by what occurred during the sale. FFOs in this study are not just interested in the amount of income received from the harvest but also other aspects such as their contract, property goals, information available and the condition of their property. The adequacy index's impact on overall satisfaction is important, but it is broad and shows that each attribute's adequacy can impact overall satisfaction. A more refined view of each individual attribute may shed more light on how and where professionals and landowners can work together for even greater satisfaction in timber transactions.

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Appendix A: Name and Definition of Variables used.

Section 1 Property Management

<i>Variable</i>	<i>Definition</i>
residence	FFO residence status. 1=Yes, 2=No, 3=I plan to in the future, 4=I plan to sell the property after logging
totac	Total acres owned.
harvacres	Total harvested acres.
numharvs	Total number of harvests completed.
lease	Lease of FFO property. 1=No, 2=Yes, leased for the purpose of_____.
ownertype	FFO description of property ownership. 1=Individual, 2=Joint with Spouse, 3=Corporation/business partnership, 4= Family, 5=Multiple ownership, 6=Trust or Estate, 7=other
taxtype	FFO taxation. 1=Managed Timberland, 2=Farmland, 3=I don't know, 4=other
writtenplan	FFO property management plan. 1=Yes, Forestry Plan, 2=Yes Farm plan, 3=No, 4=I don't know

Section 2: Deciding to sell your timber

<i>Variable</i>	<i>Definition</i>
guidance	FFO use of information and guidance. 1=No, 2=Yes from where_____.
events	FFO decision to sell timber. 1=I was asked to sell timber, 2=I first decided to sell timber, 3=other
Decision to harvest	
decneigh	Neighbors were selling timber. 1=Strongly Disagree, 4=Strongly Agree
decincome	FFO needed income. 1=Strongly Disagree, 4=Strongly Agree
decstand	Stand improvement 1=Strongly Disagree, 4=Strongly Agree
deaccess	Improve access or change land use. 1=Strongly Disagree, 4=Strongly Agree
decother	Other reasons. Open ended and 1=Strongly Disagree, 4=Strongly Agree
mcon	FFO's main concerns with selling timber.
Management knowledge	
beferosion	FFO knowledge of erosion. 1=Strongly Disagree, 4=Strongly Agree
befinvasive	FFO knowledge of invasive species. 1=Strongly Disagree, 4=Strongly Agree
befcontract	FFO knowledge of logging contracts. 1=Strongly Disagree, 4=Strongly Agree
befgoals	FFO established goals for property. 1=Strongly Disagree, 4=Strongly Agree
befneigh	FFO discussed selling timber with neighbors. 1=Strongly Disagree, 4=Strongly Agree
beffamily	FFO discussed selling timber with family. 1=Strongly Disagree, 4=Strongly Agree
befliability	FFO understood liabilities associated with logging. 1=Strongly Disagree, 4=Strongly Agree
beflookduring	FFO preparation for look of property during harvest. 1=Strongly Disagree, 4=Strongly Agree

Section 3: Planning the timber sale

<i>Variable</i>	<i>Definition</i>
FFO Preparation	
beflookduring	FFO preparation for look of property during harvest. 1=Strongly Disagree, 4=Strongly Agree
beflookafter	FFO preparation for looks of property after harvest. 1=Strongly Disagree, 4=Strongly Agree
beincome	FFO preparation for income received from harvest. 1=Strongly Disagree, 4=Strongly Agree
befexpect	FFO knew what to expect from the harvest. 1=Strongly Disagree, 4=Strongly Agree
Parties involved in the sale	
ICforester/IPforester	Importance and Performance of consulting forester. 1=Not Important-4=Essential, 1=Poor-4=Excellent
IPforester/PPforester	Importance and Performance of procurement forester. 1=Not Important-4=Essential, 1=Poor-4=Excellent
ISforester/PSforester	Importance and Performance of state forester. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Ilogger/Plogger	Importance and Performance of loggers. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Iotherparty/Potherparty	Importance and performance of other parties that may have been part of the sale. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Harvest planning	
Ireessold/Ptreessold	Determined trees to be sold. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Iboundaries/Pboudaries	Determined property and harvest boundaries. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Iofflimits/Pofflimits	Marked areas that were off limits to use. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Iequipment/Pequipment	Determined size and type of equipment to use in the harvest. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Iroads/Proads	Determined road placement. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Igoals/Pgoals	Determined property goals. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Itaxes/Ptaxes	Determined how taxes would be dealt with. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Ibmps/Pbmps	Discussed BMPs. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Ipayment/Ppayment	Discussed method of payment. 1=Not Important-4=Essential, 1=Poor-4=Excellent
conttype	Type of contract used. 1=Sealed bid, 2=Negotiated sale, 3=Paid on shares, 4=other

Section 3 The logging operations (I/P=importance/performance),

<i>Variable</i>	<i>Definition</i>
visits	Number of times the FFO visited the site.
FFO Communication	
Iwelcome/Pwelcome	FFO was welcomed to the site. 1=Not Important-4=Essential, 1=Never Occurred-4=Always Occurred
Iconcerns/Pconcerns	FFO concerns and questions were answered. 1=Not Important-4=Essential, 1=Never Occurred-4=Always Occurred
Iloads/Ploads	FFO was notified of loads leaving site. 1=Not Important-4=Essential, 1=Never Occurred-4=Always Occurred
Iproblems/Pproblems	FFO was notified of problems that occurred. 1=Not Important-4=Essential, 1=Never Occurred-4=Always Occurred
Iwvdof/Pwvdof	FFO was notified of State Forester visits or findings. 1=Not Important-4=Essential, 1=Never Occurred-4=Always Occurred
Iprices/Pprices	FFO was notified of change in prices. 1=Not Important-4=Essential, 1=Never Occurred-4=Always Occurred
Harvesting operations attributes	
Iagreedtrees/Pagreedtrees	Loggers only harvested agreed upon trees. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Iareas/Pareas	Loggers stayed in agreed upon areas. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Igatesroads/Pgatesroads	Loggers used gates and roads that were approved by FFO. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Ibmpsfol/Pbmpsfol	Loggers followed BMPs. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Iruits/Pruts	Loggers filled in ruts. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Imulched/Pmulched	Loggers mulched and reseeded trails and landings. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Iresidtrees/Presidtrees	Residual trees were left in good shape. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Ismoothed/Psmoothed	Loggers smoothed trails and landing. 1=Not Important-4=Essential, 1=Poor-4=Excellent
Ifollcont/Pfollocont	Loggers followed contract. 1=Not Important-4=Essential, 1=Poor-4=Excellent

Section 5 After the logging was completed

<i>Variable</i>	<i>Definition</i>
infoS	Who or what was the main source of information during the sale and was it accurate?
satrevrec	Satisfied with the amount of revenue. 1=Very Dissatisfied-4=Very Satisfied
sattimbersale	Satisfied with the entirety of the timber sale. 1=Very Dissatisfied-4=Very Satisfied
satcontract	Satisfied with contract. 1=Very Dissatisfied-4=Very Satisfied
satgoals	Satisfied with how well goals were accomplished. 1=Very Dissatisfied-4=Very Satisfied
satcond	Satisfied with the condition of the property after harvest. 1=Very Dissatisfied-4=Very Satisfied
satharvprac	Satisfied with information received about harvesting practices. 1=Very Dissatisfied-4=Very Satisfied
addact	Additional work had to be performed after the sale. 1=No, 2= Yes, what was done?
best	Positive aspects of sale.
worst	negative aspects of sale
again	Willingness to harvest again. 1=Yes, 2=No, why not?
changes	Issues encountered during the harvest and how they would be corrected by the FFO.
concerns	Financial concerns

Part 6 Demographics

<i>Variable</i>	<i>Definition</i>
gender	Gender of the respondent. 1=Male, 2=Female
age	Age of the respondent in years. 1=18-24, 2=25-34, 3=35-44, 4=45-54, 5=55-64, 6=65-74, 7=75-84, 8=84 or greater
grossincome	Annual household income of the respondent. 1=15,000-24,999, 2=25,000-49,999, 3=50,000-74,000, 4=75,000-99,000, 5=100,000-199,999, 6=200,000 or more
educ	Education level of the respondents 1=Some High School, 2=High School, 3=Associate's degree, 4=Bachelor's Degree, 5=Master's Degree, 6=Ph.D. or Higher, 7=Trade School, 8=Prefer not to say

Appendix B: Questionnaire Cover Letter.

DAVIS COLLEGE OF AGRICULTURE, NATURAL RESOURCES AND DESIGN
EXTENSION SERVICE — AGRICULTURE AND NATURAL RESOURCES

September 27, 2019

Dear West Virginia Woodland Owner:

We are writing to ask for your help in a research project that is exploring the question “What makes a timber sale successful?” We are contacting woodland owners in West Virginia who have recently harvested timber to ask what they have learned in the process of selling timber. The primary goal of this research is to share findings with others to achieve improved environmental, economic, and social benefits in future West Virginia timber sales.

Please consider contributing your experience and knowledge to this research effort by taking a few minutes to fill out this survey. Your participation in this survey is voluntary and you can quit at any time without penalty. You do not have to answer all the questions, but any information you provide will contribute to the project’s success. You must be over 18 years of age to participate. If you do not wish to participate, please let us know by returning the enclosed questionnaire, blank or with a note in the prepaid envelope provided.

Information you provide is confidential; only summaries will be reported in which a single individual’s answers cannot be identified. When you return your completed questionnaire, your name will be deleted from the mailing list and will not be connected to your answers in any way. Acknowledgment of this study is on file with West Virginia University’s Institutional Review Board.

If you have any further questions, please feel free to contact us at the phone numbers below. Thank you in advance for your participation. It is with your generous help that our research can be successful.

Sincerely,

A handwritten signature in blue ink, appearing to read 'David McGill'.

Dr. David McGill
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(304) 293-5930
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A handwritten signature in blue ink, appearing to read 'Jeff Lee'.

Jeffrey Lee
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Equal Opportunity/Affirmative Action Institution

Appendix C: Survey Instrument.

West Virginia Timber Sale Survey

February 2020. Research in collaboration with:

About This Survey

The goal of this survey is to ask landowners what they have learned about timber sales after having had one. Timber sales can be very successful, catastrophic, or everything in between. With your help, we may improve the environmental, economic, and social benefits of West Virginia timber sales.

Please fill the survey out even if you have just started a timber sale on your property. Your participation is voluntary, and you have the right to refrain from answering any question. Your answers will be kept confidential. Please make sure any changed answers are either clearly erased or crossed out, then mail it back in the enclosed, pre-posted envelope.

Thank you for your assistance with this important research! If you have any questions, please contact:

Dr. Dave McGill, Primary Investigator
Professor/Extension Specialist
dmcgill@wvu.edu
304-293-5930

Jeff Lee
Graduate Research Assistant
jlee20@mix.wvu.edu

J2228

START HERE:

Please read carefully the following items and *check all that apply*.

- ☐ I have already **completed** my timber sale.
- ☐ I am in the **process** of completing my timber sale.
- ☐ I am in the **process** of planning my timber sale.
- ☐ I would like to receive a copy of the results from this survey
- ☐ **I prefer not to participate in this survey (please return blank questionnaire).**

-----Part 1. Management of your property-----

1. Please indicate your residence status for the property you have most recently harvested.

- ☐ Yes ☐ No ☐ I plan to in the future. ☐ I plan to sell my property after logging.

2. My property is _____ total acres and I harvested _____ acres during the most recent sale.

3. How many timber harvests have you ever completed? _____

4. Do you *lease* or *let others use* any part of this property?

- ☐ No ☐ Yes, leased for the purpose of: _____

5. Which category below best describes your ownership? (*check only one*)

- ☐ Individual ☐ Joint with spouse ☐ Corporation/business partnership
☐ Family ☐ Multiple ownership ☐ Trust or estate
☐ Other (*please specify*) _____

6. How is your property taxed? (*check all that apply*)

- ☐ Managed Timberland ☐ Farmland ☐ I don't know ☐ Other: _____

7. Do you currently have a written plan for your property?

- ☐ Yes, Forestry Plan ☐ Yes, Farm Plan ☐ No ☐ I don't know

-----Part 2. Deciding to sell timber-----

8. Prior to deciding to sell timber, did you receive guidance or information on the best way to harvest timber?

- ☐ No ☐ Yes If Yes, from where? _____

9. What was the sequence of events when you were deciding to sell your timber? (*Please select one*)

- ☐ I was asked to sell my timber by a logging company or timber buyer, then decided to sell.
☐ I first decided to sell my timber, then I contacted a professional (e.g., logger, forester).
☐ Other: _____

10. Please read the following statements and mark how strongly you agree or disagree.

	Strongly Disagree	Disagree	Agree	Strongly Agree
<i>I decided to harvest because...</i>				
...my neighbors were logging their timber.	1	2	3	4
...I needed income. (e.g., house, vacation, medical expenses)	1	2	3	4
...I needed to improve conditions of my stand. (e.g., remove diseased trees, wildlife habitat)	1	2	3	4
...I wanted to improve access to my property. (e.g., housing site, roads, create pasture)	1	2	3	4
...other: _____	1	2	3	4

11. When you were deciding to sell timber, what were your main concerns?

12. Please read the following statements and mark how strongly you agree or disagree.

	Strongly Disagree	Disagree	Agree	Strongly Agree
<i>Before I sold timber I...</i>				
...knew about ways to minimize logging erosion.	1	2	3	4
...was able to identify invasive plant species.	1	2	3	4
...knew that a contract was important.	1	2	3	4
...had a clear set of goals established for my property.	1	2	3	4
...discussed selling timber with my <u>neighbors</u> .	1	2	3	4
...discussed selling timber with my <u>family</u> .	1	2	3	4
...was aware of my potential liability to logging and logging related injuries.	1	2	3	4

-----Part 3. Planning the timber sale-----

13. Please read the following statements and mark how strongly you agree or disagree.

	Strongly Disagree	Disagree	Agree	Strongly Agree
<i>Before the logging began, I felt I was prepared for...</i>				
... how my property would look <u>during</u> the logging.	1	2	3	4
... how my property would look <u>after</u> the logging.	1	2	3	4
... how much income I was to receive.	1	2	3	4
... the harvest. I knew what to expect.	1	2	3	4

Directions: Please mark answers clearly. For **sections** with 2 *columns* below please see the following:

To answer each item please mark in both the Importance and Performance columns. This will allow us to determine how important each item was to you during your harvest and how well it was accomplished.

<i>Actions and activities</i>	Importance				Performance			
	Not Important(1)-Essential(4)				Poor(1)-Excellent(4)			
Determined trees to be sold.	1	2	3	4	1	2	3	4
Marked boundaries to be harvested.	1	2	3	4	1	2	3	4

This side of the table is for you to describe how important an item was to the success of the transaction.

This side is to describe how well each item was performed.

14. Please *circle* the numbers that best describes how *important* each individual was to the success of your timber sale and how well they *performed* during your timber sale. If an individual was not part of the timber sale, please circle “not contacted”.

<i>People who may have been involved</i>	Importance Not Important (1)- Essential(4)				Performance Poor(1) Excellent(4)				
Private Consulting Forester	1	2	3	4	1	2	3	4	Not contacted
Company Procurement Forester	1	2	3	4	1	2	3	4	Not contacted
WV DOF (State) Forester	1	2	3	4	1	2	3	4	Not contacted
Logging company	1	2	3	4	1	2	3	4	Not contacted
Other Party: _____	1	2	3	4	1	2	3	4	Not contacted

15. Please select how *important* each item was to the success of your timber sale and how well each item was *performed* during the planning phase.

<i>Actions and activities during planning</i>	Importance Not Important(1)-Essential(4)				Performance Poor(1)-Excellent(4)			
Determined trees to be sold.	1	2	3	4	1	2	3	4
Marked boundaries to be harvested.	1	2	3	4	1	2	3	4
Marked boundaries of areas off limits to loggers.	1	2	3	4	1	2	3	4
Determined types of equipment to be used.	1	2	3	4	1	2	3	4
Determined potential layouts for skid/wood roads.	1	2	3	4	1	2	3	4
Determined goals for my property	1	2	3	4	1	2	3	4
Determined how taxes would be paid.	1	2	3	4	1	2	3	4
Discussed Best Management Practices	1	2	3	4	1	2	3	4
Discussed method of payment.	1	2	3	4	1	2	3	4

16. Please select the most correct statement for your timber sale (*please check only one*).

My timber was sold as...

- ☐ **Sealed bid-** An inventory of the timber was sent to as many buyers as possible. The company was selected based on the quality of the bid submitted.
- ☐ **Negotiated sale-** Sold to a single representative of a mill or logging company.
- ☐ **Paid on shares-** The logging company harvested the trees and sold them at the mill. The logging company then gave me a percentage of the money that was received from the mill.
- ☐ **Other:** _____

-----Part 4. The Logging Operations-----

17. How often did you visit the site while logging was occurring? _____

18. Please select how important each item was to the success of your logging operation. Then please select how well you perceived that each item that was performed during the harvest.

<i>During the timber harvesting, I felt...</i>	Importance				Performance			
	Not Important(1)- Essential(4)				Never Occurred(1)- Always Occurred (4)			
...welcome when I visited the site.	1	2	3	4	1	2	3	4
...questions and concerns were answered.	1	2	3	4	1	2	3	4
...informed of each load that was sent to the mill.	1	2	3	4	1	2	3	4
...notified of problems during the harvest.	1	2	3	4	1	2	3	4
...the logger notified me of state forester visits or findings.	1	2	3	4	1	2	3	4
...notified of changes in pricing of different species.	1	2	3	4	1	2	3	4

19. Please select how important each item was to the success of your logging operation. Then please select how well you perceived that each item that was performed during the harvest.

<i>The logging company....</i>	Importance				Performance			
	Not Important(1)- Essential(4)				Poor(1)-Excellent(4)			
...logged <u>only</u> trees that were agreed upon.	1	2	3	4	1	2	3	4
...stayed in agreed upon areas.	1	2	3	4	1	2	3	4
...only used designated gates and roads.	1	2	3	4	1	2	3	4
...followed Best Management Practices.	1	2	3	4	1	2	3	4
...filled in ruts.	1	2	3	4	1	2	3	4
...seeded and mulched trails and landing.	1	2	3	4	1	2	3	4
...left <u>residual trees</u> in good condition.	1	2	3	4	1	2	3	4
...smoothed trails and landing.	1	2	3	4	1	2	3	4
...followed the contract.	1	2	3	4	1	2	3	4

-----Part 5. After logging was completed-----

20. *Who* or *what* was your *main source* of information during the timber transaction? Do you feel satisfied with accuracy of the information received?

21. Please read the following statements and mark how strongly you agree or disagree

<i>In general, how satisfied were you with the...</i>	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied
...amount of revenue received?	1	2	3	4
... entire timber sale?	1	2	3	4
...your contract?	1	2	3	4
...completion of your property goals?	1	2	3	4
...condition of your property after the harvest?	1	2	3	4
...information related to harvesting practices?	1	2	3	4

22. Were there any *additional* activities after the harvest?

☐ No ☐ Yes, what was done? Were you *satisfied*? *Why* or *why not*.

23. What were the best things about your most recent timber sale?

24. What were the worst things about your most recent timber sale?

25. Do you plan to harvest again?

☐ Yes ☐ No. **If No**, why not? _____

26. If you could do it again, how would you do it differently to make it more successful?

27. During the entire timber sale, from the first idea to sell until its completion, were you ever concerned about the financial aspects? **If so**, when and why were you concerned? **If not**, why not?

-----Part 6. Demographics-----

28. What is your gender?

☐ Male ☐ Female

29. What is your age?

☐ 18-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64
☐ 65-74 ☐ 75-84 ☐ 84 or greater

30. What is your annual gross income

☐ \$15,000-\$24,999 ☐ \$25,000-\$49,999 ☐ \$50,000-\$74,999
☐ \$75,000-\$99,999 ☐ \$100,000-\$199,999 ☐ \$200,000 or more

31. What is the highest level of education you have completed?

☐ Some High School	☐ High School	☐ Associate's Degree
☐ Bachelor's Degree	☐ Master's Degree	☐ Ph.D. or higher
☐ Trade School	☐ Prefer not to say	

Thank you for participating in this survey!

Please return the completed questionnaire in the postage-paid envelope.