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Aesthetic Values of Five Primary Wood Transporting Methods Common to Northern New England

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AESTHETIC VALUES OF FIVE PRIMARY WOOD TRANSPORTING METHODS COMMON TO NORTHERN NEW ENGLAND

By

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Forwarder

Tractor

Horse

Skidder

Bulldozer

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Thesis Advisor: Dr. Andrew F. Egan

An Abstract of the Thesis Presented
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Throughout northern New England and across the country, increasing populations and the exurbanization of rural forested landscapes have had a tremendous impact on forest management. As forested areas become more populated, society has become more exposed to the sights and sounds associated with different forest operations. As a result, aesthetics are increasingly driving public reaction to and concern about forestry practices, especially timber harvesting. How people perceive forestry harvesting can be significant in defining the future of forest management, particularly in more populated woodlands.

The objective of this study was to better understanding public values as they relate to timber harvesting, especially as it occurs in forested residential areas and other places where people come in contact with working forests. Our goal was to develop information that will help NIPF owners and foresters better fit timber harvesting into the flow of community life, with all of its constraints, rather than to expect communities to adjust to the temporary inconveniences often associated with the conduct of logging.

By utilizing videography, media editing technology, focus groups, and a written survey, this research was able to assess and compare the visual and aural qualities of five timber harvest yarding methods based on a battery of attributes and situations. The operations evaluated consisted of a forwarder, a rubber-tired cable skidder, a bulldozer, a farm tractor, and a workhorse. This study was successful in clarifying the aesthetic preferences of these yarding methods among a subsample of the general public, as well as among members of forestland owners associations in the northern New England region. In addition, this study investigated the relationships between several possible explanatory variables (e.g., age, education) and respondents' preferences for the logging methods studied.

Throughout much of the video survey, response patterns were very similar between the general public, represented by students, and landowners, represented by landowner group association members. Though acceptability ratings and preference rankings of the timber harvest yarding methods were similar, statistical tests (e.g., chi-square analysis, polytomous logistic regression, and repeated measures analysis of variance) revealed significant differences that existed between the two populations.

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CHAPTER 1: INTRODUCTION

Current Situation

Northern New England is known for its scenic beauty derived from picturesque towns that are dispersed among its forests and farmlands. It is also noted as being home to the Great North Woods, in relation to the large tracts of remote wilderness that dominate its landscape. Maine, nicknamed the Pine Tree State, is the most forested state in the country (90%), followed by New Hampshire (84%), and more than three-quarters of the state of Vermont is forested (Egan and Taggart 2004). This region has a long history of its residents relying on its abundance of timber and scenic quality (tourism) to provide them with economic opportunity and a way of life (Edwards 2003).

In a study to evaluate baseline information on current aspects of logging communities and logging businesses in northern New England, Egan and Taggart (2004) reported that over two-thirds of the logging systems in use were classified as conventional (cable skidder-manual felling), while nearly 30 percent were mechanized (feller-buncher with grapple skidder or forwarder with processor), and under five percent were small-scale systems (tractor and/or horse).

Increasing populations and the urbanization of rural forested landscapes across the country has had a tremendous impact on forest management (Barlow et al. 1998). Rural communities, particularly those within the urban-forest interface, which is classified as the geographic area where forest management meets urban development, have

experienced dramatic social and community value changes due to a remarkable shift in the pattern of forestland ownership (Barlow et al. 1998). The increasing number of landowners controlling land use and management decisions on smaller parcels of land has made it more difficult to conduct management activities that are accepted by adjoining landowners, yet economically feasible. Barlow (1998) reported that former urbanites that take residence in rural areas frequently hold different values for the forests and often promote regulations to protect woodlands from perceived damage caused by forest management activities. As a result, intercommunity conflicts are arising that stem from more than just boundary disputes; the differences in landowner objectives and values often sets the stage for a political war usually involving a side that promotes active forest management and a side in vocal opposition to such traditional practices.

The associated phenomena of fragmentation, which is the division of blocks of contiguous forests into smaller blocks, and parcelization, which is the division of forest blocks into units of ownership through subdivision, along with the shift in landownership have complicated managing today's forests from a landscape perspective (Luloff et. al. 2000). A major concern is that urbanization reduces short-term and long-term timber supply as woodlands are lost to development and active timber management is sharply reduced in these areas (Barlow et al. 1998). Thorne (2000) found that smaller parcel sizes increase timber harvest and forest management operating costs and reduces stumpage prices. In addition, a higher proportion of harvests are of liquidation cuttings and terminal harvests in preparation for development and other land use conversions.

Furthermore, as parcel size decreases, the likelihood of landowners hiring a forester and having a written management plan also declines.

Aesthetic Values

Aesthetics are increasingly driving public concern about forestry practices, especially timber harvesting (Bourgeouis and Kodama 1999). However, although several studies have investigated the aesthetic values associated with post-harvest forest conditions, little or no empirical research has been conducted on the aesthetics of logging operations in progress. For example, what is the general public's reaction to the sights and sounds of logging? What if any, are their preferences among the array of possible logging methods appropriate for residential areas or on their neighbor's woodlot? What are the preferences of nonindustrial private forest (NIPF) owners, who own most of the forestland in the region, for various logging methods? Can these preferences be predicted from a person's age, education, place of residence, or other possible explanatory variables?

Utilizing videography, media editing technology, focus groups, and a written survey we were able to take a unique approach to assess and compare the visual and aural qualities of five timber harvest yarding methods and determine preferences for them among populations of non-industrial private forestland owners and the general public. It was our intent to provide useful information that will aid forestland managers, landowners, and loggers in selecting timber harvest operations that are acceptable and compatible with community life on the urban fringe.

In its most basic form, this is a study of human and public perceptions, values, and attitudes. The concept of "perception," defined as the process for gathering and processing information pertaining to the landscape or a scene, may have particular relevance to several aspects of forestry, such as patterns of logging or logging systems, which may be classified by some people as belonging to a type of bad forestry or a destructive type of forest operation. Preference studies can tell us a great deal about what people like and dislike, although it does not necessarily explain why. In this study the preference ranking section within the forest operations video survey helped to identify timber harvest yarding methods that people prefer. However, it is a challenge to answer the deeper questions about how and why certain operations are preferred over another. An object or scene is constructed from a number of components, each possessing describable characteristics; whereby the parts act together to create the scene (Bell 2001). These various elements (e.g., color, shapes, sounds) provide sensory stimulation, which plays an important role in the process of perception. In addition, people perceive and recognize a particular scene differently depending on such things as culture, experience, and knowledge (Bell 2001). These factors are difficult to separate and often conflict, thereby adding complexity to such research.

Objectives

For populations of non-industrial private forestland owners and the general public of northern New England, this study:

1. Assessed the visual and aural quality ratings of five timber harvest yarding methods
2. Determined preferences among the five timber harvest yarding methods

In addition, the study investigated the relationships between several possible explanatory variables (e.g., age, education) and respondents' preferences for the logging methods studied.

Hypotheses

The following hypotheses were tested:

$H1_0$: No difference between non-industrial private forestland owners and general public in their ratings for each yarding method studied

$H2_0$: No difference between non-industrial private forestland owners and general public in their preferences for each yarding method studied

In addition, several explanatory variables were used to describe the populations to evaluate response differences within the groups.

CHAPTER 2: LITERATURE REVIEW

Psychological and Sociological Contexts

The evaluation of aesthetics and landscape perception in the field of psychology differs significantly from that of sociology. Psychologists use the term psychophysics in reference to the study and scientific measure of relationships between human perceptions or preferences for scenic beauty: physical characteristics of an environment, such as forest attributes (Pings and Hollenhorst 1989).

According to Zube (1982), "Experimental psychology views the environment as a source of stimulus to which the individual responds" (pg 7). Research efforts have focused on understanding the experience of interacting with the landscape and how people relate to it. Very little attention has been given to the identification and manipulation of specific high quality elements in the landscape, which is the predominate focus in the sociological perspective relating better to forest management. Zube (1982) cites the work of Dewey & Bentley (1949), Ittelson and Cantril (1954), and Zube et al. (1975) in explaining landscape perception as the interaction of humans and the landscape. He suggested that the human component encompasses past experience, knowledge, expectations, and the socio-cultural context of individuals and groups. The landscape component includes both individual elements and landscape entities.

Literature on aesthetic values studies with a psychology context consists mainly of complex theoretical perspectives and terminology (Slovic 1995). In-depth discussion and understanding of this topic is outside of the scope of this thesis since to completely

understand the subject matter would require prior knowledge of the topic or extensive examination and reference to the implicit and explicit theories embedded within them (Zube 1982). Ribe (1989) criticizes the psychophysical approach for lacking a strong aesthetic theoretic foundation and explanatory content. Indeed, social scientists and psychologists have struggled to find common ground in defining the interrelated terms of values, attitudes, and perceptions.

History of Aesthetics in Forest Management

Legislative recognition of aesthetic values in forest management was first identified with the Multiple-Use and Sustained-Yield Act of 1960 (MUSY), which originated from the clear-cutting controversy following World War II (Bergen 1995). A substantial body of legislation followed thereafter (e.g., the National Environmental Policy Act of 1969, the Forest and Rangeland Renewable Resources Planning Act of 1974, the National Forest Management Act of 1976, the Surface Mining Control Reclamation Act of 1977, the Clean Air Act of 1977) that paralleled the framework of MUSY, directing attention to the identification and management of scenic resources (Zube 1982; Ross 1979; Bergen 1995). These acts of legislation were created to ensure that nonquantifiable amenity values (recreation, aesthetics) are included in recommendations for legislation or other federal actions that significantly affect the quality of the environment (Cubbage et al. 1993). Over the past half-century, these laws have served as a vital tool to address aesthetic impacts associated with the management of wild and scenic rivers, recreational trails, scenic highways, environmental and visual impacts of major development projects, coastal zone management and natural resource planning (Zube 1982).

In response to this legislature and increased public concern about the forested landscape, publicly funded forest visual quality research began to provide information on how to manage, plan, and design landscapes to make them more visually appealing (Zube 1982; Hull 1989).

The use of empirical research methods to investigate aesthetic preferences for forests was also advocated in Europe, and methods specifically aimed at forest preference identification and explanation then developed in North America and Europe (Ribe 1989). In the 1970s the United States Forest Service developed the Visual Quality Management System (VMS) to help in the visual management of federally owned lands. The VMS is based on using the expert opinion of landscape architects to describe the visual quality of a scene or landscape. Professional landscape architects identify visually sensitive areas where site specific management techniques can be applied to improve or stabilize the visual quality of that area (Pings and Hollenhorst 1993). During the same time period, the Scenic Beauty Estimation Method (SBE) was developed by Daniel and Boster (1976). This methodology was based on psychophysical scaling procedures using photographic assessment techniques to measure the perception of the general public to determine scenic beauty (Vodak et al. 1985).

Summary of Aesthetic Based Research

Many studies on aesthetic values of forestry have been conducted. Though a majority of the studies are similar in focus, often a variety of different titles and terms are used to essentially describe the same topic. For example, forestry aesthetic studies have been classified as studies of: visual quality management (Pings and Hollenhorst 1993), visual resource management (Ross 1979), aesthetic preference (Daniel 2001), aesthetic values (Schuh 1995), environmental perception (Daniel and Ittelson 1981), landscape perception (Zube 1982), and scenic beauty (Shelby et al. 2003). In addition, comprehensive reviews of forest scenic preference studies have been conducted (e.g., Zube et al. 1982 and Ribe 1989) that evaluate numerous empirical studies on specific factors deemed influential to aesthetic perception. These factors have been categorized into over fifteen different areas, such as fire impacts, insect impacts, post harvest treatments, plantations, tree size, ground vegetation, contextual influences, etc. (Zube et al. 1982 and Ribe 1989). One of the most scrutinized areas is the visual effects of timber harvesting activities (Zube et al. 1982 and Bergan 1995). For example, pre-harvest and post-harvest perceptions have been studied intensively for a variety of forest types. The perception of western forest management and silvicultural practices have been investigated extensively by the United States Department of Agriculture Forest Service (USDA FS) and the United States Department of Interior Bureau of Land Management (USDI BLM) (Schweitzer et al. 1976, Shelby et al. 2003). A visual resource management system was developed by the BLM to help assess, plan, and manage for the aesthetic qualities of public landscapes (Ross 1979). "With the notable exceptions of researchers' Litton, Shafer, Daniel, Buhyoff and their colleagues there is a strong suggestion in the American forestry

journals that proper silvicultural management automatically yields quality landscape aesthetics" (Zube 1982) (p 13). While this may be true among the professional forestry community, whether the same can be said of the attitudes held by the general public remains, at best, unshown (Zube 1982). Because of their influence on policy and decision makers (Tindall 2001) aesthetic perception and preference studies predominately target members of the general public as their primary research subjects. Arthur et al. (1977) verified a recent trend among the public to preserve the beauty of public lands, which has lead to the development of scenic assessment models that rely on public input. In addition, western forest management is very dependent upon broad public input, which occurs through environmental impact assessment processes (Vining and Orland 1989). The importance of aesthetic values studies is evident in their effectiveness in measuring public reaction to variables that were previously felt unquantifiable (Buhyoff and Leuschner 1978).

A data collection methodology that is universally accepted to capture a representative cross-section of the general public has yet to be established. Due to project limitations, respondents usually consist of special groups such as college students (Tindall 2001, Hollenhorst et al. 1993, Bourgeouis and Kodama 1999, Daniel 2001), recreationalists (Freimund et al. 2002) or special interest groups (McCool et al. 1986). College students provide sampling convenience for the researcher and are therefore often relied upon as a proxy for the general public. Studies have confirmed that average responses on forestry issues by first year college students represent opinions somewhere between those of the general public and environmentalists (Tindall 2001). Furthermore, visual preferences for

natural landscapes among freshmen and sophomore college students have been shown to be representative of the general public (Buhyoff and Leuschner 1978).

Evaluations of the general public's preferences for forestry activities using proxy groups have been conducted that compare attitudes and preferences among people with diverse cultures, political, social and economic agendas, and a variety of sociodemographic characteristics (McCool et al. 1986). Hollenhorst et al. (1993) targeted specific groups that he thought would benefit most from his work, such as resource policy makers, public land managers, tourism interests, and private landowners. His findings were different from past aesthetic research based on insect damage in that he concluded that gypsy moth management does not need to be tailored to meet the aesthetic and recreational preferences of different user groups.

It is common in the findings of forest aesthetic studies substituting data from the general public to report that the most visually appealing harvests or activities may not be as attractive from an ecological, operational, or economic standpoint (Bergen 1995). The West Virginia Forestry Association found in a 1998 survey that a high percentage of their respondents felt a loss of scenic beauty due to clearcutting and timbering (Bourgeouis and Kodama 1999). The clear cutting controversy of the 1960's led to public perception studies of clearcutting and other silvicultural methods (Bliss 2000). Social research findings on the public's reaction to forest practices has overwhelmingly concluded that Americans find clearcutting aesthetically offensive (Bliss 2000). The public mind perceives clearcutting as a depletion of natural resources. They associate it with

environmental decline: loss of biodiversity, increased soil erosion, landslides, and degradation of water resources. Similar results were found for some landowner populations (Egan et al. 1997).

A Weyerhaeuser division in Washington State conducted a visual quality study that relied upon public responses to different silvicultural activities. One major objective was to define what the public finds visually displeasing about clearcuts through a series of public interviews (Schuh 1995). Findings revealed that the general appearance of clearcuts raise public concerns about environmental resource damage and that a clearcut that dominates the visual landscape is perceived as detrimental to public resources (Schuh 1995). Using college students as research subjects, Pings and Hollenhorst (1993) reported that clearcuts had the lowest visual quality of various silvicultural systems studied, including deferment cuts, crop tree release, shelterwood, area-wide thinning, and single tree selection. Their study showed that the no cut mature forests were rated the highest.

Major forest industries have recognized the importance of forest aesthetics (Schuh 1995). Companies such as MeadWestvaco are participating in the Sustainable Forestry Initiative which is a certification program developed by the American Forest and Paper Association in 1994 (MeadWestvaco 2003). US forest industries have relied on SFI to improve member company performance and enhance public confidence in industrial forest management. The program involves a third party audit to assess compliance with SFI standards, which promote active forest management while protecting associated values,

such as wildlife, aesthetics, vegetative diversity, and water quality (MeadWestvaco 2003). The development of landowner assistance (Cooperative Forest Management - CFM) programs has allowed some forestry companies and wood consuming mills to offer forestry expertise to NIPF owners to help protect and maintain the integrity of areas of geologic, biologic, and historic significance (MeadWestvaco 2003). These programs target the active management of forests while protecting associated values such as wildlife, water quality, reforestation, and aesthetics. Some forestry companies are working with landscape architecture firms to develop workshops to train their professional foresters on aesthetic principles in forest management (Schuh 1995). Weyerhaeuser, for example, has conducted visual sensitivity studies to identify company lands, which were being utilized most in terms of travel, recreation, and general visual exposure. This information was used to assist company land managers in determining where additional visual management procedures should be implemented (Schuh 1995).

Other studies have been completed on the visual effects of various factors considered to influence the visual landscape. For example, Hollenhorst et al. (1993) evaluated the near-view aesthetic impact of gypsy moth damage on oak-dominated hardwood forests of the northeastern United States. He reported findings that differed from that of previous insect damage research. By taking a near-view approach to evaluating scene preferences, he found some positive influences that were correlated with gypsy moth damage at some level. Change in species composition and increased light to the understory were some of the positive effects. Significant associations were found between preference and respondent's knowledge of the subject of study i.e., gypsy moth, southern pine beetle,

timber harvesting activities, etc. Similar studies focused on such topics as how defoliation, discoloration of foliage, and tree mortality affects scenic beauty judgments (Rosenberger and Smith 1998). The scenic impact of the southern pine beetle on coniferous forests in the Appalachian region was evaluated in the work of (Buhyoff and Leuschner 1978). Visual preferences for scenic overlooks and distant vistas decreased rapidly as forest damage from southern pine beetle increased. All of these studies report that forest insects and diseases can affect the perceived visual quality of a forest in many ways. Defoliation and tree mortality resulting from forest pests and disease has an enduring visual impact, particularly at intensively used recreation areas, along scenic byways, or where private forestland owners place high value on the scenic qualities of their property (Hollenhorst et al. 1993).

A number of other findings identifying scenic values of certain forest characteristics are reported by Ribe (1989). These finding are relatively intuitive, including results that indicate that evenly stocked rather open stands of large timber are considered more attractive than multiple canopy forests with densely stocked clumps of small diameter trees. Ground slash and other signs of harvest activities detract from aesthetic beauty. Diversity and variety in vegetative composition and species are considered to enhance forest scenes, while evidence of fire and natural disturbance detract from landscape visual quality. Investigating the aesthetics of roads, Schweitzer et al. (1976) reported that people prefer older roads with established vegetation and dislike newly constructed roads with bare earth and exposed rocks showing. Other studies have focused on how perception and aesthetic values change over time. A variety of case studies have been

conducted to compare the visual impact of alternative harvesting methods and determine how rapidly areas receiving different treatments recover over time (Benson and Ullrich 1981).

Outdoor recreation specialists have recognized the importance of the relationship between people and the recreation landscape (Zube et al. 1982). Traditionally, outdoor recreation studies have assessed the perceived quality of different visual environments. The use of computer technology to show the visual effects of alternative management actions by animating visual changes over time has become a useful tool assisting land managers in decision making (Freidmund and Miller 1995). Image capture technology (ICT) the capture and editing of photographic images, has also been effective in helping to evaluate National Park visitor perceptions. In another study conducted by Freidmund et al. (2002) the authors were able to analyze visitor norms and determine how certain recreational activities (e.g., use of varying numbers of watercraft, sounds from aircraft and motorized boats, and the acceptability of floating outfitting camps) and changes in the visual and aural quality of specific scenes can impact the visitor experience. Their findings were consistent with other studies conducted in backcountry areas reporting that various activities can significantly influence/violate park visitor norms and impact their overall experience.

Although, measuring aesthetic appreciation and preferences for landscapes has engaged the interests of individuals from a variety of disciplines and professions, it has been of vital importance to landscape architects. Vining and Orland (1989) compared the ratings

of the scenic beauty of slide and video images of three different environments, including scenes from urban city streets, viewpoints from an arboretum a few minutes outside of Chicago, and different scenes from eastern U.S. hardwood and western conifer forests. They found no significant differences in respondents between the two methodologies. Landscape planning in special environments, such as coastal recreational development, has received much attention from both recreational scientists and landscape architects (Zube et al. 1982). Forest recreation studies are distinguished from specialized landscape planning studies by an emphasis on a specific recreational activity and the social context and landscape that it takes place.

Again, however, systematic investigations of logging-in-progress are lacking in peer-reviewed literature, despite concerns about the intrusion of the sights and sounds of timber harvesting in forests proximate to exurban and urban fringe populations.

Elements of Bias

Preference rankings and acceptability ratings involve much more than a visual or aural evaluation of a static or dynamic scene (Kroh 1997). Humans are multi-sensory beings that rely on senses to perceive an external scene. We each possess the same sensory faculties and apart from those who are impaired, have the same access to perceptual surfaces, sounds, smells, tastes, and kinaesthetic responses. While sight and hearing, which are thought of as the distance senses, are vital to evaluating a scene, many other elements play influential roles. People perceive a scene differently depending on their knowledge, culture (Freimund et al. 2002), experience, age (Hull 1989), and other factors

(Bell 2001). Another critical, yet often overlooked concept that greatly influences peoples' perceptions is their *purpose* (Hull 1989). One's purpose is defined in relation to how the individual classifies the landscape or scene for its use. For example, a hiker interested in backpacking will look for different environmental characteristics in the environment than a hunter interested in specific wildlife habitat, or a personal searching for medicinal or edible plants, or a camper concerned about vegetation for adequate privacy yet open enough for scenic viewing, or a real-estate investor looking to buy land for residential development.

Theory and Philosophy of Aesthetic Preference

There is theoretical justification for being concerned with the different elements that influence perception and preference. Multiple theories have been developed based on the psychology of perception and the philosophy of aesthetics. Bell (2001) provides a thorough summary of the various mechanisms and theories of visual perception. Scientists have evaluated visual perception from the very basic aspects of the initial reception of light into the eye to the more in-depth basis of the Primal Sketch, which encompasses how humans process shapes and patterns to separate out the elements of a scene for evaluation. Theories such as the *Gestalt Psychology* and *Gibson's Theory of Affordance and Optic Flow* are founded on complex and diverse arrays of scientific information that relates to perception and the aesthetics of the landscape.

Zube and his colleagues (1982) elaborated on theories and methodologies developed and used in scenic beauty research by professionals in six broad disciplinary categories, i.e., landscape, geography, forestry, recreation, interdisciplinary/environmental, and behavior. A prominent theory well used throughout psychology-based landscape perception studies is the landscape perception paradigm (Kroh 1997). Upon the review of 20 research journals, over 160 articles were identified to have made reference or were based on the following four paradigms: 1) the expert paradigm 2) the psychophysical paradigm 3) the cognitive paradigm and 4) the experiential paradigm. Each paradigm is based upon certain respondent qualities that make them a preferred sample of study (Zube 1982). The *expert* paradigm relies on skilled and trained observers who are educated in art and design along with resource management fields to evaluate the quality of a landscape. The *psychophysical* paradigm involves the landscape assessment of the general public or select populations. The *cognitive* paradigm searches for human meaning associated with landscapes or landscape properties. The human observer collects visual information and in conjunction with past experience, future expectation, and sociocultural conditioning, applies meaning to the landscape. The *experiential* paradigm considers landscape values to be formulated by the experience of the human and landscape interaction, which is an ongoing interactive process.

The expert and psychophysical paradigm patterns are better adapted for the use in forest aesthetic values studies due to their emphasis on problem related research. The cognitive and experiential paradigms are most appropriate for psychology research that focuses on the human mind due to their applicability for use with applied and theoretical issues

(Zube 1982). In conjunction with the different paradigms, four psychophysical methods have been used extensively to help characterize scenic beauty: summed rankings, average ratings (Brunson and Reiter 1996 and Vining and Orland 1989), scaling of paired comparisons (Thurstone's Law of Comparative Judgment) (Hull et al. 1984) and Scenic Beauty Estimates (Daniel 1979).

Simon Bell's work compliments Zube's (1982) by further expanding upon the psychology of perception and the philosophy of aesthetics contribution to the better management of forest landscapes. Bell examines and compares different views on aesthetics (e.g., integrationist vs perceptual) and takes an intensive look at philosophical perspectives of perception and preferences. Overall, perceptual theories are too numerous and complex to cite and discuss them all. However, it is important to identify their relevance and influence, adding to the challenges associated with aesthetic value studies.

Aesthetic Guidelines

Several publications and pamphlets have been written to provide guidance in managing for aesthetics. "A Guide to Logging Aesthetics" (Jones 1989, 1993, and 1995) outlines procedures considered practical and cost-effective in minimizing the negative impacts of timber harvesting. Several state division of forestry and natural resources departments have published Best Management Practices Guidelines for logging aesthetics that include specific techniques to managing the visual quality of a forest (Minnesota 1994). Other groups like the Washington Forest Protection Association have dedicated time and

resources to producing documents that inform how to conduct harvest practices and forest management activities in visually sensitive areas (Bradley 1996). Furthermore, articles written by social scientists (Buhyoff and Leuschner 1978), psychologists (Zube 1982), landscape architects (Bell 2001) and forest scientists (Ribe 1989) have provided breakdowns and in-depth summaries of a wide range of forestry topics and their influence on aesthetic management. Ribe (1989) summarizes empirical approaches to forest aesthetics and covers in great detail the forest scenic preference studies by select topics up to that time period. An article published by the Pennsylvania State University, College of Agriculture Extension Service entitled "Aesthetics Related to Selected Forest Practices" sheds light on what forest landowners consider to be pleasant and unpleasant forest scenes (Radar 1992). The article outlines forest landowner responses to certain forest attributes. For instance, slash was nearly always rated unpleasant, while canopy openings that allowed light to enter and strike the understory of the forest floor was highly rated as pleasant. All of the studies within this summary provide information on how specific tangible and intangible variables are perceived and they identify ways to manage these variables to satisfy the aesthetic preference of the greater good. However, at this time there appears to be little or no published empirical work on the aesthetic values associated with logging system operations in progress.

CHAPTER 3: METHODS

This multiple method research combined four focus groups, videography, and a video survey to gather information about the reactions of non-industrial private forest landowners and the general public toward logging-in-progress.

Focus Group

Focus group interviewing is a viable technique for gaining better understanding of specific items of interest (Kingsley et al.1988). A focus group is a discussion led by a moderator who guides the discussion keeping it within the scope of the intent of the study. The moderator introduces various issues to initiate a group discussion focusing on matters of interest to the researcher. The moderator avoids being an active participant, but he or she will intervene when the conversation slows or to encourage participation from all group members. An important objective in conducting a focus group interview is to avoid question and answer type sessions and promote open discussions that incorporate participant's feelings and opinions on the research topics (Kingsley et al. 1988).

Table 3.1. Focus groups held throughout northern New England.

Date	Location	Woodland Owner Group	# Participants	Male/Female	Length of Discussion
6/21	Buckfield, ME	SWOAM - Western Chapter	9	8/1	30 minutes
6/30	Epping, NH	RC-NHTOA	7	5/2	45 minutes
7/14	Woodstock,VT	VT Coverts	12	10/2	35 minutes
8/5	Holden, ME	SWOAM - Penobscot Chapter	4	4/0	60 minutes

Four separate focus group interviews were conducted during the summer of 2003. These discussion were arranged by contacting woodland owner groups by email and phone. For convenience, the majority of the focus group interviews occurred within the time period designated for an already scheduled meeting for that specific organization. Each meeting consisted of a moderator and members of a specific woodland owner group of northern New England. Focus groups were conducted with two separate chapters of Small Woodland Owners of Maine (SWOAM); the Western Chapter in Buckfield and the Penobscot Chapter in Holden; the Vermont Coverts; and Rockingham Country Chapter of the New Hampshire Timber Owners Association (Table 3.1.). With each group's approval, all conversations were recorded on a digital voice recorder to capture participants' verbal exchanges and to preserve the form and context of all comments. Recorded discussions were then transcribed into written transcripts.

The researcher served as the moderator in all interviews. An outline of specific questions (Appendix C) was referenced by the moderator during the interviews to keep the discussion on matters of specific interest and to ensure consistency among the topics mentioned.

The main objective for these discussions was to prepare for a subsequent survey and to develop information that might add depth to survey responses. This was accomplished by eliciting the targeted audience's attitudes toward and experiences with different forest management activities. The discussions also helped to uncover jargon common to the groups. One of the most important aspects in constructing an effective survey is the

development of meaningful questions. Investigators often assume that words familiar to them are also familiar to the targeted audience (Egan et al. 1994). Yet if this assumption is wrong the survey questions and participant responses may be misinterpreted. The information collected during the focus group interviews was content analyzed. The focus group discussions were not used to provide information that could be generalized among the broader small woodlot owner groups of the region.

In preparation for focus groups, a manuscript was designed to provide guidance to the moderator in presenting a consistent introduction and explanation to the purpose of the meeting and to initiate conversation. Each meeting started by the moderator stating, "I greatly appreciate the opportunity to sit down and have an open discussion with you all. I am very interested in hearing your thoughts and concerns, as well as goals, objectives, and other issues pertaining to your woodlots. This meeting should last for approximately a half hour to an hour. And I would like to point out that the digital voice recorder is on to capture the group discussion for my own personal use in going back to reevaluate key points that otherwise would have been forgotten or unnoticed. I would appreciate if we could go around the table and you all could briefly introduce yourselves and give some general information about your woodlots (e.g., location, acreage, years of ownership).

Approximately a dozen specific questions were formulated to aid the moderator in presiding over the focus groups. Questions such as, "tell us about your logging experiences and please identify logging equipment that you have used and prefer" were designed to coerce participant responses that were most relevant to this study's

objectives. Similar questions like, "do you think that logging jobs in progress have an aesthetic influence and does certain equipment have a better image or visual and aural appeal than others?" were employed for the same purpose. As a preventative measure in case group discussions become stale or off topic, the questions of "do neighbor's, friends, or family ever comment or address concerns about logging operations and do you think people are more concerned or affected by a logging operation in progress or after the harvest?" can be implemented to entice the respondents back into appropriate dialogue.

Written Survey

The five page written survey was developed and printed by the end of summer 2003. (Appendix A) The survey was comprised of three sections. The first section consisted of a three-point Likert type acceptability scale; one represented an unacceptable rating, two acceptable, and three very acceptable. Most studies that rely upon photographic images ask the viewers to rate their preference for each image using some type of scaling system (Tarrant et al. 2003). Section one of the written survey was designed for the respondent to rate the acceptability of each yarding method based on specific system attributes (e.g., visual appearance, sound produced, perceived efficiency, potential disturbance) and use in certain situations (e.g., use in a residential area, your woodlot, your neighbor's woodlot). Questions regarding efficiency (section 1) and sustainability (section 2) were incorporated into the survey because of their importance to small woodland owners, which was documented during the focus group discussions. The second section of the survey asked respondents to rank the five yarding methods based on the same questions

used in the first section. The third section of the survey was entitled background information and was designed to collect background information for each respondent, including age, gender, education, place of residence, etc. Content analysis of the focus group discussions significantly influenced the development of this section of the survey. One's knowledge of timber harvesting and their current place of residence as well as residence during their teenage years were formulated from the information gathered from the focus groups.

Video

Many scenic quality and aesthetic preference based studies have followed the scenic beauty estimation method (Daniel and Bolster 1976) or variations of it, relying on color photographic images or slides to serve as a surrogate for actual on-site visits (Hull et al. 1984 and Yeiser and Shilling 1978). However, because of the dynamic nature of logging and its range of visual and aural attributes, videography rather than still photography was used to capture respondents' reactions to the yarding methods studied. The forest operations video was filmed over the span of a month during the summer of 2003. Filming was conducted by Kim Mitchell, a video producer at the University of Maine's Department of Marketing (Figure 3.1.). A Sony Betacam Model UVW-100 professional grade video camera and equipment were used in all filming sessions (Appendix D). Kim Mitchell's services were also contracted to assist in the editing and production of the final version of the video survey.

Table 3.2. Information on each timber harvest yarding method

System	Model	Year	Horsepower	Additional Information
 **Forwarder**	Valmet 546	1993	102	Torque 277 ft-lbs Weight 19,880 lbs Width 102 inches Length 368 inches
 **Skidder**	John Deere 440-B	1974	70	Diesel 4 cylinder Rubber-tired
 **Bulldozer**	John Deere 350-C	1980	70	Diesel 4 cylinder JD cable skidder winch
 **Tractor**	Kubota MD-4500	1980	55	Diesel 4 cylinder Mechanical farm winch model
 **Horse**	¾ Percheron ¼ Belgium	8 years old	1600 lbs	Diesel 4 cylinder Mechanical farm winch model

Four of five different yarding systems were filmed during actual timber harvest operations at the University of Maine Demeritt Forest. Yarding systems consisted of a 1993 Valmet 546 forwarder, a 1974 John Deere 440-B rubber-tired cable skidder, a 1980 John Deere 350-C bulldozer, a 1980 Kubota MD-4500 farm tractor, and an eight-year old Percheron x Belgian work horse (Table 3.2.).

Video shooting started on July 25th and concluded on August 28th. A total of sixty minutes and fifteen seconds of video footage was collected during five mornings of filming. All video footage, with the exception of that taken of the horse logging method,

was recorded on a 40-acre woodlot parcel owned by the University of Maine. The woodlot is part of the Demmerit Forest located on the northern side of campus adjacent to the Witter Farm. The tract was similar in vegetative and topographic characteristics, including stand type, site index, slope, aspect, and general soil type. The horse logging system was filmed on a privately owned woodlot located approximately 10 miles west of the Demmerit Forest. This site was similar in forest and land characteristics to the Demmerit Forest. In conducting aesthetic based research it is very important to control for scene bias by carefully selecting physical properties (landscapes and viewing conditions) and accounting for elements that can be manipulated (Sheppard 2001). By having similar forest and land characteristics all background elements in the video footage were similar except for the differences in yarding methods.

Figure 3.1. Videography

Figure 3.2. Measurements

Video footage was collected in the morning hours between 8 am and 12 noon. The following criteria were used when deciding when and where to collect footage:

- weather sunny to partially overcast
- temperatures ranging from 60 to 75 degrees Fahrenheit
- shooting angles in a northern/northeasterly direction to avoid direct sunlight

Hollenhorst et al. (1993) and Buhyoff and Leuschner (1978) cite that specific landscape scenes or elements that a researcher wants to evaluate are captured most often in the near-view position from a 35 mm camera. In this study, video footage was recorded of each logging system at similar near-view distances ranging from sixty to one-hundred feet. Flagging was used to mark video setup location and logging operation location. Distance measurements were taken at a later time to confirm that scenes were filmed within the specified distances (Figure 3.2). One of the filming objectives was to capture the visual and aural attributes of each system in a manner that adequately represented the scene from a normal perspective of a passing observer. Actual sound levels produced by each yarding system could not be accurately duplicated on video due to equipment limitations. To resolve the problem, sound levels for each system were measured and recorded in decibels by a sound level meter to ensure that any adjustments in the video footage volumes would remain consistent among the different systems (Appendix D). For the video survey, volume levels produced by the yarding methods were reduced but were proportional to the actual sound levels recorded in the field. This alleviated exposing video survey participants to actual volume levels that could be potentially damaging.

Editing

The development and formation of the finalized forest operations video was integrated with the format of the written survey. It was determined through the creation of the written survey that the forest operations video includes text and graphics that guide respondents through the survey.

Actual video footage depicting individual yarding system operations was needed for the acceptability questions in section 1 and a highlight reel of all systems was needed for the preference or ranking of the systems in section 2. The respondent background information collected in section three of the survey was not cross-referenced to the video.

Table 3.3. Video editing equipment and editing work history

Hardware	Software	Date	Time/Hrs.
Macintosh G-4	Media 100 Version 8	Friday, Sept. 12th, 2003	2
		Tuesday, Sept. 16th, 2003	1
		Tuesday, Sept. 23rd, 2003	2.5
		Thursday, Sept. 25th, 2003	2.5
		Friday, Sept. 26th, 2003	2
		Tuesday, Sept. 30th, 2003	1
Total			11

All video editing procedures and manipulations were conducted while working in the videography studio located at the University of Maine. A Macintosh G-4 computer with media 100 version 8 video editing software was used in all editing and video creation applications. A total of 11 hours were spent working together to edit and create the final video product (Table 3.3.). The video editing process consisted of reviewing all 60 minutes and 15 seconds of raw video footage recorded. All footage for each yarding system was digitized and separated and placed into "bins" for storage and further manipulation. A "bin" is a tool used in Media 100 editing software for storing and saving digitized video clips that can be easily revisited and further edited.

Figure 3.3. Video editing

Each logging system's footage included specific operational scenes such as, "start up empty" which is the initial phase of starting the machine and then, "navigate empty" which is the process of maneuvering the equipment or animal into the work area, followed by "load or choke wood" which refers to the manner of preparing the timber for transport to the landing. The next stage filmed was "start up full," which depicted the yarding method readying for the phase of "navigate full," which involves active transport of wood to the landing. The final scene portrays the system "unloading or unchoking," which refers to the process of detaching the wood at the landing for secondary transportation. Operational scenes were carefully reviewed and notes were taken on their time span and quality.

Table 3.4. Individual segment and summary highlight times within the forest operations video

Yarding System	Individual Video Segment Time	Summary Highlight Time
Forwarder	1:02	0:11
Cable Skidder	0:49	0:11
Bulldozer	1:09	0:11
Farm Tractor	1:00	0:11
Work Horse	0:56	0:11

The objective of section 1 of the written survey was to create 5 one-minute video segments that adequately portrayed each yarding system's operations from start to finish. The major editing task was to reduce the time span of each operational scene so that the remaining video clips would be short but adequate in representing the visual and aural characteristics associated with each yarding systems operational activities. Once each scene was reduced in length of time and appeared sufficient in representing the true form of each operational stage, the individual video clips for each logging method were pieced

together to construct the final video segment for each system. To soften scene breaks, "pushes" and "dissolves" were implemented to make transitions appear smooth and more natural (see DVD enclosed with this thesis).

The final video segments produced for section 1 of the written survey were consistent in length of time and scenes depicted for each of the five yarding methods (Table 3.4.). Individual video segment times for each timber harvest yarding method ranged from 0:49 seconds to 1:09 seconds in length. A brief 30-second highlight segment was created to summarize each yarding system to refresh the minds of the viewers to prepare them for the ranking questions of section 2. To complete this task, the "navigate full" and "unload/unchoke" scenes from the individual video segments used in section 1 were copied together to construct the highlight segment. Individual summary highlight times for each yarding method were approximately 0:11 seconds in length. In addition, a digital picture of each yarding system was selected and inserted into the final video scene. The pictures were labeled by their system name and the University of Maine "dark blue" coloration was used as a background. These pictures were used in conjunction with the highlight segment for the ranking questions in section 2 of the written survey.

Participants were cued by text within the video to respond to the background information requested in section 3 of the written survey. Text was used throughout the video, predominately in section breaks, to remind the viewer of what they saw and to direct their attention to specific questions on the written survey (Appendix A). Five-second dark

screens were installed between instructional clips and logging method segments. The purpose of these screens was to provide the moderator with a visual warning that scenes were about to change. They also served as short breaks, which could enable the moderator to pause the video in case extra time was needed for viewers to finish responding or if questions arose.

Editing of the forest operations video was completed by the first week of October 2003 and had a total viewing time of 13 minutes and 15 seconds.

Human Subjects Review

The survey instrument was subject to review by the University of Maine Office for the Protection of Human Subjects. According to University policy, "students, employees, and agents of the University who conduct research involving human subjects must comply with the University Policy and Procedures for the Protection of Human Subjects of Research. These procedures exist for the rights and welfare of the people who participate in UMaine research. No systematic investigation of information obtained by observing or interacting with people, or by collecting and examining any form of identifiable private information about people, may be conducted until: 1) A unit review committee has reviewed the research protocol and determined that the project is exempt from further review, or, 2) the Protection of Human Subjects Review Board has approved the research protocol."

An application for the approval of research with human subjects was submitted on behalf of this study by Dr. Andrew Egan (Appendix B). The finalized forest operations video and accompanying survey were qualified for an expedited review and were processed by the Human Subjects Review Committee within the College of Natural Sciences, Forestry, and Agriculture at the University of Maine. The review concluded that the research instruments developed for this study involved the use of human subjects and are exempt under category 2 of the IRB. This exemption is essentially an approval of the video and survey verifying that its use posed no foreseeable risks to participants.

One mandatory guideline set forth by the Human Subjects Review Committee was the issuing of an "informed consent statement" that must be verbally delivered to the participating audience during the introduction of the data collection presentation. The informed consent statement put into practice for this study followed the format of the sample "informed consent" document on the IRB website. (http://www.orsp.umesp.maine.edu/HumanSubjects.htm) (Appendix B), and was read to potential survey participants prior to their participation in this study.

Data Collection

Psychology professors, departmental staff, and administrative representatives at several universities and colleges across northern New England were contacted via email in request of utilizing entry-level psychology students for this project. The pursuit of arranging data collection opportunities ceased once a cooperative contact was located from each of the three states representing the targeted region.

Table 3.5. Summary of location and participation of entry-level psychology student respondents throughout northern New England

Date	University	Town	State	# of Respondents
Nov. 3rd, 2003	Plymouth State University	Plymouth	New Hampshire	51
Nov. 6th, 2003	University of Vermont	Burlington	Vermont	29
Nov. 11th, 2003	University of Maine	Orono	Maine	34
Feb. 3rd, 2004	University of Maine	Orono	Maine	15
Total				129

Universities willing to assist with my request included the Psychology Departments at Plymouth State University in Plymouth, New Hampshire, the University of Vermont in Burlington, Vermont, and the University of Maine, in Orono, Maine. Three of the four data collection sessions were conducted after university hours and served as an extra credit opportunity for entry-level psychology students. In one case, thirty minutes of a psychology 101 class lecture was dedicated to the conduct of the survey (Table 3.5.).

Figure 3.4. Location map of data collection with entry-level psychology students at the University of Maine, Plymouth State University, and the University of Vermont (northern New England)

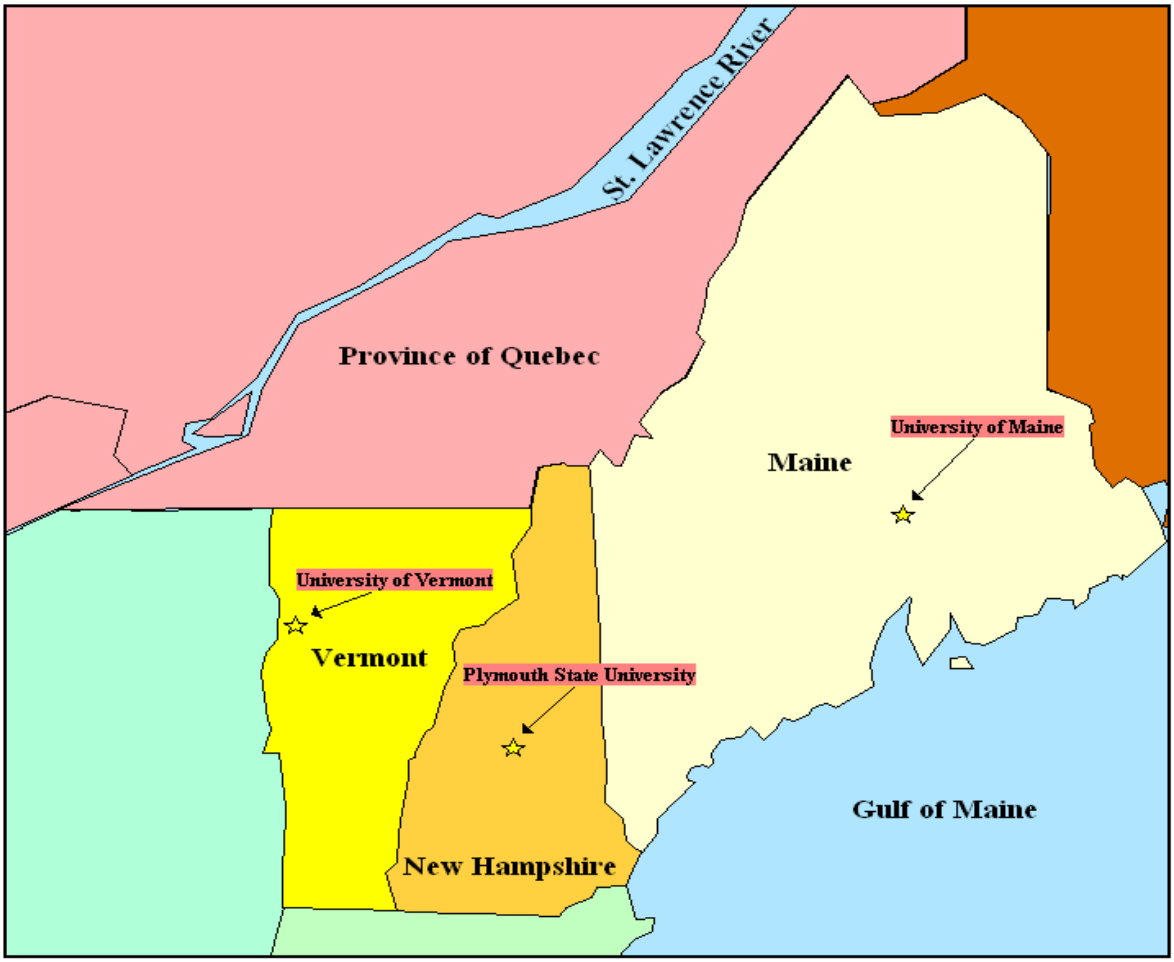


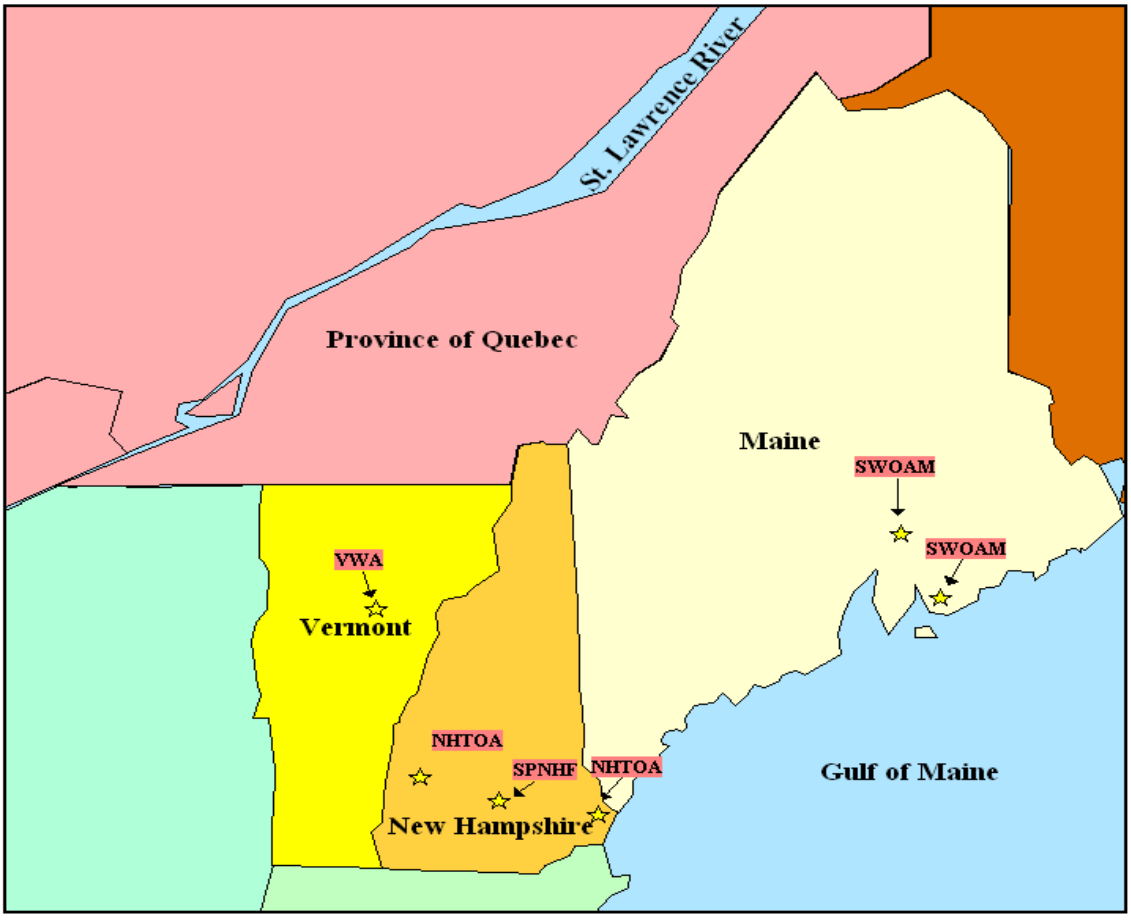
Table 3.6. Summary of location and participation of non-industrial private forestland owner group association members

Date	Non-Industrial Private Forestland Owner Group	Town	State	# of Respondents
Oct. 4th, 2003	Small Woodland Owners Association of Maine	Lamoine	Maine	15
Oct. 11th, 2003	Small Woodland Owners Association of Maine	Holden	Maine	12
Oct. 27th, 2003	New Hampshire Timber Owners Association, (Rockingham County)	Epping	New Hampshire	6
Dec. 10th, 2003	New Hampshire Timber Owners Association, (Sullivan County)	Newport	New Hampshire	4
Dec. 11th, 2003	New Hampshire Timber Owners Association, (Sullivan County)	Claremont	New Hampshire	4
Dec. 11th, 2003	New Hampshire Timber Owners Association	Concord	New Hampshire	7
Jan. 3rd, 2004	Vermont Wilderness Association	Berlin	Vermont	10
Total				58

Directors and administrative staff members working for non-industrial private forest landowner groups were contacted via email and telephone to request their assistance in arranging showings of the video survey to this targeted group. SWOAM allowed the video survey and data collection to occur during two chapter field trips. Survey responses were gathered at SWOAM field trips in East Lamoine, Maine, and at another field event in Holden, Maine.

Two separate chapters of the New Hampshire Timber Owners Association set aside thirty minutes of their agenda time during chapter meetings for participation in this study. The first meeting was with the Rockingham County chapter of the NHTOA held at the Rockingham County Cooperative Extension Office in Epping, New Hampshire and the second meeting was with the Sullivan County chapter of the NHTOA held at the Sullivan County Cooperative Extension Office in New Port, New Hampshire. A third and final

Figure 3.5. Location map of data collection with the Small Woodland Owners Association of Maine, New Hampshire Timber Owners Association, Society for the Protection of New Hampshire Forests, and Vermont Woodlands Association (northern New England)



data collection session in the state of New Hampshire occurred with the assistance of an executive director with the Society for the Protection of New Hampshire Forests in Concord, New Hampshire. Video survey response data for NIPF owners in Vermont were collected during a Vermont Wilderness Association (VWA) meeting held in Berlin, Vermont (Table 3.6.).

Analysis

The surveys were completed in the presence of the moderator who was careful to express no opinions during the data collection process. Once the data collection process was completed, all surveys were organized by the date that they took place and by the group participating. Once sorted, all survey responses were entered into an Excel spreadsheet. Traditional data entry methods were used to convert survey responses to data for use by StatView. StatView is a computer software program by Statistical Analysis System Incorporated (SAS) (StatView 1989). The design of the survey made the data entry process very easy since all rating and ranking answers had a numeric value. The respondent background information section was the only part of the survey in which responses were coded into numerical form (e.g., yes / no responses became 1 / 2 and rural, suburban, urban became 1 , 2, 3, etc.).

Chi-Square Analysis

Acceptability rating data from section 1 of the written survey were arranged into a contingency table – a two-way tabular arrangement of observed frequencies categorized into one group for each of the two nominal (grouping) variables (StatView 1989). Chi-

square analysis tests for independence were used to test for associations between various subgroupings in the data (e.g., student v. landowner association member) and responses to the ratings questions. This is done by calculating the expected frequencies, given H_o (of independence) and comparing them with observed frequencies consistent with the following model:

$$\text{Chi-Square} = \text{Sum of } \frac{(f_o - f_e)^2}{f_e}$$

Where:

f_o = an observed frequency
f_e = an expected frequency given H_o

Polytomous Logistic Regression

Two independent variables (age and education) were entered into the data set as continuous variables; therefore they did not lend themselves to chi-square analysis without converting them to categorical variables with the resultant loss of information. As a result, polytomous logistic regression was used to further explore any relationships between respondents' background information and their categorical acceptability ratings for the logging system attributes and logging situations.

Polytomous logistic regression models were designed to extend the logistic model to account for more than two outcome variables Y (StatView 1989). In this study the relationships between three ordered nominal dependent variables, 1 = unacceptable, 2 = acceptable, 3 = very acceptable, were examined with seven independent variables that included age, gender, education, place of residence, time of residence, place of residence during teenage years, landownership, and knowledge of timber harvesting.

Polytomous logistic regression can be illustrated by the following model:

$$\text{Log}\left\{\frac{\Pr(Y = 1 \mid x_1, x_2, \ldots)}{\Pr(Y = 0 \mid x_1, x_2, \ldots)}\right\} = b_{10} + b_{11}x_1 + b_{12}x_2 + \ldots$$

$$\text{Log}\left\{\frac{\Pr(Y = 2 \mid x_1, x_2, \ldots)}{\Pr(Y = 0 \mid x_1, x_2, \ldots)}\right\} = b_{20} + b_{21}x_1 + b_{22}x_2 + \ldots$$

Repeated Measures Analysis of Variance

Preference ranking data from section 2 of the written survey were coded in a manner to calculate mean preference scores for each timber harvest yarding method for each of the eight questions used within this section. Repeated measures analysis of variance was used to determine significant differences among and between the populations: members of non-industrial private forestland owner group associations and entry-level psychology students. The repeated measures analysis of variance model is designed for longitudinal

studies in which the participants answer multiple questions (e.g., ratings and rankings) in response to the same topic (e.g., the five yarding methods studied).

In order to conduct a repeated measures analysis of variance using StatView, the within factors (e.g., each yarding system identified with each attribute or situation) must be stored as compact variables in the data. Compacting variables is a special structure that expresses the same information in fewer cells and helps StatView to understand that certain columns are related and represent different groups (or levels) of the within factor. (StatView 1998). For example, the seven questions (attributes and situations) became an individual factor and within each of these questions the five yarding methods were compacted within.

The AOV model employed in this analysis was:

$$\text{Total SS} = \text{Sum of } y^2ij - \frac{(\text{Sum of } yij)^2}{rt}$$

Where:

Total SS = Total sum of squares
Sum of y^2ij = uncorrected sum of squares
Sum of yij^2/rt = corrected form / number of observations in data set

CHAPTER 4: RESULTS AND DISCUSSION

The focus groups proved very beneficial in the development of the video survey and added depth to landowner responses. Furthermore, the focus groups helped to establish communication lines with additional non-industrial private forestland owner group associations in New Hampshire and Vermont, which played an integral part in successful data collection. The information collected through the group discussions helped to identify landowner group association member concerns and views toward timber harvest yarding methods common to northern New England.

Summary of Focus Group Discussions

Often the most valuable comments from focus group discussions were elaborated responses to a general question. These responses were usually in the form of a personal story or experience that inherently identified key elements that the moderator was in search of (e.g., visual and aural attributes of an operation, perceived efficiency) along with highlighting the respondent's personal qualities (e.g., experience, knowledge, place of residence) that influence their perception and attitudes.

In the process of synthesizing the focus group discussions, it seemed that the majority of the participants were quite familiar with and even to some degree experienced with, a variety of forest management activities and operations. Nearly all of the respondents identified cutting firewood, and conducting "pruning, weeding, thinning, and harvesting" (SWOAM) activities on a periodic basis. In terms of forest operations, the most

commonly used equipment consisted of the conventional cable skidder and farm tractor. "All of my basic logging is done with a farm tractor, four-wheel drive style Kubota packed with a winch, very low impact I feel and not quite as expensive" (SWOAM).

Another SWOAM participant stated, "I kind of like the small skidder and then I clean up with a tractor and a winch. Farm tractor 55 horse and a winch; 165 foot cable can get the stuff out without doing a heck of a lot of damage." A third SWOAM member summarized his assortment of equipment that included a 443 skidder, a Kubota four-wheel drive farm tractor, a loader mounted to a bunk and trailer, along with a truck for hauling wood. Many of the Vermont Coverts responded in a similar fashion, "I do most of my forestry work primarily with a tractor and a winch" and "I had a 22 horse-power John Deer with a portable forklift system that could pick up three or four pulp sized logs, with a three-point hitch on the back to pick up butt logs and haul where I wanted with minor damage" "All my logging jobs were done with a cable skidder, pretty much impractical to use horses due to steep terrain and it's a long uphill skid for most of my logs." Another person followed by saying "I've tried to skid logs with a farming winch behind my 24 horse tractor and it was so limited in what I can pull, it's not very practical in volume." Other replies related to operational experiences included, "I have used a skidder to harvest on a small tree farm" (NHTOA) and "I prefer rubber-tired skidders and have been impressed with my operator" (VT Coverts).

A few participants talked about using a bulldozer or workhorses. A SWOAM member cited using "small crawler to skid a chord of pulpwood after the ice storm and another responded with, "on occasion I use a dozer to pull out trees in isolated areas, but it is rather labor intensive, but the benefit is you can get into tighter areas" (SWOAM). "I would prefer to use a dozer over a skidder due to it being good for fixing and maintaining roads. The skidder leaves the roads bumpy making it tough for me to travel the roads with my tractor and gator" (SWOAM). One Vermont Covert was anxious to describe his management activities, "I have never used a skidder because I rely entirely on horses and small farm tractors."

Another similarity among the landowner group participants was that a high percentage of them have either had or expect to have timber harvests conducted on their properties. Possibly the most useful information was collected in responses that further described the participant's experiences and views toward different forest operations. "I have been involved with many conventional skidder operations and I like them best. A good skidder crew is important to minimize site damage" (SWOAM). A female SWOAM member spoke about observing a cut-to-length operation, "I actually like the one that was non-devastating, the fellerbuncher, I was really impressed with how gentle it was, it just lays everything down." Another SWOAM member expressed that he didn't like forwarders, "because trees are delimbed at certain landings which clumps the piles of limbs. I like when the limbs are spread out throughout the property." Most of the respondents agreed that "finding a good logger and sticking with him is important for a successful job" (SWOAM). "I have a lot of experience, some good some bad. Some

loggers haven't followed my management plan, some took trees that weren't marked and left trees that were, but overall most of my experiences have been good" (NHTOA). Negative experiences that were identified were attributed more to the logger or operator than the yarding method. "I have been having my land logged for over 30 years, with some good experiences, but more bad than anything. Loggers stole timber by taking more loads than they claimed and they took only desirable species and left me with too many red maples. Heck, they never even came back to clean up the roads" (NHTOA).

Content analysis revealed a high frequency of concern among landowners for "low impact" and promoting a "sustainable harvest." A Vermont Covert informed us that he "relied on a consulting forester to make sure minimal damage is done" (referring to the forest). Another Covert responded with, “I am always looking for a way to do low impact. I really wish I could attract somebody with a forwarder to do some cut-to-length work for me.” A SWOAM member brought up the importance of finding a system that fits your needs. Conversation followed discussing equipment size. "Small equipment does less damage to potential new growth trees" and another member agreed by stating, "I am interested in low impact otherwise, I am not too worried about productivity" (SWOAM).

A Vermont Covert stated that, "the money from these cuts is not the motivation" (referring that he wants a healthy and productive forest). However, in discussing what systems are preferred, most agree that it "comes down to the economics" (SWOAM). "Equipment is becoming ever so much more expensive" (SWOAM). "It's all job related,

depends what needs to be done, the territory, the ground; cable skidders have done a marvelous job. There is a whole lot of factors and I don't think certain equipment can work well and speaking of economics, there is only so many jobs you can use a forwarder on and if you are not using it, you can't afford to have it parked" (NHTOA). "It all depends on the application of the job and the objectives of the landowner" (NHTOA). "Though, I prefer smaller equipment that can get around, down here the skids aren't as long," so larger machines aren't necessary (NHTOA).

Very few discussions were established that addressed opinions on visual and aural attributes of logging operations-in-progress. The landowners had a tendency to relate aesthetics to silvicultural activities and the visual appearance following a timber harvest. In terms of aesthetics, some landowner association members agreed that "logging is messy, you can't get around it, you're going to make a mess" and "if a job is done properly, take the slash and nip it up and run over it with a skidder and put it tight to the ground, it rots faster and it is that much less time before it begins to look good again" (SWOAM). A Vermont Covert made a similar statement, "things are going to look messy for a few years, but things will come back." "Aesthetics has not been important to me in the woods, I make my cut pay for itself more really by leaving slash and not having the slash weigh down in the contract" (VT Covert). "I think the problem is that people don't understand forest operations" (NHTOA). Another SWOAM member stated that "the bigger and louder an operation is, the more threatening it appears to the unknowledgeable public." "Noise discipline is important". "Skidders now-a-days are more quiet compared to the old Timberjacks" (NHTOA). "I don't know why they don't

muffle those?" (VT Covert). One covert spoke of a recent experience that relates to the aural attributes of forest operations. "There is a skidder operation right now and I don't know what the skidder is, but the damn noise is disturbing people for a mile around hour by hour, enough to make me go into town and have a noise ordinance." A SWOAM member spoke of a how the perception of sound can differ based on residence and personal experiences, "As a young kid growing up on a wheat farm, I used to love the sound of a chainsaw. It was a little bit of security knowing that someone was around. It was a good sound. Even now as a forester, hearing the skidder off in the distance is something that I'm used to and like. It is a good sound. People from away come in and try to impose their ideas on the way life should be."

Respondent Comments

Within section 2 of the written survey, under the heading "Preference Rankings," space was designated for the respondent to explain any of their rankings or to issue written comments pertaining to the survey. Approximately 40 percent of the participants volunteered written comments, however those that were received were helpful in differentiating landowner and student perspectives.

Landowners

There were similarities between the landowner focus group results and their written comments on the survey. As in the focus groups, the landowners responded more to the questions involving perceived efficiency, potential disturbance, and forest sustainability. In addition, a high percentage of their comments were in the form of a personal

experience or reflected upon individual knowledge that greatly influenced their ranking decisions. Written survey comments also often helped to validate preference rankings for the use of certain yarding methods in a particular situation. For example, a NHTOA member who ranked the use of horses in residential areas as most preferred, but ranked horses low in terms of efficiency, wrote, "horse and small logging systems are quieter and exhibit less aesthetic disruption, so they would be better acceptable in residential areas or areas with intense public scrutiny. However, they are less efficient and not economical for large scale forestry."

Few written survey responses were directed to the aural attributes of the yarding methods. However, one SWOAM member simply wrote, "I like the sound of productive equipment" and his preference rankings favored the forwarder, skidder, and bulldozer. Once again, landowner comments usually reflected their prior experience with or knowledge of timber harvesting. For example a NHTOA member wrote, "I have had good experiences with all methods except the dozer … I own a horse. I don't like the brutality or the very limited efficiency and applicability of horse logging. I prefer real tools, such as a skidder or forwarder. The horse and tractor methods, while novel, are not efficient and the bulldozer causes too much impact."

There seemed to be a tendency for landowners to interpret some questions in a variety of unintended ways. For example many comments were directed to the challenges associated with ranking the yarding methods based on efficiency, disturbance, and sustainability, which impacted their rankings for use on a specific woodlot. A NHTOA

member responded by writing, “disturbance to the forest could be interpreted two ways. For some species site scarification is desired, therefore, I can’t answer this question. Forest sustainability is also a difficult one to answer because this depends on silvicultural objectives and the stand (e.g., northern hardwoods patch cuts are desirable, therefore a skidder or bulldozer would be preferred versus a single tree selection during a thinning operation where a horse or small tractor would be preferred.” Another NHTOA member replied by writing, “forest sustainability is difficult to rank because it gets to efficiency and damage, economic and ecological sustainability. It depends on the situation which method will be most sustainable.” A Vermont Wilderness Association member expressed some frustration by writing, “forest sustainability makes no sense in the context of ranks”. Additional NHTOA member responses included, “in terms of sustainability, the forwarder ranks high because it minimizes skidding damage. The skidder would also cause much disturbance in terms of silvicultural disturbance but hopefully not erosion problems” and “the skidder is by far the preferred method of logging in central and southern New Hampshire.” A Vermont Wilderness Association member’s response incorporated personal thoughts that formed a rationale for whether a method was practical by writing, “while the horse ranks high in some categories, it would not ever be considered in today’s logging operations except for the horse hobbyist or demonstration purposes.”

Psychology Students

A high percentage of the psychology student written comments were on the horse. University of Maine students wrote, "I personally prefer horses because they are quiet, add to the soil with their manure, and don't seem to tear the ground up as much." "I think it is wonderful that people still think about using horses" and "the horse is preferable, but not practical, and use on my neighbor's woodlot, I wrote "E" (horse) as my most preferred because he has workhorses." Another UM student wrote, "sure the horse obviously looks like the cleanest mode of logging, but the forwarder seems most efficient by far, the sound wasn't too bad, no log-dragging (which I didn't like much) and visual appearance was fine because I'm used to seeing stuff like that in Maine. More eco-system minded people might think the farm tractor at least looks a little better, but I'd rather just use the forwarder and get it done with." University of Vermont students wrote, "even though the horse method received the most "1's" if I had a woodlot I am pretty sure that I would use a farm tractor" and "I chose the horse as preferred the best because it is quieter and is more appealing to the eye than a clunky truck. Also less harm is done with the horse." "The horse caused the least disturbance and the forest would sustain from that method the longest; the methods are ranked down from there" and "using a horse is not realistic" (but he rated the horse as the most preferred method visually, aurally, in terms of potential disturbance, and for use in a residential area).

Two UVM students did not approve of logging with a horse, "the idea of using a horse seems wrong (animal cruelty)" and "the horse method seemed cruel and not very efficient". A Plymouth State University student responded with, "I prefer the horse

because there is actual work involved and not so much machine technology, also less disturbance to the earth is made."

A couple of respondents commented on the amount of disturbance made by more mechanized yarding equipment. For example, a UVM student wrote, "I gave machines that dragged many logs behind them lower rankings for their disturbance to the forest. The fact that the forwarder had a flat bed for the logs gave the machine more control over its destruction." A UM student also wrote, "this is all given that the ruts from the forwarder would be the same as the other big wheeled methods. It didn't seem too harsh, especially with the maneuverability for its size." And a PSU student described the skidder as "making the biggest mess".

Some student comments centered on efficiency. For example, according to one PSU student, "the most effective way is the forwarder" and "I liked the forwarder because of its efficiency, it doubled and tripled output of all the other methods" and "the forwarder was definitely the most efficient, but would I want it in my backyard? NO!" Other students addressed the question of which yarding method is preferred for use in a residential area. For example, "I live in a residential area that is heavily wooded, but lots are small and the area is zone for livestock, so horses seem like a good idea" and "the horse was good because it was quiet and not disturbing if used in a residential area" (PSU). A UM student wrote, "the horse only ranked higher in residential area because it's so much quieter, but I don't think it's efficient/as productive as the other methods."

Survey Responses

Overall, 187 participants completed the logging systems video survey. Of these, 129 responses were from psychology students attending a northern New England university: University of Maine (n = 49), Plymouth State University (n = 51), University of Vermont (n = 29). The remaining 58 surveys were completed by non-industrial private forest landowner group members: Small Woodland Owners Association of Maine (n = 27), New Hampshire Timber Owners Association (n = 21), and Vermont Wilderness Association (n = 10).

Survey Participant Background Information

Table 4.1. Summary of entry-level psychology student's background information

	Male	Female		
Gender	53	76		
	Mean (yrs)	St. Dev. (yrs)	Range (yrs)	
Age	19.41	4.29	18 - 51	
Education	12.34	0.78	12 - 15	
	Rural (%)	Suburban (%)	Urban (%)	
Residence	43.41	42.64	13.95	
Residence as a teen	41.86	44.19	13.95	
	Mean (yrs)	St. Dev. (yrs)	Range (yrs)	
Time of residence (rural)	12.32	7.32	1 - 23	
Time of residence (suburban)	14.63	6.53	0.5 - 30	
Time of residence (urban)	14.05	7.28	1 - 22	
	Yes (%)	No (%)		
Forestland ownership	20.15	79.85		
Timber sale	11.54	88.46		
	Mean	St. Dev.	Range	
Acres owned (within landowners)	50.15	69.7	10 - 300	
	Not (%)	Somewhat (%)	Knowledge (%)	Very (%)
Knowledge of timber harvesting	66.67	26.36	4.65	2.32

Of the 129 psychology student respondents, 53 were male and 76 were female. This group had an average age of 19.4 years and an average education of 12.3 years. Approximately 43% of the respondents resided in a rural area, 43% in a suburban area,

and 14% in an urban setting. Those who resided in a rural area had an average time of residency of 12 years and suburban and urban respondents both had an average time of residency of 14 years. When asked to describe their place of residence during their teenage years, 42% of this group said that they lived in a rural area, 44% lived in a suburban area, and 14% lived in an urban setting. Approximately 20% of the psychology respondents owned forestland with an average ownership of 50 acres. About 12% of the psychology students who owned forestland had conducted a timber sale on their property. Of all the psychology student responses, nearly 67% answered that they were not knowledgeable about timber harvesting, 26% said that they were somewhat knowledgeable, 5% described themselves as knowledgeable, and the remaining 2% rated themselves as being very knowledgeable about timber harvesting (Table 4.1.).

Table 4.2. Summary of non-industrial private forestland owner group association member's background information

	Male	Female		
Gender	48	10		
	Mean (yrs)	St. Dev. (yrs)	Range (yrs)	
Age	54.87	13.73	28 - 80	
Education	16.00	2.48	10 - 22	
	Rural (%)	Suburban (%)	Urban (%)	
Residency	70.68	20.69	8.63	
Residency as a teen	53.44	34.49	12.07	
	Mean (yrs)	St. Dev. (yrs)	Range (yrs)	
Time of residence (rural)	18.97	15.17	1 - 60	
Time of residence (suburban)	20.04	13.67	0.5 - 40	
Time of residence (urban)	27.40	20.32	5 - 57	
	Yes (%)	No (%)		
Forestland ownership	77.59	22.41		
Timber sale	60.00	40.00		
	Mean	St. Deviation	Range	
Acres owned (within landowners)	253.48	496.39	12 – 2,500	
	Not (%)	Somewhat (%)	Knowledge (%)	Very (%)
Knowledge of timber harvesting	13.79	22.41	24.14	39.66

Of the 58 small woodland owner respondents, 48 were male and 10 were female. This group had an average age of 54.8 years and an average education of 16.0 years. Nearly 71% lived in a rural area with an average time of residency of 19 years, 21% lived in a suburban area with an average time of residency of 20 years, and 8% lived in an urban setting with an average time of residency of 27 years. Approximately three-quarters of the landowner respondents owned forestland with an average ownership of 253 acres. Over a half (60%) of the small woodland owners who owned forestland had conducted a timber sale on their property. Of all the non-industrial private forestland owners, 14% answered that they were not knowledgeable about timber harvesting, 22% said that they were somewhat knowledgeable, 24% described themselves as knowledgeable, and the remaining 40% rated themselves as very knowledgeable about timber harvesting (Table 4.2.).

There were significant differences between the background information of the two populations studied. There were over twice as many responses from students as from forestland owner association members.Furthermore, the male to female ratio was significantly different between the two groups. Students had a ratio close to 1:1, while landowners had nearly a 5:1 ratio. There were also considerable age and educational differences between the two groups. The majority of the students were 19-year-old college freshmen with a high school education. Landowners were predominately older and more educated with more variation in both attributes. Both populations had high frequencies of residency in rural and suburban areas, however a higher percentage of landowners resided in rural areas than anywhere else. Differences in time of residence

were caused by the age gap between the populations. A significantly lower percentage of students owned land and had conducted timber sales than landowners. And the majority of students rated themselves as having little knowledge of timber harvesting, whereas the majority of landowners rated themselves as somewhat to very knowledgeable on the topic.

Acceptability Ratings

Because of low frequencies for some responses and to facilitate analyses of the acceptability ratings, the three-point acceptability scale - *unacceptable, acceptable, very acceptable* - was collapsed to a two-point scale - *unacceptable* and *acceptable* - by combining the acceptable and very acceptable ratings into a simple acceptable category. Landowners and psychology students rated the acceptability of each timber harvest yarding method for the following attributes and situations: visual appearance, sound produced, efficiency, potential disturbance, use in a residential area, use on my woodlot, and use on my neighbor's woodlot.

Figure 4.1. Acceptability ratings for each timber harvest yarding method based on visual appearance (%)

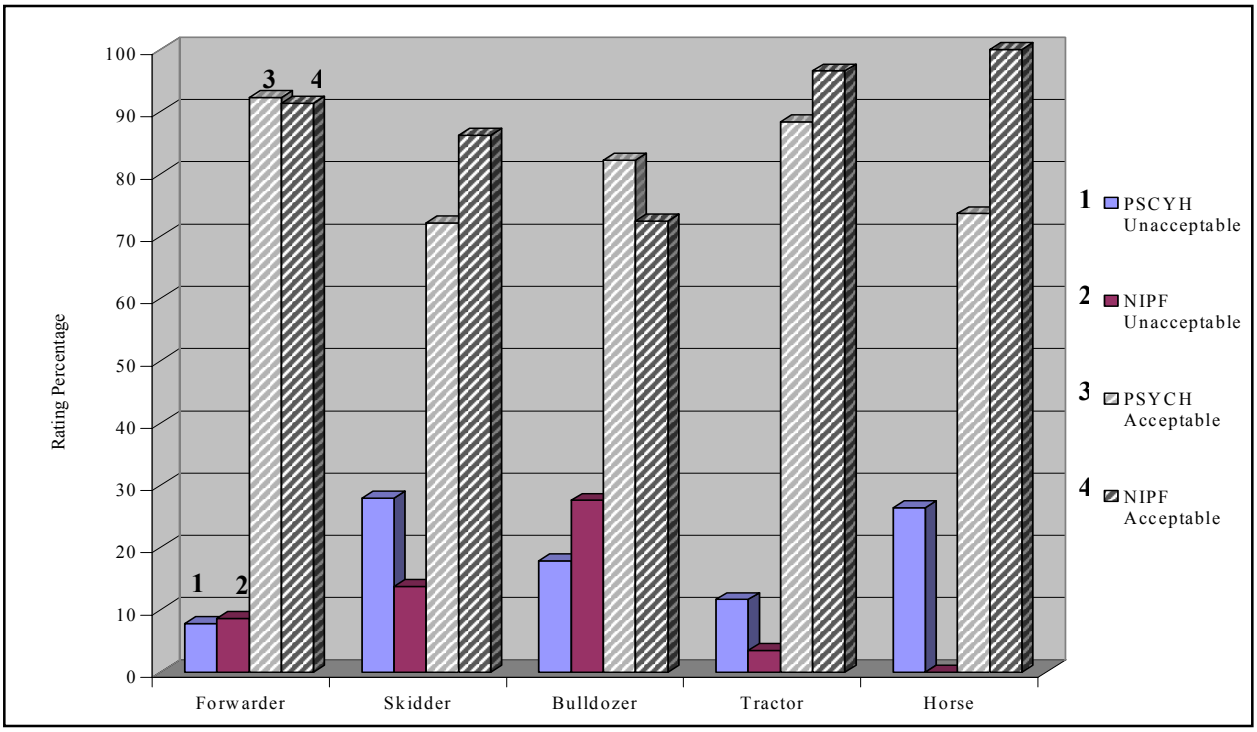


Table 4.3: Acceptability ratings for each timber harvest yarding method based on visual appearance (%)

	Psychology Student Unacceptable	NIPF Unacceptable	Psychology Student Acceptable	NIPF Acceptable
Forwarder	8 %	9	92	91
Skidder	28	14	72	86
Bulldozer	18	28	82	72
Tractor	12	3	88	97
Horse	26	0	74	100

Landowners rated the horse as the most visually acceptable, followed by the tractor and forwarder. The bulldozer and the skidder were rated as the least visually acceptable. The psychology students rated the forwarder as most visually acceptable, followed by the tractor, bulldozer, horse, and skidder. (Table 4.3.)

Figure 4.2. Acceptability ratings for each timber harvest yarding method based on sound (%)

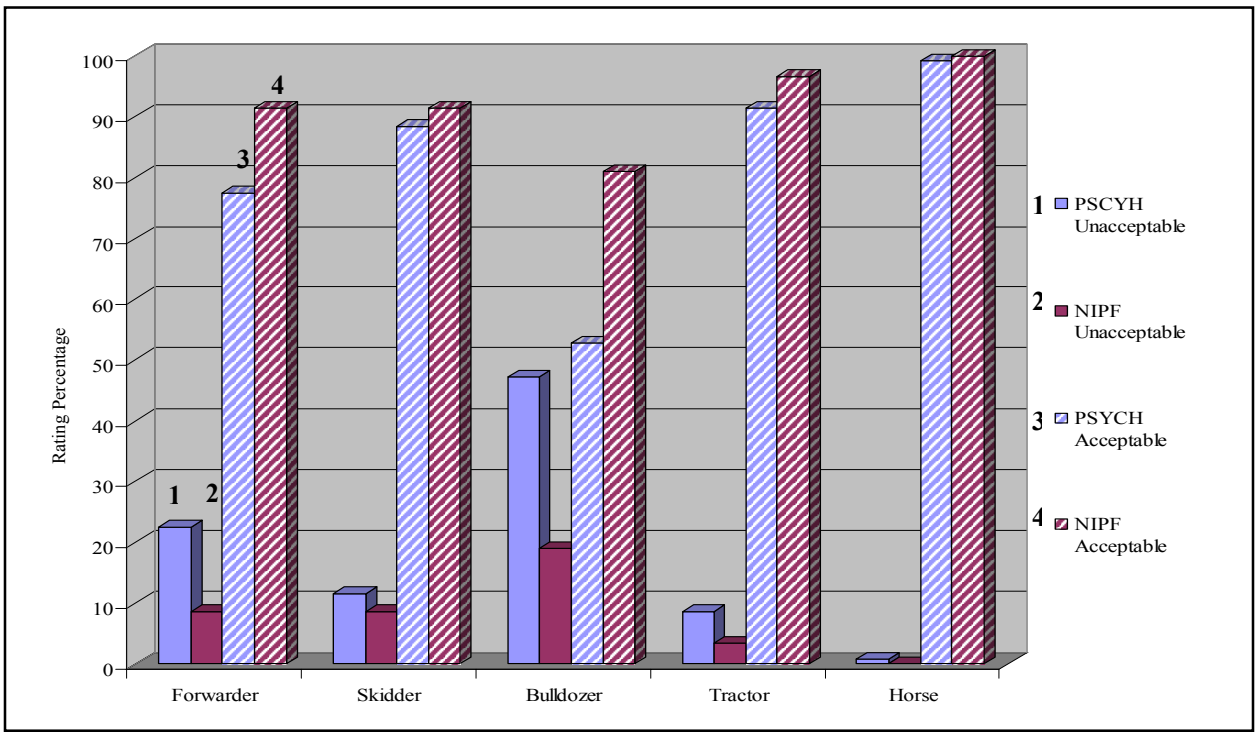


Table 4.4. Acceptability ratings for each timber harvest yarding method based on sound (%)

	Psychology Student Unacceptable	NIPF Unacceptable	Psychology Student Acceptable	NIPF Acceptable
Forwarder	22 %	9	78	91
Skidder	12	9	88	91
Bulldozer	47	19	53	81
Tractor	9	3	91	97
Horse	1	0	99	100

With the exception of the bulldozer, the sound produced by all of these yarding methods were rated as *acceptable* by landowners. Approximately, 20% of the respondents considered the sound produced by the bulldozer to be unacceptable. The horse received no unacceptable ratings. Psychology student responses were similar to those of the landowners, both groups agreed the sound produced by the bulldozer was unacceptable.

However a higher percentage of students (more than twice that of landowners) rated the forwarder as *unacceptable*. Overall, students identified the sound produced by the horse as most acceptable, followed by the tractor, skidder, forwarder, and bulldozer. (Table 4.4.)

Figure 4.3. Acceptability ratings for each timber harvest yarding method based on perceived efficiency (%)

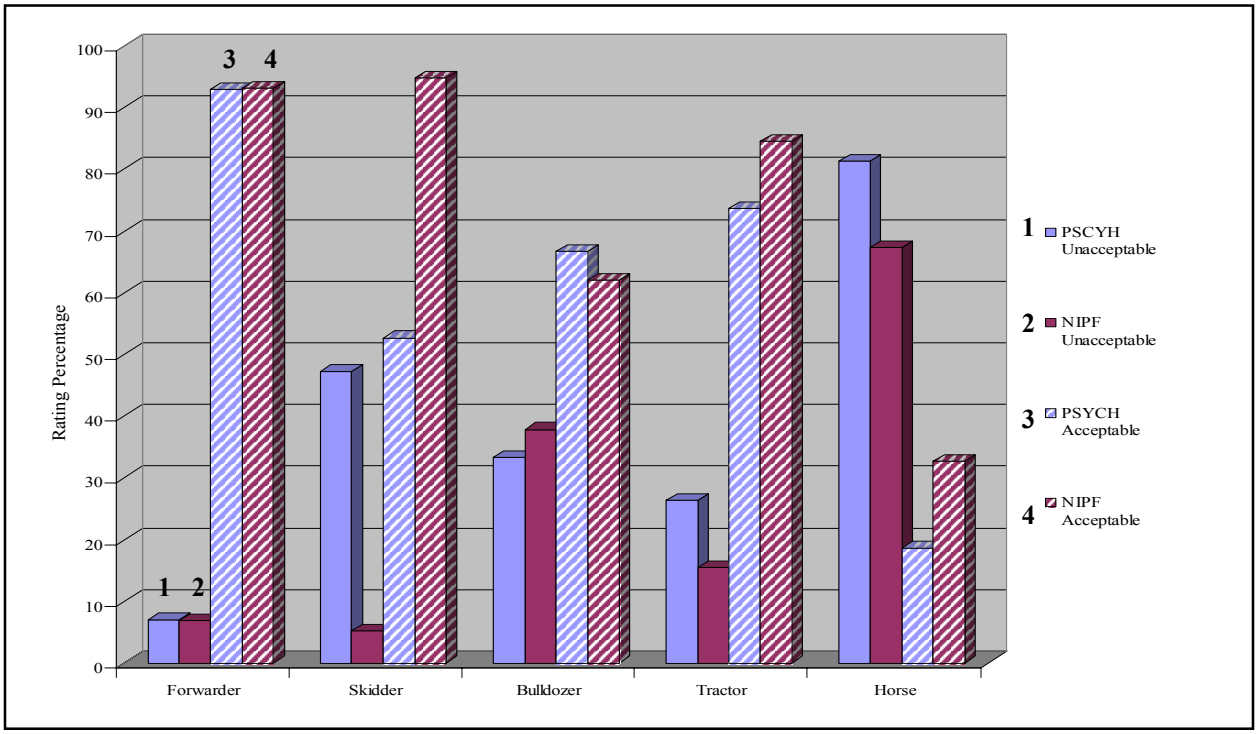


Table 4.5. Acceptability ratings for each timber harvest yarding method based on perceived efficiency (%)

	Psychology Student Unacceptable	NIPF Unacceptable	Psychology Student Acceptable	NIPF Acceptable
Forwarder	7 %	7	93	93
Skidder	47	5	53	95
Bulldozer	33	38	67	62
Tractor	26	16	74	84
Horse	81	67	19	33

The acceptability ratings for the perceived efficiency of each logging method varied somewhat between the two groups. Landowners rated the forwarder and the skidder, both with over 90% approval ratings, as the top two selections for efficiency followed by the tractor. Students agreed that the forwarder seemed efficient, with a 93% approval rating, however the skidder was rated as appearing to be the least efficient method after the horse. Landowners identified the bulldozer and horse as appearing to be by far the two least efficient methods by giving them the lowest acceptability ratings for this attribute, whereas almost half of the psychology students rated the skidder's efficiency unacceptable. Overall, students rated the forwarder as the most efficient yarding method followed by the tractor, bulldozer, skidder, and horse (Table 4.5.).

Figure 4.4. Acceptability ratings for each timber harvest yarding method based on potential disturbance to the forest (%)

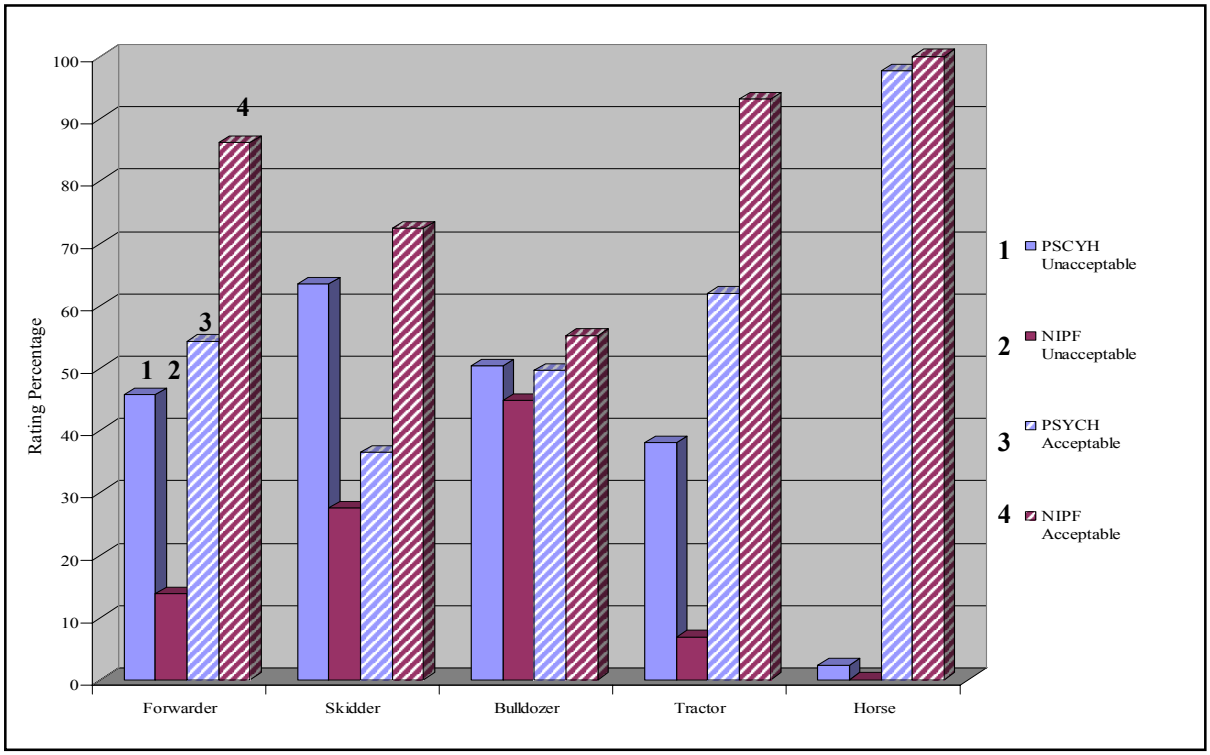


Table 4.6. Acceptability ratings for each timber harvest yarding method based on potential disturbance to the forest (%)

	Psychology Student Unacceptable	NIPF Unacceptable	Psychology Student Acceptable	NIPF Acceptable
Forwarder	46 %	14	54	86
Skidder	64	28	36	72
Bulldozer	50	45	50	55
Tractor	38	7	62	93
Horse	2	0	98	100

The landowners and students categorized the horse as most acceptable with regards to potential disturbance, followed by the tractor and forwarder. Landowners and students agreed that the horse was most acceptable in terms of its potential disturbance. In addition, both groups gave similar low acceptability ratings for the potential disturbance caused by the bulldozer. The forwarder, skidder, and farm tractor were perceived differently in that landowners rated them high, whereas students did not. However the landowners rated the skidder's potential disturbance as more acceptable than the bulldozer, whereas students identified the bulldozer ahead of the skidder (Table 4.6.).

Figure 4.5. Acceptability ratings for each timber harvest yarding method based on their use in a residential area (%)

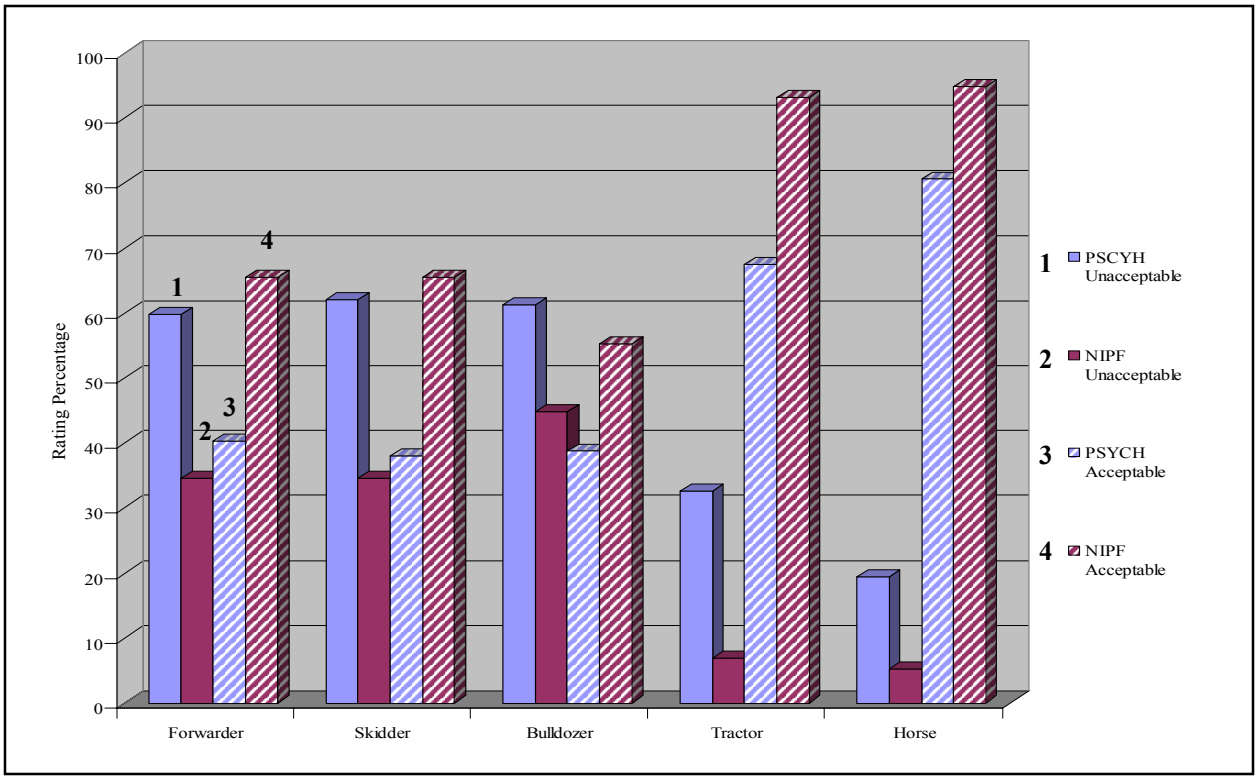


Table 4.7. Acceptability ratings for each timber harvest yarding method based on their use in a residential area (%)

	Psychology Student Unacceptable	NIPF Unacceptable	Psychology Student Acceptable	NIPF Acceptable
Forwarder	60 %	34	40	66
Skidder	62	34	38	66
Bulldozer	61	45	39	55
Tractor	33	7	67	93
Horse	19	5	81	95

The horse and the tractor were rated by both groups as being most acceptable in terms of their use in a residential area, however with slightly different response frequencies. The other three methods received considerably lower percentages of *acceptable* ratings for this attribute. Landowners rated the forwarder and skidder both with 66% acceptability

ratings as the third most acceptable yarding method for residential use. The bulldozer received the highest unacceptability ratings. The students' choice for third most acceptable timber harvest yarding method was the forwarder followed closely by the bulldozer and skidder (Table 4.7.).

Figure 4.6. Acceptability ratings for each timber harvest yarding method based on their use on your woodlot (%)

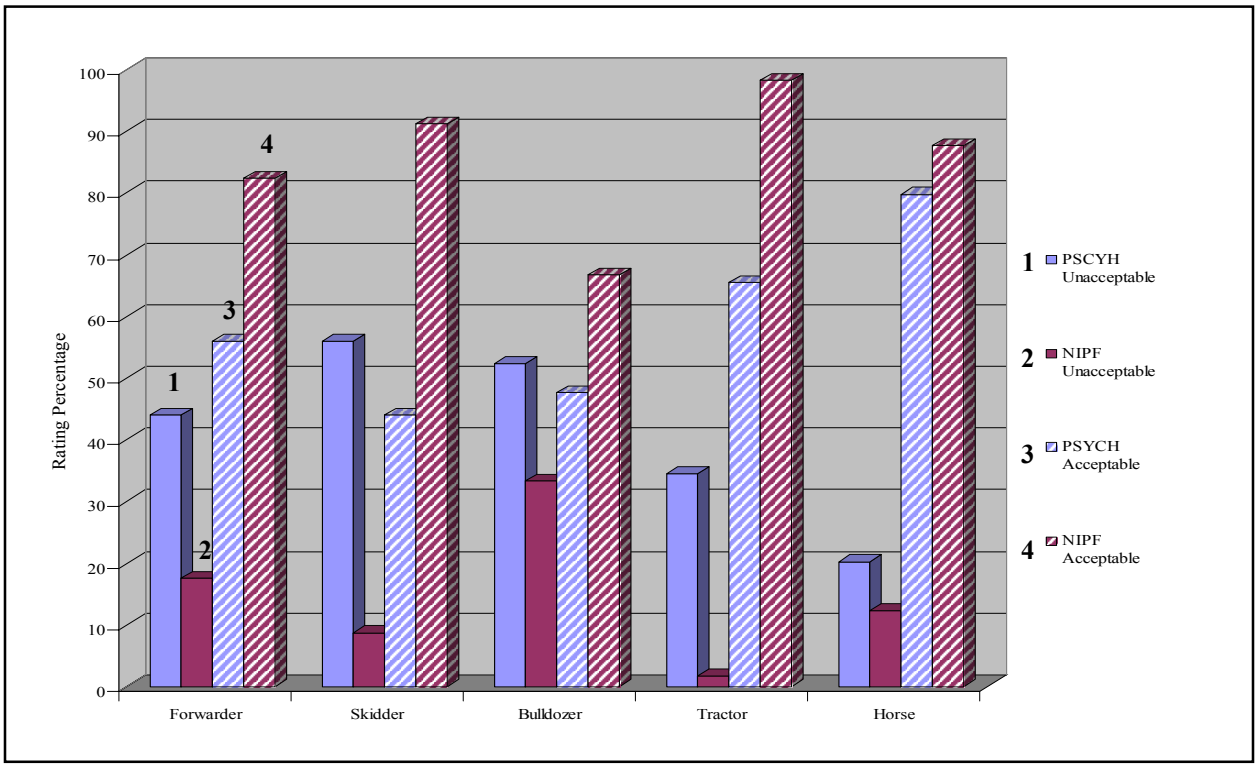


Table 4.8. Acceptability ratings for each timber harvest yarding method based on their use on your woodlot. (%)

	Psychology Student Unacceptable	NIPF Unacceptable	Psychology Student Acceptable	NIPF Acceptable
Forwarder	40 %	24	60	76
Skidder	53	21	47	79
Bulldozer	53	42	47	58
Tractor	35	7	65	93
Horse	28	24	72	76

When asked to rate the acceptability of each yarding method's use on your own woodlot, landowners favored the tractor significantly over the other methods. However, the forwarder, skidder, and horse received favorable ratings as well. Approximately 79% of the landowners rated the skidder as acceptable making it the second most acceptable yarding method followed by the forwarder and horse. The bulldozer received the lowest acceptability ratings (58%) for its use on a landowner's personal woodlot. There was less agreement among psychology students in terms of selecting the most acceptable yarding method to use on their woodlot. The horse was their first choice followed closely by the tractor and forwarder. The bulldozer and skidder were rated as the two most unacceptable methods both receiving equally low (47%) acceptability ratings (Table 4.8.).

Figure 4.7. Acceptability ratings for each timber harvest yarding method based on their use on a neighbor's woodlot (%)

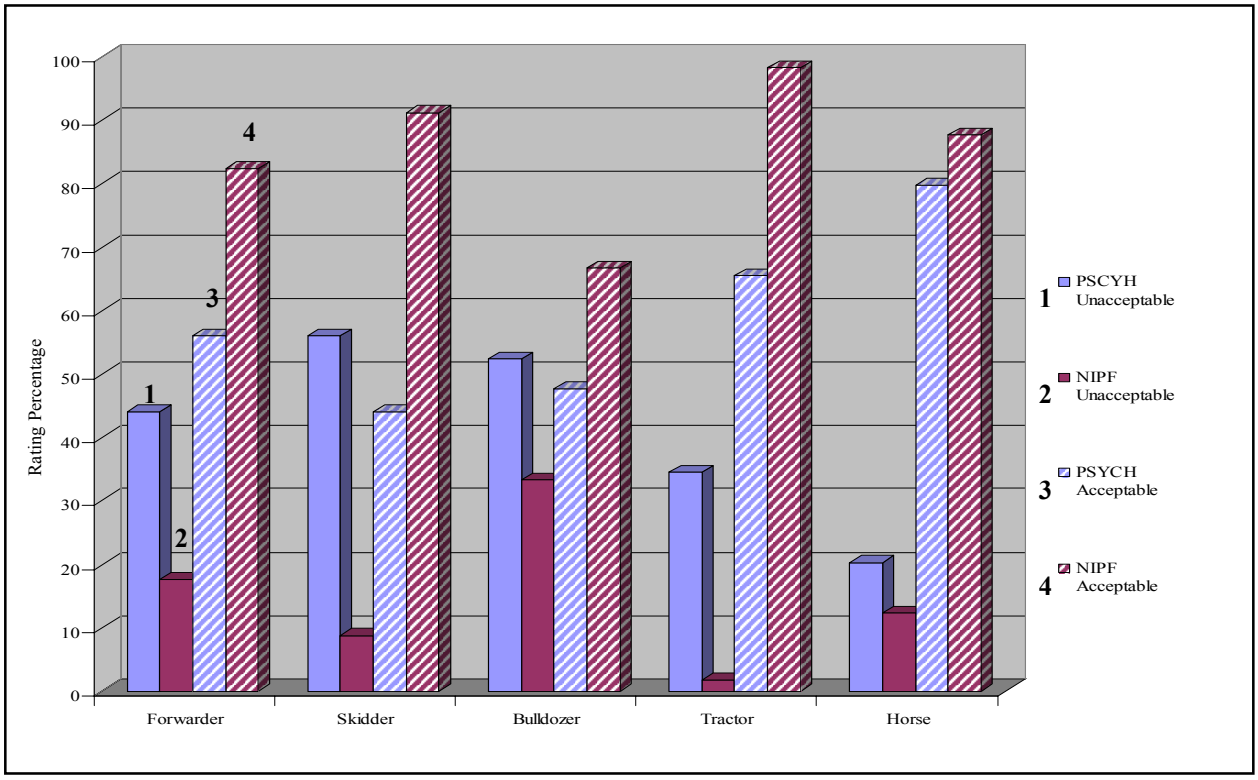


Table 4.9. Acceptability ratings for each timber harvest yarding method based on their use on a neighbor's woodlot (%)

	Psychology Student Unacceptable	NIPF Unacceptable	Psychology Student Acceptable	NIPF Acceptable
Forwarder	44	18	54	82
Skidder	56	9	44	91
Bulldozer	52	33	48	67
Tractor	35	2	65	98
Horse	20	12	80	88

In response to the final question based on which yarding methods are acceptable for your neighbor's woodlot, landowners selected the tractor as the most acceptable followed by the skidder, horse, forwarder, and bulldozer. Over 80% of the landowners rated all the yarding methods as acceptable with the exception of the bulldozer, which received a little less than 70% of the respondents rating it as acceptable. Psychology student ratings were significantly lower in terms of the percent of positive scores. The horse was selected as the most acceptable yarding method to use on a neighbor's woodlot followed by the tractor and forwarder. The bulldozer and the skidder received the lowest acceptability ratings (Table 4.9).

Chi-Square Analysis

Acceptability rating results for each yarding method based on specific respondent type (i.e., landowner v. student) were analyzed using a chi-square test of independence. All chi-square analyses that were found to be significant, indicating that there was an association between respondent type and their ratings of the acceptability of a yarding method (p-value $<= 0.05$) are reported.

Table 4.10. Significant chi-square analyses of ratings for the acceptability of the visual appearance of a tractor and horse

	Unacceptable (%) NIPF / Student	Acceptable (%) NIPF / Student	Very Acceptable (%) NIPF / Student
Visual appearance of tractor Chi-square = 11.639 p-value = 0.003	3.45 / 11.63	63.79 / 75.19	32.76 / 13.18
Visual appearance of horse Chi-square = 26.859 p-value =<0.001	0.00 / 26.36	22.41 / 32.56	77.59 / 41.09
	Unacceptable NIPF / Student	Acceptable NIPF / Student	Very Acceptable NIPF / Student
Cell chi-square values Visual appearance of tractor	2.03 / 0.91	0.50 / 0.23	5.50 / 2.47
Cell chi-square values Visual appearance of horse	10.55 / 4.74	0.97 / 0.43	7.02 / 3.16

Chi-square analysis suggested that there was an association between respondent population (i.e., non-industrial private forestland owner group association member/entry-level psychology student) and their acceptability ratings for the visual appearance of the tractor and horse. High chi-square values were driven by the percentage of landowner and student ratings of unacceptable and very acceptable (Table 4.10).

Table 4.11. Significant chi-square analyses of ratings for the aural acceptability of a forwarder, bulldozer, and tractor.

	Unacceptable (%) NIPF / Student	Acceptable (%) NIPF / Student	Very Acceptable (%) NIPF / Student
Sound emitted by forwarder Chi-square = 10.239 p-value = 0.006	8.62 / 22.48	68.97 / 68.99	22.41 / 8.53
Sound emitted by bulldozer Chi-square = 13.813 p-value = 0.001	18.97 / 47.29	75.86 / 48.06	5.17 / 4.65
Sound emitted by tractor Chi-square = 19.539 p-value = <0.001	3.45 / 8.53	50.00 / 75.19	46.55 / 16.28
	Unacceptable NIPF / Student	Acceptable NIPF / Student	Very Acceptable NIPF / Student
Cell chi-square values Sound emitted by forwarder	2.92 / 1.31	<0.01 / <0.01	4.15 / 1.87
Cell chi-square values Sound emitted by bulldozer	5.75 / 2.59	3.76 / 1.69	0.02 / 0.01
Cell chi-square values Sound emitted by tractor	1.02 / 0.46	2.60 / 1.17	9.85 / 4.43

Results indicated that the acceptability ratings for the sound of the forwarder, bulldozer, and tractor were associated with whether the respondent was a member of a non-industrial private forestland owner group or an entry-level psychology student. High chi-square values were driven by the *unacceptable* and *very acceptable* ratings directed to the aural qualities of the forwarder and the *unacceptable* and *acceptable* ratings for the bulldozer. The significant associations for the tractor resulted from the *very acceptable* ratings given by both landowners and students (Table 4.11).

Table 4.12. Significant chi-square analyses of ratings for the acceptability of a skidder based on perceived efficiency.

	Unacceptable (%) NIPF / Student	Acceptable (%) NIPF / Student	Very Acceptable (%) NIPF / Student
Perceived efficiency of skidder Chi-square = 31.913 p-value = <0.001	5.17 / 47.29	74.14 / 43.41	20.69 / 9.30
	Unacceptable NIPF / Student	Acceptable NIPF / Student	Very Acceptable NIPF / Student
Cell chi-square values Perceived efficiency of skidder	14.30 / 6.43	4.92 / 2.21	2.79 / 1.25

Based on the chi-square analyses, there was a significant association between respondent type (landowner/student) and their acceptability ratings for the skidder based on perceived efficiency. The high chi-square values were driven by landowner and student *unacceptable* ratings (Table 4.12).

Table 4.13. Significant chi-square analyses of ratings for the acceptability of a forwarder, skidder, tractor, and horse based on disturbance to the forest.

	Unacceptable (%) NIPF / Student	Acceptable (%) NIPF / Student	Very Acceptable (%) NIPF / Student
Disturbance to forest by forwarder Chi-square = 32.421 p-value = <0.001	13.79 / 45.74	60.35 / 51.16	25.86 / 3.10
Disturbance to forest by skidder Chi-square = 20.833 p-value = <0.001	27.59 / 63.57	67.24 / 33.33	5.17 / 3.10
Disturbance to forest by tractor Chi-square = 31.604 p-value = <0.001	6.90 / 37.98	60.35 / 55.04	32.76 / 6.98
Disturbance to forest by horse Chi-square = 7.840 p-value = 0.019	0.00 / 2.33	20.69 / 38.76	79.31 / 58.92
	Unacceptable NIPF / Student	Acceptable NIPF / Student	Very Acceptable NIPF / Student
Cell chi-square values Disturbance to forest by forwarder	7.86 / 3.53	0.43 / 0.19	14.07 / 6.33
Cell chi-square values Disturbance to forest by skidder	6.82 / 3.07	7.24 / 3.25	0.32 / 0.14
Cell chi-square values Disturbance to forest by tractor	9.41 / 4.23	0.13 / 0.06	12.25 / 5.51
Cell chi-square values Disturbance to forest by horse	0.93 / 0.42	2.72 / 1.22	1.76 / 0.79

Based on chi-square analyses, respondent type (landowner/student) had a significant association with the acceptability ratings for the forwarder, skidder, tractor, and horse based on disturbance to the forest. High chi-square values for the forwarder and tractor were driven by landowner and student *unacceptable* and *very acceptable* response frequencies. Significant associations for the skidder resulted from the *unacceptable* and *acceptable* ratings for both respondent types and high chi-square values for the horse resulted from landowner *acceptable* and *very acceptable* ratings, along with *acceptable* ratings given by students (Table 4.13).

Table 4.14. Significant chi-square analyses of ratings for the acceptability of a forwarder, skidder, tractor, and horse based on use in a residential area.

	Unacceptable (%) NIPF / Student	Acceptable (%) NIPF / Student	Very Acceptable (%) NIPF / Student
Use of forwarder in residential area Chi-square = 12.948 p-value = 0.001	34.48 / 59.69	46.55 / 34.11	18.96 / 6.20
Use of skidder in residential area Chi-square = 12.262 p-value = 0.002	34.48 / 62.02	58.62 / 33.33	6.90 / 4.65
Use of tractor in residential area Chi-square = 25.737 p-value = <0.001	6.90 / 32.56	56.90 / 57.36	36.21 / 10.08
Use of horse in residential area Chi-square = 14.711 p-value = <0.001	5.17 / 19.38	18.97 / 34.11	75.86 / 46.51
	Unacceptable NIPF / Student	Acceptable NIPF / Student	Very Acceptable NIPF / Student
Cell chi-square values Use of forwarder in residential area	3.38 / 1.52	1.27 / 0.51	4.43 / 1.99
Cell chi-square values Use of skidder in residential area	3.91 / 1.76	4.29 / 1.93	0.26 / 0.12
Cell chi-square values Use of tractor in residential area	7.39 / 3.32	<0.01/ <0.01	10.36 / 4.66
Cell chi-square values Use of horse in residential area	3.72 / 1.67	2.15 / 0.97	4.28 / 1.92

Chi-square analyses indicated that the acceptability ratings for the use of a forwarder, skidder, tractor, and horse in a residential area were dependent on whether the respondent was a member of a small woodland owner group or a psychology student. High cell chi-

square values in the *unacceptable* and *very acceptable* ratings contributed most to these relationships (Table 4.14).

Table 4.15. Significant chi-square analyses of ratings for the acceptability of a skidder and tractor for the use on your woodlot.

	Unacceptable (%) NIPF / Student	Acceptable (%) NIPF / Student	Very Acceptable (%) NIPF / Student
Use of skidder on their own woodlot Chi-square = 15.551 p-value = <0.001	21.43/ 53.01	62.50 / 42.17	16.07 / 4.82
Use of tractor on their own woodlot Chi-square = 16.825 p-value = <0.001	7.27 / 34.94	56.36 / 49.40	36.36 / 15.66
	Unacceptable NIPF / Student	Acceptable NIPF / Student	Very Acceptable NIPF / Student
Cell chi-square values Use of skidder on their own woodlot	4.94 / 3.37	1.64 / 1.11	2.70 / 1.82
Cell chi-square values Use of a tractor on their own woodlot	6.37 / 4.22	0.19 / 0.12	3.37 / 2.36

Chi-square analyses also indicated that respondent type (landowner/student) had a significant association with the acceptability ratings for the use of a skidder and tractor on their own woodlot. High chi-square values resulted from landowner and student *unacceptable* and *very acceptable* response frequencies (Table 4.15).

Table 4.16. Significant chi-square analyses of ratings for the acceptability of a forwarder, skidder, and tractor for the use on a neighbor's woodlot.

	Unacceptable (%) NIPF / Student	Acceptable (%) NIPF / Student	Very Acceptable (%) NIPF / Student
Use forwarder on neighbor's woodlot Chi-square = 10.791 p-value = 0.004	17.54 / 44.05	59.65 / 41.67	22.81 / 14.29
Use of skidder on neighbor's woodlot Chi-square = 35.323 p-value = <0.001	8.77 / 55.95	75.44 / 41.67	15.79 / 2.38
Use of tractor on neighbor's woodlot Chi-square = 24.931 p-value = <0.001	1.75 / 34.52	57.90 / 48.81	40.35 / 16.67
	Unacceptable NIPF / Student	Acceptable NIPF / Student	Very Acceptable NIPF / Student
Cell chi-square values Use forwarder on neighbor's woodlot	4.26 / 2.89	1.34 / 0.91	0.83 / 0.56
Cell chi-square values Use of skidder on neighbor's woodlot	12.21 / 8.29	4.17 / 2.83	4.66 / 3.16
Cell chi-square values Use of tractor on neighbor's woodlot	10.21 / 6.93	0.32 / 0.22	4.32 / 2.93

Chi-square analyses also suggested that respondent type (landowner/student) was associated with the acceptability ratings for the use of a forwarder, skidder, and tractor on a neighbor's woodlot. Cell chi-squares for the unacceptable rating contributed most to this relationship (Table 4.16).

Polytomous Logistic Regression

Aside from determining that there are significant differences between landowner and student ratings for different attributes and uses for the five timber harvest yarding methods studied, this research quantified the rating differences within the two populations, based on their background information.

Acceptability rating results for each yarding method were further analyzed to determine variables (e.g., age, gender, education, place of residence, time of residence, place of

residence during teenage years, landownership, and knowledge of timber harvesting) that help explain student and landowner responses.

General Public

Table 4.17. Significant correlations between psychology students' background information and their ratings for the acceptability of the five yarding methods based on attributes and logging situations.

Forwarder	Background Information Variable	Chi-square	P-value	R-square value
Visual appearance	Education	9.219	0.010	0.186
Sound produced	Age	7.495	0.023	0.176
Perceived efficiency	Time of residence	10.259	0.005	0.093
Potential disturbance	Education	6.960	0.030	0.132
Use in a residential area				0.085
Use on my woodlot	Age	7.516	0.023	0.159
Use on my neighbor's woodlot	Landownership	10.043	0.006	0.186
Skidder	**Background Information Variable**	**Chi-square**	**P-value**	**R-square value**
Visual appearance	Age	6.303	0.042	0.080
Sound produced				0.077
Perceived efficiency	Gender	9.194	0.010	0.158
Potential disturbance	Education Place of teenage residence	8.821 12.754	0.012 0.012	0.053
Use in a residential area				0.079
Use on my woodlot	Age Gender Education Place of teenage residence	20.364 11.586 11.125 9.908	< 0.001 0.003 0.003 0.042	0.289
Use on my neighbor's woodlot	Age Education	6.001 7.567	0.049 0.022	0.217
Bulldozer	**Background Information Variable**	**Chi-square**	**P-value**	**R-square value**
Visual appearance	Knowledge of timber harvesting	14.152	0.028	0.142
Sound produced	Time of residence Knowledge of timber harvesting	8.673 14.783	0.013 0.022	0.161
Perceived efficiency				0.117
Potential disturbance				0.000
Use in a residential area	Landownership	8.233	0.016	0.101
Use on my woodlot	Age Education	9.002 7.230	0.011 0.026	0.221
Use on my neighbor's woodlot	Age Place of residence Time of residence	11.015 12.058 10.136	0.004 0.016 0.006	0.250

	Place of teenage residence	12.553	0.013	
Tractor	**Background Information Variable**	**Chi-square**	**P-value**	**R-square value**
Visual appearance				0.121
Sound produced	Place of teenage residence	11.004	0.026	0.148
Perceived efficiency				0.107
Potential disturbance				0.090
Use in a residential area				0.069
Use on my woodlot				0.125
Use on my neighbor's woodlot				0.125
Horse	**Background Information Variable**	**Chi-square**	**P-value**	**R-square value**
Visual appearance	Gender	8.240	0.016	0.106
Sound produced				0.000
Perceived efficiency	Age Time of residence	7.033 8.462	0.029 0.014	0.280
Potential disturbance				0.120
Use in a residential area	Place of residence Place of teenage residence	14.560 13.638	0.005 0.008	0.168
Use on my woodlot	Place of teenage residence Knowledge of timber harvesting	11.595 12.694	0.020 0.048	0.218
Use on my neighbor's woodlot	Age Place of teenage residence	6.752 11.526	0.034 0.021	0.194

Results indicated that the acceptability ratings for the visual appearance of four of the five yarding methods were associated with some sociodemographic characteristic among students. Ratings for the appearance of the forwarder were associated with a respondent's education. The average education for students that rated the appearance of the forwarder as unacceptable and acceptable was 12.3 years. Those who rated the visual appearance of the forwarder as very acceptable had a mean education of 12.8 years. Ratings for the visual acceptability of the skidder were associated with a respondent's age. The mean age for students who rated the appearance of the skidder as unacceptable was 18.7 years, whereas those who gave acceptable ratings had an average age of 19.8 years. Students who gave very acceptable ratings had a mean age of 18.8 years. One's

knowledge of timber harvesting was related to the bulldozer ratings and gender was related to the visual ratings for the horse (Table 4.17).

In addition, the acceptability ratings for the sound emitted by the forwarder was associated with age. Students who rated the sound produced by the forwarder as unacceptable had an average age of 18.7 years. Those who gave acceptable ratings had a mean age of 19.8 years and those who gave very acceptable ratings had a mean age of 18.1 years. A student's time of residence, which is the time span in years of where they have resided in terms of a certain area, and their knowledge of timber harvesting effected the aural acceptable ratings for the bulldozer and their place of residence during teenage years was significant to the ratings of the tractor. Students who rated the sound produced by the bulldozer as unacceptable had an average time of residence of 13.8 years. Those who rated the sound emitted by the bulldozer as acceptable had a mean age of 12.7 and those who gave very acceptable ratings had a mean age of 15.3 years (Table 4.17).

Logistic regression analysis suggested that the perceived efficiency ratings for the horse are related to the respondent's age. Students who rated the efficiency of the horse as unacceptable had an average age of 19.7 years. Those who rated the horse's efficiency as acceptable had a mean age of 18.2 years and those who gave it very acceptable ratings had a mean age of 18.3 years. In addition, the efficiency ratings for the horse and the forwarder were related to one's time of residence. Respondents who rated the efficiency of the horse as unacceptable had an average time of residence of 13.61 years. Those who rated the horse's efficiency as acceptable had an average time of residence of 10.42 years

and those who gave very acceptable ratings had a mean time of residence of 17.63 years. In regard to the forwarder, respondents who rated its efficiency as unacceptable had an average time of residence of 13.3 years, while those who gave acceptable ratings had an average of 15.1 years. Furthermore, those who rated the efficiency of the forwarder as very acceptable had a mean time of residence of 11.6 years. Respondent's gender was also associated with perceived efficiency ratings for the skidder (Table 4.17).

In terms of the potential disturbance caused by each yarding method, acceptability ratings for the forwarder and the skidder were related to one's education. Respondents with the least education (mean = 12.3 years) rated the potential disturbance caused by the forwarder as unacceptable while students with higher levels or more education rated the forwarder as acceptable (mean = 12.4 years) or very acceptable (mean = 12.8 years), thus indicating that as one's level of education increases so does their tendency to rate the potential disturbance caused by the forwarder as acceptable. Respondents who rated the potential disturbance caused by the skidder as unacceptable had an average education of 12.4 years. Those who gave acceptable ratings had a mean education of 12.2 years and those who gave very acceptable ratings had a mean education of 12.3 years. The ratings for the skidder were also related to one's place of residence (Table 4.17).

The acceptability ratings for the use of a horse to log in a residential area were associated with a student's current place of residence and their place of residence during teenage years. Ratings for the use of a bulldozer in a residential area were associated by whether or not a student classified him or herself as a landowner (Table 4.17).

A student's age had a significant association with their acceptability ratings for the use of a forwarder, skidder, and bulldozer on their own woodlot. Students who rated the forwarder as an unacceptable method to use in logging their woodlot had an average age of 18.7 years, while those who rated it as acceptable (mean = 21.0 years) and very acceptable (mean = 19.2 years) were older. Respondents who rated the skidder as an unacceptable method to use in logging on their woodlot had an average age of 19.0 years. Those who rated the skidder as acceptable for use on your own woodlot had an average age of 21.0 years and those who gave very acceptable ratings had an average age of 18.5 years. Furthermore, students who rated the bulldozer as an unacceptable method to log on their woodlot had an average age of 19.8 years. Those who rated the bulldozer as an acceptable method had an average age of 20.0 years and those who gave very acceptable ratings had an average age of 18.4 years. In addition gender, education, and place of residence during teenage years had an association with these ratings for the skidder. Students who rated the skidder as an unacceptable method for logging on their woodlot had an average education of 12.5 years. Those who rated the skidder as acceptable had an average education of 12.3 years, while those who gave very acceptable ratings had an average education of 12.8 years. The bulldozer ratings for use on a personal woodlot were also related to one's education, whereas ratings for the use of a horse were associated with place of residence during teenage years and knowledge of timber harvesting. Respondents with the least education (mean = 12.3 years) rated the use of a bulldozer on their woodlot as unacceptable, while students with higher levels or more education (mean = 12.6) rated the bulldozer as acceptable and or very acceptable, thus

indicating that as one's level of education increases so does their tendency to rate the use of a bulldozer as more acceptable for logging one's woodlot (Table 4.17).

The fifth rating question, based on how acceptable these yarding methods are for use on a neighbors woodlot, were significantly associated with age. Age was associated with the ratings for the skidder, bulldozer, and horse, whereas the ratings for the forwarder were related to landownership. Students who rated the use of a skidder as unacceptable for logging a neighbor's woodlot had an average age of 18.8 years, where as those who rated it as acceptable (mean = 21.1) and very acceptable (mean = 19.0) were older. Those who rated the bulldozer as an unacceptable method to log a neighbor's woodlot had an average age of 19.8 years. Students who gave acceptable ratings had an average age of 19.9 years and very acceptable ratings 18.5 years. Furthermore, students who rated the horse as an unacceptable method to log a neighbor's woodlot averaged 18.8 years of age while those who gave acceptable ratings (mean = 20.3 years) and very acceptable (mean = 19.7 years) were older. The only other demographic that was associated with the ratings for the horse were the respondent's place of residence during their teenage years, whereas current place of residence, time of residence, and place of residence during teenage years correlated with the ratings for the bulldozer. Students with the least time of residence (mean = 13.0 years) rated the bulldozer as an unacceptable method to log a neighbor's woodlot, whereas those with longer periods of residence rated the use of the bulldozer as acceptable (mean = 14.5 years) and very acceptable (mean = 16.0 years), thus indicating that as one's time of residence increases so does their tendency to rate the use of a bulldozer as acceptable for logging a neighbor's woodlot. The final relationship to be

identified was between the ratings for the skidder and one's education. Students who rated the use of a skidder for logging a neighbor's woodlot as unacceptable and acceptable had an average education of 12.4 years, while those who rated it as very acceptable had an average education of 13.5 years (Table 4.17).

Non-Industrial Private Forestland Owners

Table 4.18. Significant correlations between non-industrial private forestland owners background information and their ratings for the acceptability of the five yarding methods based on attributes and logging situations

Forwarder	Background Information Variable	Chi-square	P-value	R-square values
Visual appearance	Age Education Place of residence Time of residence Place of teenage residence Landownership Knowledge of timber harvesting	9.089 9.374 19.058 11.032 18.412 17.103 21.212	0.010 0.009 < 0.001 0.004 0.001 < 0.001 0.001	0.488
Sound produced				0.528
Perceived efficiency				0.362
Potential disturbance				0.222
Use in a residential area	Age Gender Knowledge of timber harvesting	6.505 6.136 12.864	0.038 0.046 0.045	0.266
Use on my woodlot	Time of residence	6.158	0.046	0.168
Use on my neighbor's woodlot	Gender Time of residence	6.651 7.705	0.035 0.021	0.257
Skidder	**Background Information Variable**	**Chi-square**	**P-value**	**R-square values**
Visual appearance	Age	8.431	0.014	0.352
Sound produced	Place of residence Knowledge of timber harvesting	17.883 20.302	0.001 0.002	0.676
Perceived efficiency	Landownership	11.294	0.003	0.489
Potential disturbance	Time of residence	8.514	0.014	0.000
Use in a residential area	Place of residence	17.182	0.001	0.367
Use on my woodlot	Education Time of residence	8.807 6.988	0.012 0.030	0.337
Use on my neighbor's woodlot	Gender Education	7.448 9.233	0.024 0.009	0.412
Bulldozer	**Background Information Variable**	**Chi-square**	**P-value**	**R-square values**
Visual appearance	Age Gender Time of residence Knowledge of timber harvesting	10.811 7.044 8.385 12.957	0.004 0.029 0.015 0.043	0.414
Sound produced	Education Time of residence Knowledge of timber harvesting	8.789 6.248 12.958	0.012 0.044 0.043	0.540
Perceived efficiency	Time of residence	6.042	0.0488	0.427

Potential disturbance	Age Time of residence	9.260 9.267	0.009 0.009	0.357
Use in a residential area	Gender Place of residence	12.097 10.389	0.002 0.034	0.377
Use on my woodlot	Gender	6.897	0.031	0.032
Use on my neighbor's woodlot	Gender Education Time of residence Landownership Knowledge of timber harvesting	6.131 6.335 6.944 7.777 15.062	0.046 0.042 0.031 0.020 0.019	0.407
Tractor	**Background Information Variable**	**Chi-square**	**P-value**	**R-square values**
Visual appearance				0.308
Sound produced				0.301
Perceived efficiency	Place of residence Time of residence Knowledge of timber harvesting	21.979 25.174 18.202	< 0.001 < 0.001 0.005	0.631
Potential disturbance	Age Education Place of residence Place of teenage residence	9.188 14.771 9.718 13.216	0.010 < 0.001 0.045 0.010	0.624
Use in a residential area	Gender Place of teenage residence Knowledge of timber harvesting	14.61 15.554 20.851	< 0.001 0.003 0.002	0.546
Use on my woodlot	Education	11.791	0.002	0.392
Use on my neighbor's woodlot	Education	8.743	0.012	0.324
Horse	**Background Information Variable**	**Chi-square**	**P-value**	**R-square values**
Visual appearance				0.121
Sound produced	Age	6.802	0.033	0.555
Perceived efficiency				0.304
Potential disturbance				0.248
Use in a residential area				0.351
Use on my woodlot				0.125
Use on my neighbor's woodlot	Place of residence	14.538	0.005	0.260

Ratings for the visual acceptability of the forwarder, skidder, and bulldozer were associated with one or more sociodemographic characteristics among non-industrial private forestland owners. Acceptability ratings for the visual appearance of all three yarding methods were associated with age. In each case, as the respondent's age increased so did their tendency to rate the visual acceptability of the three methods as less acceptable. Landowners who rated the visual appearance of the forwarder as

unacceptable had an average age of 57.0 years. Those who gave acceptable ratings had an average age of 56.8 years and very acceptable 49.8 years. Respondents who gave the appearance of the skidder unacceptable ratings had an average age of 64.6 years, whereas the average age for acceptable (mean = 54.0 years) and very acceptable (mean = 48.0 years) were much younger. The same trend was identified with the ratings for the bulldozer. Landowners who rated the appearance of the bulldozer as unacceptable had an average age of 59.8 years, while those who gave acceptable and very acceptable ratings had an average age of 53 years. Furthermore, time of residence and knowledge of timber harvesting were related to the forwarder and bulldozer. Landowners who rated the forwarder as visually unacceptable had an average time of residence of 18.2 years. Those who gave acceptable (mean = 21.4 years) and very acceptable (mean = 17.2 years) had longer average periods of residence. Similarly, landowners who rated the bulldozer as visually unacceptable had the least average time of residence (mean = 16.0) while those who gave acceptable (mean = 21.2 years) and very acceptable (mean = 22.3 years) had the most average time of residence. In addition, the visual acceptability ratings for the bulldozer had a significant correlation with gender. Other associations that were identified for the visual ratings for the forwarder included education, place of residence, place of teenage residence, and landownership. In regards to the appearance ratings given to the forwarder based on education, as the respondents education increased so did their tendency to rate the visual appearance of this method as more unacceptable. Those who rated the forwarder as visually unacceptable had a mean education of 17.2 years, while those who gave acceptable ratings (mean = 16.1 years) and very acceptable (mean = 15.5 years) had a lower average education (Table 4.18).

The acceptability ratings for the sound levels produced by the skidder and bulldozer were related to a landowner's knowledge of timber harvesting. The aural ratings of the bulldozer were associated with education and time of residence, while place of residence was related to the ratings for the skidder. Landowners that rated the sound emitted by the bulldozer as unacceptable had an average education of 15.1 years and an average time of residence of 14.8 years. Those who gave acceptable ratings (mean education = 16.2 years & mean time of residence = 21.1 years) and very acceptable ratings (mean education = 16.0 years & mean time of residence 21.0 years) had a higher average education and longer average time of residence.

Acceptability ratings for the sound produced by the horse was associated with age. Landowners that rated the sound produced by the horse as acceptable had a mean age of 49.0 years and those who gave very acceptable ratings had a mean age of 55.6 years. The aural quality of the horse received no unacceptable ratings from landowner respondents.

Logistic regression analysis suggested that the perceived efficiency ratings for the bulldozer and tractor were related to one's time of residence, which is defined as years spent in a particular living area (e.g., rural, suburban, urban). Respondents who rated the perceived efficiency of the bulldozer as unacceptable had an average time of residence of 16.7 years, whereas those who gave acceptable (mean = 22.0 years) and very acceptable (mean = 19.5 years) had longer average times of residence. In a similar manner, those who rated the perceived efficiency of the tractor as unacceptable had the shortest time of

residency (mean = 15.1) whereas those who gave acceptable (mean 18.5 years) and very acceptable ratings (mean = 37.2 years) had longer average times of residence. In regard to the tractor ratings, as the respondents time of residence increased so did their tendency to rate the perceived efficiency of this method as more acceptable. In addition, the acceptability ratings for the perceived efficiency of the tractor were associated with one's place of residence and their knowledge of timber harvesting. Finally, landownership was the single variable identified to be related to the efficiency ratings for the skidder (Table 4.18).

In terms of potential disturbance caused by each yarding method, acceptability ratings for the skidder and bulldozer were associated with a landowner's time of residence. Landowners who rated the potential disturbance caused by the skidder as unacceptable had an average time of residence of 15.5 years. Those who gave acceptable ratings had an average time of residence of 22.4 years and very acceptable raters had an average of 11.0 years. Similarly, landowners who rated the potential disturbance caused by the bulldozer as unacceptable had an average time of residence of 17.6 years. Respondents who gave acceptable ratings averaged 22.9 years of residence and those who gave very acceptable ratings had an average time of residence of 11.7 years. Age was another significant variable identified to be associated with the potential disturbance ratings for the bulldozer and tractor. Those who rated the potential disturbance caused by the bulldozer as unacceptable were older with a mean age of 58.0 years, while those who gave acceptable and very acceptable ratings had an average age of 52.3 years. In terms of landowner ratings for the potential disturbance caused by the tractor, as the respondents'

age increased so did their tendency to give acceptable and very acceptable ratings. The mean age for landowners who rated the potential disturbance of the tractor as unacceptable was 50.3 years. Those who gave acceptable ratings had an average age of 52.2 years and very acceptable raters had an average age of 60.8 years. In addition, education, place of residence, and place of teenage residence were correlated with the potential disturbance ratings for the tractor. The four landowners who rated the potential disturbance caused by the tractor as unacceptable had the highest average education (mean 17.0 years) while those who gave acceptable (mean 16.5 years) and very acceptable ratings (mean = 14.8) had lower averages for education. This indicated that as one's level of education increased their tendency to rate the potential disturbance caused by the tractor as acceptable decreased (Table 4.18).

The acceptability rating for the use of a forwarder, bulldozer, and tractor in a residential area were associated with gender. In addition, place of residence was correlated with the ratings for the skidder and bulldozer. Landowner acceptability ratings for the use of a forwarder and tractor in a residential area were associated with their knowledge of timber harvesting. Ratings for the use of a forwarder in a residential area were related to one's age and the use of a tractor in this same situation was related to a landowner's place of teenage residence (Table 4.18).

A landowner's education had a significant association with their acceptability ratings for the use of a skidder and tractor on their own woodlot. In both cases, as the landowners' age increased their tendency to rate the use of the skidder and tractor as acceptable for

logging on their woodlots decreased. The average education for landowners who rated the skidder (mean = 17.3 years) and tractor (mean = 18.5 years) as unacceptable for logging on their woodlot were higher than those who gave the methods acceptable ratings. The average age for landowners who rated the skidder (mean 15.9 years) and tractor (mean = 16.4 years) as acceptable were higher than those who rated the skidder (mean = 14.7 years) and tractor (mean = 14.8 years) as very acceptable. Time of residence was also associated with the acceptability ratings of the skidder as well as the forwarder. Landowners who rated the skidder as an unacceptable method for logging on their woodlot had the lowest mean time of residence 14.9 years, while those who gave acceptable ratings had a mean time of residence at 23.2 years and very acceptable 17.1 years. Respondents who rated the forwarder as an unacceptable method for logging on their woodlot had an average time of residence of 19.6 years, whereas those who rated the method as acceptable had an average of 23.7 years. Those who gave the forwarder very acceptable ratings for use on their own woodlot had an average time of residence of 14.0 years. Thirdly, gender was related to the ratings for the use of a bulldozer on one's woodlot (Table 4.18).

The acceptability of the skidder and bulldozer for use on a neighbor's woodlot were associated with education and gender. Further evaluations indicated that as the respondents education increased so did their tendency to rate the use of the skidder and bulldozer on a neighbor's woodlot as unacceptable. The average education for landowners who rated the skidder (mean = 17.8 years) and the bulldozer (mean = 16.7 years) were higher than those who rated them as acceptable (mean = 16.1 years) and very

acceptable (mean = 14.7 years). Those who rated the bulldozer as an acceptable method to log on a neighbor's woodlot averaged 15.7 years and very acceptable 15.0 years. In addition, the acceptability ratings for the use of a tractor on a neighbor's woodlot was associated with education and the ratings for the use of a forwarder on a neighbor's woodlot was associated with gender. Landowners who rated the use of a tractor as an unacceptable method to log on a neighbor's woodlot had an average education of 16.0 years. Those who rated it as acceptable had an average education of 16.6 years and those who rated it as very acceptable had an average education of 15.0 years. Additionally, the use of a bulldozer on a neighbor's woodlot was associated with time of residence, knowledge of timber harvesting and whether or not the respondent owned land. Landowners who rated the bulldozer as unacceptable had an average time of residence of 16.2 years while those who gave acceptable (mean = 22.2 years) and very acceptable ratings (mean = 22.0 years) averaged longer periods of residency. Landowner ratings for the use of a forwarder on a neighbor's woodlot were associated with their time of residence. The mean time of residence for the three acceptability ratings indicated that as a landowners time of residence increased so did their tendency to rate the use of a forwarder on a neighbor's woodlot as unacceptable. Respondents who rated the forwarder as unacceptable had an average time of residence of 22.9 years. Those who rated it as an acceptable method averaged 22.3 years time of residence and very acceptable 12.6 years time of residence. Acceptability ratings for the use of a horse in a neighbor's woodlot was associated with landowners place of residence. (Table 4.18).

It is recognized that the limited sample sizes for each population (students n = 129; landowners n = 58) and the narrow ranges of ages and education levels for the students restricted the significance of these results. Age, education, and knowledge of timber harvesting activities were associated with a high percentage of the acceptability ratings within student and landowner responses. For the student population, age and educational differences were separated most often by less than one year, calling into question the degree to which these variables can be used to explain the ratings within this study.

Landowner respondents had more variation between their personal background information (e.g., age, education, time of residence, etc.) however, the small sample size caused problems within the analyses. In some cases, particularly with the horse, independent variables were closely related causing colinearity. Another problem, identified as an error matrix, was experienced when a yarding method received no unacceptable ratings, which caused the regression model to fail.

Knowledge of timber harvesting activities and education were most often identified to have frequent association with student and landowner ratings. This study had respondents rate their own knowledge of timber harvesting activities based on a 4-point scale: unknowledgeable, somewhat knowledgeable, knowledgeable, and very knowledgeable. To measure a person's knowledge on a specific subject can be a difficult task, which may warrant a study to target this single variable alone. If a future study were to incorporate one's knowledge of forestry or timber harvesting they may want to

take a different approach to determine a more accurate response, such as with a test or short survey to quantify the respondent's knowledge.

Age, gender, education, time of residence, and knowledge of timber harvesting activities were frequently correlated with landowner acceptability ratings. Further studies for both populations should be conducted to identify trends and the influence among such variables.

Ranking

Landowners and psychology students ranked their preferences for each timber harvest yarding method with a 1 being most preferred and a 5 least preferred based on the following attributes and situations: visual appearance, sound, efficiency, disturbance to the forest, forest sustainability, use in a residential area, use on my woodlot, and use on my neighbor's woodlot. Mean preference scores were calculated for each yarding method to simplify the reporting of the results of the ranking section.

Repeated measures analysis of variance was employed to determine significant differences between the two populations studied: non-industrial private forestland owner group association members and entry-level psychology students.

Figure 4.8. Mean preference rankings for each timber harvest yarding method based on visual appearance

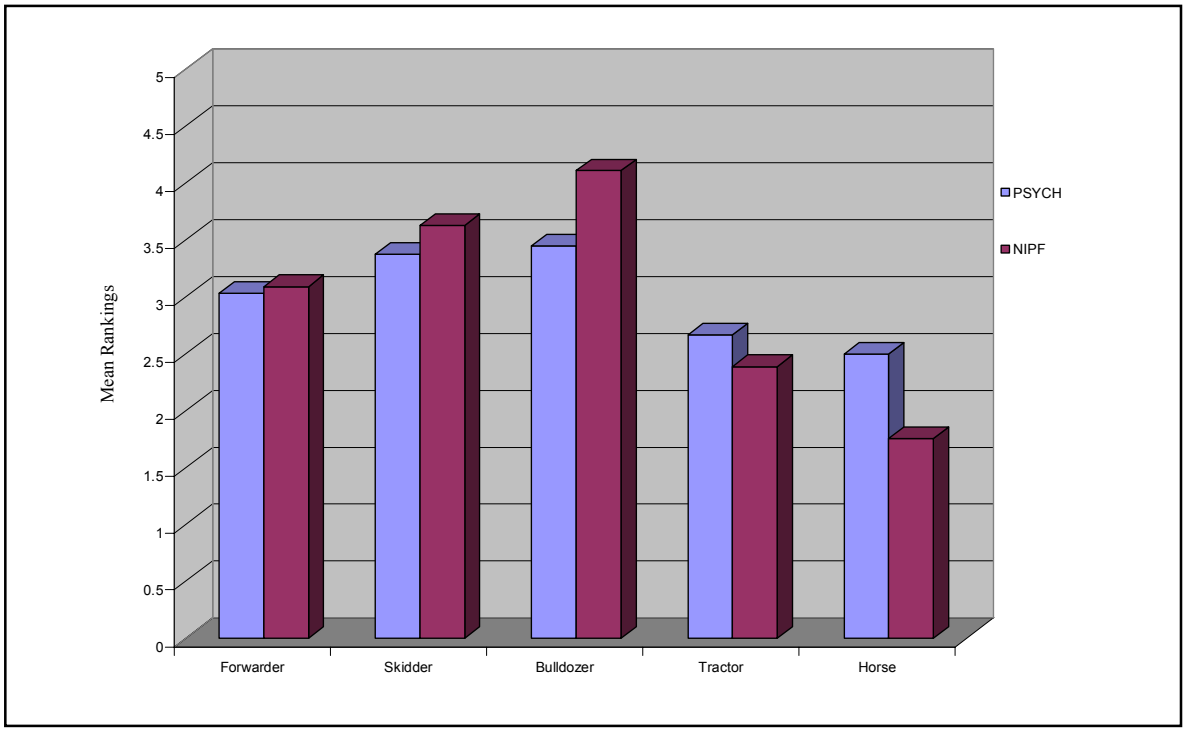


Table 4.19. Repeated Measures ANOVA results for the rankings of each yarding method based on visual appearance.

Repeated Measures Analysis of Variance – Visual Appearance					
		F-Value		P-Value	
Visual Appearance		33.064		< 0.0001	
Visual Appearance x Group		5.039		0.0005	
Group	**Yarding Method**	**Mean**	**Std. Error**	**CI (low)**	**CI (high)**
Psych Students	Forwarder	3.039	0.143	2.837	3.241
Landowners	Forwarder	3.089	0.182	2.832	3.346
Psych Students	Skidder	3.370	0.093	3.238	3.502
Landowners	Skidder	3.625	0.139	3.428	3.822
Psych Students	Bulldozer	3.433	0.097	3.296	3.570
Landowners	Bulldozer	4.107	0.134	3.918	4.296
Psych Students	Tractor	2.669	0.103	2.523	2.815
Landowners	Tractor	2.411	0.134	2.222	2.600
Psych Students	Horse	2.488	0.157	2.266	2.710
Landowners	Horse	1.768	0.173	1.523	2.013

The preference ranking results for the yarding methods based on visual appearance were very similar for both non-industrial private forestland owner group association members and entry-level psychology students. Both groups ranked the horse as the most visually preferred yarding method followed by the tractor, forwarder, and skidder. The bulldozer was the least preferred method in terms of visual appearance. Analysis of variance results indicated that there were significant differences in visual preference rankings among the respondents. There were also significant differences among the preference rankings, indicating that the patterns of preference rankings based on visual appearance by each yarding method were different between the two populations.

By comparing confidence intervals of the mean preference rankings, significant differences between landowners and students were identified in the visual rankings of the bulldozer and horse. No significant differences were found between respondents for the forwarder, skidder, and tractor (Table 4.19).

Figure 4.9. Mean preference rankings for each timber harvest yarding method based on sound.

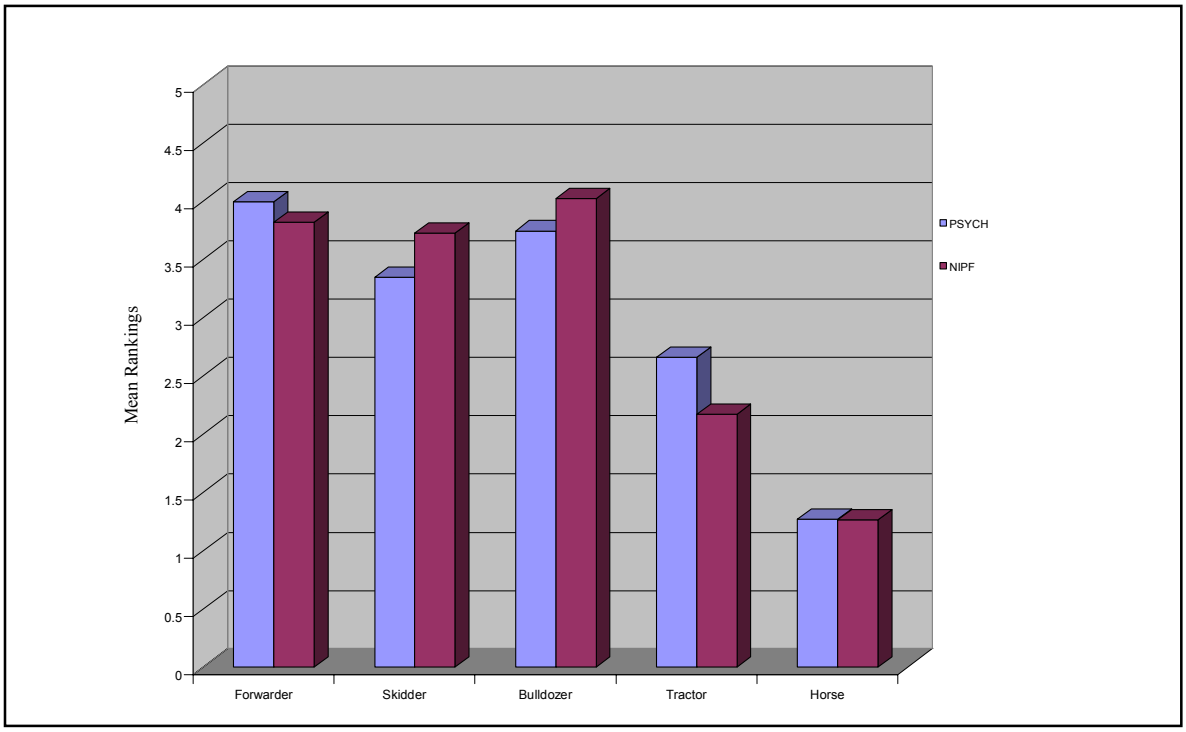


Table 4.20. Repeated Measures ANOVA results for the rankings of each yarding method based on sound.

Repeated Measures Analysis of Variance – Sound					
		F-Value		**P-Value**	
Sound		159.945		< 0.0001	
Sound x Group		3.768		0.0048	
Group	**Yarding Method**	**Mean**	**Std. Error**	**CI (low)**	**CI (high)**
Psych Students	Forwarder	3.992	0.117	3.827	4.157
Landowners	Forwarder	3.815	0.157	3.593	4.037
Psych Students	Skidder	3.344	0.800	2.213	4.475
Landowners	Skidder	3.722	0.113	3.562	3.882
Psych Students	Bulldozer	3.742	0.088	3.618	3.866
Landowners	Bulldozer	4.019	0.131	3.834	4.204
Psych Students	Tractor	2.656	0.078	2.546	2.766
Landowners	Tractor	2.167	0.083	2.050	2.284
Psych Students	Horse	1.266	0.086	1.144	1.388
Landowners	Horse	1.278	0.128	1.097	1.459

Landowners and students ranked the horse as the most preferred yarding method in terms of sound followed by the tractor and skidder. The differences in ranks resulted in landowners ranking the forwarder fourth and the bulldozer fifth, while psychology students ranked the bulldozer fourth and the forwarder was their least preferred method in terms of aural preference. ANOVA results suggested that aural preference rankings were different among the respondents and that there were significant differences in aural preference rankings between the two populations as well.

Further analyses indicated that there was a significant difference for the aural preference rankings of the tractor between landowners and students. Differences among other rankings between the two respondent types were found to be insignificant (Table 4.20).

Figure 4.10. Mean preference rankings for each timber harvest yarding method based on perceived efficiency.

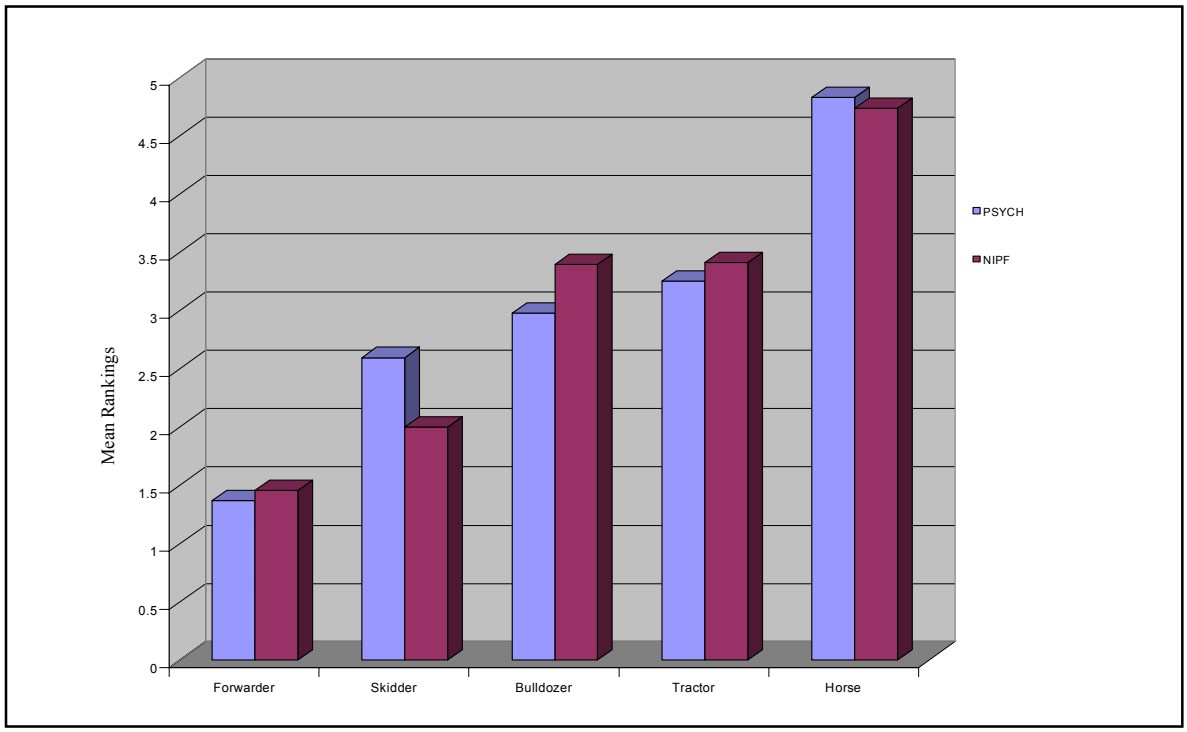


Table 4.21. Repeated Measures ANOVA results for the rankings of each yarding method based on perceived efficiency.

Repeated Measures Analysis of Variance – Efficiency					
		F-Value		**P-Value**	
Efficiency		268.815		< 0.0001	
Efficiency x Group		6.094		< 0.0001	
Group	**Yarding Method**	**Mean**	**Std. Error**	**CI (low)**	**CI (high)**
Psych Students	Forwarder	1.362	0.086	1.240	1.484
Landowners	Forwarder	1.464	0.122	1.291	1.637
Psych Students	Skidder	2.591	0.076	2.484	2.698
Landowners	Skidder	2.000	0.095	1.866	2.134
Psych Students	Bulldozer	2.969	0.079	2.857	3.081
Landowners	Bulldozer	3.393	0.107	3.242	3.544
Psych Students	Tractor	3.252	0.079	3.140	3.364
Landowners	Tractor	3.411	0.113	3.251	3.571
Psych Students	Horse	4.827	0.063	4.738	4.916
Landowners	Horse	4.732	0.110	4.576	4.888

Preference ranking results based on efficiency were similar for landowners and students. Both groups ranked the forwarder as the most preferred yarding method in terms of efficiency followed by the skidder, bulldozer, and tractor. The horse was the least preferred method. Analysis of variance indicated that there were significant differences in perceived efficiency preference rankings among the respondents and that there were significant differences in preference rankings based on efficiency between landowner group association members and psychology students. Significant differences between landowners and students were identified in the perceived efficiency rankings of the skidder and bulldozer. No significant differences were found between respondent rankings for the forwarder, tractor, and horse (Table 4.21).

Figure 4.11. Mean preference rankings for each timber harvest yarding method based on potential disturbance to the forest.

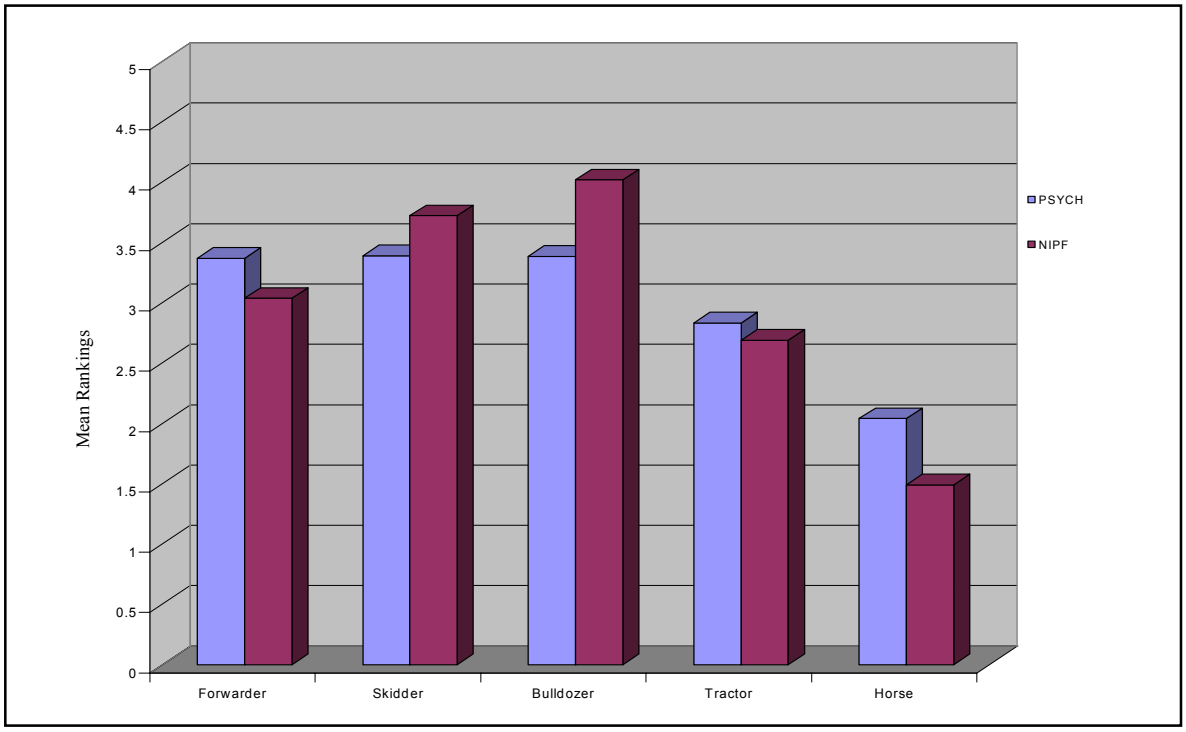


Table 4.22. Repeated Measures ANOVA results for the rankings of each yarding method based on potential disturbance to the forest.

Repeated Measures Analysis of Variance – Potential Disturbance					
		F-Value		P-Value	
Potential Disturbance		45.139		< 0.0001	
Potential Disturbance x Group		4.345		0.0018	
Group	**Yarding Method**	**Mean**	**Std. Error**	**CI (low)**	**CI (high)**
Psych Students	Forwarder	3.339	0.139	3.142	3.536
Landowners	Forwarder	3.037	0.173	2.792	3.282
Psych Students	Skidder	3.419	0.099	3.279	3.559
Landowners	Skidder	3.722	0.148	3.513	3.931
Psych Students	Bulldozer	3.371	0.101	3.228	3.514
Landowners	Bulldozer	4.019	0.139	3.822	4.216
Psych Students	Tractor	2.815	0.091	2.686	2.944
Landowners	Tractor	2.722	0.125	2.545	2.899
Psych Students	Horse	2.056	0.150	1.844	2.268
Landowners	Horse	1.500	0.169	1.261	1.739

Landowners and students ranked the horse as the most preferred method based on disturbance to the forest, followed by the tractor and forwarder. However, landowners ranked the skidder as the fourth most preferred method and the bulldozer was the least preferred, whereas students preferred the bulldozer to the skidder. ANOVA results suggested that both populations ranked the timber harvest yarding methods differently in terms of disturbance to the forest. Furthermore, significant differences were found in these preference rankings between the two groups. Differences in preference rankings for the bulldozer and horse were found to be significant. All other ranking differences between respondents based on disturbance to the forest were insignificant (Table 4.22).

Figure 4.12. Mean preference rankings and standard error for each timber harvest yarding method based on forest sustainability.

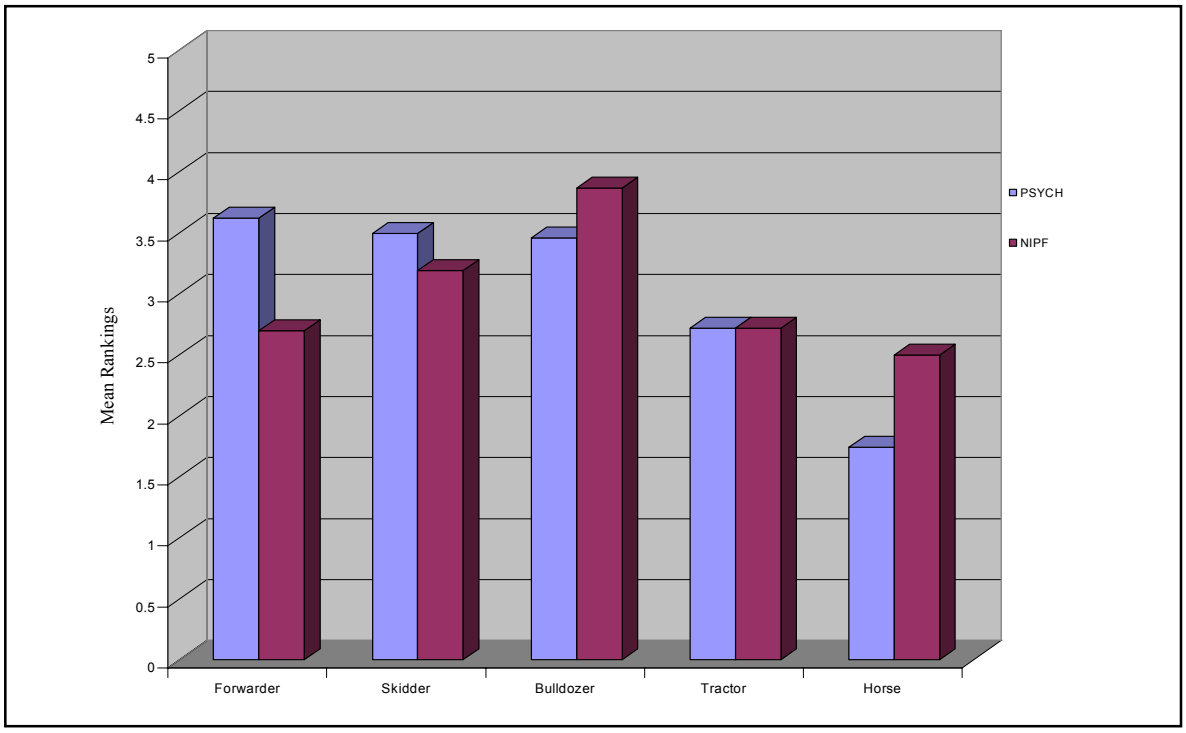


Table 4.23. Repeated Measures ANOVA results for the rankings of each yarding method based on forest sustainability.

Repeated Measures Analysis of Variance – Forest Sustainability					
		F-Value		**P-Value**	
Forest Sustainability		26.262		< 0.0001	
Forest Sustainability x Group		8.053		< 0.0001	
Group	**Yarding Method**	**Mean**	**Std. Error**	**CI (low)**	**CI (high)**
Psych Students	Forwarder	3.624	0.135	3.433	3.815
Landowners	Forwarder	2.698	0.203	2.411	2.985
Psych Students	Skidder	3.480	0.093	3.348	3.612
Landowners	Skidder	3.189	0.170	2.949	3.429
Psych Students	Bulldozer	3.456	0.100	3.315	3.597
Landowners	Bulldozer	3.868	0.152	3.653	4.083
Psych Students	Tractor	2.696	0.084	2.577	2.815
Landowners	Tractor	2.717	0.136	2.525	2.909
Psych Students	Horse	1.744	0.129	1.562	1.926
Landowners	Horse	2.528	0.240	2.189	2.867

In terms of forest sustainability, the landowners ranked the horse as the most preferred method followed by the forwarder, tractor, skidder and bulldozer. The students also ranked the horse as the most preferred method, however they preferred the tractor as next best method followed by the bulldozer, skidder, and forwarder. Analysis of variance results indicated that there were significant differences in forest sustainability preference rankings among the landowners and students. In addition, significant differences were identified between the two populations in terms of the preference rankings based on forest sustainability. Comparison of confidence intervals for the mean ranking results between the two respondent types determined that there were significant differences in the rankings of the forwarder, bulldozer, and horse based on forest sustainability. The variation in ranking for the skidder and tractor were found to be insignificant (Table 4.23).

Figure 4.13. Mean preference rankings for each timber harvest yarding method based on their use in a residential area.

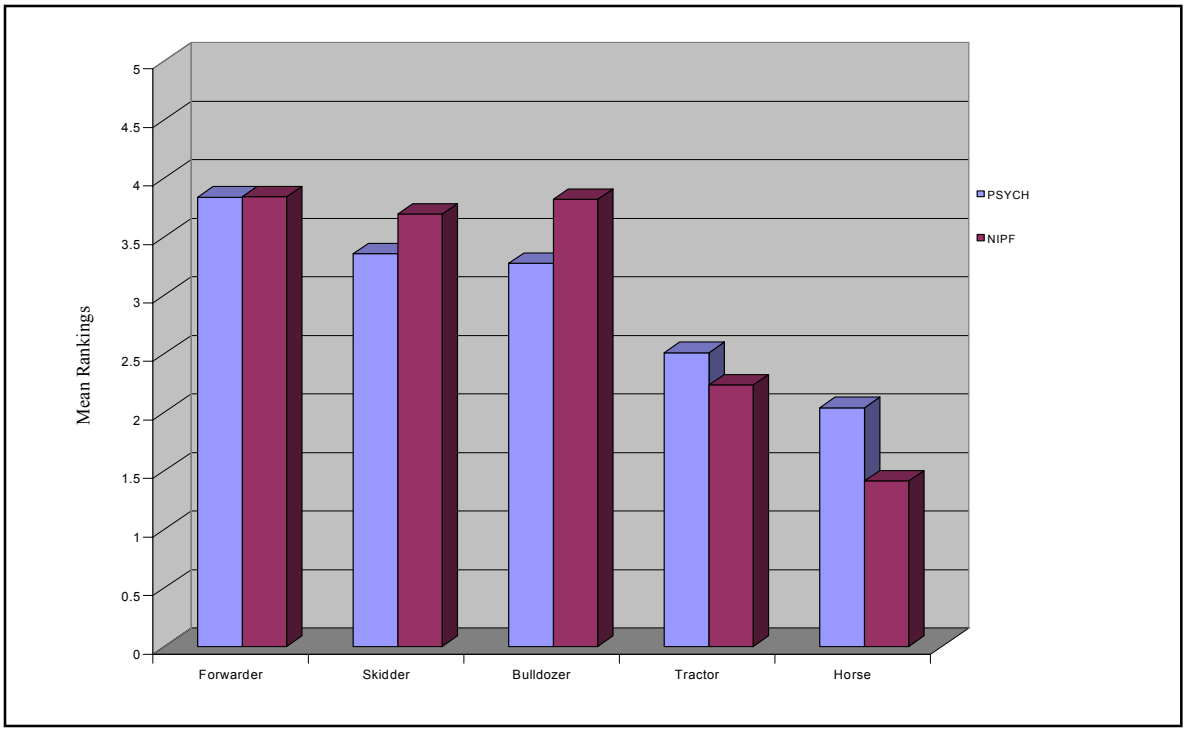


Table 4.24. Repeated Measures ANOVA results for the rankings of each yarding method based on their use in a residential area.

Repeated Measures Analysis of Variance – Residential Area					
		F-Value		**P-Value**	
Residential Area		69.558		< 0.0001	
Residential Area x Group		4.562		0.0012	
Group	**Yarding Method**	**Mean**	**Std. Error**	**CI (low)**	**CI (high)**
Psych Students	Forwarder	3.827	0.132	3.640	4.014
Landowners	Forwarder	3.818	0.162	3.589	4.047
Psych Students	Skidder	3.346	0.093	3.214	3.478
Landowners	Skidder	3.691	0.132	3.504	3.878
Psych Students	Bulldozer	3.283	0.099	3.143	3.423
Landowners	Bulldozer	3.818	0.145	3.613	4.023
Psych Students	Tractor	2.504	0.089	2.378	2.630
Landowners	Tractor	2.255	0.114	2.094	2.416
Psych Students	Horse	2.039	0.138	1.844	2.234
Landowners	Horse	1.418	0.132	1.231	1.605

In ranking timber harvest yarding methods that are preferred for use in a residential area, landowners and students ranked the horse as the most preferred method followed by the tractor. Landowners preferred the skidder to the bulldozer, whereas psychology students ranked the bulldozer third and the skidder fourth. Both groups ranked the forwarder as the least preferred yarding method for use in a residential area. Analysis of variance reported significant differences among and between the preference rankings given by landowners and students as they relate to the use of the five timber harvest yarding methods in a residential area. Significant differences were found between the respondent preference rankings for the skidder, dozer, and horse. Variation between the mean rankings for the forwarder and tractor were not significant between the two populations (Table 4.24).

Figure 4.14. Mean preference rankings for each timber harvest yarding method based on their use on your woodlot.

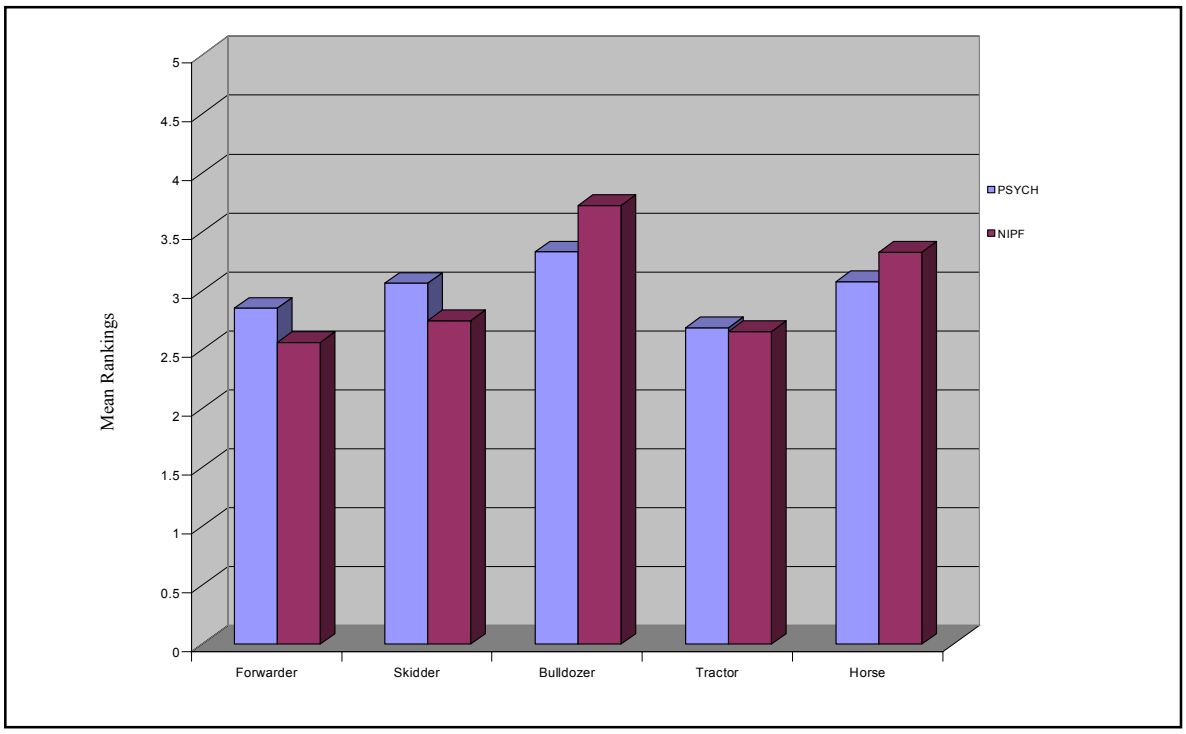


Table 4.25. Repeated Measures ANOVA results for the rankings of each yarding method based on their use on your woodlot.

Repeated Measures Analysis of Variance – Personal Woodlot					
		F-Value		**P-Value**	
Personal Woodlot		6.050		< 0.0001	
Personal Woodlot x Group		1.163		0.3265	
Group	**Yarding Method**	**Mean**	**Std. Error**	**CI (low)**	**CI (high)**
Psych Students	Forwarder	2.848	0.193	2.575	3.121
Landowners	Forwarder	2.558	0.224	2.241	2.875
Psych Students	Skidder	3.063	0.114	2.902	3.224
Landowners	Skidder	2.744	0.216	2.439	3.049
Psych Students	Bulldozer	3.329	0.124	3.154	3.504
Landowners	Bulldozer	3.721	0.161	3.493	3.949
Psych Students	Tractor	2.684	0.140	2.486	2.882
Landowners	Tractor	2.651	0.152	2.436	2.866
Psych Students	Horse	3.076	0.199	2.795	3.357
Landowners	Horse	3.326	0.261	2.957	3.695

Landowners ranked the forwarder as the most preferred yarding method to use on their own woodlot, followed by the tractor, skidder, horse, and bulldozer. The psychology students ranked the tractor as the most preferred method to use on their own woodlot, followed by the forwarder, skidder, horse, and bulldozer. Significant differences were found among the preference rankings for both populations, however significant differences were not found in the preference rankings between the two respondent types (Table 4.25).

Figure 4.15. Mean preference rankings for each timber harvest yarding method based on their use on a neighbor's woodlot.

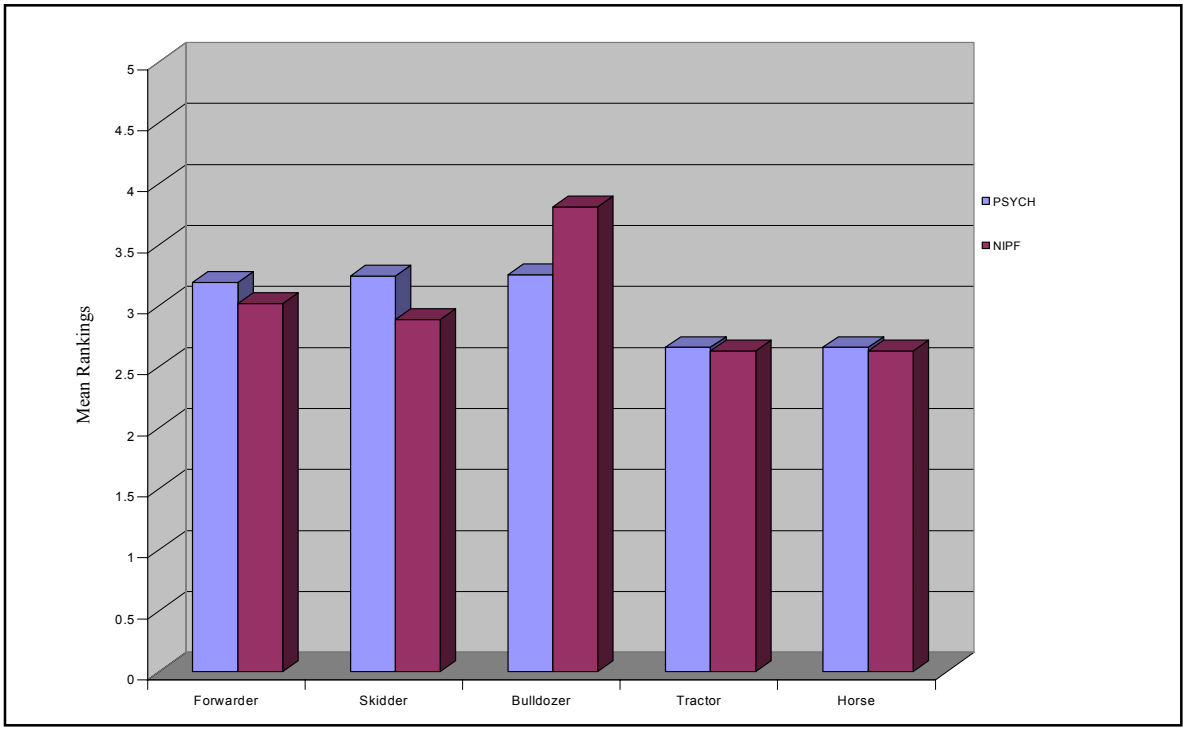


Table 4.26. Repeated Measures ANOVA results for the rankings of each yarding method based on their use on a neighbor's woodlot.

Repeated Measures Analysis of Variance – Neighbor's Woodlot					
		F-Value		P-Value	
Neighbor's Woodlot		7.000		< 0.0001	
Neighbor's Woodlot x Group		1.595		0.1742	
Group	**Yarding Method**	**Mean**	**Std. Error**	**CI (low)**	**CI (high)**
Psych Students	Forwarder	3.190	0.186	2.927	3.453
Landowners	Forwarder	2.981	0.193	2.708	3.254
Psych Students	Skidder	3.241	0.130	3.057	3.425
Landowners	Skidder	2.887	0.186	2.624	3.150
Psych Students	Bulldozer	3.253	0.125	3.076	3.430
Landowners	Bulldozer	3.811	0.166	3.576	4.046
Psych Students	Tractor	2.658	0.130	2.474	2.842
Landowners	Tractor	2.660	0.132	2.473	2.847
Psych Students	Horse	2.658	0.197	2.379	2.937
Landowners	Horse	2.660	0.241	2.319	3.001

The final ranking question was based on which timber harvest yarding methods were preferred for use on a neighbor's woodlot. Landowner and student ranking results had the horse and tractor tied as the best methods. The third and fourth most preferred yarding systems were the skidder and forwarder for landowners and the forwarder and skidder for students. Both groups ranked the bulldozer as the least preferred method for use on a neighbor's woodlot. In terms of analysis, ANOVA reported that there were significant differences in the preference rankings among the respondents based on the yarding methods use on a neighbor's woodlot, however no significant differences were identified in preference rankings between landowners and students (Table 4.26).

Results Summary

This study found significant differences between NIFP owner association members and entry-level psychology students in their acceptability ratings and preference rankings among the five timber harvest yarding methods. When comparing landowner and student preference rankings and acceptability ratings, a similar response pattern was noticeable. Respondents often agreed on their most and least preferred and the most and least acceptable yarding methods based on a specific attribute or for their use in a particular situation, however several statistical tests (e.g., chi-square analysis, polytomous logistic regression, and repeated measures analysis of variance) helped to identify differences that exist between the two populations.

The horse and tractor were the two most preferred and most acceptable yarding methods throughout much of the survey, with the exception of their perceived efficiency. However, landowner responses were consistent in rating the bulldozer as unacceptable and least preferred, whereas student criticism was more evenly distributed among the skidder, dozer, and forwarder.

In evaluating the significant associations made within the acceptability ratings between respondent type (members of non-industrial private forestland owner group associations and entry-level psychology students) for each yarding method based on the original three-point scale - unacceptable, acceptable, very acceptable - a trend is evident. In general, landowners were more accepting of the different timber harvest yarding methods based on the attribute and situational questions than students. Most, if not all, of the significant

contingency table results were explained by a higher frequency of landowner ratings of acceptable/very acceptable than expected. The significant chi-square findings for student responses were almost always due to observed frequencies for the unacceptable ratings being significantly higher than the expected frequencies

Table 4.27. Explanation of how to interpret Figures 4.16 and 4.17.

Explanation for Figures 4.16 – 4.17.
Most Preferred = lowest mean ranking for that category
Least Preferred = highest mean ranking for that category
Most Acceptable = highest (%) of respondents rating that method as acceptable
Least Acceptable = lowest (%) of respondents rating that method as acceptable (in some cases the least acceptable method was not rated as unacceptable by 50% or more of the respondents – e.g., Table 4.3.)

Figure 4.16. Yarding methods ranked most and least preferred and rated most and least acceptable by entry-level psychology student and non-industrial private forestland owner group association member respondents based on visual appearance.

Visual Appearance				
	Most Preferred	**Most Acceptable**	**Least Preferred**	**Least Acceptable**
Psych Students	 **Horse**	 **Forwarder**	 **Bulldozer**	 **Skidder**
Landowners	 **Horse**	 **Horse**	 **Bulldozer**	 **Bulldozer**

Figure 4.17. Yarding methods ranked most and least preferred and rated most and least acceptable by entry-level psychology student and non-industrial private forestland owner group association member respondents based on sound.

Sound Quality				
	Most Preferred	**Most Acceptable**	**Least Preferred**	**Least Acceptable**
Psych Students	 **Horse**	 **Horse**	 **Forwarder**	 **Bulldozer**
Landowners	 **Horse**	 **Horse**	 **Bulldozer**	 **Bulldozer**

Visual and Aural Qualities

The visual appearance and aural attributes of the horse and tractor were preferred to the forwarder, skidder, and bulldozer by both landowners and students. Furthermore, nearly all landowners along with a high percentage of students rated the visual and aural qualities of the horse and tractor as acceptable. Similar written and verbal comments were made by both respondents that helped to reinforce the results and further explain why the visual and aural qualities of the horse and tractor were preferred. Of the five yarding methods, the forwarder, skidder, and bulldozer received the least preference and higher percentages of unacceptable ratings by both respondent types.

It was noticed that a higher percentage of landowner respondents rated the visual and aural attributes of the skidder as acceptable compared to students. In reference to the focus group discussions, some landowners spoke of how skidders now-a-days are more quiet compared to the old Timberjacks and such. This might help explain the difference

in ratings and preference. Landowners may be familiar with the advancements and changes made to the design and sound levels produced by certain equipment, such as the skidder, whereas students are basing their ratings and rankings solely on what the video depicted (Figures 4.16. and 4.17.).

Based on the yarding methods studied in this research, the bulldozer received high percentages of unacceptable ratings and low preference ranks throughout much of the survey, especially among landowners. Based on related comments, this pattern may be attributed to the bulldozer being perceived as visually and aurally destructive.

Repeated measures analysis of variance highlighted the significant response differences between landowner and student preference rankings. There were very few differences between the two populations preferences based on the visual and aural attributes of each yarding method. The differences in the visual appearance rankings were in the bulldozer and horse. The tractor was the lone difference in the aural rankings. These differences seem to originate from landowners favoring the appearance and aural qualities of the horse and tractor, while disliking these attributes for the bulldozer. Maybe some of the visual and aural preference rankings from landowners were influenced by other elements, such as productivity and disturbance, which landowners have a tendency to focus on. Students were less in agreement towards which methods are most preferred based on visual and aural qualities, probably because they were more focused on answering these questions strictly on the basis of those attributes. Students are probably less likely to be influenced by those external factors, (e.g., productivity, disturbance, etc.) that constantly

plays a part in the decision making process of landowners. It is evident that the preferred yarding methods were smallest in physical size and most quiet in terms of sound emitted.

It became evident through the focus groups that the majority of small woodland owner group association members had been exposed to and were experienced with different forest operations. They seemed more focused than the students on efficiency, low impact, and the economics associated with certain operations. Many of the participants stated that they owned equipment (predominately skidders and farm tractors) and used them to gather firewood or yard pulpwood for an occasional delivery to the local mill. Landowner's repeatedly expressed much concern about wanting a *low impact* operation. One landowner stated, "small equipment does less damage to potential new growth". Other landowners indicated having had positive experiences with horse, tractor, and skidder operations and prefer them due to minimal site damage.

The only unacceptable ratings and low preference rankings given to the horse and tractor were associated with their perceived efficiency. Both methods received low preference rankings and high unacceptable ratings for this attribute, however perceived efficiency did not appear to influence the other results. Analysis of variance suggested that differences in preference patterns increased between landowner and student rankings for the skidder and bulldozer based on their perceived efficiency.

In terms of potential disturbance to the forest and in maintaining the integrity and sustainability of the forest, once again landowners and students agreed that the horse and tractor were most preferred and highly acceptable. This result is probably associated with the small size of these methods and their appearance of being least destructive. A psychology student wrote next to his preference rankings, "in regards to disturbance and sustainability, the horse caused the least disturbance and the forest would sustain from that method the longest, the other methods are ranked down from there". ANOVA identified significant differences between landowner and student preference rankings for the bulldozer and horse based on disturbance to the forest and differences between the two population rankings for the forwarder, bulldozer, and horse in regards to forest sustainability.

Obviously, there are other elements that influenced the rankings of these two groups. Once again, landowner results are likely affected by their past experiences and exposure to these methods in operation, whereas students are relying more on the information provided by the video survey and have less personal experience to draw on to influence their decisions.

The question of which yarding methods are most preferred and acceptable for conducting timber harvesting operations in a residential area yielded no significant difference in terms of the current response trend. The horse and tractor were reported as the best choices and the forwarder was identified as the worst for this attribute.

Adding onto an earlier response, "the horse and small logging systems are quieter and exhibit less aesthetic disruption, so they would be better acceptable in residential areas or areas with intense public scrutiny. However, they are less efficient and not economical for large scale forestry" (NHTOA). Students comments were similar, "the horse was good because it was quiet and not disturbing if used in a residential area" and "even though the horse method received the most "1's" (most preferred) if I had a woodlot I am pretty sure that I would use a farm tractor". "The forwarder was definitely the most efficient, but would I want it in my backyard? NO!!" wrote a student. Using repeated measures ANOVA helped to identify significant differences between the landowners and students in their rankings of the skidder, bulldozer, and horse based on their use in a residential area. Like with the other significant findings, these differences probably can be associated with the experiences that these two populations have had with timber harvesting in residential areas.

CHAPTER 5: CONCLUSIONS

This study was successful in clarifying the aesthetic preferences of logging-in-progress among a subsample of the general public, as well as among members of forestland owners associations in the northern New England region. This research developed the following key findings:

- Landowners and students had similar response patterns, with a few exceptions
- Both populations liked the smaller operations of the horse and tractor for many of their attributes and uses, compared to the other yarding methods
- Both groups liked the efficiency of the forwarder and recognized the limitations of the horse in terms of this attribute
- Landowners disliked the bulldozer; rating it often as unacceptable and least preferred
- Landowners were more accepting of the skidder and forwarder and responded more positive to them than students
- Students disliked the skidder, however they were more evenly critical and less accepting of the forwarder and bulldozer as well
- Landowners were more in agreement with their ratings and rankings as a group, often having similar responses
- Student results had more variation; they were in less agreement with one an other as a group

In general, this study has shown that, although there are many similarities between student and landowner acceptability ratings and preference rankings of timber harvest yarding methods, significant differences exist between the two populations. However, for this information to be useful, it is important to place this study in the broader context of forest operations, rather than to consider, even accept, the results of this study in isolation.

Placing this research in context. In disseminating the findings of this study, it is clear that the highest percentage of student and landowner respondents rated the horse as acceptable/very acceptable and they repeatedly preferred the qualities and use of the horse in certain situations over the other yarding methods. However, does this mean that horse logging should be used in most or all logging situations on NIPFs, especially those proximate to exurban or urban fringe populations? Indeed, many survey respondents acknowledged that the use of a horse in most situations is not realistic and would not even be a feasible consideration in today's logging operations. Another survey participant commented that, "horse logging seems in a way nostalgic, however it is least efficient and least economical compared to the other systems and the only people using horses to log are the horse hobbyist and those doing it for demonstrational purposes." In some areas, such as western New Jersey, increasing populations in rural areas have resulted in landownership of smaller parcels combined with increasingly negative attitudes towards logging and active forest management. Horse logging may be a viable tool in these situations. This traditional technology offers a more palatable forestry operations to those who have determined that larger, noisier, mechanized operations are

unacceptable (Farr 2004). The result of actions taken by board members of a community group to conduct forest management activities and develop a Forest Stewardship Plan in a Western Washington middle class suburban neighborhood indicated that small parcels of land in urbanizing areas can be actively managed if a plan is developed to address the needs and desires of the community. In this case, horse logging played a vital role in helping to achieve a successful ending (Meacham 2000).

Another concern in urbanizing areas, especially in the northeast, is the rapid decline of parcel size (Kittredge et al. 1996). When woodlots become too small, operating costs associated with moving equipment in and getting the wood to the mill often become too large, thereby reducing the profitability of forest management activities (Thorne 2000). Horse logging and other small-scale logging systems may be a viable option to combat the financial challenges that surround small parcel sizes.

However, with advances in mechanization and logging efficiency, horse logging has become a far less common means of primary wood transport in the northern New England region than it had been just decades ago. This is due to its high costs per unit of production, the difficult manual work associated with horse logging, as well as the safety implications associated with working with horses (vs. mechanized logging systems) (Egan 1998). Horses have very definite operational limitations. On average, a logging horse will pull only its weight per yarding cycle, and is generally restricted to skidding distances of 300-500 feet. Adverse grades are also very limiting. This results in a niche

that for logging that, in general, is very specific and somewhat limited compared to more mechanized logging methods (Egan 2000).

Through a written comment, another respondent mentioned that he rated and ranked the horse, as the most acceptable and preferred method throughout the survey, even though he knew it wasn't practical or realistic. The results of this study are based on the respondent's perception, not on what is scientifically most efficient or least destructive to the forest based on research findings. For example, a number of respondents ranked the perceived disturbance of the horse to be most preferred and associated comments revealed that many of these people thought that horse logging causes very minimal if any damage to the forest. However, studies have suggested that the horse maybe the most damaging method where soil compaction is concerned. In addition, foresters have expressed concern about the negative effects of horses introducing non-native plants to forested areas (Egan 1998).

Study challenges, improvements, and future research. Similar to other studies of aesthetic values in forestry research, study design and execution had limitations related to finite funding and time resources that were acknowledged from the inception of the study, but that may help develop a rationale and improved approaches for further study in the area of logging aesthetics.

Collecting response data that adequately represented a cross-section of the general public, along with representative samples of non-industrial private forestland owners was a

pivotal challenge of this study. For example, when mail and telephone surveys are used, the researcher is often able to obtain information for a broad population of respondents. In such studies, potential survey participants are often identified from an appropriate directory and questionnaires are completed through mass multiple survey mailings or telephone calls. If, for example, 1,000 questionnaires are mailed and there is a 25% response rate, the researcher has 250 responses with which to work.

In contrast, this study required the presence of a moderator to assure that the video survey was being used and conducted consistently for each group of respondents. It was neither feasible nor economical to create hundreds of video surveys and mail them out to a large sample of the general population and NIPF landowners. This approach often encounters logistical challenges (e.g., arranging a time and a place when the survey can be viewed and executed by a group of participants) not assumed by mail or phone surveys, generally resulting in lower response rates (Salant and Dillman 1994).

Although using entry-level psychology students to represent the general public is widely accepted in the research profession (Tindall 2001), many scientists believe that there is a better method or a different approach, which must be developed to more accurately represent the public. One possible tactic might be to arrange data collection opportunities at public events or areas that draw a diverse spectrum of people, such as carnivals, shopping plazas, malls, etc. The challenge would be in luring people who are attending the event for another reason (e.g., entertainment, shopping) to participate in a video survey. An incentive would probably be the best tool to increase the participation rate in

such circumstances. However, this would necessarily increase the costs associated with the survey, while not guaranteeing significant increased participation.

In conducting face-to-face interviews and group surveys, the moderator must have personal organization, strategic planning, and adequate communication skills to achieve data collection objectives. The researcher must be flexible and willing to compromise on how, when, and where the data collection event will be organized. Research budget limitations often reduce the possibility of offering real incentives to those involved in organizing or participating in research related events. Delegating money towards incentives, such as t-shirts, coffee mugs, or a catered meal would make organizing the data collection event easier and would likely attract more participants.

Timing and communication were two elements that influenced the overall success of this study's data collection process. In order to arrange data collection opportunities, it took a great deal of personal organization and persistence to make contact with a variety of people who had the potential to assist with this study's objectives. The challenge in using entry-level psychology students from different campuses spread across northern New England was in locating professors or departmental staff members who were willing to assist with the request. In addition to the difficulty associated with finding people willing to accommodate the needs of the study (which included an allotment of 30 minutes in a setting conducive to having students view a video and respond to it through a written survey) there was often variation in standard university policies that restrict who can conduct survey research, along with specific dates, times, and locations.

Organizing data collection opportunities with small woodland owner group associations was challenging as well. Many people who were contacted (e.g., extension foresters, board members of landowner group associations) were hesitant to participate due to their initial perceptions that (a) the survey may have hidden anti-forestry, anti-logging agenda, or (b) the survey was actually an attempt by a corrupt media outlet looking to write an unfavorable article or broadcast a news segment that would cast a negative image of their group. This occurred more often when trying to arrange data collection opportunities with landowner groups in more urbanized areas of New Hampshire, such as in coastal Rockingham County where landowners and the residents may have higher incomes and significantly different values and perceptions in regard to land management than more rural, lower income regions (Bourke and Luloff 1994). For example, an extension agent in New Hampshire repeatedly ignored emails and voicemail messages that were used in attempts to make contact with her. When I was finally able to speak with her, she sounded extremely irritated and immediately rejected my request, claiming that the topic didn't fit well with her field events and that it was too controversial a subject, before I could explain the study's purpose. More than once, while attempting to introduce myself and the study to board of directors of NIPF landowner group associations, I was interrupted and accused of being a member of a local special interest group trying to cause problems. The most common scenario was that the contact would decide that the survey was inappropriate for their group or not consistent with the intent of their meeting or field trip.

Is there is a better representative sample of NIPF landowners to draw from than small woodland owner group association members? No published literature was found that reports on how well small woodland owner group association members represent the total NIPF landowner population. It would seem that small woodland owner group association members represent a special group within the broader NIPF owning public, and are likely those who care most about their land and have the desire to expand their knowledge on forestland management topics and issues. A high percentage of the members of the NIPF landowner group associations that this study worked with were well educated, over 40 years old, and were professionals in an occupation related to forestry. Is this truly representative of NIPF owners? Bourke and Luloff (1994) confirm some of these patterns in a study that compared the attitudes and background information of Pennsylvania NIPF landowners and the general public. It was reported that landowners are more likely to be Protestant, conservative, older, and rural residents.

Videography was an essential component to this study. Every effort was made to control external variables that had potential to cause scene bias. Through verbal and written comments, a few landowner survey respondents issued concerns by questioning the design of the video survey and criticizing certain elements. For example, a Vermont Wilderness Association members commented that "it would have been good to change the scene order" and asked, "what about: winter versus summer logging, steep terrain versus flat terrain, wet terrain versus dry, small woodlot versus large woodlot?"

In response to such questions/comments, one needs to understand the limitations and complexity of such research. It was understood in the very beginning of this work that the forest operations video was not going to portray all situations or land types, forest types, or equipment types. The focus was to depict different timber harvest yarding methods operating in a very similar if not identical forested scene. The objectives were to determine how certain people perceive each yarding method in terms of its acceptability in different situations (e.g., harvesting in a residential area) and which methods they preferred based on the machine's attributes (e.g., sight and sound of the machine). Future studies that build from the findings of this one may want to further evaluate the acceptability and preference of timber harvest yarding methods based on their operation in variable terrain or season conditions. The same can be said for manipulating scene order. A researcher may want to evaluate if changing the order in which the audience views a scene has an effect on their ratings and rankings.

This study captured the visual and aural components of five different timber harvest yarding methods operating in progress – forwarder, skidder, bulldozer, tractor, and horse. One study constraint was replicating the actual sound levels emitted by the five different yarding methods. Videography was unable to capture and produce the actual sound levels manufactured by each of the four mechanical operations. If these sound levels could have been demonstrated at their true decibel levels, the audience would have had to wear ear protection, otherwise the sound would have been detrimental to their hearing. Rather than exposing study participants to potentially damaging equipment sound levels, the sound volumes were reduced for the screenings of the video survey. However, sound

levels for the survey were proportional to the actual sound levels (measured in decibels during the videography) emitted by the equipment. There appears to be no safe way of evaluating participant reactions to the actual sound levels produced by the equipment studied (except, perhaps, the quality of the sound being emitted), unless video/viewing stations are further from the equipment being studied than in this study. Since actual sound levels were not accurately portrayed to the listeners, the results pertaining to this attribute are of less value in assessing preference and acceptability.

Video editing procedures were used to reduce elements of bias and create scenes in a consistent manner so that viewers could experience them in the convenience of a classroom or office building. Some studies have been conducted by using on-site visits to gather response data (Meacham 2000). On-site visits were not used in this study for several reasons, including lack of accessibility to logging locations, difficulty scheduling the operations at times when participants may view them, and challenges of maintaining logging scenes and equipment positions that would be consistent from one participant group to another.

Although this study focused on the sites and sounds of logging-in-progress for five of the most common yarding methods used in the region, it was limited in the number and style of timber harvest yarding methods that were able to be studied. For instance, the evolution of forest machinery has been enormous in the past four decades (Drushka 1997). A variety of makes and models of yarding machines exists and researchers and engineers are constantly working to develop more innovative designs with different

features and functions. Each machine can vary in visual appearance (e.g., tracked machines vs. rubber-tired; grapple vs. cable skidders) and aural qualities (e.g., variability within mufflers, engine sizes and components). This research was not designed to depict the diversity within each yarding method category. Furthermore, it is understood that the forest operations video could not possibly represent or depict all situations, land types, and forest types.

By using a video survey, this study took a unique approach to identifying timber harvest yarding methods that are most preferred and acceptable for use in woodlands experiencing increasing population pressures. This study is a step directed to better understanding public values as they relate to timber harvesting, especially as it occurs in forested residential areas and other places, such as public parks and town forests, where more people come in contact with working forests. It is important to understand that the context of this study is much larger than simply an evaluation of the visual and aural attributes of timber harvest yarding methods. Additional work is being conducted to evaluate the issues that surround the use of small-scale logging systems. In conjunction with this study, work is being performed to investigate the actual efficiency, economics, and potential disturbance for each of these yarding methods. Combining that information with the results of this study will help us to understand which yarding methods are most appropriate in certain situations and contexts. It was not the intent of this study to suggest that a specific yarding method is better to use or needs to be implemented more often than another. Our goal was to develop information that will help NIPF owners and foresters better fit timber harvesting into the flow of community life, with all of its

constraints, rather than to expect communities to adjust to the temporary inconveniences often associated with the conduct of logging.

This study, along with other scientific research and future studies, will hopefully assist in making necessary adjustments to forest operations to make them more compatible with the attitudes of residents and communities of the urban fringe. As the general public and NIPF landowners continue to acquire more control and influence on our nation's forests, it is essential that future studies be conducted, especially on timber harvesting, to evaluate and understand the relationship among society's perceptions, values, and attitudes and how they may influence forest management.

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Appendix A. Copy of Written Survey

College of Natural Sciences, Forestry, and Agriculture

You will experience the sights and sounds of five logging methods – a forwarder, skidder, bulldozer, farm tractor, and horse logging – that took place in similar forest stands during the summer of 2003. Although actual sound volumes have been reduced for the purposes of this video, relative sound levels for each method are consistent with those experienced by an observer standing at the camera position.

After viewing and listening to approximately one minute of each logging method, please respond to the questions for that method. At the conclusion of the five one-minute segments, we will then ask you to RANK your preferences for each logging method.

Please remember that all of your responses will remain anonymous and that the information that you provide will help to characterize opinions and preferences on logging methods commonly used in northern New England.

Thank you for participating in this study.

Forwarder

	Unacceptable	Acceptable	Very Acceptable
The visual appearance of this logging method is …	**1**	**2**	**3**
The sound produced by this logging method is …	**1**	**2**	**3**
The efficiency of this logging method appears to be…	**1**	**2**	**3**
The potential disturbance to the forest from this logging method is…	**1**	**2**	**3**
The use of this logging method in a residential area is…	**1**	**2**	**3**
Using this logging method on my woodlot would be…	**1**	**2**	**3**
Using this logging method on my neighbor's woodlot would be…	**1**	**2**	**3**

Skidder

	Unacceptable	Acceptable	Very Acceptable
The visual appearance of this logging method is …	**1**	**2**	**3**
The sound produced by this logging method is …	**1**	**2**	**3**
The efficiency of this logging method appears to be…	**1**	**2**	**3**
The potential disturbance to the forest from this logging method is…	**1**	**2**	**3**
The use of this logging method in a residential area is…	**1**	**2**	**3**
Using this logging method on my woodlot would be…	**1**	**2**	**3**
Using this logging method on my neighbor's woodlot would be…	**1**	**2**	**3**

Bull-Dozer

	Unacceptable	Acceptable	Very Acceptable
The visual appearance of this logging method is …	**1**	**2**	**3**
The sound produced by this logging method is …	**1**	**2**	**3**
The efficiency of this logging method appears to be…	**1**	**2**	**3**
The potential disturbance to the forest from this logging method is…	**1**	**2**	**3**
The use of this logging method in a residential area is…	**1**	**2**	**3**
Using this logging method on my woodlot would be…	**1**	**2**	**3**
Using this logging method on my neighbor's woodlot would be…	**1**	**2**	**3**

Farm Tractor

	Unacceptable	Acceptable	Very Acceptable
The visual appearance of this logging method is …	**1**	**2**	**3**
The sound produced by this logging method is …	**1**	**2**	**3**
The efficiency of this logging method appears to be…	**1**	**2**	**3**
The potential disturbance to the forest from this logging method is…	**1**	**2**	**3**
The use of this logging method in a residential area is…	**1**	**2**	**3**
Using this logging method on my woodlot would be…	**1**	**2**	**3**
Using this logging method on my neighbor's woodlot would be…	**1**	**2**	**3**

Horse

	Unacceptable	Acceptable	Very Acceptable
The visual appearance of this logging method is …	**1**	**2**	**3**
The sound produced by this logging method is …	**1**	**2**	**3**
The efficiency of this logging method appears to be…	**1**	**2**	**3**
The potential disturbance to the forest from this logging method is…	**1**	**2**	**3**
The use of this logging method in a residential area is…	**1**	**2**	**3**
Using this logging method on my woodlot would be…	**1**	**2**	**3**
Using this logging method on my neighbor's woodlot would be…	**1**	**2**	**3**

Ranking All 5 Logging Methods

Please rank the 5 different logging methods (represented with letters A-E) in order of *most preferred* "1" to *least preferred* "5" for the attributes listed.

A = Forwarder **B** = Skidder **C** = Bull-Dozer **D** = Farm Tractor **E** = Horse

	Most Preferred System "1"	"2"	"3"	"4"	Least Preferred System "5"
Visual Appearance					
Sound					
Efficiency					
Disturbance to the Forest					
Forest Sustainability					
Use in a Residential Area					
Use on my Woodlot					
Use on my Neighbor's Woodlot					

Background Information

1) How old were you on your last birthday? _____years

2) Please indicate your gender (please circle one) Male Female

3) Last grade of school completed: (for example: 9th grade, 12th grade, 2 yrs college, 4 yrs college, etc) _____

4) What city, town, village, or municipality do you live in? (write name of place below)
Example: Orono, Maine

_____

5) How would you describe your place of residence? (circle one) Rural Suburban Urban

6) How long have you lived there? _____years

7) How would you describe your place of residence during your teenage years? (please circle one)

Rural Suburban Urban

8) What is your occupation? (if you are retired or unemployed, please state this and list your former occupation)

_____

9) Do you own at least 10 acres of forest land? (please circle one) Yes No

If yes, how many acres do you own? _____acres;

If yes, where? (town, state) _____

If yes, have you ever conducted a timber sale on your forestland? Yes No

10) How would you rate your knowledge of timber harvesting? (please circle one)

a) I am *not knowledgeable* about timber harvesting

b) I am *somewhat knowledgeable* about timber harvesting

c) I am *knowledgeable* about timber harvesting

d) I am *very knowledgeable* about timber harvesting

Thank You

Appendix B. Approval of research application for Human Subjects Review

Psych 001 Subject Use, Fall 2003

Please return this form to Michelle Alexander

Investigator's name: Dr. Andrew F. Egan assisted by Michael Eckley

e-mail address: Michael.Eckley@umit.maine.edu or aspenforest11@hotmail.com

Investigator's office number: 5755 Nutting Hall

Investigator's phone #: 207-827-0258(home) 207-581-4739(office) 207-949-2041(cell)

Supervising faculty member (if applicable): Dr. Andrew Egan (207) 581-4739

Total number of participants needed: 20 or more respondents preferably

Total duration of each session, including time for the subject to read and sign consent form, complete the research participation, to hear instructions and debriefing, etc. Don't guess, test the time needed: 2 minutes instructions, 13 minutes video, 15 minutes survey = 30 minutes total

Does the study have HSRC approval? Study was reviewed by U-Maine HSRC and ruled exempt from further review under category 2.

Dates when participants will participate in the research As soon as possible

Attach the following pages:

- The handout to students you intend to use that lists:
  - title and description of project
  - your name, telephone number, and email
  - who is eligible to participate
  - # of credits for participation (the ratio is 5 per hr; 3 per half-hr)
  - when and where to go

After we approve your request, we'll ask you for a supply of handouts and sign-up sheets. PLEASE PAY ATTENTION TO THE GUIDELINES OUTLINED ABOVE! We get many handouts and overheads that lack the proper info, and that means a lot of extra work for us.

Thank you, - Psych 1 Staff

Appendix C. Introduction and questions used by the moderator for focus groups conducted throughout northern New England during the summer of 2003

I am a graduate student at the University of Maine in the Department of Forest Management. My research focus is on small-scale logging equipment and operations.

I greatly appreciate the opportunity to sit down and have an open discussion with you all. I am very interested in hearing your thoughts and concerns, as well as goals, objectives, and other issues pertaining to your woodlots. This meeting should last for approximately a half hour to an hour. And I would like the point out that the digital voice recorder is on to capture the group discussion for my own personal use in going back to reevaluate key points that otherwise would have been forgotten or unnoticed.

I would appreciate if we could go around the table and you all could briefly introduce yourselves and give some general information pertaining to your woodlot. Ex. location, acreage, years of ownership, etc.

As landowners, have you all conducted a harvest/logging operation on your property?

For those of you who said yes, can you tell us about your logging experience?

Tell us about the logging equipment used.
What size do you prefer?
What is it about certain equipment that makes it more preferable than others?

Do neighbors, friends, or family ever make comments or have concerns about the operation?
If so, what are they saying or asking?

How important are aesthetics when it comes to a harvest operation?
Obviously aesthetics are a major concern after a logging operation, but do you think that a logging job in progress can have an aesthetic influence? Does certain equipment have a better image than others.

Do you think different logging equipment used in a harvest can influence or have a different affect on people. How so?

Do you think people are more concerned or affected by a logging operation in progress or after the harvest?

Thank You,

Appendix D: Information on sound level meter used to measure sound levels of each timber harvest yarding method during filming

Instrument	Use	Information	Reference
Sound Level Meter – Model 710 AKA Noise Dosimeter Made by Larson*Davis	Measures sound pressure levels with high degree of accuracy	It is the latest micro-processor technology with an advanced analog instrumentation circuitry. Used predominately for measuring dB for OSHA requirements	Larson Davis Laboratories Manual Version 2 1989 1681 West 820 North Provo, Utah 84601

Information on videographer and equipment used for filming

Videographer	Company	Video Camera	Camera Settings	Filming Equipment
Kim Mitchell	University of Maine Department of Marketing	Sony Betacam Model UVW-100	F-Stop 4.5 Filter 5600 K+1/16ND Audio Level Setting 12:30 Channel 2	Maxell Professional B-30 Tape (30 minutes)

BIOGRAPHY OF THE AUTHOR

Mike Eckley was born in State College, Pennsylvania on November 6, 1979. He attended Bellefonte Area High School in Centre County, Pennsylvania and graduated in 1998. He received a Bachelor's of Science degree in Forest Resources Management and a minor in Communications from West Virginia University in June of 2002. Before attending graduate school, Mike served as an intern with the Department of Interior, Office of Wildland Fire Coordination in Washington DC. He entered the graduate program in the Department of Forest Management at the University of Maine in the fall of 2002.

After receiving his degree, Mike will be working as a County Forester for the Virginia Department of Forestry. He is a candidate for the Master of Science degree in Forest Management from the University of Maine in August of 2004.