Willingness to Pay for Stumpage Requiring Timber Harvesting Guidelines: An Evaluation of Bidder Characteristics, Strategies, and Perceptions

A Report to the Minnesota Forest Resources Council

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INTRODUCTION

In 2002, the Minnesota Forest Resources Council commissioned a study to assess the extent to which forest landowners incur additional financial costs resulting from the application of Minnesota's timber harvesting guidelines. This study, undertaken by the University of Minnesota's Department of Forest Resources, auctioned 27 timber tracts in northern Minnesota managed by the Minnesota Department of Natural Resources and St. Louis County Land Department though a sealed bidding process. Each study tract was set up and offered for sale both with and without the requirement to apply a specific set of guidelines. The guidelines required on the study tracts included:

- Remove a maximum of 50 percent of the merchantable volume within a designated inclusion equal to approximately 10 percent of the sale area (designed to mimic riparian management zone guidelines which provide recommendations for residual basal area),
- Retain at least six scattered leave trees/acre greater than six inches diameter breast height (DBH) across the site,
- Follow guidelines for road and skid trail location and construction, water diversions, and landings,
- Backhaul all slash across the site, and
- Leave all snags possible where safety permits.

Prospective purchasers were required to submit a pair of bids on each study tract—one to purchase the timber sale with and the other without the use of timber harvesting guidelines. The treatment method for each study tract (i.e., harvest with guidelines; harvest without guidelines) was randomly determined after the close of bidding, and tracts were awarded to the highest bid for the treatment selected. Auctions for all study tracts were held in the fall 2002.

A total of 80 paired bids were received from 36 logging businesses, resulting in the sale of timber on 23 study tracts. On average, stumpage bids were $2.66 per cord lower when guidelines were required as part of the timber sale specifications (Table 1). This amounted to a 10.1 percent discount below bids on the same tracts when guidelines were not specified. Individual bids for a particular tract when guidelines were required ranged from a 5 percent premium to nearly 40 percent below the bid when guidelines were not required (Figure 1). The wide range in discounted stumpage prices offered by timber harvesters reflects the variable perception as to the extent to which guidelines increase timber harvesting costs across a range of tract and harvesting conditions.

The 36 timber harvesters who bid on the study tracts were mailed a two-page questionnaire in spring 2003. The questionnaire requested information about their logging business (e.g., years in business, annual harvest volume, existence of financial records for each tract harvested), how they developed their bids for the study tracts (e.g., sources consulted, tract characteristics, influence of specific guidelines), and perceptions on how different bidding strategies affect who bears the cost of implementing guidelines (Appendix A). Prior to mailing the questionnaire, human subjects approval was granted by the Institutional Review Board at the University of Minnesota.

The survey was administered using techniques developed by Dillman (2000). There were 33 questionnaires returned (a 92 percent response rate) which accounted for 93 percent of the paired bids submitted on the 23 study tracts. All returned questionnaires were completed and deemed useable in the study.

Table 1. Summary statistics: paired bids submitted on the 23 study tracts sold.

	Without guidelines bid ($/cord)	With guidelines bid ($/cord)	With guidelines bid difference ($/cord)	With guidelines bid discount (percent)
MEAN	$27.22	$24.56	$ 2.66	-10.1
MEDIAN	$27.48	$24.10	$ 2.25	-8.2
STD DEV	$ 4.82	$ 5.65	$ 2.55	9.9
MAXIMUM	$16.92	$12.24	-$ 1.05	-38.4
MINIMUM	$41.15	$41.15	$10.45	5.0
N	80	80	80	80

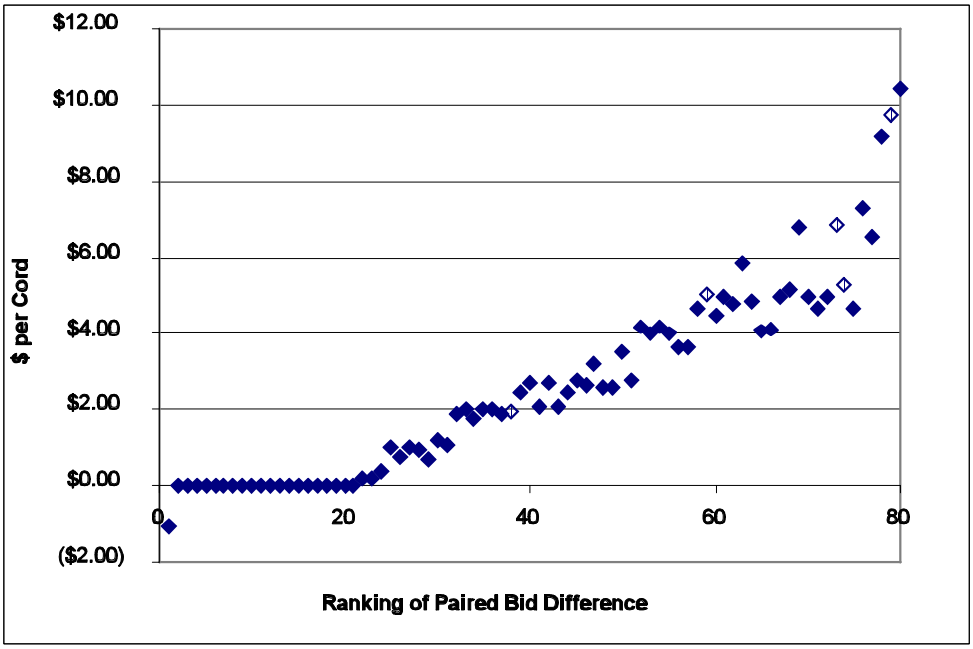

Figure 1. Distribution of differences in bid prices for paired bids ($/cord) on the 23 study tracts sold.

RESULTS

Experience and Production

The timber harvesters who responded to the survey were very experienced, averaging 27 years in the logging business (Table 2). This average is four years greater than the state average number of years of experience reported by timber harvesters in 1996 (Puettmann et al. 1998). No individual bidding on a study tract had been logging less than nine years, and two had been logging for at least 50 years. Individuals responding to the survey harvested, on average, approximately 14,000 cords annually—substantially above the statewide average production level of 5,000 cords reported in 1996 (Puettmann et al. 1998) (Table 3). The range in annual wood production among respondents was substantial, from 250 to 60,000 cords. All but seven respondents indicated annual production levels less than 20,000 cords. Collectively, the 33 timber harvesters responding to the survey produced 462,400 cords or 13 percent of the state's estimated total wood production in 2002 (Minnesota Department of Natural Resources 2003).

Table 2. Experience of timber harvesters who submitted paired bids on the 23 study tracts.

Number of survey respondents	Number of years in business
1	<10
7	10-19
10	20-29
9	30-39
4	40-49
2	>50
AVERAGE	27
MAXIMUM	51
MINIMUM	9

Table 3. Annual timber production of timber harvesters who submitted paired bids on the 23 study tracts.

Number of survey respondents	2002 timber production (cords)
15	<10,000
11	10,000-19,999
3	20,000-29,999
0	30,000-39,999
3	40,000-49,999
1	>49,999
AVERAGE	14,012
MAXIMUM	60,000
MINIMUM	250

Record-Keeping

Only 21 percent (n=7) of the respondents indicated that they maintain separate financial records for each tract they harvest. Analysis of financial record-keeping tendencies indicates that these timber harvesters have been in business nearly 4.5 years less, on average, than timber harvesters who indicated they do not keep financial records of each tract harvested (Figure 2). The average annual production in 2002 was nearly identical for timber harvesters who maintained individual tract records and for those who did not (13,460 versus 14,160 cords per year, respectively).

Sources Consulted When Developing Bids

We asked timber harvesters who bid on the guideline study tracts to identify what sources were consulted in developing their paired bids. Seven of ten (n=23) responding timber harvesters indicated they did not consult any unique or special sources to develop their paired bids (Figure 3). Of those sources that were consulted, general business records of

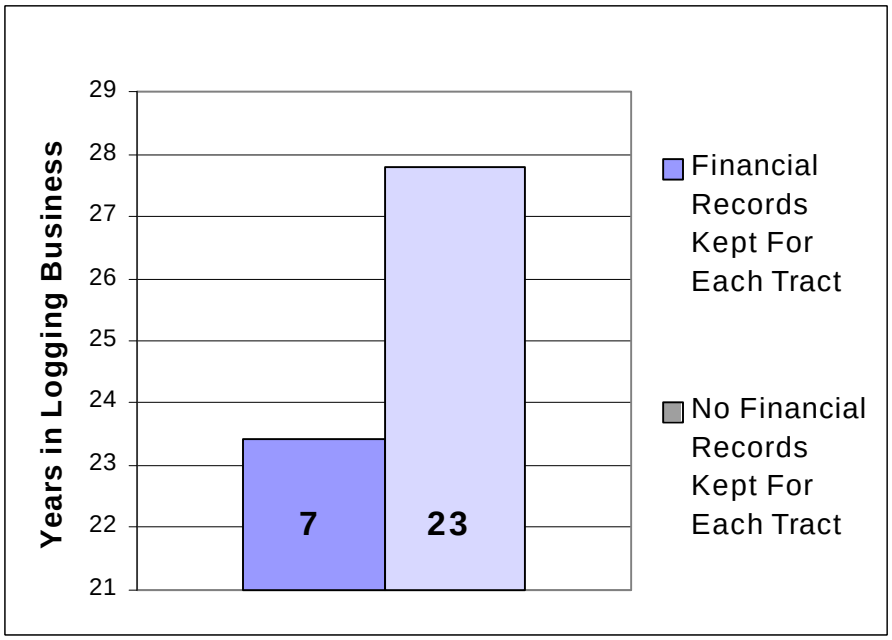

Figure 2. Average years of experience in the logging industry for survey respondents who maintain financial records on each tract harvested versus average years experience for those timber harvesters who do not maintain separate financial records for each tract harvested (number indicates number of respondents).

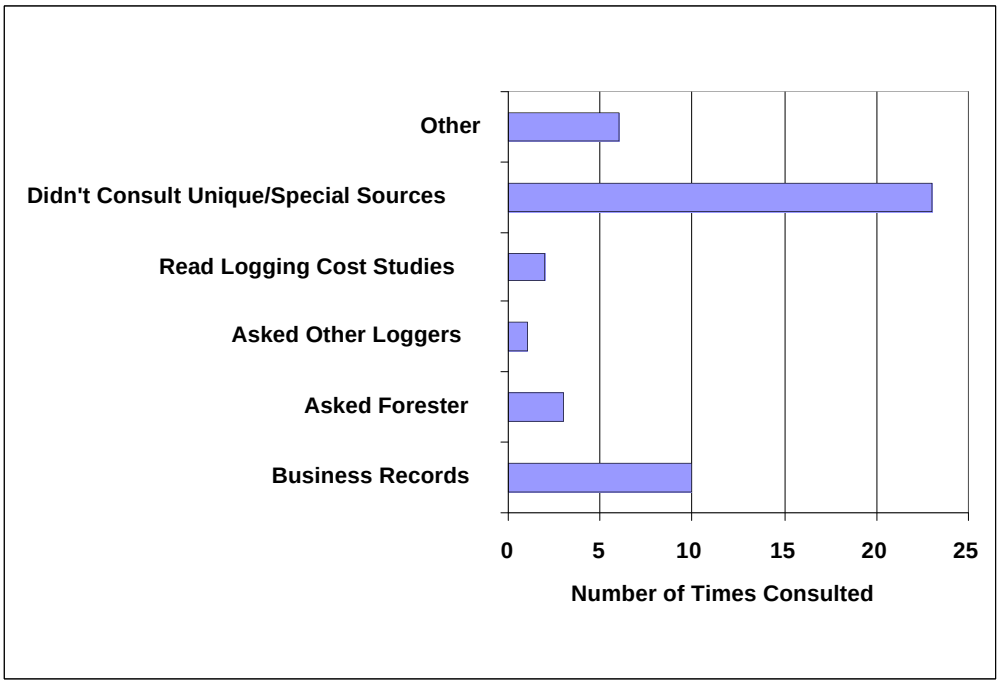

Figure 3. Types and frequency of sources used by timber harvesters in developing paired bids on the 23 study tracts.

logging production costs was the most frequent, cited by ten timber harvesters. Three bidders asked the forester who set up the sale for ideas on how to bid, whereas one asked other timber harvesters how they planned to develop their paired bids. Two timber harvesters considered previous reports that documented the impact of guidelines on logging costs to assist in developing their with-without guideline bids. Other sources mentioned by timber harvesters included basing their bids on previous experience (three timber harvesters cited this), personally looking at the tract to see how guidelines affected the sale (e.g., skidding distance) (mentioned by two timber harvesters), examining information on the tract provided by the forester in the timber sale appraisal form (one respondent), and "just doing our own calculating" (one respondent).

Visiting the Tract Prior to Bidding and Awareness of Bidding Activity

A surprising finding of the survey was the frequency by which timber harvesters personally inspected the tracts they bid on. Only half of all bidders actually visited the tract prior to submitting the paired bids for that tract (Table 4). This finding suggests many timber harvesters rely heavily to exclusively on information about the tract contained in the agency's timber appraisal report in formulating their bids for the stumpage. When asked about general knowledge of bidding activity on the study tracts at the time paired bids were submitted, all but two (94 percent) indicated they were unaware of how many other bids had been submitted. This latter finding confirms our premise that the sealed bid method used to auction the study tracts produced paired bids whose values were not dependent on the level of bidding activity for that tract.

Table 4. Percent of timber harvesters bidding on the 23 study tracts who, prior to submitting paired bids, visited the tract; knew the level of bidding activity.

	Visited tract prior to submitting bids (percent)	Knowledge of other bidders prior to submitting bids (percent)
Yes	50	6
No	50	94

Factors Influencing With-Without Guideline Stumpage Bids

Site-Specific Tract Factors

We asked bidders to rate a number of tract-specific factors thought to influence the bids submitted on the study tracts. Respondents were given four response categories to express the degree to which a given factor influenced their bids—substantial, moderate, minimal, and none. Of those tract variables examined in the survey, total volume of merchantable timber on the tract was the most influential in shaping a timber harvester's bid on the study tracts, receiving an average rating of 3.42 (4 = substantial influence; 1 = no influence) (Table 5 and Figure 4). Specific site characteristics of the tract and species composition were the second highest rated influences, each receiving a mean rating of 3.27. The size of the tract also had more than a moderate influence on the bids submitted on the study tracts, averaging 3.21. All site-specific tract factors were perceived to have, on average, at least a moderate influence on bidding.

Sale-Specific Tract Factors

Sale-specific tract variables evaluated for their affect on stumpage bids on the study tracts included who appraised the tract, the location

Table 5. Summary statistics: influence of tract factors on the development of paired bids submitted on the 23 study tracts (1 = none, 2 = minimal, 3 = moderate, 4 = substantial).

	Site-specific factors					Sale-specific factors		
	Tract size	**Sale volume**	**Site characteristics**	**Appraised value**	**Species composition**	**Timber appraiser**	**Proximity to other sales**	**Need for tracts**
Average	3.21	3.42	3.27	3.03	3.27	2.45	2.61	2.61
Maximum	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Minimum	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
S. Deviation	0.65	0.66	0.76	0.85	0.88	1.06	1.03	1.03
Count	33	33	33	33	33	33	33	33

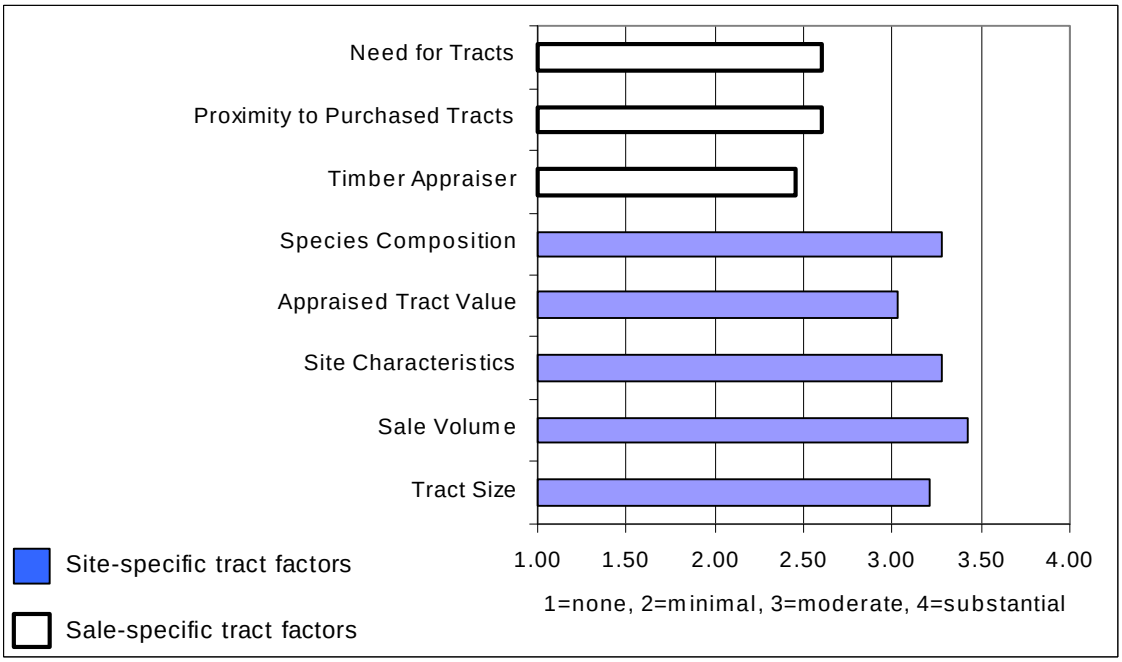

Figure 4. Influence of site- and sale-specific tract factors on the development of paired bids submitted on the 23 study tracts (mean rating).

of the tract in proximity to other existing stumpage tracts held by the timber harvester, and the timber harvester's current inventory of purchased tracts. None of these three factors influenced stumpage bids to the degree of the site-specific factors (Table 5 and Figure 4). Of the three sale-specific variables evaluated, the tract's proximity to other timber sales owned by the bidder and the bidder's inventory of purchased tracts were considered to have the greatest influence in developing stumpage bids (mean score of 2.61 each). Knowledge of the forester who set up the timber sale was least influential to the timber harvesters in developing their bids on the study tracts (2.45).

Guideline Factors

Applying the same rating scale used to assess the influence of site- and sale-specific tract

factors on stumpage bids, we asked timber harvesters to indicate how each of the six guidelines used in the study influenced their bidding behavior on the study tracts. Guidelines that required the timber harvester to leave residual trees on site (e.g., at least six trees per acre greater than six inches diameter breast height in patches or scattered throughout the study site; no less than 50 percent of the merchantable volume within the marked inclusion which is equal to 10 percent of the harvest area) were considered to have the greatest influence on with-without guideline stumpage bids (Table 6, Figure 5). Retaining leave trees in patches or individual trees received a mean score of 2.97, whereas bidders rated selective harvesting within the inclusion boundary as 2.94. Leaving snags (dead trees) standing was considered least influential in developing stumpage bids with and without the use of guidelines. None of the guidelines were considered to have, on average, at least a moderate influence on bidding.

Table 6. Summary statistics: influence of guidelines on the development of paired bids submitted on the 23 study tracts (1 = none, 2 = minimal, 3 = moderate, 4 = substantial).

	Harvesting in inclusion	Leave trees	Road/skid trail placement	Landing placement	Logging slash	Retain snags
Average	2.94	2.97	2.64	2.64	2.52	2.21
Maximum	4.00	4.00	4.00	4.00	4.00	4.00
Minimum	1.00	1.00	1.00	1.00	1.00	1.00
S. Deviation	1.00	0.85	0.93	0.93	0.80	0.89
Count	33	33	33	33	33	33

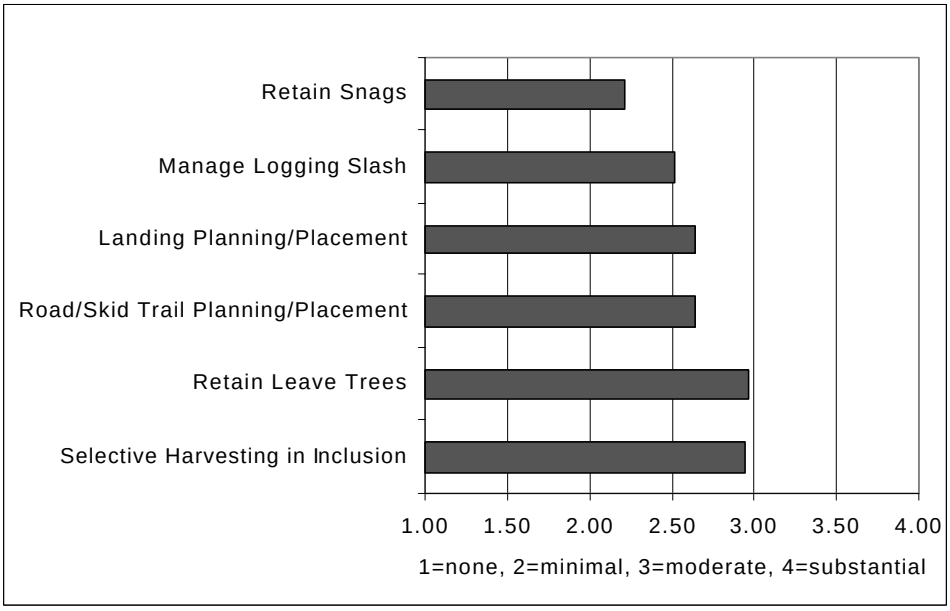

Figure 5. Influence of guidelines on the development of paired bids submitted on the 23 study tracts (mean rating).

Comparing Tract and Guideline Factors

Figure 6 contrasts the mean scores for the tract factors and guidelines examined in the survey. To generalize, a tract's physical characteristics were perceived to have a greater overall influence on the development of paired bids than did specific guidelines. The average ratings of influence for all five of the tract's site characteristics were higher than any of the six guidelines, implying a tract's characteristics factored more prominently in determining the willingness to pay for stumpage than did guidelines. Ratings for the three sale-specific tract factors were less than any of a tract's physical characteristics, and within the range of influence guidelines were found to have on stumpage bids.

Timber Harvester's Perception of Who Bears the Cost of Guidelines

The practices or restrictions recommended in Minnesota timber harvesting guidelines can increase the marginal cost of timber harvesting in a variety of ways. These increased costs can be in the form of additional material purchases (e.g., culverts, road crossing and erosion control structures), decreased productivity per acre (e.g., leaving merchantable trees for wildlife and visual purposes), additional planning time (e.g., pre-harvest consultation with a forester), and increased variable operating cost per unit harvested (e.g., alternative road and skid trail patterns).

Economic theory suggests these additional costs are shared with forest landowners to the extent timber harvesters differentiate their willingness to pay for stumpage when guidelines are required. Any difference in per cord bids with and without the requirement to use guidelines represent that portion (possibly all) of the perceived additional harvesting costs transferred from a timber harvester to a forest landowner in the form of lower willingness to pay for stumpage. Stumpage bids with and without guidelines that are of equal value per cord indicate timber harvesters are not passing any guideline-related costs on to forest landowners.

We asked timber harvesters who they thought bears the cost of implementing guidelines under different bidding scenarios. Overall, the bidder's perception of how differences in with-without guideline bids impacted the incidence of any guideline-related costs was quite variable.

When bidders were asked who bears the cost for implementing guidelines when there is no difference in the paired bid for a given tract, 58 percent felt it was the timber harvester, 29 percent believed both the timber harvester and landowner were sharing the cost, and 13 percent thought the burden fell solely on the forest landowner (Table 7).

When given the scenario that a bid for stumpage when guidelines are required is significantly lower than stumpage bids for that same tract when guidelines are not required, 39 percent felt timber harvesters bear the costs (Table 7). An equal number of respondents felt the cost of guidelines was shared among timber harvesters and landowners. Only 22 percent believed the landowner was solely bearing the cost of guidelines under the scenario where stumpage bids with and without guidelines have a large difference in value.

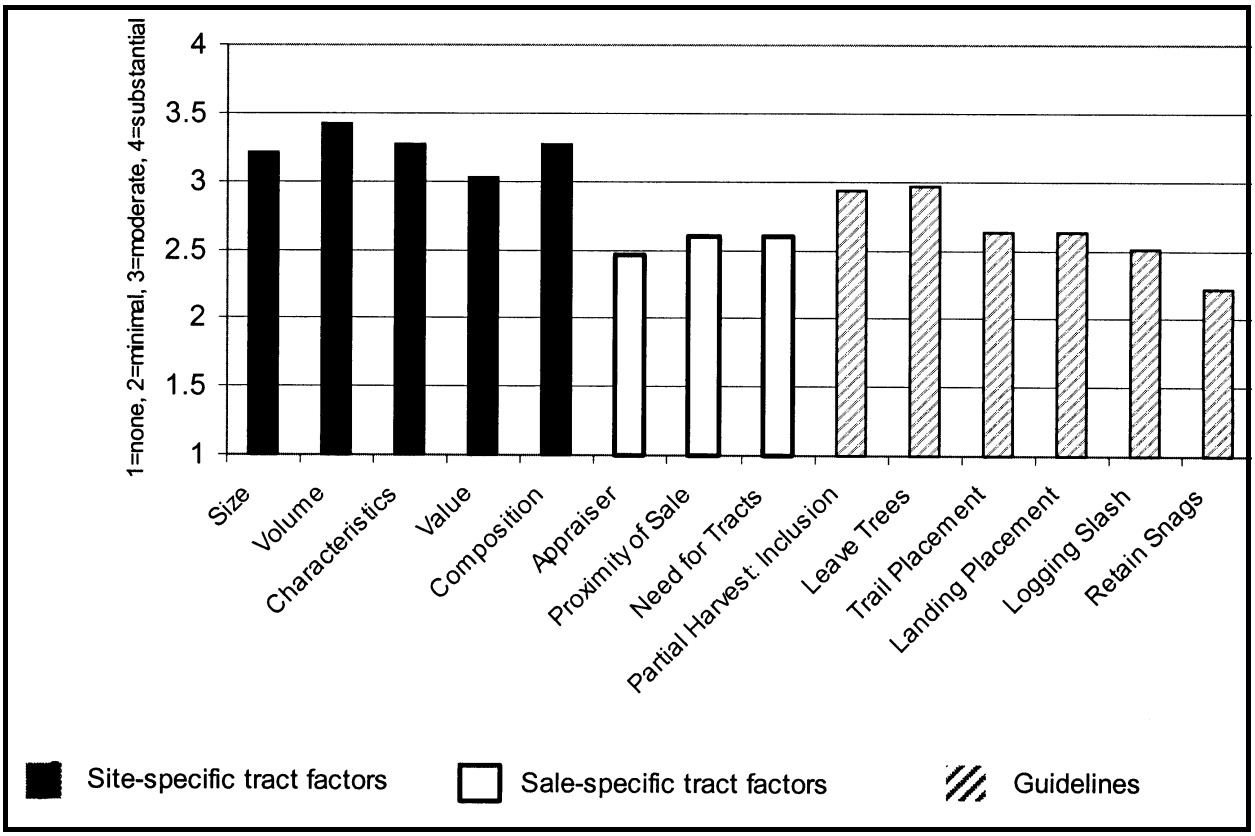

Figure 6. Influence of tract factors and guidelines on the development of paired bids submitted on the 23 study tracts (mean rating).

Table 7. Timber harvester perception of who bears the cost of implementing timber harvesting guidelines when with-without guideline bids are similar and different.

	Paired bid	
Perception of who bears the cost of guidelines	**Little-to-no difference (percent)**	**Large difference (percent)**
Timber harvester	58	39
Landowner	13	22
Both timber harvester and landowner	29	39

SUMMARY

The survey revealed a number of important findings about how timber harvesters approach the development of stumpage bids when guidelines are required, as well as how various factors influence their bidding behavior. These findings include:

- Greater than three of four timber harvesters who bid on the study tracts do not keep detailed financial records on each tract they harvest, making it difficult for individual operators to quantify how various tract characteristics and use of specific guidelines impact per unit logging costs.

- Most timber harvesters did not consult any special or unique sources in developing their paired bids on the study tracts, suggesting the availability of additional information may not be very important in determining the cost of implementing guidelines.

- Only half the responding timber harvesters visited the tract prior to submitting sealed bids for the stumpage. This finding indicates many timber harvesters rely heavily to exclusively on information about the tract contained in the agency's timber appraisal report in formulating their bids for the stumpage. It also may suggest that personally visiting each site represents a substantial cost to many stumpage purchasers relative to the additional benefits they might gain by visiting the tract.

- Of the site-specific tract factors evaluated, the total volume of merchantable timber in a timber sale was perceived to have the greatest influence on stumpage bids. This finding suggests the importance of being able to minimize the marginal increase in per unit production costs imposed by guidelines by spreading these costs over a large quantity of timber harvested.

- Knowing who the forester was who set up the timber sale, the location of the sale in proximity to other tracts held, and the bidder's inventory of tracts all had less than a moderate influence on stumpage bids.

- The influence of specific guidelines on bidding behavior was also modest. None of the six guidelines evaluated in our study generated an average score of three, meaning they had less than a moderate influence on the bids developed for the study tracts.

- In comparing site-and sale-specific tract factors and guidelines, a tract's physical characteristics were perceived to have a greater overall influence on the development of paired bids than did specific guidelines. The average ratings of influence for all five of the tract's site characteristics were higher than any of the six guidelines, implying a tract's characteristics factored more prominently in determining the willingness to pay for stumpage than did guidelines.

- The perception of who bears the cost of implementing guidelines among timber harvesters and forest landowners is quite variable among the individuals who bid on the study tracts.

CONCLUSIONS AND IMPLICATIONS

This study demonstrated that the perceived cost of harvesting timber is influenced by many variables, including the use of guidelines. The perception among individual timber harvesters of the degree to which a given set of guidelines influence harvesting costs also varies considerably. Individual proficiency in using the guidelines, business and organizational policies and practices, site and timber sale characteristics, and overall market conditions all influence the degree to which these costs are passed on to forest landowners in the form of lower stumpage prices. To the extent possible, this variability needs to be considered in the design of public policy strategies to mitigate any adverse financial effects of implementing these practices.

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APPENDIX A

Stumpage Price Bidding Questionnaire

Survey Identification Number: _____ (For mailing purposes only)

Stumpage Price Bidding Survey

Last fall, you bid on timber tracts offered by the Minnesota Department of Natural Resources or St. Louis County Land Department that were part of a study conducted by the University of Minnesota. The purpose of the study was to assess the extent to which stumpage prices reflect any additional costs associated with Minnesota's timber harvesting and forest management guidelines. This information will help the state better understand the economic impacts associated with implementing the guidelines.

The questions below are intended to help us understand more about the firms who bid on the study tracts sold in November and December 2002, as well as what factors were considered in developing the bids for those tracts. While we have included an identification number on your survey to help us relate survey responses to previous bids on the study tracts, your responses will be kept completely confidential.

Information About Your Logging Business

1. How many years have you been in logging?
   _____ Years

2. What was your approximate volume produced during 2002?
   _____ Cords
   _____ Thousand board feet
   _____ Tons

3. Does your logging business maintain separate financial records (e.g., information on harvesting costs) for each individual tract you harvest?
   _____ Yes
   _____ No

Information about How You Developed Your Bids for the Study Tracts

4. Which of the following sources did you use to help you develop your paired bids on timber tracts used in the study? (Please check all the sources you used.)
   _____ Business records on logging production costs
   _____ Asked the forester who set up the sale for ideas on how to bid
   _____ Asked other loggers about how they were going to bid
   _____ Read or heard about studies that reported the impact of guidelines on logging costs
   _____ Didn't consult any special sources to develop my paired bids
   _____ Other: _____

5. Did you or someone else from your logging business personally visit a tract prior to submitting a set of paired bids for that tract?
   _____ Yes
   _____ No

6. Did you know how many other bids had been submitted on the tract(s) when your paired bids were submitted?
   _____ Yes
   _____ No

7. To what extent did the following influence the bids you submitted on the study tracts?

Factors NOT Related to Guidelines	Degree of Influence on Bid: Substantial	Moderate	Minimal	None
Size of tract (acres)	4	3	2	1
Estimated sale volume of tract	4	3	2	1
Specific site characteristics of tract	4	3	2	1
Total appraised value of tract	4	3	2	1
Species composition	4	3	2	1
Person who appraised timber	4	3	2	1
Proximity to other purchased tracts	4	3	2	1
Low inventory of purchased tracts	4	3	2	1
Factors DIRECTLY Related to Guidelines				
Selective harvesting within inclusion boundary	4	3	2	1
Retaining leave trees (patches or individual trees)	4	3	2	1
Planning/placement of road/skid trails	4	3	2	1
Planning/placement of landings	4	3	2	1
Managing logging slash	4	3	2	1
Retaining snags (dead trees)	4	3	2	1

8. For each bidding scenario below, indicate who you **think** bears the costs of implementing guidelines.

A. **Paired bids have little or no difference in value (i.e., the same price is bid for the stumpage regardless of whether guidelines were required).**

_____ Logger
_____ Landowner
_____ Both logger and landowner

B. Paired bids have large difference in value (i.e., **bids for stumpage when guidelines are required is significantly lower than the bid when guidelines were not required).**

_____ Logger
_____ Landowner
_____ Both logger and landowner

9. Please provide any additional comments about your participation in bidding on these tracts.

*****Please return your completed survey in the self-addressed, stamped envelope by April 21st *****

☐ Yes, I would like to receive a copy of the study results.