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Assessing the Accuracy of Respondents Reports of the Location of Their Home Relative to a National Forest Boundary and Forest Cover

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1. Introduction

Managing forest fire and logging are vital and often contentious policy issues in the United States. Over the last 10 years the United States has experienced an increasing number of high intensity forest fires that have endangered and ended lives, destroyed property worth millions of dollars, and cost taxpayers very large sums. Managing forests as timber resources and wildlife habitats often brings competing wood products industry and environmental conservation interests into conflict.

Local, state, and national agencies charged with managing wildlands in the United States are now seeking to learn more about the public's preferences for managing forests. For this reason agency wildland managers are making use of survey research to supplement their public input processes. Agency managers often choose random-digit dial telephone surveys because of the speed and relatively low cost associated with this mode of administration.

Respondent proximity to a wildland area managed by a government agency, and the presence of forest cover surrounding a respondent's home are two important variables for survey research that examines opinion about agency wildland management. It is hypothesized that respondents who live in a forested area have a different opinion about forest management tools like prescribed burning than those who live outside a forested area. Respondents who live in or near a National Forest may also have different views about logging practices than those who live far from the Forest. Because of the hypothesized importance of these variables it is necessary to examine the accuracy of respondent reports about these two topics.

This paper assesses the accuracy of responses to a question that asks the location of respondents' homes relative to a National Forest boundary. The analysis also assesses the accuracy of respondent reports on forest cover in the area surrounding their home. We find non-ignorable error in the responses to both questions. The remainder of this paper is divided into three sections. First, the methods used for this study are described as are limitations of the study. Second, we illustrate the study's results. Finally, we discuss our results and conclusions.

2. Methods

The survey data used in this study were collected as part of the Bitterroot National Forest (BNF) Trust Survey which was administered by Computer-Assisted Telephone Interview (CATI) from May 10, 2004 through June 21, 2004. The purpose of the BNF Trust Survey was to examine respondents' trust in the management of the U.S.D.A Forest Service's Bitterroot National Forest. The sponsors of the BNF Trust Survey were the Aldo Leopold Wilderness Research Institute and The University of Montana College of Forestry and Conservation. The survey was administered by the Bureau of Business and Economic Research of The University of Montana.

The survey population was non-institutionalized residents of Ravalli County, Montana, aged 18 or older, who lived in a dwelling with a land-line telephone. BNF is contained almost entirely within the borders of Ravalli County, Montana. The sampling method was random digit dial. Within household sampling was conducted using the Kish table method (Kish, 1949). The sample was stratified by three regions within the county; north, middle, and south. The data collection effort yielded 1,164 completed interviews. Overall sampling error rate for this survey was +/- 3 percent using a 95 percent confidence interval. The unit response rate for the survey was 62.6 percent. This rate was calculated using the American Association for Public Opinion Research response rate formula 3 (AAPOR 2004)¹.

The following questions were used to produce the survey data examined in this paper:

Q1. Do you live within one half mile of the Bitterroot National Forest?

Yes
No

Q2. Is the place you live?

In a forested area
On the edge of a forested area
Outside a forested area

¹ e = .145 based on 2003-4 Federal Communication Commission data for active and working telephone numbers in Montana, and the proportion of active household telephone numbers in Montana.

Q1 was asked at the request of the Aldo Leopold Institute. The Institute was interested in exploring the possibility of using the area within one half mile of a National Forest boundary as an operational definition of the urban-wildland interface. The interface is the area on the edge of a forest where many residences and other structures can be found.

Respondent answers to these questions were compared to the actual location of each respondent's home and the forest cover currently surrounding their home. The location of respondent homes was determined by conducting a World-Wide Web search of reverse telephone directories to obtain respondent addresses.² Addresses were entered into a GIS software package and assigned a geo-code. Data for the Ravalli County, Montana geo-codes and the various boundaries within the county were taken from the TIGER/Line Files 1st edition (U.S. Census Bureau, 2004). Forest cover was derived from 2002 satellite data enhanced by The University of Montana's College of Forestry and Conservation (UM-WSAL, 2002).

The survey data presented in the remainder of this paper are based on 767 completed cases (66 percent) for which the authors were able to obtain usable addresses. Many dwelling addresses in rural areas like Ravalli County, Montana are incomplete; they are often only "East of Darby." Such addresses did not provide enough information to geo-code. In addition, many other respondents had unlisted telephone numbers.

Respondents for whom useable addresses were obtained did not differ significantly from respondents for whom no address was obtained when compared by sex, education, income, and length of residence in the county. However, respondents who said they live in a forested area were less likely to be assigned an address than were those who said they live on the edge of or outside a forested area (Pearson chi-square value 50.1, p value .000). Similarly, respondents aged 50 – 64 were less likely to be assigned an address than were respondents of other ages. Respondents aged 65 and older were more likely than respondents of other ages to be assigned an address (Pearson chi-square value 13.8, p value .003). The results presented here should be viewed with this in mind. However, the paragraphs that follow will show that almost all demographic characteristics were found to be unrelated to errors in respondent reports.

² Reverse telephone directories used included www.dexonline.com, www.anywho.com, and www.intelius.com

Satellite data have limitations as well. Images are limited by their resolution and are at times obscured by cloud cover. The U.S. Census Bureau TIGER files are known to have a very small number of unsystematic errors. Finally, no effort was made to determine the error rate of the various reverse telephone directories used in this analysis.

3. Results

The primary findings of this study are shown in Table 1. The data are presented as number of responses and proportion of incorrect responses.

	Response Option	N	Incorrect N	Incorrect %
Q1	Yes	158	112	70.9
	No	609	21	3.4
	Total	767	133	17.3
Q2	In forest	96	14	14.6
	Forest edge	200	27	13.5
	Outside Forest	471	49	10.4
	Total	767	90	11.7

70.9 percent of respondents who reported living within one half mile of the BNF actually lived more than one half mile away from the boundary. Fewer respondents (3.4 percent) said they did not live within one half mile of the BNF when in fact they did.

Incorrect Yes responses to Q1 were examined to determine how far they were off in miles. Over two-thirds of the incorrect Yes responses (69 percent) actually lived more than 1.5 miles away from the boundary of the BNF. About 31 percent of the incorrect Yes responses lived less than 1.5 miles away from the boundary (Pearson chi-square value 405.3, p value .000).

Only two demographic survey items were found to be related to incorrect responses to Q1. Respondents who reported living in a town were more likely to give an incorrect response to Q1 (19.4 percent) than were respondents who reported living outside of town (9 percent) (Pearson chi-square value 14.2, p value .007). Thirty-five percent of respondents who said they live in a forested area gave an incorrect response to Q1, while 8.7 percent of those who said they live outside a forested area gave an incorrect response (Pearson chi-square value 70.1, p value .000).

The proportion of incorrect responses in Q2 ranged from 10.4 percent to 14.6 percent. Visual inspection of the data indicates a much more even distribution in the magnitude of distance errors in Q2 than in Q1. The only demographic survey item related to incorrect responses to Q2 was Q1 as described in the previous paragraph.

4. Discussion and Conclusions

The magnitude of response error in Q1 makes this error non-ignorable in spite of the limitations of this study.³ Even if the 34 percent of respondents with no usable address all answered Q1 correctly the response error in this question would overwhelm sampling error. The magnitude of response errors in Q2, while not as great as Q1, is also quite high.

The concentration of errors in the Yes responses to Q1 is particularly interesting. Why is it so high? Prior to the analysis the authors had four hypotheses:

H1: No or low magnitude of response errors present.

H2: Response errors caused by respondent confusion over what a half mile is or over where exactly the BNF boundary is.

H3: Response errors caused by acquiescence.⁴

H4: Response errors caused by satisficing.⁵

H1 is rejected. The remaining hypotheses cannot be rejected. The data do, however, provide two clues about the causes. First, if respondents were confused by where exactly the boundary is or what a half mile is, then one would expect more errors among those who live close to the half mile cutoff. But this was not the case. Over two-thirds of respondents who answered Yes to Q1 lived 1.5 miles or more away. Second, none of the “usual suspect” demographic variables associated with satisficing, like education or age, are related to incorrect answers to Q1, though the question is asked near the end of the interview.

The survey data make no cause of the incorrect responses to Q2 immediately apparent. The authors

³ Non-ignorable here means that the proportion of incorrect responses is so high it calls into question the value of the data. See Groves et. al, 2004 for another use of this term.

⁴ Acquiescence is the tendency to answer affirmatively regardless of the content of the question (Groves, et. al, 2004).

⁵ Satisficing respondents don't try to understand the question completely, just well enough to provide a reasonable answer (Groves, et. al, 2004).

believe the response options, especially, “On the edge of a forested area,” are vague and probably cause respondents to make errors.

Much more work remains to be done to develop questions that produce more accurate responses than those examined here. Such work may improve Q2 to the point that the remaining error is ignorable. Questions that ask about the relationship between a respondent's home and a boundary, like a National Forest or a city limit, may be more difficult. The cognitive effort associated with these questions is quite high.

Researchers should consider using the reverse telephone directory/ geo-coding method in combination with a “near home location” question that respondents are willing and able to answer. The authors of this paper are currently testing a question that asks respondents the street names at the intersection nearest to their home. The cost of implementing the reverse telephone/geo-coding method was under \$6,000 for this study. However, the problem of obtaining addresses for unlisted telephone numbers may make using this method prohibitively expensive for many state and local agency survey research clients.

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