Small-scale Forestry (2017) 16:169–177
DOI 10.1007/s11842-016-9349-7

RESEARCH PAPER

Methods for Increasing Cooperation Rates for Surveys of Family Forest Owners

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Accepted: 15 August 2016 / Published online: 31 August 2016

Abstract To maximize the representativeness of results from surveys, coverage, sampling, nonresponse, measurement, and analysis errors must be minimized. Although not a cure-all, one approach for mitigating nonresponse errors is to maximize cooperation rates. In this study, personalizing mailings, token financial incentives, and the use of real stamps were tested for their impacts on cooperation rates for family forest owners asked to participate in the U.S. Forest Service's National Woodland Owner Survey in the state of Connecticut. Token financial incentives, a two-dollar bill included in the first questionnaire mailing, significantly increased cooperation rates by 13 percentage points. Neither personalization nor real stamps showed significant impacts on cooperation rates. While these results are for just one state in the USA, we hypothesize that similar patterns would be observed in other states and likely other countries.

Keywords Response rate · Survey methods · National Woodland Owner Survey · United States

Introduction

Surveys, be they of the general public, family forest ownerships, or trees, are intended to quantify characteristics of the population of interest based on a representative sample of said population. For the results to be reliable, the potential sources of error

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need to be minimized: coverage, sampling, nonresponse, measurement, and analysis (Cochran 1977; Dillman et al. 2014). Coverage errors arise when not all members of the population have non-zero inclusion probabilities. This error is mitigated by utilizing appropriate sampling frames. Sampling error results from not all members of a population being surveyed. This cannot be totally negated unless a complete census is conducted, but power analyses can be used to determine appropriate sample sizes that ensure sampling errors are reasonable given the objectives of the study. Some quantification of the sampling errors associated with estimates, such as standard errors, should always be reported with estimates derived from samples. Nonresponse errors arise when the attributes of the responders are systematically different than those of the non-responders. The standard method for minimizing nonresponse errors is to maximize response rates. Measurement errors occur when the responses do not capture what the question is intended to address. This error is mitigated by carefully designing and pre-testing the survey instrument. Although not typically explicitly discussed, analysis errors occur when inappropriate analytical tools are applied, such as not properly accounting for inclusion probabilities or using incorrect statistical models.

Of the sources of error, nonresponse is the most irksome—it is difficult to detect and even harder to adjust for biases detected (Groves et al. 2002). The problem is that, by definition, we do not know the attributes of interest of those who did not respond. If we are lucky, there may be ancillary data attached to the sampling frame for all potential respondents that can help assess bias, but even this is far from ideal. The only way to assure no nonresponse errors is to get 100 % of the respondents to respond. This is a laudable goal, but is rarely, if ever, obtained. A quinquennial census of farmers is conducted in the US Department of Agriculture and farmers are legally required to participate, but the response rate for the 2012 Census of Agricultural was still only 80.1 % (USDA 2014). The more practical goal therefore is to maximize response rate. It should be noted that even if the response rate is high, there can still be a nonresponse bias if there is a substantial difference between the attributes of the respondents and nonrespondents. And conversely, a survey with a low response rate may have no nonresponse bias if the nonresponse is random across the sample.

To conceptualize why some people respond to surveys and others do not, different theories have been put forth. The Social Exchange Theory describes how people interact with each other and, as applied to surveys, suggests that responses are increased when the perceived benefits are maximized, the costs to the respondents are minimized, and the respondents trust the surveyors (Dillman et al. 2014). The Leverage-Salience Theory looks at survey response as a function of topic, burden, incentives, and authority of sponsorship (Groves et al. 2009). Both of these theories simplify to responses occurring when perceived benefits outweigh perceived costs. These theories lead to specific methods for implementing surveys that should increase response rates, but if, and by how much, the methods increase response rates will depend on the characteristics of the population of interest.

Implementation methods to maximize response rates have been well researched and are outlined in many survey texts, including Dillman et al. (2014), Marsden and Wright (2010), and Groves et al. (2009). The specific recommendations vary across

sources, as do the reported impacts of the approaches, but common recommendations include:

- Minimizing survey length and complexity
- Where possible, avoiding sensitive topics
- Using an appealing and professional layout design
- Avoiding subjugating, parent-to-child language
- Making the survey content interesting
- Using multiple contacts
- Using multiple contact modes
- Tailoring the number and timing of contacts
- Using sponsorship from a trusted authority
- Cleaning and updating addresses
- Providing token financial incentives
- Personalizing mailings
- Maximizing differentiation from junk mail

Some of these elements can be controlled, e.g., number of contacts, and other cannot, e.g., sponsorship. The last three items on the list are the focus of this research note, and readers are encouraged to see Dillman et al. (2014), Marsden and Wright (2010), Groves et al. (2009) and other texts for reviews and recommendations related to the other items.

Incentives, particularly financial incentives, can increase response rates (Church 1993; Beckler et al. 2005). Of the eight experiments presented in Dillman et al. (2014), a token financial incentive of US$2 increased response rates by 12–31 percentage points. It has been noted that smaller cash incentives are more effective than lotteries for larger amounts of money. It has likewise been noted that financial incentives are better than non-financial incentives, such as food or key rings. The incentives are typically provided with the initial questionnaire.

In thinking through the response process for mail-based surveys, a common technique for surveying family forest owners, the first step it to get the potential respondent to open the envelope. This is analogous to getting people to answer the phone in telephone surveys or open an email in an online survey. The mail-survey packages are designed to help ensure the mailing is not considered junk mail and therefore discarded without being opened. Hand addressing the envelopes and using use real stamps rather than an indicia, a postal marking that is printed on the envelope for bulk mailings, are potential methods for differentiating the mailing, but the impacts of these methods have not been quantified.

The objective of this study is to quantify the impacts of token financial incentives, stamps, and personalization on response rates for family forest owners responding to a mail-based survey. While these techniques have been studied to different degrees in previous studies, there are no published studies on their impacts on this specific population—family forest owners. The data presented here are from a randomized experiment conducted using the U.S. Forest Service, National Woodland Owner Survey implemented in the state of Connecticut. While the methods were tested in only one state in one country, we believe the results are potentially applicable to others states and other countries as we discuss at the end of this paper.

Methods

The National Woodland Owner Survey (NWOS) is part of the U.S. Forest Service's Forest Inventory and Analysis program and is a complement to its biophysical resource inventory (Bechtold and Patterson 2005). The goal of the NWOS is to provide timely and reliable statistics on the attitudes and behaviors of the private forest ownerships of the USA: who they are, why the own land, how they have used it in the past, and how they intend to use it in the future. A stratified random sampling design is used (Dickinson and Butler 2013; Butler et al. 2016a). The USA is divided into hexagons with hexagon size varying by state, due to financial constraints and a goal of minimum sample sizes per state (Butler et al. 2016b). Within each hexagon, a random sample point is located. Remote sensing is used to determine if the point is forested, and if it is, the ownership is determined from public property tax records. The private forest ownerships identified by this process are invited to complete a questionnaire. The experiment presented here was carried out in the state of Connecticut where funding was available for increasing the number of contacts, and the state cooperator was interested in the experiment. Five hundred and sixty-nine family forest ownerships were contacted as part of this experiment.

The basic implementation method involved a four-wave mailing modeled on the recommendations of Dillman et al. (2009). The first mailing was a pre-notice postcard alerting potential respondents that they will soon be receiving a questionnaire and providing some basic background information. Five days later, they received a copy of the questionnaire along with a cover letter providing additional background information and a return envelope. A week later, they received a thank you/reminder postcard. For those who had not yet responded, 10 days later they received a second questionnaire along with a modified cover letter and another return envelope. Although not relevant to the experiment presented here and not included in the results below, a final contact via telephone was attempted for a subset of the nonrespondents.

To investigate methods for increasing response rates, three treatments were tested: stamps, personalization, and token financial incentives (Table 1). A factorial experimental design (Box et al. 2005) was utilized to distribute the sample among the treatments. This design allows for efficient examination of treatments, both independently as well as the interactions among them. There were a total of eight treatment combinations including a control (Table 2). The 569 family forest ownerships contacted were randomly assigned to the treatments.

For each treatment, response rates and cooperation rates were calculated. The differences between these rates depends on how the undeliverable mailings are treated [American Association for Public Opinion Research (AAPOR) 2016], but many researchers incorrectly use the terms interchangeably. Response rates (RR) should be calculated as:

$$RR = \frac{r}{r + nr + u}$$

where r = responses, nr = nonresponses, and u = undeliverable mailings. Cooperation rates (CR) should be calculated as:

Table 1 Description of survey response experiment treatments

Treatment	Treatment description	Non-treatment description
Stamp	Postage stamps affixed to postcards, outgoing envelopes, and return envelopes	Bulk mail indicia used on postcards and outgoing envelopes and business reply envelopes used
Personalization	Addresses were handwritten on all correspondence and wet signatures were applied to all letters and postcards	Addresses computer printed and photocopied signatures were used
Token financial incentive	Two-dollar bill included with first questionnaire	No money included with any mailings

Table 2 Treatments groups and sample sizes used to test response rates to a mail-based survey of family forest ownerships

Treatment	Group							
	A	B	C	D	E	F	G	H
Stamp		X			X	X		X
Personalization			X		X		X	X
Token financial incentive				X		X	X	X
Sample size	75	65	75	73	64	71	72	74

$$CR = \frac{r}{r + nr}$$

Cooperation rates, while usually mislabeled, are most commonly reported and are the focus of the analyses below.

A logistic regression model (Hosmer and Lemeshow 1989) was used to evaluate what, if any, impacts treatments have on cooperation rates. The dependent variable, survey response, was coded as one for those who responded and zero otherwise. Similarly, the treatment variables were coded as one if the respondent received the treatment and zero otherwise. Interaction terms were tested for the possible combined impacts of treatments, but as the greater number of variables decreases the power of the model and none of the terms were significant, the interaction terms were dropped from the final model.

Results

A total of 569 family forest ownerships were contacted. Twenty-one mailings (3.7 %) were returned as undeliverable (Fig. 1). Of the remaining contacts, 249 responded to the first mailing and 56 responded to the second mailing. The response rate is 53.6 %, and the cooperation rate is 55.7 %.

The cooperation rates vary substantially across the treatments (Fig. 2). The results from the logistic regression model show that the token financial incentive significantly impacts cooperation rates (p value = 0.002), but the other treatments

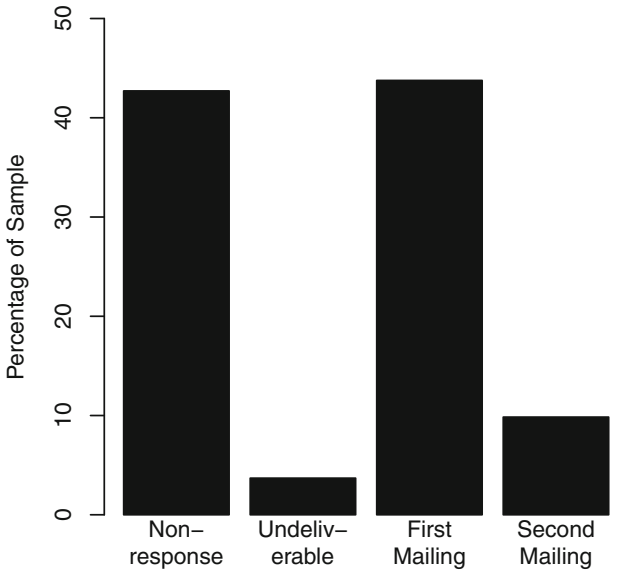

Fig. 1 Percentage of potential family forest ownership respondents by response status

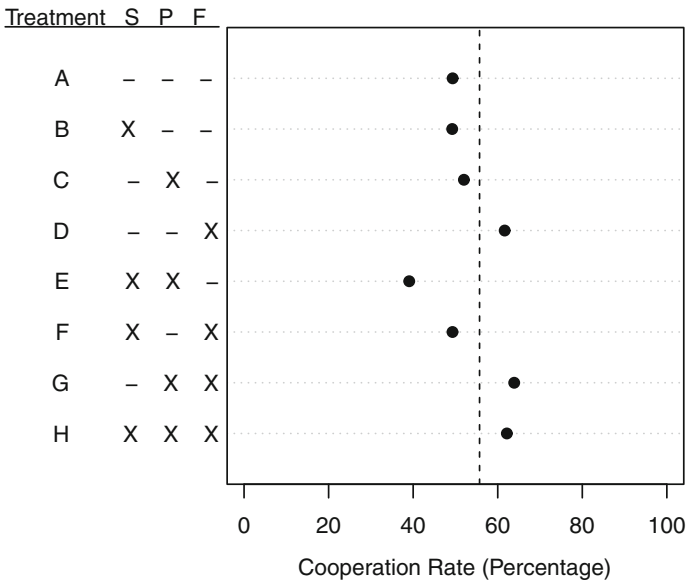

Fig. 2 Cooperation rates of family forest ownerships to a self-administered mail survey by treatments intended to test cooperation rates. *S* stamp, *P* personalization, *F* token financial incentive. The *dashed line* represents the average cooperation rate (55.7 %) and is included as a reference level

do not (Table 3). The cooperation rate for those ownerships that received a token financial incentive is 62.1 % compared to 49.1 % for those ownerships that did not receive a token financial incentive. The odds ratio implies that survey participants

Table 3 Results from the logistic regression analysis of the survey response experiment

Variable	Coefficient	p value	Odds ratio
Intercept	0.067	0.691	1.070
Treatment			
Stamps	−0.328	0.060	0.721
Personalization	0.095	0.585	1.100
Financial	0.548	0.002	1.729

are 1.7 times more likely to return the survey if they receive a token financial incentive than participants who do not receive the incentive. The effect of the personalization treatment on cooperation rate was not statistically significant (p value = 0.585). The effect of the stamped treatment on cooperation was not statistically significantly at the traditional 0.05 level, but its p value of 0.060 is suggestive, although the direction of the influence is that opposite of what was expected—i.e., those who received the stamped treatment were marginally less likely to respond than those who did not receive this treatment.

Discussion

The overall response and cooperation rates for family forest ownerships (53.6 and 55.7 %, respectively) to the NWOS in Connecticut are respectable, but they imply that 44.3 % of the potential respondents (46.4 % excluding undeliverable mailings) did not respond. As a point of comparison, the national cooperation rate for the latest iteration of the NWOS is 52.0 % (Butler et al. 2016c). To close the gap between the response and cooperation rates, it may be possible to do more in terms of "sampling frame hygiene." Researchers can use address verification/standardization and change of address services to clean the lists, as this study did do, but unfortunately, the underlying problems are often with the property tax records being out of date or simply inaccurate—issues that researchers cannot correct.

Of the treatments tested, the token financial incentive treatment was the only one that significantly increased cooperation rates. All else being held constant, this treatment increased response rates by 13.0 percentage points. The exact reason for the increase is uncertain, but it is consistent with previously published literature which has been attributed to building more trust (Dillman et al. 2014) or may have something to do with a guilt factor. The stamped treatment was marginally significant (p value = 0.060), but contrary to the hypothesized impact, the relationship was negative. The decrease in cooperation rate may be due to the stamp making the mailing looking more like junk mail while the null treatment is more official looking. The lack of impact of the personalization is also contrary to the hypothesized impact and may be related to specific attributes of this population, or maybe trying too hard can cause some mistrust. The explanations for these effects are purely hypothetical and would require interviews with respondents and nonrespondents to verify.

Conclusions

The results of this study provide strong evidence that token financial incentives are an effective way to increase cooperation rates to surveys of family forest owners. This study also provides evidence that personalization and stamps do not significantly impact cooperation rates. In fact, stamps may decrease cooperation rates. Token financial incentives do come with financial and administrative barriers, but the increase appears worth the effort.

There are of course numerous other treatments that could be tested. Survey length, sponsorship, amount of money, and timing (both time of year and length between mailings) are but a few. In addition, while there is no reason these results should not apply to other geographic areas, at least within the USA, it would be good to test these findings in other states and, ideally, in other countries. Testing other potential correlates, such as respondent age or size of holdings, may prove enlightening if the information can be obtained for both respondents and nonrespondents.

Acknowledgments Funding for this project was provided by the USDA Forest Service, State and Private Forestry program (Grant Numbers 09-DG-11420004-118 and 10-DG-11420004-081) and the USDA Forest Service, Northern Research Station. We would like to thank: Nancy Marek for assistance with data collection, the private landowners who participated in the study, and the manuscript reviewers for their constructive comments.

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