The Influence of Ethnicity and Language on Economic Benefits of Forest Fire Prevention From Prescribed Burning and Mechanical Fuel Reduction Methods[1]

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Abstract

This paper compares the non-market benefits received by several ethnic groups from prescribed burning and mechanical fuel reduction programs in California. A mail booklet with follow-up phone interview was used to elicit responses. Whites, African Americans and half the Hispanics received the survey in English, while the other half of the Hispanic sample received the survey in Spanish. Univariate test statistics on ethnicity and language indicated there were significant differences in interview response rates of Whites, African Americans and Hispanics (using both English and Spanish language versions). There is no statistical differences in willingness to pay logistic regression coefficients of Hispanics, Whites and African Americans for the prescribed burning program, but there were significant differences across groups for the mechanical fuel reduction program. Mean willingness to pay for prescribed burning was the $100 lower per year for Whites ($400) than African Americans ($505), but these differences are not significantly different. Willingness to pay of Whites ($437) for the mechanical fuel reduction program was half that of Hispanic's taking the survey in Spanish ($863), but the large confidence intervals suggest these differences are not statistically significant. The bid coefficient for African American's was insignificant for the mechanical fuel reduction program, while for Hispanics it was insignificant for the prescribed burning program. It is interesting that different ethnic groups respond differently to the two fuel treatment programs. Nonetheless, there is a substantial support and willingness to pay by Whites and African Americans for prescribed burning and for Whites and Hispanics for mechanical fuel reduction in California.

Introduction

Increasing numbers of wildfires each summer has brought forward legislative and administrative proposals for expanding prescribed burning and mechanical fuel reduction programs. A policy of accelerating the amount of land to be mechanically

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thinned or prescribed burned is not without opposition. Prescribed burning can generate significant quantities of smoke that affects visibility and creates health problems for people with respiratory conditions. Prior initiatives to increase prescribed burning in states such as Florida and Washington have often been limited by citizen opposition due to smoke and health effects. The prescribed burning program is also expensive and costs as much as $250 per acre. Thus a policy relevant issue is whether this time there will be sufficient public support for an active prescribed burning program to occur. This paper extends our previous work in Florida (Loomis and others 2002) on the performance of contingent valuation method (CVM) in representing the views of Spanish speaking Hispanics and English speaking residents of Florida towards prescribed burning and mechanical fuel reduction in two directions. First, we add a targeted sample of a third minority group (African Americans). Secondly, we inquire whether there are differences in CVM responses of Hispanics asked to take the survey in English (as is commonly done) versus in Spanish, typically a more native language for Hispanics. This allows us to better isolate the effect of language (Spanish versus English) from ethnicity (Hispanics, Whites and African Americans). The results provide the most comprehensive evaluation of the performance of CVM in a multi-racial and multi-lingual society such as California.

The importance of understanding ethnic and language differences when making public policy decisions is growing. Collectively, minority groups are close to becoming the majority in many states of the United States. Many of these minority groups speak languages other than English. U.S. Bureau of Census data indicates that 32 million adults in the U.S. speak a language other than English in their home. Census data from 1990 to 1999 showed that on average, the Hispanic population grew by 39% in the U.S, with states such as Arizona, California, Florida, New Mexico and Texas, having an even more rapidly increasing Hispanic population. In our study area in California, nearly one-third of the population (11 million people) are of Hispanic or Latino origin. Another important racial or ethnic group in California are Blacks or African Americans, representing 7.5% of the California population or 2.5 million people.

A "guiding assumption" of survey methodology has been that similarity between interviewers and respondents has some influence on survey responses (Reese and others 1986), and this similarity may increase the validity of survey responses (Hurtado 1994). However, there has been little testing of racial/ethnic interviewer effects in phone interviews (Cotter and others 1982). We suspect there would also be response rate differences to mail and phone surveys due to race and ethnicity. Besides any obvious language difficulties, many minority cultures often feel marginalized by the dominant public institutions such as government agencies and universities. As such they tend to have low voter participation. It is plausible that the same disinterest may carry over to answering referendum contingent valuation surveys, particularly if sponsored by the dominant culture’s institutions like government or universities.

Whether explicit omission of non-English speakers in the sample or implicitly through language selection effects, either potentially leads to unrepresentative samples that limits the generalizability of empirical results or yields an underestimate of benefits by omitting benefits received by non-English speaking households. To date, no studies have specifically compared CVM responses of Whites, African American, and Hispanic households.

The objective of this study is to determine if differences exist in survey response rates, overall WTP question protest responses, and differences in WTP estimates for White households, African American households, and Hispanics households (half of which took the survey in English, as is typical, and half took the survey in their native Spanish language). The two wildfire fuel reduction programs under study are quite relevant to people living in California due to the state's frequent wildfires. The unique feature of this experimental design of having half the Hispanics take the survey in English and half in Spanish will aid in understanding how a respondent's native language may shape their participation and response in CVM surveys. If cultural differences are found, it may suggest the need to tailor material in the CVM survey so as to better communicate with each culture. This research will also allow us to evaluate how well traditional non-market valuation methods such as CVM work with different ethnic groups. The methodological approach demonstrated here has broad applicability to other fire prone states with large Hispanic populations such as Arizona and New Mexico.

Hypotheses Tested

Response Rate and Refusals to Pay

Our survey modes involve an initial random digit dialing phone call with a short (5 minutes) initial interview. We then request their name and address to mail a survey booklet and schedule a time for an in-depth (20 minute) interview. Thus, the first basis of comparison is whether African Americans, Hispanics and Whites respond equally to the initial phone call and follow through on the in-depth interview. Since the interviewers identified themselves as being with a California university, it is hypothesized that these three groups might react differently to a request from a university. Therefore they may not be equally responsive to the request for an initial interview, and a follow-up in-depth interview. Such a differential response rate would make it more difficult to generalize resulting economic values from the survey sample to the population. The null hypothesis is that the overall survey response rate (R) to the CVM survey is independent of language and ethnicity:

$$\text{Ho: } R_{\text{AfricanAmericans}} = R_{\text{Hispanic-Spanish}} = R_{\text{Hispanic-English}} = R_{\text{White}}$$

This will be tested using separate four by two contingency tables and a χ^2 test for both the first and second interviews.

Responses to the WTP questions elicited during the in-depth interview are the main focus of our analysis. First, we compare the four groups reasons for refusing to pay anything. Some refusals are valid expressions of zero WTP since they reflect lack of value for the good or low income (i.e., inability to pay). Other respondents that give a zero valuation or refuse to pay because they reject the scenario or rationale that citizens should have to pay for this program, are often termed protest responses (Mitchell and Carson; Halstead and others). These respondents often do not "buy into" the premise that they are responsible for paying for the solution, or are unconvinced the solution will actually work, or feel government will not spend the money collected on the specific program. Here too, cultural differences between the majority culture and a minority culture may result in systematically different responses, with higher protest responses from a more distrusting minority culture.

To determine what might potentially be a protest response the following strategy was used in the voter referendum CVM question sequence. First, if a respondent

indicated he or she would vote against the program at their initial bid amount, they were asked whether they would pay $1. If they said they would not pay $1, they were asked an open-ended question "Why did you vote this way?". The interviewer was instructed to type in exactly what the respondent said. After all interviews were completed, the reasons were analyzed for content to classify answers by similar reasons given by the respondent. This open-ended response approach avoids having respondents fit themselves into pre-set protest categories or having the interviewer place them into pre-set categories.

Comparing the overall protest reasons given, we will test the null hypothesis of no difference between the four groups in terms of acceptance of the premise and credibility of the CVM survey. The null hypothesis is that the distribution of refusals to pay and protest responses to the CVM survey are independent of ethnicity and language:

$$\text{Ho: Protest}_{\text{AfricanAmericans}} = \text{Protest}_{\text{Hispanic-english}} = \text{Protest}_{\text{Hispanic-spanish}} = \text{Protest}_{\text{White}}$$

This will be tested using a four by two contingency table. Significance tests will be performed using a χ^2 test.

WTP Model and Related Hypotheses Tests

As suggested by the NOAA panel on contingent valuation, a voter referendum willingness to pay question format was used (Arrow and others 1993). Hanemann (1984) suggests how a respondent may answer a dichotomous choice CVM question. He views the respondent as evaluating the utility difference associated with the status quo versus paying some amount ($X) to have the program. If the utility difference is positive for the program, the individual would respond "Yes". If the utility difference is distributed logistically, a logit model can be used to estimate the parameters and allow for calculation of WTP. The effect of language and ethnicity will be tested for using a logit model in two primary ways. First, we can test whether ethnicity and language simply shifts the logit function up or down by an intercept shifter (e.g., B2, B4, B6) or affects the bid slope of the logit function (e.g., B3, B5, B7) in equation

(1): ln(Pi/1-Pi)=B0+B1Bid+B2 AfricanAmericans

+B3 Bid*(AfricanAmericans) + B4 Hispanic-Spanish

+ B5 Bid*(Hispanic-Spanish) + B6 Hispanic-English

+ B7 Bid*(Hispanic-English) +..BnXn

where: Bid is the dollar amount the respondent is asked to pay

AfricanAmericans is one for African Americans, and zero for Whites and Hispanics

Hispanic-Spanish is one for Hispanics taking the survey in Spanish

Hispanic-English is one for Hispanics taking the survey in English

The null hypotheses are:

Ho: B2 = 0; Ho: B3 = 0; Ho: B4 = 0; Ho: B5 = 0; Ho: B6 = 0; Ho: B7 = 0

The hypotheses are tested through evaluation of the t-statistic on the respective coefficients.

A more general test is to evaluate whether all the coefficients in the logit equation would vary with ethnicity and language. Thus, four separate logit equations are estimated, one each for Whites (W), African Americans (AA), Hispanic-Spanish (HS) and Hispanic-English (HE) of the form:

(2a) $\ln(Pi/1-Pi) = W0 + W1\ Bid + W2\ X2 + W3\ X3 + ... + WnXn$

(2b) $\ln(Pi/1-Pi) = AA0 + AA1\ Bid + AA2\ X2 + AA3\ X3 + ... + AAnXn$

(2c) $\ln(Pi/1-Pi) = HS0 + HS1Bid + HS2X2 + HS3X3 + ... + HSnXn$

(2d) $\ln(Pi/1-Pi) = HE0 + HE1Bid + HE2X2 + HE3X3 + ... + HEnXn$

The null hypothesis is of coefficient equality across all four groups:

Ho:W0=AA0 =HS0=HE0; W1=AA1=HS1=HE1;...Wn=AAn= HSn = HEn

The null hypothesis is tested using a likelihood ratio test comparing the separate logit equations to a pooled logit equation of all four groups. The significance test is conducted by evaluating the chi-square statistic. If this null hypothesis is rejected, then it is sensible to investigate which ethnicity and language treatments are the ones that are statistically different from each other, and which, if any, are not statistically different from each other. Thus, we will conduct a series of pairwise tests if needed.

Comparisons of mean WTP estimates across ethnicity and language groups will be used to establish if differences exist in the benefits of the public program to each group. The null hypothesis tests whether the WTP estimate by ethnicity and language are equal:

Ho:WTPWhite=WTPHispanic-English=WTPHispanic-Spanish= WTPAfricanAmericans

The results are determined by whether the confidence intervals overlap or not.

Survey Design

The survey booklet was developed in conjunction with forestry professionals in California. It described the acreage that is burned by wildfires in an average year as well as the typical number of houses lost to wildfire each year. Next, a program increasing the use of prescribed fire or controlled burning in California was described. Specifically, respondents were told that the prescribed burning fuel reduction program would reduce potential wildfire fuels through periodic controlled burning. It was acknowledged that prescribed burning does create some smoke, although far less than a wildfire. Then the survey booklet provided additional information and drawings contrasting wildfire and prescribed fire. The cost of financing this program of prescribed burning was described as a cost-share program between the State of California and the county the individual lived in.

The WTP elicitation wording was:

California is considering using some state revenue as matching funds to help counties finance fire prevention programs. If a majority of residents vote to pay the county share of this program, the Expanded California Prescribed Burning program would be implemented in your county on federal, state, and private forest and rangelands. Funding the Program would require that all users of California's forest and rangelands pay the additional costs of this program. ...If the Program was

undertaken it is expected to reduce the number of acres of wildfires from the current average of 362,000 acres each year to about 272,500 acres, for a 25% reduction. The number of houses destroyed by wildfires is expected to be reduced from an average of 30 a year to about 12. Your share of the Expanded California Prescribed Burning program would cost your household $__ a year. If the Expanded Prescribed Burning Program were on the next ballot would you vote

__In favor ___Against? "

The mechanical fire fuel reduction program was defined in the booklet as the following: *Another approach to reducing the buildup of fuels in the forest is to "mow" or mechanically chip the low- and medium-height trees and bushes into mulch. This is especially effective at lowering the height of the vegetation, which reduces the ability of fire to climb from the ground to the top or crown of the tress. In addition, mechanical "mowing" slows the growth of new vegetation with the layer of mulch acting as a barrier.*

The mechanical fire fuel reduction program was stated as not producing any smoke, unlike the prescribed burning method, so as not to deteriorate the air quality. The survey booklet explained the number of acres and houses that are destroyed each year in California due to wildfires and it stated that only one of the two programs would be implemented. The mechanical fire fuel reduction dichotomous choice willingness to pay question was stated as follows:

If the Mechanical Fire Fuel Reduction Program was undertaken instead of the Expanded Prescribed Burning Program, it is expected to reduce the number of acres of wildfires from the current average of approximately 362,000 acres each year to about 272,500 acres, for a 25% reduction. The number of houses destroyed by wildfires is expected to be reduced from 30 a year to about 12. Your share of this Mechanical Fire Fuel Reduction Program would cost your household $X a year. If the Mechanical Fire Fuel Reduction program were the ONLY program on the next ballot would you vote? ____ In favor____ Against

The funding of both of these fuel treatment programs was explained as being on a county-by-county basis, where if a majority of the county residents voted for the program, the state of California would match funds for the approved counties and everyone in the county would be required to pay the additional stated amount for their county. The bid amount, denoted by $X, varied across respondents and had the following values: $15, $25, $45, $65, $95, $125, $175, $260, $360, and $480.

Data Collection and Survey Mode

The survey was conducted through a phone-mail-phone process. To obtain a representative sample of households, random digit dialing of the households living in a sample of California counties was performed. The counties were selected so there was a mix of counties that frequently experience wildfires, counties that occasionally experience wildfires, and counties that almost never experience wildfires. Once initial contact was established, language was verified along with elicitation of initial attitude and knowledge of wild and prescribed fire, followed by the scheduling of appointments with individuals for detailed follow-up interviews. During the interim time period, a color survey booklet was mailed to the household. These interviews were conducted with the aid of this color booklet. The booklet was sent in English to Whites, African Americans and approximately one half of the Hispanic households.

The other half of the Hispanic households were sent the survey booklet in Spanish. The individuals were asked to read the survey booklet prior to the phone interview. Phone interviews were conducted in either English or Spanish depending on the language of the booklet received.

Results

Comparison of Survey Response Rates

Because the survey was conducted in two waves, ethnic groups are compared on response rates from the initial random digit dial phone survey and the follow-up in-depth interviews separately in Table 1. While, the response rates to the initial phone calls were all over 40%, there is a statistically significant difference between the four groups in response to the initial phone call. The highest response rate (75.5%) is by Hispanics phoned by a Spanish-speaking interviewer. The extra effort to contact people in their native language was definitely worthwhile in the initial interview. Specifically, a significantly higher response rate was obtained (based on the chi-square statistic of 9.98) by conducting the initial interview with Hispanics in Spanish as compared to English.

Table 1—*Comparison of Response Rates by Ethnicity and Language*

First Wave - Screener	Caucasian	African American	Hispanic English	Hispanic Spanish	Total
Total Initial Sample Contacted	794	708	733	620	2855
Completed Initial	328	308	421	468	1525
1st Wave Response Rate	41.3%	43.5%	57.4%	75.5%	53.4%
Chi-Square Total					**58.61****
Chi-Square (AA vs C)					0.298
Chi-Square (HE vs HS)					**9.98****
Second Wave - In-Depth Interview					
Refused to give address	4	4	9	1	18
Phone disconnected, moved, not available	16	25	37	47	125
Not called by end	51	3	0	0	54
Net sample for 2nd wave	257	276	375	420	1328
Total surveys completed	187	126	170	139	622
2nd Wave Response Rate	72.8%	45.7%	45.3%	33.1%	46.8%
Chi-Square Total					**34.25****
Chi-Square (AA vs C)					**10.51****
Chi-Square (HE vs HS)					**5.48***

*Significant at the 5% level

**Significant at the 1% level

Unfortunately, the opposite effect occurs in the in-depth interviews. After mailing a Spanish language booklet to Hispanic households, a relatively low response rate of 33% was obtained in this phase, significantly lower than obtained from Hispanics who were sent the survey booklet in English. This initially appeared somewhat counter-intuitive since one would have expected that the prospect of being called back by a Spanish language interviewer would have resulted in a higher response rate on the in-depth interview phase. However, the use of Spanish language on the initial call resulted in such a high response rate (75%), that we might have recruited some people who typically would not answer surveys. When they received the survey booklet and saw it was substantial (7 pages), they declined to participate in the in-depth interview. Whereas in the initial calls to Hispanics in English, we obtained a lower initial response rate (57%) but it may have been people who were serious about completing the entire survey process. On the flip side, the response rate of Whites was the highest in the in-depth interviews. Overall, the chi-square statistic suggests there is a statistically significant difference in response rates to the initial phone interview across the four samples (chi-square = 58.61) and the in-depth phone interview (chi-square 34.25). However, in the in-depth interviews, Whites have a statistically higher response rate than African Americans, while in the initial interviews they were not different.

Reasons Why Households Would Not Pay for the Program

Table 2 presents the categorization of refusals to pay, i.e., individuals that indicated they were in favor of the prescribed burning or mechanical fuel reduction program at no cost, but then would neither pay their initial bid amount nor pay $1 in the follow-up willingness to pay question. These individuals appear to favor the program but essentially have a zero WTP. Table 2 lists the reasons why a person would not pay the $1 for the prescribed burning program. The first three reasons listed in Table 2 are not considered protest responses because having no value for the program or receiving no benefits from the program, as well as not being able to afford to pay, are valid reasons for zero WTP. However, the other three categories of responses are considered protests because they were frequently prefaced with, "I am in favor of program" or "I'm all for it, but I think the program should be paid for by those living in the forests or with existing taxes."

Table 2—Reasons why respondents would not pay $1 for prescribed burning

Reason	African Americans	Hispanics-English	Hispanics-Spanish	Whites	Total
Non Protest Responses					
No Value/No Benefits	0	3	0	1	4
Cannot Afford	1	1	0	3	5
Taxes Already too High	0	0	0	2	2
Non Protest Total	**1**	**4**	**0**	**6**	**11**
Protest Responses					
Should be Paid for with Existing Taxes	2	0	0	4	6
Those that Live in Forest Should Pay	1	0	0	0	1
Other	1	3	0	1	5
Protest Total	**4**	**3**	**0**	**5**	**12**

Because of the frequency of zero cell entries for some ethnic groups for specific protest responses, only an overall chi-square of protest responses versus non-protest responses can be computed. The calculated chi-square of 1.994 indicates no statistically significant difference among the ethnic groups in the pattern of protest and non-protest reasons for refusing to pay. Nonetheless, it is noteworthy that no refusals to pay were received from Hispanic households being interviewed in Spanish. Across all four groups there is substantial overall support for prescribed burning as a means to reduce wildfire. Specifically, there were only 23 households out of 622 households (3.7%) that would not pay $1, and only 12 of these were considered protest responses. There were 116 people who said NO to their initial bid, but of these, 92 said YES to the $1.

Table 3—*Reasons Why Respondent Would Not Pay $1 for the Mechanical Fire Fuel Reduction Program*

Reason	Whites	African-American	Hispanic-English	Hispanic-Spanish	Total
Non-Protest Responses					
No Value/Benefits Where I Live	1	2	2	1	6
Cannot Afford	1	2	0	0	3
Reduces Food/ Vegetation For Wildlife	4	7	4	1	16
Method is Unnatural/ Leave Nature Alone	3	6	2	0	11
Dislike Mechanical Fuel Program	3	4	3	1	11
Non-Protest Total	**12**	**21**	**11**	**3**	**47**
Protest Responses					
Prefer Prescribed Burning Method	5	2	2	0	9
Others Should Pay For It	1	3	1	0	5
Does Not Need Additional Funding	2	2	0	0	4
Wants More Information About Program	1	1	0	0	2
Does Not Trust the State	0	1	0	0	1
Harms Their Business	0	1	0	0	1
Other	1	4	1	1	7
Protest Total	**10**	**14**	**4**	**1**	**29**
Total	**22**	**35**	**15**	**4**	**76**

Table 3 presents the result of the mechanical fuel reduction refusals to pay. The upper half of the table reflects non-protest refusals to pay while the lower half reflects protests or rejections of the premise of the CVM constructed market. Hispanics had the least amount of protest responses (5), while African Americans protested the most with 14 responses. A chi-square test was used to determine if there are differences in reasons for refusals to pay across ethnicities. With three degrees of freedom, the calculated chi-square was 1.68 and the critical chi-square value was 7.815. Since the calculated chi-square was less than the critical chi-square, we accept our null hypothesis that there was no statistical difference among ethnicities for protest and non-protest reasons for not paying at least $1 for the mechanical fuel reduction program.

Results of Logit Regressions

Table 4 presents the results of the "full" logit model that includes not only the ethnicity and language variables, but also other demographic variables (Age, Education, Home Value, Gender, Income, number of people in the household, and whether they owned their own home), attitudes (prescribed burning causes health problems-Health Problems from Prescribed Burning), as well as whether they have witnessed a forest fire (Witnessed Fire) and observed their neighbors house burning (NeighborHouseBurn). In the prescribed burning analysis, we also included a variable (FireTown) which reflects whether the household lives in a town that has either had a fire in the recent past (e.g., Oakland) or lives adjacent to forests that repeatedly burn. These other non-ethnicity variables were included to attempt to control for as many of these factors as possible to guard against our hypothesis tests of ethnicity and language being influenced by omitted variable bias.

Overall, the coefficient on the bid amount (Bid) is negative and statistically significant for both the prescribed burning and mechanical fuel reduction program. Education level and whether respondents view prescribed burning to cause health problems from smoke were both significant at the 0.05 level for the prescribed burning program. In terms of our hypotheses regarding ethnicity and language, Table 4 indicates that none of the ethnicity or language logit intercept shift variables or logit bid slope interaction terms are statistically significant at conventional levels for the prescribed burning program. However, for the mechanical fuel reduction program the Hispanic-English (HE Bid) bid slope interaction term and the Hispanic-Spanish (HS) intercept shifter were significantly different from zero at the 10% and 2% level, respectively. This suggests a less price sensitive demand for the mechanical fuel reduction program among Hispanics given the survey in English, and a higher overall support for Hispanics given the survey in Spanish.

Taken as a whole, the results in Table 4 suggest if there are other differences in ethnicity and language, they may not be adequately accounted for solely by a simple intercept shifter and bid slope interaction terms. Thus, the differences might be more pervasive, involving differences in all the coefficients. Using a specification focusing on just the variables in Table 4 with t-statistics greater than one, we estimated a reduced model for each of the four groups individually, without, of course, the ethnicity and language variables. To conserve space these are not reported here (see Ellingson, 2003 for details on the mechanical fuel reduction logit models).

Table 4—*Logit Function with Ethnicity Intercept and Bid Slope Interactions*

	Prescribed Burning			Mechanical Fuel Reduction		
Variable	Coefficient	t-Statistic	Prob.	Coefficient	t- Statistic	Prob.
Constant	2.5123	3.030	0.002	1.0525	1.24	0.212
Bid	-0.0052	-3.523	0.000	-0.0024	-1.93	0.052
African American (AA)	-0.0489	-0.089	0.928	-0.0984	-0.251	0.801
AA Bid	0.0010	0.464	0.642	0.0015	0.808	0.418
Hispanic-English (HE)	-0.0995	-0.186	0.852	-0.1124	-0.291	0.771
HE Bid	0.0029	1.387	0.165	0.0027	1.641	0.100
Hispanic-Spanish (HS)	0.4861	0.717	0.473	1.1234	2.272	0.023
HS Bid	0.0029	1.154	0.248	-0.0008	-0.424	0.671
Gender	-0.3114	-1.211	0.225	-0.3284	-1.694	0.090
Home Value	4.17E-07	0.767	0.442			
Health Problems from Prescribed Burning	-0.8459	-2.572	0.010	-0.2540	-1.038	0.299
Witnessed Fire	0.1649	0.585	0.558			
Neighbor House Burn	0.5292	1.057	0.290			
Income	-5.08E-06	-1.383	0.166	-1.50E-05	-1.571	0.116
$Income^2$				1.07E-10	1.943	0.052
Age	-0.0022	-0.245	0.806	0.0099	1.361	0.173
Number in Household	0.1115	1.262	0.206	0.0447	0.687	0.491
Education	-0.0982	-2.033	0.042	-0.0329	-0.712	0.475
Experience Smoke				-0.0296	-0.147	0.883
Own Home				-0.1228	-0.537	0.591
FireTown	0.2375	0.690	0.489			
Mean dependent variable	0.79					.63
McFadden R^2	0.096					.060
LR statistic (17 df)	45.787					42.14
Probability (LR stat)	0.0001					0.0004
Sample Size	474					536

Prior to reporting the results of the likelihood ratio test for coefficient equality we summarize the results of the individual logit equations. For the prescribed burning program the bid slope coefficients are statistically different from zero at the 1% for Whites and African Americans but not for either Hispanic group. It is encouraging that the sign is negative on bid in both Hispanic regressions, but it is unusual for the bid coefficient to be insignificant in dichotomous choice CVM responses. This is contrary to what Loomis and others (2002) found for Hispanics living in Florida for a

prescribed burning program there. One difference may be that Hispanics in Florida are predominantly from the Caribbean area, while Hispanics in California are from Mexico and Central America. For the mechanical fuel reduction program the bid amount is statistically significant at the 5% level for Whites and Hispanics given the survey in Spanish, but not for Hispanics given the survey in English or for African Americans.

To test whether the logit willingness to pay coefficients are different between all the four treatments, likelihood ratio tests were conducted, and are reported in Table 5. For the prescribed burning program, there appears to be no statistical difference in the sets of coefficients between the four models (calculated chi-square =33.34 while the critical was 36.15 at the .05 level). These results are consistent with what Loomis, and others (2002) found in Florida when comparing English and Spanish samples logit models as well. However, for the mechanical fuel reduction models, this same test indicates there is a statistically significant difference at the 5% level between the four groups logit willingness to pay coefficients. In the conclusion we hypothesize why the results are different for the two programs.

Table 5—*Likelihood Ratio Tests of Coefficient Equality Across Ethnic Groups.*

	Prescribed Burning	**Mechanical Fuel Reduction**
Groups	Log Likelihood	Log Likelihood
White	-70.91	-103.95
African Americans	-46.35	-71.70
Hispanic-English	-62.19	-101.51
Hispanic-Spanish	-33.48	-54.79
Sum of Unrestricted	-212.93	-331.95
Pooled-Restricted	-229.61	-349.13
Calculated Chi-Sq	33.34	34.36
Critical Chi Sq @5%	36.15	28.87
Significantly Different?	No	Yes

Willingness to Pay Results

Table 6 displays the mean willingness to pay for Whites, African Americans, and Hispanics given the survey in Spanish and the respective confidence intervals. We used the following formulae (Hanneman 1989) to calculate mean willingness to pay:

$$\text{Mean WTP} = (\ln (1 + \exp (\alpha))) / \beta$$

The product of the coefficient and mean values for all independent variables excluding the bid coefficient is denoted by α and β is the absolute value of the bid coefficient (Park and others1991).

Mean willingness to pay for prescribed burning was $100 lower per year for Whites ($400) than for African Americans ($505), but these differences are not significantly different. Interestingly, using the African American logit coefficients with demographics of Whites, cuts the difference in WTP in half, suggesting that demographic differences play a large role in the difference in WTP. For the mechanical fuel reduction program, willingness to pay of Whites ($437) is half that of Hispanics taking the survey in Spanish ($863), but the large confidence intervals suggest these differences are not statistically significant. The bid coefficient for African American's was insignificant for the mechanical fuel reduction program, while for Hispanics it was insignificant for the prescribed burning program, thus precluding calculation of statistically significant estimates of mean WTP. It is interesting that different ethnic groups respond differently to prescribed burning and mechanical fuel reduction. Nonetheless, there is a substantial support and willingness to pay by Whites and African Americans for using prescribed burning, and for Whites and Hispanics for mechanical fuel reduction in California. Whites mean WTP is similar for the prescribed burning and mechanical fuel reduction program.

Table 6—*Mean WTP and 90% Confidence Intervals for Prescribed Burning and Mechanical Fuel Reduction Program in California.*

	Mean	90% Confidence Interval
Prescribed Burning		
Whites	$400	$312-$608
African Americans	$505	$363-$1,126
Mechanical Fuel Reduction		
Whites	$437	$278-$1,813
Hispanic-Spanish	$863	$494-$2,124

Conclusions

This paper investigated if there were ethnicity and language differences in survey response rates, reasons for refusing to pay, and willingness to pay for forest fire management policies. Using a univariate test (chi-square), we found a statistical difference in survey response rates between African Americans, Whites and Hispanics for both the initial random digit dialed interviews and the scheduled follow-up CVM phone interviews. Using Hispanics' native language (Spanish) did improve the response rate to the initial interviews, but this did not carry over to the follow-up CVM interviews involving the survey booklet. Reasons for not being willing to pay even one dollar for the prescribed burning and mechanical fuel reduction programs were similar among African Americans, Whites, and Hispanics taking the survey in English and Spanish. A logit regression that pooled all four groups responses to the prescribed burning program, and simply controlled for ethnicity and language using an intercept shifter variable and bid slope interaction term did not indicate any statistical differences between the four groups. A likelihood ratio tests on the four separate ethnicity and language logit models confirmed that the coefficients in the logit equations are not statistically different for the prescribed burning program.

Hispanics had an insignificant coefficient on the prescribed burning program

bid, a finding robust to whether the survey was administered in English or Spanish. In contrast, Whites and African Americans had a negative and statistically significant coefficient on the bid amount for prescribed burning, allowing us to calculate their mean willingness to pay for this program. Whites' willingness to pay was $400 while African Americans was $505 for the prescribed burning program, but these differences are not significantly different. Using the African American logit coefficients with demographics of Whites, cuts the difference in WTP in half; suggesting that demographics differences play a large role in the difference in WTP.

For the mechanical fuel reduction program, there were significant differences in the bid slope coefficient for Hispanics given the survey in English, with this group being less price sensitive to the cost of the program than Whites and African Americans. Hispanics given the survey in Spanish also voted in favor of the mechanical fuel reduction program at a higher rate, than any of the other three groups. Hispanics given the survey in Spanish had an annual willingness to pay per household of $863, twice that of Whites at $437. One possible reason for statistically significant differences in logit willingness to pay coefficients for Hispanics and higher willingness to pay of Hispanics may be that the mechanical fuel reduction program is quite labor intensive compared to prescribed burning. As such, Hispanics may believe the mechanical fuel reduction program will provide them with job opportunities, resulting in greater support for this program.

Overall, our results suggest substantial willingness to pay of California households for a prescribed burning or mechanical fuel reduction program that would decrease the number of acres burned by wildfires in California by 25% and reduce the number of houses burned in a typical year by 18. African Americans appear to prefer prescribed burning, and Hispanics appear to prefer mechanical fuel reduction. Whites have equivalent willingness to pay for either program.

With average willingness to pay of at least $400, and more than 12 million households in California, the willingness to pay for either of these programs is about $5 billion. Note, the survey explicitly indicated that only one of the programs would be implemented, so that it would be incorrect to add the values of these two fuel reduction programs together. Finally, this survey was conducted before the major wildfires swept through Southern California during the fall of 2003. We would expect that these willingness to pay value would have increased substantially had we conducted the survey after these wildfires. A comparison of the post fall 2003 values and these pre 2003 values might yield interesting insights as to whether willingness to pay is sensitive to these recent fire events in Southern California.

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