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**The Effects of Climate Change Perceptions on  
Willingness to Fund the Prevention of Wetland Loss**

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*Selected Paper prepared for presentation at the Southern Agricultural Economics  
Association Annual Meeting, Orlando, FL, February 6-9, 2010*

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## **Abstract**

Using contingent valuation, we estimate willingness to pay for prevention of wetland loss in coastal Louisiana, and identify the factors that influence respondent choice, specifically climate change perceptions. Eighty two percent of respondents were willing to pay for some form of wetland loss prevention.

## **Introduction**

In April of 2007 the Louisiana Governor signed *Louisiana's Comprehensive Master Plan for a Sustainable Coast*, which details the state's plan for restoring and sustaining the Louisiana coast. This document details the State of Louisiana's position on what steps must be taken to sustain its coast that has lost 1.2 million acres since the 1930's and is, at present, losing 15,300 acres annually (CPRA, 2007). A substantial portion of this land loss is in Louisiana's wetlands. Refer to Figure 1, which is a map of coastal Louisiana that illustrates past wetland loss and projected future wetland loss. The benefits of preventing further loss of wetlands include storm damage mitigation, providing recreational opportunities, and protecting valuable ecosystems.

The Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) authorized federal funds for projects designed to restore, maintain, and prevent the future losses of wetlands, and more will soon be implemented. Federal and State governments have already begun to prevent the future loss of wetlands, but the perception of these efforts by the public is important for the continued progress of these projects. The primary reason for the need of continued support by the public and policymakers is due to the scale of the projects that are being proposed and the cost associated with sustaining

these ecosystems into the future. At present there is little to no evidence on whether public support exists.

Another issue that has arisen over recent years is what type of land loss prevention projects should be used to maintain coastal Louisiana. The two primary types of projects that are being compared are rapid land-building, which build wetlands rapidly through dredging, and more natural methods such as river diversions, which take a longer time period to prevent losses of wetlands. Both approaches have positive benefits and drawbacks depending on why one desires the wetlands to be maintained. Before hurricanes Katrina and Rita the primary focus of building and preventing the loss of wetlands was the improvement of the coastal ecosystem, and the more natural processes such as river diversions provide better ecological benefits than do the rapid land-building approach. Due to the devastating effects of Hurricanes Katrina and Rita on human life and businesses, focus has shifted from being solely concerned with ecological benefits of Louisiana's wetlands towards encompassing human-benefits. Due to this shift more projects have been concerned with restoring and maintaining wetlands quickly so that the benefits of storm damage mitigation can be achieved in the near future rather than in the distant future. Hence, more projects are using the rapid land-building approach to restore and maintain the coastal wetlands of Louisiana.

The objective of this study is to provide estimates of the value that residents of Louisiana place upon the prevention of projected future wetland loss. This will be accomplished using the contingent valuation method to obtain willingness to pay and willingness to accept values. In addition to providing estimates of the public's willingness to pay for these projects, this thesis identifies the motivating factors that

contribute to public support of the prevention of projected future wetland loss. Possible motives for support or non-support include benefits to the environment, storm damage mitigation, impacts and combating sea level rise due to climate change, preference for land now versus in the future.

A key focus of this study is the perception of climate change as a motivating factor for supporting or, not supporting, and choosing between long run and short run projects that prevent future wetland loss. This thesis first clarifies how residents of Louisiana perceive climate change and how they believe climate change affects sea-level rise. This thesis determines if and how the public's perception of sea-level rise due to climate change affects their willingness to pay for coastal wetland protection projects. The data that are needed for this analysis were obtained via a mail survey sent out to a random sample of Louisiana residents.

This paper is organized as follows. The next section provides background information on Louisiana's wetlands. This is followed by a section discussing the factors that are believed to affect respondent's decision making process. The next section covers the survey methods and the results from the survey. Econometric estimation methods and results are then covered, and followed by the WTP/WTA estimation. This paper ends with concluding remarks.

## **Background**

Louisiana wetlands are some of the most important and largest wetlands in the United States. Louisiana's wetlands make up 25 percent of the nation's total coastal wetlands and 40 percent of the nation's total salt marshes are located in Louisiana (CPRA, 2007). A wetland can be defined in many different ways. One of the most basic

definitions is that wetlands are areas where soil is saturated with water either seasonally or year round (LAC, 2004).

More important than what makes up the wetlands are benefits that wetlands provide. Louisiana's wetlands provide many benefits environmentally, commercially, and socially. Environmentally these wetlands provide habitat for mammals, amphibians, fishes, and migratory birds. They can also act as nurseries for shellfish and fish.

The wetlands also play a vital role in reducing damage from storms along Louisiana's Gulf Coast. The wetlands provide a natural barrier for the inland by reducing storm surge and decreasing wave energy.

The wetlands of Louisiana also play a vital role for the state economically. Twenty six percent (by weight) of commercial fish landings in the lower 48 states is provided by Louisiana's wetlands. Almost 30,000 of Louisiana's citizens have a job that is provided through this commercial fishing industry (LAWF 2005). Louisiana's wetlands also play an important role in protecting the state's and the nation's energy infrastructure from storm damage.

Governments, business entities, and individuals have undertaken practices that have harmed and decreased the quantity and quality of wetlands. Such practices include the construction of canals and levees; oil and natural gas exploration, production, and pipelines; and agricultural practices. Yet, the responsibility does not solely fall upon humans for damages to wetlands. Natural processes such as subsidence, saltwater intrusion, wave erosion, tropical storms and hurricanes, and sea level rise have also played a role in the decrease in wetlands.

Louisiana's land lost since 1932 has been about 1,900 square miles, which is about size of the state of Delaware. This coastal wetland loss in Louisiana accounts for 80 percent of the total wetland loss in the lower 48 states (LWCRTFWCRA, 1998). If no actions are taken to curve this trend of wetland loss 700 square miles could be lost in Louisiana by the year 2050 (LCA 2004).

Actions have been taken by the federal government and the State of Louisiana's government to prevent wetland loss and attempt to restore the wetlands of Louisiana. One of the major pieces of legislation that has addressed is the Coastal Wetlands Planning, Protection and Restoration Act (PL-101-646, Title III, CWPPRA).

Then in 2005 Hurricane Katrina and Rita devastated coastal Louisiana. Reports estimated that approximately 217 square miles of wetlands were converted into open water. The also had devastating affects on human life, infrastructure, and property. It is estimated that the losses of physical capital from Hurricanes Katrina and Rita totaled between \$70 and \$130 billion (CPRA, 2007). Pre-Katrina and pre-Rita protection and restoration efforts were primarily focused on environmental and ecological benefits of the wetlands. Post-Katrina and post-Rita efforts have become increasingly more concerned with the protection that wetlands can provide against hurricane and flood damage.

### **Factors Affecting Choice**

This analysis is aimed at determining whether individuals are willing to support a short or long run proposal over no action being taken to prevent future wetland loss. It also determines if one of the proposals that prevents future wetland loss is preferred over the other. It also allows us to determine what factors influence an individual to prefer one of the three proposals.

The independent variables that are included in the analysis are as follows: income, bid, climate change perceptions, risk preferences and perceptions, time preference of money, proximity of home to the coast, hurricane expectations, age, gender, race, and education. Many of these variables are found in almost all contingent valuation analyses.

#### *Price and Income*

Income and bid need to be in the model because the model is determining if and how much an individual is willing to pay to receive a good or the benefits from a good, and economic theory dictates that price and income should influence the decision. Income needs to be in this type of contingent valuation model because it is a hypothetical model and not based on a real transaction where a budget constraint can affect willingness to make a transaction. Income provides a measure of the budget constraint on the respondent's decision. Bid has to be in the model because of the law of demand. As the price for the proposals increases the probability of support should decrease.

#### *Climate Change Perceptions*

One of the major aspects of this study is determining how climate change perceptions affect willingness to pay for projects that will prevent future wetland loss in Louisiana. There has been a substantial amount of work done on how people's perceptions of climate change affect their willingness to pay for climate change mitigation, but there has not been an extensive amount of work done concerning how perceptions of climate change affect individuals' willingness to pay for a specific environmental project that can be affected by climate change.

Cameron (2005) has evaluated willingness to pay for climate change mitigation in multiple papers. Cameron (2005) found that people's willingness to pay for climate



change mitigation was dependent upon their perceptions of climate change. It was found that if people perceived climate change to be damaging in the future they were more willing to pay to mitigate climate change. Yet, uncertainty about the effects of climate change caused individuals to be less willing to support policies.

We hypothesize that if people have the perception that climate change affects sea level rise and that sea level rise is a threat to respondents, then their willingness to pay for programs that will protect current wetlands and build future wetlands will be affected. There were four questions asked in the survey to obtain the respondents' perceptions about climate change.

#### *Time Preference*

Because individuals are comparing proposals that provide benefits over different periods of time, it is hypothesized that respondent's time preference will have an effect on their decision as well. In our decision model, the respondents chose between three proposals. One proposal, short run, provides benefits sooner but the benefits do not last as long, the next proposal, long run, does not provide benefits as soon but the benefits last longer into the future, and finally an option where no benefits will be provided. The cost of the long run and short run proposals are assumed to be the same, but the long run proposal provides more aggregate benefits. So, if the respondents were choosing solely on the benefits themselves and not the timing of the benefits then the long run proposal should be chosen, if they are willing to support any kind of action being taken.

Yet, if respondents do choose the short run over the long run proposal, and the only difference between the two proposals is timing, it is assumed that this decision is due to discounting. This discounting could be caused by the time preference of money,

desiring land now as compared to later due to age and/or an assumption of lower probability of receiving benefits in future time periods. Questions were asked on the survey that will provide data on implied discount rates.

### *Risk*

Since the decision in question can have implications for improving individual's safety it is hypothesized that individual's risk perception and risk preference will have an affect on their decision between the three proposals. The conclusions of Lusk and Coble (2005) imply that both risk preferences and risk perceptions could affect the public's willingness to pay for the prevention of future wetland loss projects. The question is how individuals perceive a risk from the loss of wetlands and if those perceptions affect their willingness to pay for these projects. Information that will allow this hypothesis about risk perception and preferences was obtained through the survey.

One way of obtaining risk perception is to obtain information on the respondent's expectations of how often category 3 or greater hurricane will affect them. These hurricane expectations are hypothesized to affect a respondent's decision because one proposed benefit of wetland loss prevention which is believed to be reduced risk from hurricanes. Risk preferences were obtained through a question asking if respondents would make a gamble.

### *Proximity to the Coast*

The variable for proximity from the coast is hypothesized to affect respondent's decision because if an individual lives closer to the coast the benefits of the actions can have more of an impact upon them than it would upon someone who does not live in close proximity to the coast. This was obtained in the survey through asking respondents

where they live and their residence information to develop a proxy of measurement for distance from the coast.

### *Payment Mechanism*

This analysis measures willingness to pay to prevent future coastal wetland loss in Louisiana and willingness to accept to allow for the same wetland loss. This section provides a discussion of willingness to pay and willingness to accept that is based on Haab and McConnell (2003). Theoretically, the value that individuals place upon the prevention of future wetland loss should not necessarily be affected by the format of the question. Yet, it has been found in empirical studies that willingness to pay and willingness to accept are not always equivalent. One explanation is prospect theory or loss aversion where individual's decision is based upon the net change relative to the status quo, but not by the individual's well-being before and after the change (Kahneman and Tversky, 1979). Another explanation for the disparity between the two is that individuals lack the ability to substitute between public and private goods (Hanemann, 1991).

Willingness to pay has become the preferred method partly because it is believed that stated preferences cannot be obtained through a measure of willingness to accept because it is not incentive-compatible, meaning respondents are more likely to exaggerate the compensation that they would require as compared to what they would be willing to pay. Due to these factors the NOAA Blue Ribbon Panel supports using willingness to pay in contingent valuation studies (NOAA, 1993). Both measures are taken in this study and a comparison of the mean willingness to pay and mean willingness to accept measurements are compared. The reason that we are using both

measures is because that we are not sure how the respondents view the property rights of the wetlands in Louisiana. If the respondents perceive that the property rights of the wetlands lands lie with them then we would need to know what they would be willing to accept to take the loss of the wetlands, but if they do not perceive the property rights to belong to them then willingness to pay to maintain the wetlands is the measure that should be used.

### *Question Order*

The order in which the long run and short run were presented in the survey was different between the different versions of the survey. Half of the surveys had the long run proposal presented first, and for the other half of the surveys the order was reversed. This treatment will also be tested to determine if it had an effect on the decision between the proposals.

### **Survey**

This section discusses the survey that was administered, the questions that were asked, and the data that was provided that was necessary to test the previously stated hypotheses. The survey was mailed to a random sample (stratified by population) of 3,000 households in Louisiana in May, 2009, and follow up survey was mailed in June, 2009. A total of six-hundred eighty surveys were returned. Of those returned 501 came from the first mailing and 179 came from the second mailing, and made 73.72% and 26.28%, respectively, of the total. The overall response rate was 22.7%.

Table 1 shows a comparison of the sample and the population demographics. Population data is from the 2005-2007 American Community Survey estimates (U.S. Census Bureau 2009).

The sample is older, whiter, more male, more educated, and wealthier than the population. Thirty percent of the sample is over the age of 65 whereas the percentage of the population over 65 is just 12.20%. The sample is 82.23% white while the population is 64% white. The sample is 59.25% male while the population is 48.60% male. Also, 53.09% of the sample holds an associates degree or higher, whereas only 24.5% of the population had achieved an associates degree or higher. Additionally, the sample's median income is \$5,732 higher than the population median income of \$40,160.

Kruskal-Wallis and two-sample tests of probability were used to determine if there was a significant difference in demographics across the two previously stated survey treatment groups, WTP/WTA and question order of long and short run proposals. No significance was found across treatment samples except for difference in education and years lived in their stated zip code under the WTP/WTA treatment. The education variable was significant at the 5% probability level ( $p = 0.0434$ ; means for each treatment are 1.77 for WTP and 1.65 for WTA). The variable for how many years the respondent has lived in this zip code was significant at the 5% probability level ( $p = .0152$ ; the mean number of years for WTP treatment = 22.23 and for WTA treatment = 22.94). Although statistically significant, we do not consider these differences to be cause for concern. Accordingly, we proceed under the assumption that the treatment samples are not biased to the extent of being a serious concern.

At the beginning of the survey respondents were given a brief introduction to wetland loss in Louisiana. The introduction stated, "Coastal Louisiana has lost an average of 34 square miles of land, primarily marsh, per year for the last 50 years. From 1932 to 2000 coastal Louisiana lost 1,900 square miles of land, roughly an area the size of the

state of Delaware.” A map was also provided that illustrated the land loss from 1932-2000, predicted land loss from 2000-2050, land gain 1932-2050, and predicted land gain from 2000-2050. Also, they are told, “Hurricanes Katrina and Rita eroded an additional 217 square miles in 2005 alone.” Finally, “if no action is taken, Louisiana could potentially lose an additional 700 square miles of land, about equal to the size of the greater Washington D.C. – Baltimore area, by the year 2050.”

There were 20 versions of the survey because of the 10 different bid values for the proposals, half being WTP and half being WTA, and half having the long run proposal presented first and half having the short run proposal presented first. Table 2 shows which bid value, WTP or WTA format, and order of the long run and short run proposals for each version. The respondents were asked to evaluate two separate proposals that will prevent future wetland losses. They were provided time frames for the implementation of the two proposals and for how long the land will be maintained once the proposal is completed. The short run proposal would take 5 years to implement and the land loss would be prevented until the year 2050, and in the long run proposal implementation would take 25 years and the wetland loss would be prevented until year 2185. Each respondent was presented with the same price for both proposals. After the proposals were presented the respondent had to decide whether to support the short run proposal or the long run proposal at the bid value once every year for ten years or to vote for no action being taken. The yes or no response for willingness to fund one of the proposals provides the WTP/WTA value and dependent variable for the choice model. Also, depending on the version the question was either asked in the WTP or WTA format. The WTP format asks respondents if they would be willing to pay a tax once a year for ten

years to prevent future wetland loss. While the WTA format asks the respondents if they would be willing not to receive a tax refund once a year for ten years.

Table 3 illustrates the respondents' preferences between the short run proposal, long run proposal, and no action being taken. Of the 628 responses 83.47% preferred some action being taken to prevent future wetland loss, while only 16.53% responded that they preferred no action to be taken. Table 4 shows the number of votes that each proposal received under the ten different bids. The table is also separates the WTP from the WTA votes.

Table 5 shows the benefits that were important to respondents when they were making their decision and the number of votes that each benefit received. The potential benefits that were of the most importance to the respondents were storm protection and protection of the environment/ecosystem, which made up 53.9% and 19.52% of the responses respectively.

The following question obtained data on the respondent's perception of climate change and its affect on the respondent's decision between the three proposals. Table 6 shows the results for following question:

*“Scientists believe that climate change is occurring and that it may significant potential consequences, such as increased temperatures leading to sea-level rise. How strongly do you believe that climate change should be taken seriously?”*

### **Econometric Estimation Methods**

The dependent variable that we analyze here has to be analyzed with a model that allows for a trichotomous unordered discrete dependent variable. The multinomial logit model was chosen for use in analyzing the dependent variable in paper. The following

discussion of the multinomial logit model is based upon Greene (2000). The model below, (1), is a multinomial logit.

$$\text{Prob}(Y_i = j) = \frac{e^{\beta'_j x_i}}{\sum_{k=0}^J e^{\beta'_k x_i}}, j = 0, 1, \dots, J. \quad (1)$$

The estimated equations provide a set of probabilities for the  $J + 1$  choices for a decision maker with characteristics  $x_i$ . Any indeterminacies in the model must be removed. If any vector of  $q$  is defined as  $\beta_j^* = \beta_j + q$ , then the identical set of probabilities result because the terms involving  $q$  all drop out. A normalization that solves this problem is to assume that  $\beta_0 = \mathbf{0}$ . The probabilities become

$$\text{Prob}(Y = j) = \frac{e^{\beta'_j x_i}}{1 + \sum_{k=1}^J e^{\beta'_k x_i}}, j = 0, 1, \dots, J, \quad (2)$$

$$\text{Prob}(Y = 0) = \frac{1}{1 + \sum_{k=1}^J e^{\beta'_k x_i}}.$$

The model implies that the  $J$  log-odds can be computed

$$\ln \left[ \frac{P_{ij}}{P_{i0}} \right] = \beta'_j x_i.$$

This can be normalized on any other probability and obtain

$$\ln \left[ \frac{P_{ij}}{P_{ik}} \right] = x'_i (\beta_j - \beta_k).$$

The multinomial model estimation is as follows. The log-likelihood can be derived by defining, for each individual,  $d_{ij} = 1$  if alternative  $j$  is chosen by individual  $i$ , and 0 if not, for the  $J + 1$  possible outcomes. Then, for each  $i$ , only one of  $d_{ij}$ 's is 1. The log-likelihood is a generalization of the logit model:



$$\ln L = \sum_{i=1}^n \sum_{j=0}^J d_{ij} \ln \text{Prob}(Y_i = j).$$

By differentiating (2), we find that the marginal effects of the characteristics on the probabilities are

$$\delta_j = \frac{\partial P_j}{\partial x_i} = P_j[\beta_j - \sum_{k=0}^J P_k \beta_k] = P_j[\beta_j - \bar{\beta}]. \quad (3)$$

Due to this, every subvector of  $\boldsymbol{\beta}$  enters every marginal effect, through the probabilities and through the weighted average that appears in  $\delta_j$ . These values are computed with the parameter estimates. Although the usual focus is on coefficient estimates, equation (3) suggests that there is at least some potential for confusion. Note, for example, that for any particular  $x_k$ ,  $\partial P_j / \partial x_k$  need not have the same sign as  $\beta_{jk}$ . The standard errors are estimated using the delta method. For computation, let  $\boldsymbol{\beta} = [0, \beta'_1, \beta'_2, \dots, \beta'_J]'$ . We include the fixed  $\mathbf{0}$  vector for outcome 0 because although  $\boldsymbol{\beta}_0 = \mathbf{0}$ ,  $\gamma_0 = -P_0 \boldsymbol{\beta}$ , which is not  $\mathbf{0}$ . Note as well that  $\text{Asy. Cov}[\beta_l, \beta_m] = \mathbf{0}$  for  $j = 0, \dots, J$ . Then

$$\begin{aligned} \text{Asy. Var}[\hat{\delta}_j] &= \sum_{l=0}^J \sum_{m=0}^J \left( \frac{\partial \delta_j}{\partial \beta_l} \right) \frac{\partial P_j}{\partial x_i} \text{Asy. Cov}[\beta_l, \beta_m] \left( \frac{\partial \delta'_j}{\partial \beta_m} \right), \\ \frac{\partial \delta'_j}{\partial \beta_l} &= [1(j=1) - P_l][P_j I + \delta_j x'] + P_j[\delta_l x']. \end{aligned}$$

Table 7 summarizes the explanatory variables that will be used in this model. This summary includes the type, a description, and the mean of the variables. Income will not be included in this model because we are assuming linear marginal utility of income. The bid variable comes from the tax/refund that was presented to the respondents. The bids are shown in Table 4. Demographic variables included in the model are gender, race, age, number of individuals living in the household, education, and latitude where the

respondent lives. Four questions in the survey sought respondents climate change preferences, and one of those questions was chosen for the model because all four were highly correlated. The variable “Discount” is the measure of time value of money, which are ranges of discount rate, that is used in the model. “RiskPref” provides the variable to explain how risk preferences affect the respondent’s decision, and “HurrFreqHI” and “HurrFreqDK” are the variable for risk perceptions. “WTP” and “QuesOrder” are the binary variables that allow for the treatment affects, WTP vs. WTA and question order of the long run and short run proposals, respectively, to be tested.

### **Econometric Estimation Results**

Table 8 represents the parameters coefficients, standard deviations, and significance levels for the multinomial logit model specified earlier, also measures of the model’s fit statistics. The base option for two of the decisions presented in this table was the no action option, and short run proposal was the base for the decision between the long run proposal and the short sun proposal. Through this model the coefficients, standard deviations, and significance levels were provided for the comparison of the short run proposal vs. no action, the long run proposal vs. no action, and the long run proposal vs. the short run proposal. The decision to choose the short run proposal compared to no action is influenced by race, latitude, climate change perception, confidence in government, and the treatment for willingness to pay. Whereas the decision to choose the long run proposal compared to no action is influenced by gender, age, climate change perception, confidence in government, and the treatment for willingness to pay. Age and climate change perceptions were the variables that influenced the decision between the long run proposal and the short run proposal.

Further interpretation of the results in Table 8 is difficult unless the parameter coefficients for the variables are converted. Table 9 presents the relative risk ratios associated with these parameter coefficients. The ratios are presented as percentage difference from the base option in the decision. The relative risk ratios represent the relative increase in the probability of observing the selected option relative to the base option. Relative risk ratios are presented for all the variables in the model, but the ratios that correspond with variables that are significant are shown in bold.

Starting with variables that were shown to be significant for decision between the short run proposal vs. no action, we observe that individuals that are white are 133.38 percent more likely to choose the short run proposal over no action being taken. Also, as latitude for the zip code of the respondent's residence increases by a unit the respondent becomes less-likely to choose the short run proposal over no action. If the respondent answered that they do not at all believe in climate change then they were 52.55 percent less likely to choose the short run proposal over no action. Also respondents that had no confidence in the government to accomplish wetland loss prevention were 82.23 percent less likely to choose the short run proposal over the no action.

For the comparison of the long run proposal vs. no action the demographic variables that are significant include gender and age. Males are 129.49 percent more likely to choose the long run proposal over no action, but as age increases by a unit the probability of choosing the long run proposal over no action decreases by 3.24 percent. As with the previous decision the choice between the long run proposal and no action is also influenced by belief in climate change and confidence in government. Respondents that do not at all believe in climate change are 80.47 percent less likely to choose the long

run proposal over no action, and if the respondent stated that they had no confidence in government to provide the wetland loss prevention are 82.47 percent less likely to choose the long run proposal over no action.

For the decision between the long run proposal vs. the short run proposal, age and climate change perception are significant influences on the decision. As age increases by a unit, the respondents are 4.00 percent less likely to choose the long run proposal over the short run proposal. If respondents do not at all believe in climate change then they are 58.84 percent less likely to choose the long run option over the short run option.

Also, for both decisions, the short run proposal vs. no action and the long run proposal vs. no action, the payment mechanism treatment, willingness to pay compared to willingness to accept, is a significant factor influencing respondents choice. In the short run proposal vs. no action decision respondents were 76.57 percent less likely to choose the short run proposal over no action when they received the WTP payment mechanism. In the long run proposal vs. no action respondents that received the WTP payment mechanism were 66.65 percent less likely to choose the long run proposal over the no action.

From the parameter coefficients and means for the variables in the above model we attempted to calculate an average measure of willingness to pay and willingness to accept. However we were not able do so because the bid coefficient is not significant, rendering any calculations of WTP/WTA meaningless (Hensher, Rose, and Greene, 2005).

## **Conclusions**

This study indicates that the respondents were heavily in favor of the short run proposal as compared to the long run proposal and no action being taken. The results show that respondents that were white and/or lived closer to the coast were more likely to choose the short run proposal option over no action, but not believing in climate change and/or having no confidence in government made them less likely to make the same choice. Factors affecting the decision between the long run proposal and no action differed slightly from the previous. The factor that made respondents more likely to choose the long run proposal over no action was being male, while increases in age, not believing in climate change, and having no confidence in government made respondents less likely to choose the long run proposal over no action. When it came to choosing between the long run and short run proposals the variables age and no belief in climate change both decreased the probability of choosing the long run proposal over the short run proposal. Also, if the respondent was presented with willingness to pay as the payment mechanism as compared to willingness to accept they were less likely to support either of the proposals over no action.

Climate change perceptions proved to have a significant affect on the respondent's decision between the three proposals. In both decisions, the short run proposal vs. no action and the long run proposal vs. no action, respondents that did not believe in climate change were less likely to support either the short run proposal or the long run proposal over no action being action. Also, when respondents did not believe in climate change they were less likely to choose the long run proposal over the short run proposal.

There will be future research performed with this data and model. Further work will be done to ascertain a meaningful willingness to pay estimate. Because bid was not a significant variable, a meaningful WTP/WTA value could not be calculated. However we believe that by separating the model by the WTP/WTA treatment effect meaningful values can be generated. Also, future research will test if the assumption about the marginal utility of income being linear is correct.

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Table 1  
Comparison of Sample and Population demographics  
Proportions (N=680)

		Sample	Population*
Household size		2.45	2.63
Age: 65 or over		30.08%	12.20%
Education	H.S. diploma	42.41%	35.30%
	Associates or Bachelor's degree	34.89%	17.70%
	Graduate or Professional degree	18.20%	6.80%
Income		\$45,892	\$40,160
Gender	Males	59.25%	48.60%
Race	White	82.23%	64.00%

\*Population data from ACS 05-07 estimates

Table 2  
Survey Versions

Version	WTP/ WTA	Order	Bids	Version	WTP/ WTA	Order	Bids
#1	WTP	SR-LR	\$50	#21	WTA	SR-LR	\$50
#2	WTP	SR-LR	\$71	#22	WTA	SR-LR	\$71
#3	WTP	SR-LR	\$101	#23	WTA	SR-LR	\$101
#4	WTP	SR-LR	\$144	#24	WTA	SR-LR	\$144
#5	WTP	SR-LR	\$204	#25	WTA	SR-LR	\$204
#6	WTP	SR-LR	\$291	#26	WTA	SR-LR	\$291
#7	WTP	SR-LR	\$413	#27	WTA	SR-LR	\$413
#8	WTP	SR-LR	\$588	#28	WTA	SR-LR	\$588
#9	WTP	SR-LR	\$836	#29	WTA	SR-LR	\$836
#10	WTP	SR-LR	\$1,189	#30	WTA	SR-LR	\$1,189
#11	WTP	LR-SR	\$50	#31	WTA	LR-SR	\$50
#12	WTP	LR-SR	\$71	#32	WTA	LR-SR	\$71
#13	WTP	LR-SR	\$101	#33	WTA	LR-SR	\$101
#14	WTP	LR-SR	\$144	#34	WTA	LR-SR	\$144
#15	WTP	LR-SR	\$204	#35	WTA	LR-SR	\$204
#16	WTP	LR-SR	\$291	#36	WTA	LR-SR	\$291
#17	WTP	LR-SR	\$413	#37	WTA	LR-SR	\$413
#18	WTP	LR-SR	\$588	#38	WTA	LR-SR	\$588
#19	WTP	LR-SR	\$836	#39	WTA	LR-SR	\$836
#20	WTP	LR-SR	\$1,189	#40	WTA	LR-SR	\$1,189

Table 3  
Preference Between Long/Short/No Action

Variables	Frequency	Percent
Short run option	436	69.32%
Long run option	89	14.15%
No action	104	16.53%
Total responses	629	

Table 4  
Willingness to Pay Responses for Different Bids

	\$50	\$71	\$101	\$144	\$204	\$291	\$413	\$588	\$836	\$1,189	Total
Short run	21	28	17	25	12	22	20	9	16	12	182
Long run	2	2	2	6	7	4	3	4	5	7	42
No action	10	6	9	8	2	8	6	6	11	4	70
Total	33	36	28	39	21	34	29	19	32	23	294

Willingness to Accept Responses for Different Bids

	\$50	\$71	\$101	\$144	\$204	\$291	\$413	\$588	\$836	\$1,189	Total
Short run	26	18	25	22	17	28	26	20	27	31	240
Long run	6	6	1	4	3	3	4	3	4	8	42
No action	5	3	3	3	1	6	0	2	2	4	29
Total	37	27	29	29	21	37	30	25	33	43	311

Table 5  
Potential Benefits of Greatest Importance

Potential benefits	Frequency	Percentage
Storm protection	359	53.90%
Protection of recreational opportunities	19	2.85%
Protection against sea-level rise due to climate change	36	5.41%
Protection of the environment/ecosystem	130	19.52%
Protection of commercial fisheries	11	1.65%
Other	13	1.95%
No potential benefits in mind	98	14.71%
Total	666	

Table 6  
Belief in Climate Change

	Frequency	Percentage
Very strongly	283	41.93%
Somewhat strongly	225	33.33%
Not at all	107	15.85%
I don't know	60	8.89%
Totals	675	

Table 7  
Multinomial Logit Model Variables and Descriptions

Variables	Type	Description	Mean*
Bid	Continuous	Cost per respondent for the stated wetland loss prevention	398.43
Gender	Binary	1 if male; 0 if female	0.62
Race	Binary	1 if white; 0 otherwise	0.87
Age	Continuous	continuous between 19 - 84	54.29
Household	Ordered	Household size 1 if # is 1; 2 if # is 2; 3 if #;	2.48
	Categorical	4 if # is 4; 5 if # is 5 or greater	
Education	Ordered	Highest level of education 1 if some school	1.73
	Categorical	or high school; 2 if associates or bachelors; 3 if masters, professional, or doctoral	
Latitude	Continuous	Latitude based upon zip code of respondent	30.66
CCperception	Binary	1 if respondents do not at all believe in climate change; 0 otherwise	0.16
PreKnowledge	Binary	1 if respondent had prior knowledge of actions to protect wetlands; 0 otherwise	0.80
Government	Binary	1 if not at all confident that government agencies can accomplish such actions; 0 otherwise	0.51
Influence	Binary	1 if respondents believe responses will influence policy; 0 otherwise	0.17
Discount	Ordered Categorical	1 if <1.89%; 2 if 1.89% - 10.31%; 3 if 10.31% - 26.425; 4 if >26.42%	2.68
RiskPref	Binary	1 if respondents does not take a gamble; 0 otherwise	0.68
HurrFreqHI	Binary	1 if respondent believes a Category 3 hurricane will affect them between 1 and 10 years; 0 otherwise	0.73
HurrFreqDK	Binary	1 if respondents don't know how often a category 3 hurricane will affect them; 0 otherwise	0.14
WTP	Binary	1 if the payment mechanism was willingness to pay; 0 if willingness to accept	0.49
QuesOrder	Binary	1 if long run proposal was presented first; 0 if short sun was presented first	0.49

\*Means calculated over observations used in regression only.

Table 8  
 Estimated Coefficients, Standard Errors, and Marginal Effects for the Multinomial Logit Model

Variables	Short Run (Base No Action)		Long Run (Base No Action)		Long Run (Base Short Run)	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Bid	-0.0001	0.0004	-0.0001	0.0005	0.0000	0.0004
Gender	0.3575	0.3241	0.8307	** 0.4164	0.4732	0.3243
Race	0.8475	** 0.4271	0.8843	0.5386	0.0368	0.4217
Age	0.0080	0.0113	-0.0329	** 0.0146	-0.0409	*** 0.0115
Household	0.0259	0.1328	0.0897	0.1660	0.0638	0.1279
Education	0.3206	0.2019	0.3367	0.2592	0.0161	0.1984
Latitude	-0.3517	** 0.1565	-0.1399	0.2078	0.2118	0.1734
CCperception	-0.7454	** 0.3771	-1.6332	*** 0.5918	-0.8878	* 0.5187
PreKnowledge	0.2714	0.3436	0.0040	0.4416	-0.2674	0.3611
Government	-1.7276	*** 0.3517	-1.7410	*** 0.4304	-0.0134	0.3092
Influence	0.3526	0.5022	0.5411	0.5905	0.1885	0.3800
Discount	-0.0134	0.1442	0.1795	0.1896	0.1928	0.1513
RiskPref	0.0891	0.3187	-0.1715	0.4015	-0.2607	0.3077
HurrFreqHI	0.2821	0.4404	0.0901	0.5638	-0.1919	0.4547
HurrFreqDK	-0.1373	0.5153	-0.2581	0.6915	-0.1208	0.5754
WTP	-1.4512	*** 0.3118	-1.0982	*** 0.3939	0.3530	0.2964
QuesOrder	0.0142	0.2861	0.2505	0.3691	0.2363	0.2898
Constant	11.9006	5.1278	5.2054	6.7894	-6.6951	5.6070

Log Likelihood = -321.51

LR chi2(34) = 104.10

Prob > chi2 = 0.00

Pseudo R2 = 0.1393

\*\*\*, \*\*, \* Significant at p = 0.01, 0.05 and 0.10, respectively

Table 9

Relative Risk Ratios (interpreted as a percentage change from the base; base category is listed second)

Variables	Short Run	Long Run	Long Run
	vs. No action	vs. No Action	vs. Short Run
Bid	-0.01%	-0.01%	0.00%
Gender	42.98%	<b>129.49%</b>	60.51%
Race	<b>133.38%</b>	142.12%	3.74%
Age	0.80%	<b>-3.24%</b>	<b>-4.00%</b>
Household	2.63%	9.39%	6.58%
Education	37.79%	40.03%	1.63%
Latitude	<b>-29.65%</b>	-13.05%	23.60%
CCperception	<b>-52.55%</b>	<b>-80.47%</b>	<b>-58.84%</b>
PreKnowledge	31.18%	0.40%	-23.46%
Government	<b>-82.23%</b>	<b>-82.47%</b>	-1.33%
Influence	42.28%	71.79%	20.74%
Discount	-1.33%	19.66%	21.27%
RiskPref	9.32%	-15.76%	-22.95%
HurrFreqHI	32.59%	9.43%	-17.46%
HurrFreqDK	-12.83%	-22.75%	-11.38%
WTP	<b>-76.57%</b>	<b>-66.65%</b>	42.34%
QuesOrder	1.43%	28.46%	26.65%