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Using contingent valuation to measure the economic impact of climate change on hiker recreation during New England peak foliage

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Using Contingent Valuation to Measure the Economic Impact of Climate Change on Hiker Recreation During New England Peak Foliage

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Abstract

This paper seeks to define and develop an economic tool for measuring willingness to pay for hiking recreation in the face of climate change in New England during the peak foliage season. Potential climate change impacts to New England are defined, along with relevant economic tools for measuring the market value of non-marketed goods. Ultimately, contingent valuation is chosen as the most viable option, and a survey is developed, pretested, and ready for implementation at the trailhead of Mt. Major in New Hampshire.

Keywords: Contingent valuation, stated preference, climate change, non-marketed public goods, New England, hiking, foliage

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Introduction

This paper will discuss the economic implications of climate change on New England hiking recreation. It will look specifically at predicted changes to leaf peeping season, and its potential implications to hiking in the New England region. For this specific niche economic public sector, the paper will delve into implications for hiking demand and consumer willingness to pay. Methodologies for measuring the value of public goods and willingness to pay (WTP) will be explored before choosing a single method. Contingent valuation will ultimately be the chosen method for evaluating consumer WTP for hiking in New England, specifically during peak foliage.

Research Questions

The three research questions discussed here are: *1) How do people value New England hiking in monetary terms? 2) How do valuations change during peak foliage as compared to other times of the year?* And *3) How might willingness to pay for hiking change as climate impacts foliage?* To answer these research questions, this paper will be split into four subsections. First, this paper will discuss climate change impacts to the U.S Northeast. Then, it will summarize the various ways economists measure valuation of non-marketed goods and propose the use of contingent valuation. Finally, the paper will explain the process of creating a contingent valuation survey to measure hiker willingness to pay for hiking during peak foliage in New England, and the impact of climate change on willingness to pay.

This research is particularly interesting because it explores the intersect of economics in public goods markets with projected climate change. The resulting real-world implications to tourism markets has yet to be researched. It is important for the tourism industry to understand

climate change implications in order to prepare, increase resiliency and adapt for predicted future changes.

Preliminary Review of the Literature

This preliminary review of literature is an overview of the main sources used in this thesis. Because little research has been done on the economic implications to climate change in New England specifically, relevant literature found pertains to each separate facet, as well as the few studies looking at economic implications of climate changes.

Scientific Background and Climate Change Literature

At the University of New Hampshire, a UNH Sustainability Institute (UNHSI) publication analyzes specific impacts of climate change to the northern New Hampshire region titled, *Climate Change in Northern New Hampshire*. Another publication focuses on, *Climate Change in Southern New Hampshire*. Local professors used statistically downscaled global climate model simulations to make predictions as to what the future climate of northern New Hampshire might look like in terms of three emissions scenarios. One key finding in this publication includes implications to New Hampshire ski areas. The publication also references the Northeast Climate Impacts Assessment Report, which will be referenced in this paper to discuss implications of climate change across New England, and not just in New Hampshire. The New Hampshire report is also important in that it details changes to a small region within New England. This information will allow for a detailed assessment of the economic implications to such changes. This UNHSI report for northern New Hampshire provides scientific information which estimates, "by the end of the century, snow-covered days are projected to decrease by 20 percent under the lower emissions scenario or 50 percent under the higher emissions scenario"

(Wake, Burakowski, & Wilkinson, 2014). The climate projections outlined in this report are referenced in Seection 1 to provide climate change background information to readers in this thesis.

These publications will help develop the scientific background needed to discuss impacts from climate change to the tourism and outdoor recreation industries in New England. Further sources are used discuss impacts of changes in climate on skiing and winter sports specifically. There is a wealth of information on climate change in New England. The challenge will be to apply the information into what changes we will see in hiking recreation as climate changes fall foliage. However, the local professors and authors of this report will be a useful resource. Further research, including national assessments of climate change, will provide additional content from which to pull scientific climate information.

EPA data is referenced in addition to the University of New Hampshire's current literature and research in the field of climate impacts to the New England area. An important component in communicating research findings will be to inform readers of the predicted future climate changes to New England. This will serve as background information to explain why the market for fall hiking activities will shift in the face of climate change. The EPA covers precipitation and sea level rise in New England, impacts on agriculture, and impacts on winter recreation (US EPA, n.d.). These seasonal climate impacts serve to inform research in this thesis, and EPA publications provide a highly regarded, and trustworthy reference.

Scientific research specifically tailored to New England climate, such as research on foliage sensitivity is referenced in Section 1. In their paper, Diver and Kyne provide an analysis of New England fall foliage sensitivity to changes in climate. Their research leads them to conclude autumn coloration will suffer in the face of climate change. Further, an unfortunate and

consequential side effect of weaker or shortened color displays is a suffering market for foliage tourism in our region. Kyne and Diver explain how New England color displays rely on a delicate balance of factors such as day length and light intensity, temperature, and moisture (Kyne & Diver, 2012). Changes to these factors due to overall climate change are guaranteed to adversely impact fall foliage, and therefore leaf peeping tourism. Leaf peeping tourism is important for other outdoor recreational tourism in New England as well. Maple production and maple tourism will be impacted by these changes, as well as hiking, among other recreational tourism activities.

This research is especially important to this thesis, as it explains the domino effect of consequences of changes to an important seasonal tourist attraction in the New England region. This reference links impacts to foliage tourism with recreational and leisure tourism and details the significant subsequent impact of small shifts in climate over time.

Scientists have ways of looking at climate change impacts to specific industries. In an article by Finger and Lehmann, they analyze climate change impacts to consumer behavior in a case study on lidos in Zurich, Switzerland. Lidos are public outdoor swimming pools, which attract over 2 million visitors to Zurich each year. Lidos are valuable to locals in Zurich as well, making them an integral feature in Swiss society and culture, in addition to being an important part of the Zurich economy (Finger & Lehmann, 2012). In this particular study, Finger and Lehmann use negative binomial regressions paired with a stochastic weather generator to model changes in lido visitation patterns associated with climate change. The researchers predict an increase in the number of lido visitors, particularly in the months August and September, as the climate continually warms. This projected increase in visitors in August and September is particularly interesting, because in New England, fall foliage is at its peak during these months.

However, Finger and Lehmann explain how temperatures too hot might actually serve to decrease visitation to lidos, and suggest that in the case of higher temperatures, individuals will favor cooler, mountain regions. For the purposes of hiking and foliage, an increase in temperatures might attract tourists, even if foliage intensity suffers.

Although this paper will not model negative binomial regressions or using weather generators to analyze visitation patterns to mountains during fall foliage, the information provided by Finger and Lehmann provide alternative insight that individuals might prefer cooler mountainous regions over lakes and swimming holes for recreation as climate warms.

How Economists View Climate Change

In order to analyze the economic impact of climate change on New England outdoor recreation, it will first be necessary to understand how economists (rather than scientists) view climate change, and what methods they use to analyze the economic impacts of these changes.

In his book, *Climate Economics: Economic Analysis of Climate, Climate Change and Climate Policy*, Richard Tol discusses valuation methods for climate change such as the Travel Cost Method, and the Hedonic Pricing method. Tol's work is reference in Section 2 to summarize revealed preference methods. The Travel Cost Method is discussed and evaluate its effectiveness in measuring the value of New England recreation in terms of tourism. And while the Hedonic Pricing method will, (most likely) not be relevant in this research, it may be summarized to showcase a variety the economic methods for measuring how people value the environment. In this book, Tol also looks at labor productivity in the face of climate change in terms of outdoor, physical labor. When he speaks of labor productivity, he is mainly talking about areas where the climate is already very hot, and where the increasing temperature will make it progressively less feasible to work outside. The impact causes increased migration, and

potentially increased tourism to New England and northern regions. In addition, Tol discusses the Contingent Valuation Method, otherwise known as the stated preference valuation method to measuring economic valuation of non-marketed goods.

While Tol's book is only one of many economic sources referenced in this paper, it covers the key economic valuation methods to tackling climate change issues. Tol's book will help summarize the basics of how economists view climate change on a microeconomic level. Economic information from this source allows for discussion of potential major economic changes in hiking recreation decisions as a result of climate changes.

The Southern Swedish Forest Research Centre at the Swedish University of Agricultural Sciences conducted a study assessing consumer valuation of nature areas using the travel cost method discussed in Tol's book. This study contributes to an overarching effort to, "assist ecosystem managers in land use planning processes and in designing a sustainable nature-based recreation strategy" (Ezebilo, 2016). To help ecosystem managers improve biodiversity and create a sustainable recreational management strategy in Sweden, they had to first develop a comprehensive understanding of the supply and demand of ecosystem services. Using the travel cost method, the researchers were able to label the economic value of recreational nature areas. This valuation was then used to assess the availability of recreational nature areas to individuals with different socioeconomic backgrounds.

This study by Ezebilo, 2016, provides an example of economic valuation of non-marketed public goods. The travel cost method will not play a fundamental role in this research to measuring the impact of climate change on hiking recreation in New England. However, it is important to see how economic tools can be applied in the real world to value public goods.

In addition to the travel cost method, there are alternative ways of viewing climate change through an economic lens. Shaw and Loomis focus on providing readers example frameworks for analyzing the economic effects of climate change on outdoor recreation. Further, the authors use their framework to predict a 14 to 36 percent increase in warm weather recreation, and a decrease in snow and cold weather recreation (Shaw & Loomis, 2008). This article provides valuable information applicable to this thesis. The paper outlines ways of analyzing climate change impacts to the New England outdoor recreation economy, and provides solid research backing a shift in the market and availability of cold weather outdoor recreation. In addition, their research references several authors who used different variations of economic modeling to analyze market challenges associated with climate change. For example, Shaw and Loomis reference Mendelsohn et al. and their development of the Ricardian model (Shaw & Loomis, 2008). The Ricardian model uses property values, as opposed to the value of goods to determine climate change impact to businesses. The frameworks mentioned in this literature, as well as the resources within it, are referenced in Section 2 to identify ways of valuing non-marketed economic goods.

Shaw and Loomis also outline shortcomings to analyzing the impact of climate change on outdoor recreation, acknowledging the need for additional research on impacts to specific activities. Section 2 of this thesis discusses shortcomings and barriers associated with the approaches mentioned.

Economic Analysis of Climate Impacts to Tourism

In a case study of the Kysuce region in the Czech Republic, Mindas and Skvarenina discuss the climate change impacts to tourism. The authors first paint a picture of what the climate in the Kysuce region will look like 60 years from now. Following the general rules of

climate modeling, Mindas et al. considers multiple climate scenarios across four different climate models. The authors conclude climate change will bring more moderate winters with increased precipitation. The models predict hotter summers and more extreme precipitation, which will cause flooding in the region (Mindas & Skvarenina, 2016). The paper is then broken down to analyze how climate change will impact the number and frequency of days in each season, where weather conditions are ideal for recreational activities. Mindas et al. consider summer weather suitable for water activities, summer weather ideal for biking tourism, snow conditions as a basis for winter tourism, and finally snow conditions fitting for downhill and cross-country skiing (Mindas & Skvarenina, 2016).

Some unexpected, yet very important information retracted from this literature are the very specific explanations of what defines ideal weather for specific recreational activities. For example, Mindas et al. explains weather suitable for hiking, "can be characterized by a sunshine or less cloudy day, with little or no wind and with minimal rainfall or no rainfall", and they approximate, "solar radiation should exceed the long-term average for the day, the wind speed should be less than 3 $m.s^{-1}$ and a rainfall should be less than 1 mm" (Mindas & Skvarenina, 2016).

While Mindas & Skvarenina's paper is not focused on the New England region, the key findings are applicable to this research in New England, and the format of the paper outlines a successful way of communicating weather impacts to recreational tourism. The paper analyzes changes in conditions on summer tourism, hiking, mountain areas, and ski tourism. And while climate change will impact New England and the Kysuce region in different ways, the similarity in latitudinal location allows leeway to make inferences. Sources evaluating climate change predictions for New England are used to further make extrapolations as to how climate changes

similar to ones facing the Kysuce region will impact New England hiking recreation and tourism. This paper does not delve into the economic implications of changes in available recreational tourism. However, discussing climate change impacts to tourism transitions seamlessly into the economic impacts of such changes to climate. Before delving into the economic implications of climate change, it will first be necessary to explain how climate change will impact the New England region.

In addition to research done across the globe, there have been studies conducted which evaluate climate change impacts to specific industries in our own New England region. In an article which features one of UNH's own professors and researchers, Ju-Chin Huang, the authors examine climate change, "direct and indirect effects on the closure of ski areas" (Beaudin & Huang, 2014). In addition, the authors take a close look at how ski areas have made specific investment decisions in an effort to secure their resiliency and sustainable competitiveness in the ski industry of New England. In the result of the study, the authors suggest climate change has played a role in shifting the New England market structure for skiing and predict consequent future alterations to the market as climate continues to change.

This research will be particularly beneficial here. Beaudin and Huang's research provides this paper with concrete evidence to the hypothesis that climate change will alter the tourism and recreation industry in New England. A discussion with Dr. Huang's to get her expert opinion on contingent valuation will be valuable in this research.

Section 1: Projected Climate Change Impacts to New England

Introduction

To measure changes in valuation of hiking recreation as a result of a change in the quality of public goods due to climate change, it is first necessary to understand climate change implications to the New England region.

An abundance of research has been conducted in the New England region to project future climate changes. Several climate researchers at the University of New Hampshire have published reports which predict climate changes to specific areas of the region. Two separate publications by the Sustainability Institute at the University of New Hampshire outline climate change impacts to the Northern and Southern New Hampshire regions (Wake et al., 2014a; Wake et al., 2014b). Additionally, a technical scientific report assesses *Past and Future Changes in Climate and Hydrological Indicators in the U.S Northeast* (Hayhoe et al., 2007). These and other publications are used in this section to provide an extensive overview of what can be expected in terms of the future climate of New England. Also, this section looks specifically at fall tourism rates, and climate change implications to fall foliage.

Climate Change Projections

Climate change is arguably one of the most pressing issues of our time. Extensive research by scientists globally has culminated in an abundance of evidence indicating that the global climate is changing, and that over the past four decades the primary driver of change is human activity (Wake et al., 2014a). The Intergovernmental Panel on Climate Change (IPCC) is the leading body internationally, which reviews and assesses the most recent climate research pertaining to technical, scientific, and socio-economic information relevant to the understanding

of climate change (IPCC). At regular intervals, the IPCC provides accurate and relevant scientific research to decision makers through Climate Assessment Reports (IPCC). The most recent report published in 2015, summarized observed changes in the climate system by saying: "Warming of the climate system is unequivocal, and since the 1950's, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen" (IPCC, 2014 pp.40). The report affirms the conclusion by Wake et al., (2014b), that anthropogenic greenhouse gas emissions have had a primary role in contributing to current and future climate changes (IPCC, 2014 pp.40). This pressing global issue will impact various regions of the world in different ways. The following section describes the impact of climate change to the New England region of the U.S.

New England Climate Changes

New England is seeing the impact of global climate changes now, and will continue to see climate change impacts well into the future. In a report on the *Past and Future Changes in Climate and Hydrological Indicators in the U.S Northeast*, Hayhoe et al. reveal that since the 1970's, temperatures in the U.S Northeast have been increasing steadily. Impacts to climate change indicators such as precipitation, temperature, drought, and growing seasons have the potential to impact agriculture, industry, natural ecosystems, rural life, and tourism. Over the last century, annual temperatures over New England have increased by an average of 0.08 °C (±0.01). Over the most recent three decades, the rate of change has increased significantly to a rate of change of 0.25°C (±0.01). In higher emissions scenarios, the projected temperatures for the coming century are predicted to be significantly greater than in lower emissions scenarios

and will have greater impact on summer temperatures relative to winter temperatures (Hayhoe et al., 2007).

These forecasts are an average of changes across the U.S Northeast. However, climate change will have variable impacts on different areas of New England. Predicted climate changes are dependent on the specific qualities of various regions such as northern or southern New Hampshire. For example, landlocked New England states may see different changes in future climate relative to coastal regions.

New Hampshire Climate Change Projections

Climate change projections vary depending on the area of interest within New England. In northern New Hampshire, noticeable changes have occurred in climate indicators including maximum annual temperatures, the number of days with minimum temperatures less than 32 degrees Fahrenheit, the length of the growing season, annual precipitation, extreme weather events, and number of snow-covered days (Wake et al., 2014a). In their assessment of these indicators in northern New Hampshire, Wake et al. found average annual maximum temperatures have warmed 0.5 to 2.1°F. Studies showed the greatest above average warming occurred during the fall and winter seasons. Further, the researchers found a decrease by two weeks in the number of days with minimum temperatures under 32°F. Data analysis showed an increase in the length of the growing season by two to three weeks, and an increase in annual precipitation by 7 to 18 percent. Another significant finding was a decrease in the number of snow covered days in northern New Hampshire (Wake et al., 2014a).

Similar climate changes are visible in southern New Hampshire as well. Wake et al. (2014b) submitted another report analyzing climate changes to southern New Hampshire with the same indicators as those evaluated in northern New Hampshire. The southern New

Hampshire report by Wake et al. showed average annual maximum temperatures have increased 1.1 to 2.6°F, slightly higher than warming in northern New Hampshire. For southern New Hampshire, the greatest warming was seen during the winter season. Comparably to northern New Hampshire, southern New Hampshire has seen a decrease in the number of days with minimum temperatures below 32°F. Additionally, the growing season in southern New Hampshire has lengthened by two to four weeks, and annual participation in the region has increased by 12 to 20 percent. Extreme participation events have also increased, with dramatic events resulting in large floods over the past decade. Finally, as in northern New Hampshire, the southern part of the state has seen a decrease in the number of snow-covered days (Wake et al., 2014b).

These findings are significant in that they show climate change is already impacting the New England region, and specifically the state of New Hampshire. These seen changes, and projected future changes further necessitate action and research pertaining to the environmental economic tourism implications of inevitable climate changes.

Climate Change Impacts to New England Foliage

Year after year, fall foliage attracts tourists from around the country and around the world to the New England region. "The most vibrant fall foliage is displayed by the red maple and sugar maple; it is the relative abundance of these two species, interspersed with evergreens, which makes the New England Region such a popular destination for tourists pursuing fall foliage displays" (Norris, 1999). Little research has been done to predict climate change impacts to peak foliage in New England. However, scientists seem to largely agree that climate change will impact the timing and intensity of foliar displays in the region. Changes in New England climate are seen through temperature, extreme precipitation events, and drought frequency

(Wake et al., 2014a). These factors, which are predicted to change greatly in the coming century, are highly influential on the quality, timing, and duration of fall foliage (Kyne & Diver, 2012).

Existing research on climate change impacts to foliar patterns in New England suggest inevitable and fluctuating predicted changes. As an additional threat, New England fall forest coloration may be impacted more by climate change relative to forests in other areas (Kyne & Diver, 2012). However, scientists have not reached consensus on whether or not these changes are likely to cause an increase or decrease in the quantity and quality of autumn color displays. Either way, climate change impacts to fall foliage have potential to impact fall tourism rates in New England (Kyne & Diver, 2012).

Kyne and Diver report there are a number of factors which influence the duration and intensity of fall foliage. Environmental factors they say, such as precipitation and soil moisture, day and nighttime temperatures and sunlight, and drought frequency, have a significant impact on foliage. In terms of precipitation, a projected increased frequency of extreme events (being precipitation events with rainfall greater than or equal to 2 inches within 24 hours) are most likely to impact the length of foliar displays in terms of their destruction capabilities. Soil moisture and a lengthened growing season are reported to potentially dull color displays during the fall. Finally, whether seen during the day or at night, warmer autumn temperatures have the potential to delay peak foliage between one and three weeks (Kyne & Diver, 2012). Kyne and Diver are able to identify correlations between foliage displays and climate change indicators. However, their research leads them to an ambiguous conclusion. Kyne and Diver conclude that climate change has the potential to dramatically impact fall foliage in New England to the extent that we will see implications to fall tourism. They do not identify whether or not the potential impacts to foliage will be positive or negative. Instead, Kyne and Diver suggest additional

research be done to assess whether or not fall foliage colorations will be positively or negatively impacted by climate change (Kyne & Diver, 2012).

Eighteen years of data collection on climate change impacts on phenology of temperate deciduous trees lead Archetti et al. to similar conclusions. In this study, researchers collected data from eight deciduous tree species in a hardwood forest of New England. Reserachers analyzed the correlation between foliar coloration, and temperature and precipitation at specific times of the year. In their analysis, researchers found a likelihood each species will have a slightly different coloration response to future climate changes (Archetti et al., 2013). In their research, Archetti at al. come to the conclusion that while their empirical analysis does, "not provide insight into the underlying mechanisms, they can help [us] identify the drivers that must be included in a model". Ultimately however, their data indicates an increase in the amount of autumn colors for most species under standard IPCC projections (Archetti et al., 2013). Like Kyne and Diver, Achetti et al. were unable to verify whether or not changes in the autumn colors they predict will have positive or negative economic and environmental implications.

So far, predictions of climate change impacts to autumn colors are somewhat ambiguous. Knowing changes have significant potential to impact our fall foliage season is enough to realize the potential threat to the New England economy. Fall foliage in New England brings tourists, along with a total of approximately $8 billion in revenues to the area each year (USDA 2011a). Specifically, Vermont foliage tourism resulted in $332 million in revenues and 3.6 million visitors in 2009 (Graham, 2011). In the same year, New Hampshire and Maine saw a combined 16.6 million visitors, and 2.6 billion in tourism revenues just for the fall season (Kane, 2010). A report published in 1999 revealed that the fall season in Vermont accounts for a reported 22% of

all tourism throughout the year. Likewise, Maine reported their fall season brings in 20% of total annual tourists (Norris, 1999).

Conclusion

Projected climate change impacts to New England will inevitably result in alterations to the foliage season. Fall in New England attracts tourists and is vital to the economy in the region. Therefore, potential negative impacts from climate change on foliage are a real and pertinent threat to the New England economy. If climate change results in dulled or shortened autumn, visitors previously attracted to the region for its foliar displays may look to alternative vacation spots. More specifically, hikers driven to the region for a vibrant, scenic view will find mountains in the region less enticing. In order to determine how much hikers value New England foliage and whether or not they will generally be adversely impacted by changes in foliage, it is necessary to understand how economists measure monetary valuation of public goods.

Section 2: A Proposal to use the Contingent Valuation Method to Evaluate the Impact of Climate Change on New England Peak Foliage Hiking

Introduction

Future climate changes will have a profound impact on the tourism industry in economies worldwide. After all, reduced, "visitation to a host community and reduced expenditures are easily understood by many to be potentially damaging economic impacts" (Shaw & Loomis, 2008). To a large extent, scientific climate analysis has been conducted to predict future climate changes in New England. However, research on the economic impact of such change on recreational tourism is less plentiful. To assess how climate change will impact New England hiking specifically, it will be necessary to gain a comprehensive understanding of how economists look at climate change. This section will compare and contrast different methods economists use to evaluate economic impacts of climate change, and identify the most viable option to measuring climate impacts to hiking in New England.

Dealing with Non-Marketed Goods

There are certain complexities associated with measuring willingness to pay for goods, which are non-marketed, which are not tangible, and which cannot be owned. Essentially, these goods only have intrinsic value to the consumer. The individual consumer may value this good, however more likely than not, they may not know or understand that value monetarily. For this paper, the non-marketed good is hiking trails. Mountain trails are a public good, meaning no person can be excluded from using it, and one person's use does not reduce the good's availability to others. Because hiking is not tangible, and because it is a free, public good, individuals may simultaneously value it intrinsically, and not understand this value in monetary

terms. Economically speaking, this presents an issue. Market goods in economics are given value based on the buyer's willingness to pay for the good in a competitive market. When no market exists for a good, and when no competition exists, it makes it difficult for economists to understand the monetary value of that good. Fortunately, there are economic methods, which can be applied in such scenarios. These methods are categorized into two groups: revealed preference methods and stated preference methods.

Economic Methods for Valuing Environmental Goods

Some research has been done to study climate change impacts on the outdoor recreation industry. In a journal published by Climate Research, authors Shaw and Loomis discuss "Frameworks for Analyzing the Economic Effects of Climate Change on Outdoor Recreation" (Shaw & Loomis, 2008). The purpose of their paper is to evaluate what methods do and don't work for measuring climate change impacts on the outdoor recreation industry. While their research was on various studies in a variety of locations around the world, the authors', "basic point is that there is evidence that visitation will be influenced by climate change, and, for some activities, the effect will be substantial" (Shaw & Loomis, 2008).

Depending on the industry at hand, economists use a variety of tools to evaluate how climate change will impact the economy. In general, economic analyses of industries are conducted to measure the value an individual or society places on a good or service. Some goods however, such as non-marketed goods, do not exist in a, "market that allows recovery of observable quantities and prices" (Shaw & Loomis, 2008). These non-marketed environmental goods, such as mountains for hiking, or shorelines for swimming, require specific methods for willingness to pay valuation. The travel cost method (TCM), the hedonic pricing method (HPM),

and the contingent valuation method (CVM) provide three optional approaches to measuring the economic value of a nonmarket environmental good.

Revealed Preference Methods

Revealed preference methods, otherwise known as indirect preference methods, use marketed complimentary goods to estimate the value of a given non-marketed good (Tol, 2014). Examples of revealed preference methods include the Travel Cost Method (TCM) and the Hedonic Pricing Method (HPM), both described in the following section. As implied in the name, the complimentary good used in the TCM are the travel costs to the consumer for traveling to a specified non-marketed destination such as a national park. The complimentary good used in the HPM are housing prices (Adamowicz et al., 1994).

The Travel Cost Method

The Travel Cost Method presents an alternative approach to the HPM and the CVM for measuring the value individuals place in a non-marketed, recreational site. Because hiking is a free good, finding its monetary value involves identifying a complimentary marketed good, with an identifiable monetary value. As the name suggests, the TCM identifies the travel cost as the complimentary good with monetary value.

The TCM measures an individual's willingness to pay to travel, in terms of the travel costs associated with the destination of interest. In other words, the TCM uses the, "costs incurred by an individual or group traveling from their origin (e.g., primary residence) to the destination as a proxy for the trip price. Price (travel cost) and quantity (number of trips) data can then be used to estimate a demand function that is applied to measure trip demand and values" (Sardana, Bergstrom, & Bowker, 2016). The measured travel cost price to the consumer takes

into account not only the costs associated with driving (travel), but other costs as well. Incorporated in the price of travel is the opportunity cost of time (Sardana et al., 2016).

In the study done by Sardana et al., researchers used the TCM to measure willingness to pay for visits to national parks in the southern U.S. Using the TCM, researchersfound the travel costs incurred by individuals and groups traveling from their origin to the destination. In their estimated demand function, price was defined by travel cost, and quantity was defined by the number of trips. Their resulting data values showed a measure of trip demand. Their research values the opportunity cost of time as one-third the value of the individual's wage rate (Sardana et al., 2016). In the same way the TCM was a viable economic method for Sardana et al., it is a potential method for the purposes of measuring climate impacts to New England hiking.

For multiple reasons, this particular method is useful for measuring the value individuals place in hiking in the New England region. First, the TCM is not exclusive to locals only, but is inclusive to all individuals no matter their distance from a New England hiking trail. Second, since hiking is an otherwise free activity, looking at a complimentary good such as the travel cost allows economists to find a dollar value associated with the recreation. While hiking gear has monetary value and is complimentary to the activity, and where hiking equipment may be used to assess consumer willingness to pay, this variable is too inconstant. The changing climate may cause hiking gear to become more expensive in some locations in New England, however other areas may actually see a decrease in gear cost. Shaw and Loomis explain this concept in their paper in regard to lift ticket prices and ski equipment prices. They explain, "… falling ski lift-ticket and ski equipment prices, as an example, in one region might be accompanied by rising prices in another". Additionally, not all hikers using New England mountains require intensive

gear. For this reason, a better indicator of climate change impacts on recreation industries is travel cost (Shaw & Loomis, 2008).

Further, while the TCM is a great approach for most activities, it may prove more difficult to use to evaluate some activities over others. In terms of hiking for example, it is difficult to track visitation to a mountain, especially where visitors are not required to pay an entry fee, and where they may not visit local shops or restaurants nearby. Shaw and Loomis however, "stress that the hiking trip has value too, and economists need to incorporate such activities into climate change impacts" (Shaw & Loomis, 2008).

The Hedonic Pricing Method

The hedonic pricing method uses property values to gain an understanding of the public perception of green spaces, and consumer willingness to pay for the quality of an environmental good (Rivas Casado, Serafini, Glen, & Angus, 2017). For instance, an economist looking to measure the value individuals place in the existence of a beautiful lake or river, will look at property values for houses in the surrounding area. Alternately, the HPM may be used to understand consumer aversion to a, "non-marketed quality" (Rivas Casado et al., 2017). When a landfill site is put in for example, the HPM can be used to measure change in property values as a result of consumer detestation to the negative externalities associate with landfills (Rivas Casado et al., 2017). Although the HPM is a reliable way of measuring willingness to pay for non-marketed qualities, it is not the preeminent tool for measuring consumer value of the environment used for outdoor recreation in New England. Measuring consumer value on recreational areas in New England, such as mountains for hiking, will require a method, which takes into consideration consumer preferences for specific activities. While the hedonic pricing

method is great option when assessing local's valuation of a public good, it does not encompass all user valuation of the good.

Stated Preference Methods

Stated preference methods, otherwise known as direct preference methods, directly ask the consumer what they would be willing to pay or accept for a change in the quality of an environmental good. Contingent valuation is the most commonly used stated preference method (Adamowicz et al., 1994). Contingent valuation is the only viable option for measuring non-use values, use-values, and option-use values, discussed in the following paragraphs.

The Contingent Valuation Method

New England mountains attract hikers from around the country, and even around the world (Mystic, 2018) For this reason, our assessment will need to measure hiker's specific willingness to pay for hiking (a free activity). The contingent valuation method (CVM) is another nonmarket valuation method. For this approach, economists evaluate how much individual consumers are willing to pay for a nonmarket good using surveys, where questions provoke individual valuation of the good at hand. Survey questions used in the CVM ask the respondent to estimate their willingness to pay (WTP) for a good, or their willingness to accept (WTA) compensation for the reduction in quality of an environmental good. Since people do not always know the monetary value they place in a good, especially when they are able to use the good for free, this method is not always the most reliable option (Ezebilo, Boman, Mattsson, Lindhagen, & Mbongo, 2015). While this approach may result in data with varying levels of accuracy, it does provide a baseline to evaluating consumer willingness to pay for a good, which otherwise has no marketed monetary value. Still, there are economists who strongly critique the CVM.

There is ongoing debate on whether or not willingness-to-pay surveys result in accurate data. Existing and continuous critiques of the CVM argue that responses to surveys are biased in various ways. This criticism stems from the fact participants are measured on their answers to questions, rather than their actual behavior (Venkatachalam, 2004). Critics claim respondents to CVM surveys will strategically choose answers that impact the respondent favorably (Bohm, 1972; Scott, 1965; Abala, 1987; Knestch and Davis, 1974; Posavac, 1998). Proponents of CVM surveys however, argue this strategic bias does not present a significant problem in most CVM results (Mitchell and Carson, 1989; Smith, 1977; Brookshire et al., 1976). Further, critics contend that respondents' answers do not accurately portray their actual behaviors and willingness to pay (Bishop and Heberlein, 1986; Feenberg and Mills, 1980; Loomis et al., 1996; Byrnes and Goodman, 1999). These biases and potential shortcomings of the CVM are important to consider during the creation of the survey. Bias may be averted with careful construction of CVM surveys, and with multiple testing and revisions even before the actual data collection process (Hanemann, 1994; Smith, 1994; Bateman and Langford, 1997; Arrow et al., 1993; Christie, 1999). Despite potential to correct for bias, strong opponents of the CVM encourage the use of alternative techniques for valuing consumer willingness to pay.

Contingent Valuation Use Values

While criticisms to contingent valuation persist, CV does offer valuation, which is lacking in the travel cost and hedonic pricing methods. Option use values, use values, and existence values are captured in CV surveys. Option-use value is the value individuals place in having the option to consume, or in our case, to use a good or service. The value individuals place in using a good is known as use value. Finally, the existence value, otherwise known as non-use value is the value individuals place in the existence of a good, regardless of whether or

not they plan to use the good. These values captured in CV studies are important benefits to take into consideration when choosing a method for measuring hiker willingness to pay.

Chosen Method

Having reviewed the potential economic methods for measuring willingness to pay for non-marketed public goods, the CVM will be the most feasible economic valuation technique. This paper will use the CVM for the purposes of measuring willingness to pay for hiking during New England peak foliage. Despite criticisms of the validity of the contingent valuation method, it is still widely used by economists researching the value of non-marketed goods. The CVM is particularly beneficial for the purposes of measuring the value of hiking, as it captures option-use values, use values, and existence values, as mentioned previously. This is important when measuring the value of hiking, because although not all individuals hike, they may value the option to hike in scenic areas. Additionally, individuals may simply value the existence of hiking trails. The existence value is also captured in the CVM (Venkatachalam, 2004).

Before the CVM survey can be constructed however, it is essential to cultivate an understanding of what brings people to New England in the first place. Additionally, previously identified climate change impacts to New England (see Section 1) more generally, so that we can make inferences on the consequential impacts to New England tourism.

The following section will discuss the history of application of CVM studies, and development of a survey to measure hiker willingness to pay for peak foliage in New England in the face of climate changes.

Section 3: Contingent Valuation Method: History of Application and Survey Development

Introduction

Measuring the monetary value of any ordinary market good is relatively easy in comparison to public goods, which present a challenge for economic valuation. Public goods are defined as non-rival and non-excludable meaning once they are provided, no one can be excluded from the use of the good, and one individual's use does not impact the quality or quantity of the good for use by another individual ("Public Good," n.d.). Because public goods are free to the consumer, and because its value is not defined by the market, economists have had to construct ways of valuing these types of goods. The previous section covered the various economic valuation techniques for measuring the value of public goods including the Hedonic Pricing Method, the Travel Cost Method, and the Contingent Valuation Method (CVM). This section will cover CVM controversy and potential drawbacks, the history and initial applications of the CVM, and the feasibility of CV surveys to measure the value individuals place on hiking in New England. This section will culminate with the creation of a CVM survey to be used for the purposes of measuring WTP for hiking at a chosen site in the New England region.

CV Controversy and Considerations

Controversy around the validity of Contingent Valuation stems from one fundamental concern, pointed out by Robert Mitchell and Richard Carson in their book: *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Mitchell and Carson explain the dispute around CV stems from the basic apprehension that the observed, stated WTP response is not indicative of an individual's underlying, unobserved, or "true" WTP (Mitchell & Carson, 1989, p.120). While this concern is legitimate, survey researchers have analyzed CV instruments

enough to understand the art of asking questions, and to be able to expose subtle problems, and construct sensible solutions to those problems. It is generally simple to identify sensible solutions to overcome or minimize issues presented from CV instruments. However, if and when problems are more difficult to overcome, or if they persist after attempts to fix or minimize the impacts, knowing the issues allows "the researcher to qualify the findings appropriately" (Mitchell & Carson, 1989, p. 125).

Survey researchers have analyzed sources of error in CV studies and broken down the types of strategic behavior and bias, which may result from an improperly formulated survey. Careful construction of the WTP question in a CV survey is imperative to receiving responses which accurately portray an individuals' WTP. If an individual's value for a good is not well developed, and if they do not completely understand the WTP questions, it is likely their answers are guesses rather than informed responses. Additionally, random error results from unrealistic scenarios and ambiguity in question wording (Mitchell & Carson, 1989, p. 122-123). Therefore, careful wording in survey questions and careful research backing the survey scenario are necessary to mitigate human error in responses.

Strategic behavior by survey respondents is another sign of a survey instrument with key shortcomings. In their book on Contingent Valuation, Mitchell and Carson (1989) delve into various types of strategic behavior.

CVM History

The CVM is one of several techniques economists have employed for decades to value public goods (Mitchell & Carson, 1989). Since the 1970's, economists have used contingent valuation surveys to measure the benefits or costs associated with changes in a wide variety of goods including recreation (Walsh, Miller, and Gilliam, 1983). Also known as stated preference

method, the CVM "circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the good in question"(Mitchell & Carson, 1989). In a CV survey, respondents are asked directly what they would be willing to pay to preserve or more rarely, what they would be willing to accept as compensation for the well-specified degradation of a good (Carson et al., 2003). While there is debate as to whether or not contingent valuation is an accurate measure of WTP, the technique has been used in a number of influential studies.

Exxon Valdez Oil Spill and Carson CV Study

One of the more famous and disputed CVM studies conducted was in response to the Exxon Valdez oil spill of 1989. As the largest tanker oil spill on U.S waters, the repercussions of the spill were far reaching. The impacts on wildlife, ecosystems, and coastal economies in Alaska drew environmental and resource economists to evaluate the monetary implications of the spill. Specifically, the state of Alaska took actionable steps against Exxon Corporation by hiring economists to evaluate the lost passive use values resulting from the spill (Carson et al., 2003). Passive use refers to the value individuals place in a good they may not ever use. To measure the loss in passive use values resulting from the Exxon Valdez oil spill, the researchers in this study chose to use a CVM survey eliciting a question on consumer WTP. The researchers indicate their decision to use WTP measures would understate losses from the spill. They claim however, that while the correct choice would have been to elicit a WTA survey, that an accurate WTA scenario is very difficult to implement, and respondents tend to regard the question as implausible (Carson et al., 2003).

The Exxon Valdez oil spill was significant in history because it was one of the largest human-caused environmental disasters. The CVM study conducted by (Carson et al., 2003) is

therefore significant because it is a study on this environmental disaster, and because the use of the CVM for measuring passive use values for this specific event sparked highly polarized dispute. As a result of the spill and CVM studies, a set of guidelines for the use of contingent valuation of resource damage assessments was created by the Natural Oceanic and Atmospheric Administration (NOAA).

CV Reform and Guidelines Created After Exxon Valdez

Exxon-sponsored criticisms were submitted to the Department of Interior (DOI) and the NOAA, and were directed toward authors of natural resource damage assessment regulations in the DOI and NOAA (Carson et al., 2003). To address these concerns regarding contingent valuation, "the NOAA General Counsel, Thomas Campbell, formed a panel of social scientists to explicitly consider the criticisms of contingent valuation and make recommendations to NOAA" (Carson et al., 2003). The NOAA panel concluded CV studies do provide useful information, on the grounds that the survey and data collection process adhere to a set of guidelines meant to resolve the impact of various biases and inconsistencies (Arrow et al. 1993).

While the Alaska study on the Exxon Valdeez Oil Spill was conducted prior to the NOAA panel, authors of the study claim to have implemented most of the guidelines (Carson et al., 2003). The NOAA guidelines the Alaskan study had previously considered include,

> "(1) the use of rigorous probability sampling with a high response rate, (2) in-person interviews, (3) a discrete choice referendum elicitation format, (4) accurate description of the program, (5) conservative design features, (6) checks on understanding and acceptance, (7) debriefing questions following the referendum questions, and (8) careful pretesting" (Carson et al., 2003).

These guidelines are considered for the creation of the CV survey to measure consumer valuation of New England hiking during peak foliage.

Common Issues for CV Studies

A few issues which arise during CV survey development and application involve bias. Three common types of bias which require strategic avoidance or impact mitigation by the survey developer include hypothetical bias, strategic bias, and anchoring. These issues were defined before developing the survey, and were used for precautionary survey planning. Such biases were a major concern, which fueled the NOAA guidelines for CV studies.

Hypothetical Bias

Hypothetical bias is one of the most commonly discussed biases in CV literature. Hypothetical bias is defined as the difference between stated purchase intentions under a hypothetical situation, and actual purchase intentions (Loomis, 2014). In other words, hypothetical bias is, "… the divergence amount of the actual WTP from the hypothetical WTP" (Banerjee & Sarkhel, 2015). Hypothetical bias occurs when respondent's lack information which would allow them to provide an accurate WTP (Diamond and Hausman, 1994). To measure hypothetical bias, one would have to know an individual's "true", as opposed to their stated WTP. This information is difficult to obtain because it is challenging, if not impossible to force people to pay for a good which is otherwise non-excludable, public, and free. (Loomis, 2014).

Fortunately, CV scientists have developed ways to mitigate the impact of hypothetical bias from survey responses. One such way of mitigating hypothetical bias is through a strategy Loomis refers to as "consequentiality design" (Loomis, 2014). To mitigate uncertainty in CV surveys, and to ultimately reduce hypothetical bias, Loomis explains a survey must discuss the provision decision, and the likelihood of payment. Loomis says failure to do so leaves the

respondent uncertain of the payment requirement or the likelihood of the public good being provided, and that this uncertainty leads to hypothetical bias (Loomis, 2014). The NOAA guidelines for CV studies requires the use of a binary, dichotomous choice question format to elicit the WTP question (Carson et al., 2003). Loomis asserts the importance of this provision by explaining how a dichotomous choice format, where respondents are given a payment level and asked whether or not they would be willing to pay, is the only WTP elicitation format which is demand revealing (Loomis, 2014).

Hypothetical bias and strategies for mitigation were considered during the development of a CV survey for this study. To mitigate hypothetical bias from respondents at the trailhead of Mt. Major taking the survey, a thorough explanation of the scenario is given both within the survey and is planned to be given orally by survey administrators. A verbal explanation of the survey in addition to a written description will resolve any information gaps from respondents skimming the scenario reading. Additionally, the survey developed uses a binary, dichotomous choice format, with follow up questions for potential double bounded survey analysis. These two strategies were implemented to reduce hypothetical bias. Additional steps can be taken after survey implementation and data collection to reduce the impact of hypothetical bias.

Strategic Bias

Strategic bias is defined as an individual's deliberate WTP choice based on external factors, apart from their level of disposable income and personal preferences. Very few CV studies deal solely with the issue of strategic bias, however it is still an important potential hindrance to accurate CV data collection. Strategic bias can either cause an overstatement or an understatement of an individuals' true WTP. Free riding strategic bias occurs when an individual expects others will pay for the good, and therefore he/she/they will not have to pay. This type of

strategic bias causes an understatement of individual WTP. On the other hand, strategic bias may cause overstatement in an individuals' WTP if the respondent assumes their stated WTP would influence the provision of the good (Venkatachalam, 2004). In this case, a person may overstate their WTP in an attempt to ensure the good in question is provided indefinitely.

Strategic behavior can be mitigated with a few precautionary steps. First, the payment vehicle, or the WTP questions should be elicited in a way that reminds respondents of their budget constraint. This reminder helps to reduce overstatements of WTP. An additional step to lessen the prevalence of strategic bias is to convey that a large number of people are taking the survey. This precautionary step ensures respondents understanding that their individual response will not influence the overall outcome of the study or the provision of the good (Venkatachalam, 2004).

Precautionary steps to mitigate for strategic bias are taken into consideration for the development of the CV survey for this research. Before elicitation of the WTP questions, respondents are asked to keep in mind their income, as well as the aforementioned survey scenario. This reminder ensures respondents will not overstate their WTP. Further, the nature of the payment vehicle as a proposed parking fee required by all visitors to Mt. Major does not allow for strategic bias to stem from a respondents' assumption that they can freeload. These steps were taken in the development of the survey for this research to mitigate strategic bias.

Anchoring Bias

Finally, anchoring bias presents a few issues for CV surveys and WTP data collection. Anchoring bias occurs when respondents use the initial bid amount administered to compare all consecutive bid amounts. Strictly speaking, anchoring bias generates "noise" on an individual level when individuals anchor their WTP after hearing or seeing an initial payment level

(Banerjee & Sarkhel, 2015). The impact of anchoring bias is dependent on whether or not the follow up bid is higher or lower than the initial bid. If the individual answers "yes" to the initial payment level proposed, and if the follow-up payment level is higher than the first, the respondent may believe the second payment level proposed is a markup over the true cost of the project (Banerjee & Sarkhel, 2015). Alternately in response to an initial "no" response to the first bid, if the second question offers an alternative payment below the initially payment amount, the respondent may consider the good in question to be of lower quality than initially expected. Whether or not the follow-up is in response to an initial "yes", or an initial "no", the follow-up response is subject to anchoring bias. The impact of an anchored response is greater, the less familiar the respondent is with the good being valued (Banerjee & Sarkhel, 2015).

A double bounded dichotomous choice WTP elicitation format was used for the purposes of this CV survey. Therefore, it will be important during data analysis to keep in mind the presence and impact of anchoring bias.

CV Survey Development for Mount Major

The CV method of valuing non-market goods is the chosen method for this research, meant to determine consumer willingness to pay for hiker recreation in New England during peak foliage season. Developing a contingent valuation survey requires consideration of a number of variables, the development of several components, focus groups and field testing before pursuing data collection. This section focuses on the process of CV survey development as applied to this research, and discusses preliminary findings from an initial focus group. The culminating CV survey (Appendix 1) delivers a hypothetical scenario with survey sections following.

The Hypothetical Scenario

The first section of a CV survey provides an in-depth description of a hypothetical scenario, structured in a way that effectively justifies why consumers would be required to pay for the otherwise free good. The well-developed survey scenario is especially important because it is the basis from which all questions are referenced. If the survey respondent does not fully believe in the hypothetical market created in the scenario, their answers will reflect this misunderstanding, resulting in implications to the data. Therefore, the scenario must be created so that respondents fully believe the hypothetical scenario and possible government/organization action, and understand completely the reasoning and payment method. Additionally, survey respondents must believe their money is required, and will be used for the stated purposes.

Developing a scenario for the purposes of this research required the integration of factors including hiking, climate change, and seasonal preferences. It was first necessary to identify a payment vehicle, for which the most viable option considered was a parking fee. And while potentially controversial, one specific site was chosen: Mt. Major, as a preliminary site for valuing willingness to pay for hiking in New England generally. The final scenario describes a previous fundraising campaign organized by the Society for the Protection of New Hampshire Forests (Forest Society), along with other key stakeholders. The campaign goal was to raise $1.8 million to put toward the purchase of four key properties of land on and near Mt. Major in order to protect and preserve hiker access to trails, and to conserve forests, wetlands, and streams (Forest Society, 2015). The scenario section then describes to the survey respondent the potential implications climate change will have on New England fall foliage. A potentially shorter, duller peak foliage season, coupled with congested trails may require increased trail maintenance and continued funding for conservation projects. The scenario developed explains the Forest

Society's intention to implement a parking fee to offset the cost of increased maintenance and raise money for future conservation projects. Finally, survey respondents are ensured their answers to the survey are completely anonymous, that there are no right or wrong answers, and that if they would like access to the results they should feel free to contact the researchers.

Section 1: Hiker Questionnaire

The first section of the survey following the scenario is the hiker questionnaire. "Section 1: Hiker Questionnaire" of the CV survey elicits questions meant to gain an understanding of the respondent's hiking experience, and what their seasonal hiking patterns look like. This short list of nine multiple choice questions asks respondents to rate their individual hiking experience, to estimate the number of times they hiked in New England and at Mt. Major in the previous year, and to estimate the number of times they hiked Mt. Major in each individually specified season. For questions regarding seasonal recreation, months were broken up into three groups of four months. The three groups are defined as December to March, and April to July, and August to November. This division is eventually edited in response to focus group feedback (see section titled, "Preliminary Results from Focus Group").

The "Hiker Questionnaire" is meant to understand respondent's commitment to hiking activities for the purposes of data analysis. For example, respondents who rate themselves as experienced hikers, and who go hiking at Mt Major often may be more or less opposed to the implementation of a parking fee at the Mt. Major trailhead. Comparably inexperienced hikers, or hikers who primarily use different New Hampshire trails may be less opposed to a parking fee at Mt. Major because they do not frequent the site.

Section 2: Recreation Site Features/Services

Section two of the survey collects information on which mountain features serve to increase the respondent's recreational enjoyment. The left column of the rating table lists seventeen different mountain site features/services commonly offered. Respondents are asked to rate on a scale of one to five the amount each feature/service increases their enjoyment. A rating of "1" for any site feature indicates the feature greatly decreases enjoyment, a rating of "3" indicates no effect on enjoyment, and a rating of "5" indicates the feature greatly increases enjoyment. Ratings "2" and "4" indicate intermediate levels of enjoyment on the scale. A "0" is also offered as an option for individuals who are unsure how the specified feature impacts enjoyment.

The purpose of this section is twofold. If in preliminary tests the parking fee proves an insufficient payment vehicle, this table helps identify alternatives. For example, if a high percentage of respondents find bathroom facilities greatly increase their enjoyment of a hiking trail, bathroom facility fees may be a better payment vehicle for the study. Additionally, the rating system is a way of identifying site features and services people look for when choosing hiking destinations.

Section 3: Willingness to Pay (WTP) Delivery

Once the scenario is developed and individual's background information is collected, the next step to creating a CV survey involves asking the survey respondent whether or not they would be willing to pay for the good in question. The willingness to pay question can be delivered a number of different ways. The "payment card" method and the "binary choice referendum" method are two ways of delivering the WTP question in a CV survey.

The payment card method offers respondents multiple ranges of potential payments and asks the respondent to choose which payment range encompasses their willingness to pay for the good

in question. The most commonly used WTP question delivery method is a binary choice referendum method, wherein respondents are asked whether or not they would be in favor of or opposed to a given payment level (Carson, 2000). This strategy works by giving a hypothetical scenario where the next voting ballot has one question: if voters would be for or against a certain payment toward a public good. Respondents are asked to select either a yes or no answer in this method. The survey created for this research uses the binary choice referendum method in order to adhere to the NOAA panel's contingent valuation guidelines.

Section 4: Demographics

The final data collection portion of the survey gathers demographic information from survey respondents. Previous sections serve to gain respondent's trust before asking questions of a more sensitive nature. Respondents are given a combination of multiple choice and fill in the blank answers which determine their age, gender, ethnicity, marital status, education level, work status, number of dependents, zip code, income, and whether or not they are an Appalachian Mountain Club member. This information helps researchers ensure diversity in data collection, as well as identify any existing correlation between the type of respondent and their preferences and WTP.

Survey Conclusion

The survey concludes by thanking respondents for their time and contribution to the research and offers space for additional thoughts. The first draft of the CV survey was created with the help of CVM experts Ju-Chin Huang, and Kelly Cullen of the University of New Hampshire.

Preliminary Results of Focus Group

A focus group was assembled on March 30th, 2018 for a preliminary test of the CV survey. Focus group participants included three UNH students, one undergraduate student, one

master's student, and one PhD student. The focus group was overseen by Associate Professor Mohr and lasted for approximately one hour. Participants were given a brief explanation of this research and the goal of the survey. Then, the survey was administered and timed, and follow-up questions were asked after surveys were completed to prompt discussion. Follow-up questions (see Appendix 2) had to do with respondent understanding of the scenario, what is being paid for and why, whether or not Mt. Major is a good place for survey administration, and other questions related to clarity, accuracy, and efficiency.

Participants recommended specifying whether or not the parking fee would be different on weekdays versus weekends. This was a valid recommendation, however while weekday and weekend adjusted parking fees are a great idea, for the purposes of data analysis the final survey defines a constant parking fee. One clarifying question asked by a focus group participant was whether or not roadside parking would be restricted at Mt. Major. This alternative parking availability at Mt. Major had not previously been considered and was a key oversight during survey design. It was decided roadside parking should be restricted; the scenario section of the survey was edited to reflect this decision.

Additionally, focus group participants expressed that a parking fee might feel more mandatory if regulated by the government. Despite this insight, the survey was left unchanged in this regard due to the fact the Forest Society would most likely be the ones collecting a parking fee at Mt. Major. Had the survey been changed to say the government would collect the parking fee, this would have falsified the scenario and resulted in biased data. Respondents of the survey must believe the scenario may actually be implemented to avoid hypothetical bias. If respondents are unsure if the state or local government would actually collect a parking fee, they may overstate their willingness to pay. Focus group participants also recommended month groupings

in the year be revised to accurately portray the fall foliage season. They recommended the fall foliage season be refined to September and October only, and that August and November be collapsed into the remaining two groups. Finally, one focus group member recommended that upon elicitation, the survey elicitor briefly summarize the survey and scenario to participants. Should this survey be implemented in the future, the survey elicitor would describe the survey and scenario upon giving individuals the survey to complete. This insight also helps correct for the presence of strategic bias. Focus group participants offered insightful feedback, which helped improve the survey. Their feedback served not only to improve the survey, but also to validate content decisions.

Additionally, focus group members were asked whether or not Mt. Major was an appropriate destination for the survey. Because Mt. Major is centrally located, because it can be climbed by most hikers, and because it provides a scenic view, participants in the focus group agreed Mt. Major is a perfect place for this CV survey implementation. Additionally, participants verified that the scenario was clearly defined, and that they understood what was being paid for and why.

The focus group was beneficial for collecting constructive feedback, to identifying key shortcomings, to understanding areas of potential confusion, and to confirming clarity and feasibility. Constructive feedback was considered, and revisions were made where appropriate. Appendix 1 is a complete construction of the finalized survey to measure WTP for hiking in New England during different times of the year.

Anticipated Survey WTP Regression Functions

Once data from this survey is collected, key response variables will be used as inputs in a regression equation to determine a WTP demand curve. The following is an anticipated WTP regression function to determine WTP with data collected from the Mt. Major survey.

> **WTP** = $ß_0$ + $ß_1$ • experience level + $ß_2$ • distance from site + $ß_3$ • weekend + $ß_4$ • weekday + $ß_5$ • age + $ß_6$ • education + $ß_7$ • gender + $ß_8$ • foliage + $ß_9$ • season+ $ß_{10}$ • income + $ß_{11}$ • work status + $ß_{12}$ • number of dependents + $ß_{13}$ • AMC member status + $ß_{14}$ • favored site feature…

This regression function takes into account answers from all sections of the survey. Living distance from site is included as an input variable to allow for travel cost estimations. Responses gathered are meant to culminate in a WTP demand curve representing each individual's demand for hiking recreation during the peak foliage season at Mt. Major. Further, an average of WTP across individuals will estimate an overall demand curve for hiker recreation at Mt. Major during peak foliage.

Conclusion

Contingent valuation has proven to be a promising tool for measuring WTP for hiking recreation in New England. Additionally, with careful question formulation, CV provides a way to compare WTP for hiking across seasons with little to no respondent bias. Once surveys are administered and data is collected, results will show WTP during peak foliage compared to hiker WTP for recreation at Mt. Major in summer and winter months. Lessons learned from previous CV studies allow for adoption of best practices in the constructed survey instrument.

Conclusion

New England provides a unique and diverse climate, which locals enjoy immensely year-round. However, climate change will impact New England's climate. Future changes have the potential to greatly impact the distribution of seasons within the year, and ultimately economic tourism revenues associated with natural seasonal patterns. These potential implications of climate change pose a threat to New England jobs, markets, market prices, tourism rates, etc. Specifically, climate change has the potential to negatively impact foliar patterns during the autumn season. Negative impacts to New England autumn foliage may decrease tourism to the region, and within the region for hiking recreation. Understanding these potential impacts is essential. However, to understand the impacts, it is first necessary to measure the value individuals place in hiking recreation during peak foliar displays as compared to other seasons.

The contingent valuation survey developed in this research offers a viable way of measuring willingness to pay for hiking recreation during New England peak foliage, as well as at other times during the year. The survey has been strategically formulated to mitigate bias, and has been tested on a focus group to ensure completeness and to correct for sources of error. At this point, the CV survey is ready for execution at the trailhead of Mt. Major. Once data is compiled and analyzed to estimate consumer willingness to pay, a similar survey may be replicated at the trailhead of mountains around New England. Ultimately, this research will contribute to narrowing the knowledge gap around valuation of hiking recreation in New England. This, along with further research will contribute to a better understanding of the value of public goods and recreation in New England's economy.

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Appendix 1: Proposed Survey to Measure WTP for Hiking in New England

Scenario

Name of person administering questionnaire: _____
Name of location where survey administered: _____
** No respondents name is to be recorded and the information given by them is to be treated as confidential. **

Hiker Recreation at Mount Major… We need your opinion!

Dear Park Visitor,

In November of 2014, a report was released indicating the Society for the Protection of New Hampshire Forests (Forest Society), along with other key stakeholders reached its campaign goal of fundraising $1.8 million. The money raised in this project went toward the purchase of four key properties of land (amounting to 980 acres) on and near Mt. Major, in order to protect and preserve hiker access to trails, and to conserve forests, wetlands, and streams (Forest Society, 2015).

Climate change is estimated to have potentially significant impacts on New England's fall foliage. Probable negative impacts include a shorter, and duller peak foliage season. As a result of these changes, it is expected hikers looking to experience peak foliage through recreation will congest popular hiking trails during this short period of time. As a result of climate changes and increased demand during the shorter peak foliage season, it is likely conservation projects, similar to the Mt. Major project in 2014 will become more frequent. In an attempt to raise money in preparation of potential future land conservation projects, the Forest Society is considering restrictions on roadside parking, and the introduction of parking fees at the Mt. Major trailhead. The parking fees are intended for the foliage season (from September to

October), but the Forest Society wants an estimate of visitors' willingness to pay during the foliage season relative to other seasons.

You are one of a small number of visitors being asked to give their opinions on this important decision. In order that the results of this study truly represent the thinking of people visiting Mt. Major, it is important that each questionnaire be completed and returned.

There are no right or wrong answers. We just want your honest opinions. All the information you need is contained within this survey booklet. Your responses are completely anonymous, you will in no way be identified. We will be happy to share our findings with you. If you would like a copy of the results, please inform one of the research volunteers, or email us at the numbers listed below.

Thank you for your cooperation with this survey,

Marina Bowie
Undergraduate Student
University of New Hampshire '18
Mjb2007@wildcats.unh.edu

Robert Mohr
Associate Professor
University of New Hampshire
Robert.mohr@unh.edu

Section 1: Hiker Questionnaire

For each question, circle the answer which best reflects your hiking background

1. If you were to rate yourself, how experienced of a hiker are you?
    a. I have never hiked
    b. Beginner
    c. Intermediate
    d. Experienced

2. Approximately how many times did you go hiking in New England in 2017? (*circle the answer*)
    a. 1-5
    b. 6-10
    c. 11-15
    d. 16 or more

3. Approximately how many times in 2017 did you go hiking at Mt. Major (*circle the answer*)?
    a. 1-5
    b. 6-10
    c. 11-15
    d. 16 or more

4. During 2017, what is the average amount of time spent on hiking trip(s) to Mt. Major (excluding driving time)?
    a. 1-3 hours
    b. 3-5 hours
    c. 5 or more hours

5. If not Mt. Major, what New England trail do you visit most (*fill in blank)*

    Trail Name (Including town and state) _

6. How many times in 2017 did you hike there (*circle the answer*)?
    a. 1-5
    b. 6-10
    c. 11-15
    d. 16 or more

7. Approximately how many times during the months *November 2017 to March 2018* did you go hiking at Mt. Major and other New Hampshire hiking sites?
    a. 0
    b. 1-3
    c. 4-6
    d. 7-10
    e. 10 or more

8. Approximately how many times during the months *April to August 2017* did you go hiking at Mt. Major and other New Hampshire hiking sites?
    a. 0
    b. 1-3
    c. 4-6

d. 7-10
e. 10 or more

9. Approximately how many hiking trips did you take during peak foliage in 2017 (*September/October*) at Mt. Major or other New Hampshire sites?
    a. 0
    b. 1-3
    c. 4-6
    d. 7-10
    e. 10 or more

Section 2: Recreation Site Features/ Services

Please indicate (*by circling one number*) how important the following qualities of a recreation site are to your enjoyment of that site.

	Greatly Decreases My Enjoyment		No Effect on My Enjoyment		Greatly Increases My Enjoyment	Don't know
Closeness to Home	1	2	3	4	5	0
Having no Entrance Fee	1	2	3	4	5	0
Uncrowded	1	2	3	4	5	0
Wildlife	1	2	3	4	5	0
Scenery	1	2	3	4	5	0
Provided Facilities **(Toilets, water pumps, etc)**	1	2	3	4	5	0
Clearly Marked Trails	1	2	3	4	5	0
Ranger Presence	1	2	3	4	5	0
Plenty of Parking	1	2	3	4	5	0
Motorized Vehicle Access	1	2	3	4	5	0
Availability of Information	1	2	3	4	5	0
Other _____	1	2	3	4	5	0

Section 3: Willingness to pay

For the following questions please answer keeping in mind your income, and the previously described scenario. You will be asked to justify your response in the questions following.

Winter Months

1. Suppose a $_____per car per day entrance fee was proposed from *November to March* for the Mt. Major recreation area. No services would change in the recreation area.

   If this fee were the only issue on the next public ballot, would you vote in favor of it?

   ☐ Yes ☐ No

2. If you answered "no" to the previous question why?
   _____
   _____
   _____

3. If you answered "no" to question 1, would you be willing to pay $_____? Why or why not?
   _____
   _____
   _____

4. If you answered "yes" to question 1, why?
   _____
   _____
   _____

Summer Months

1. Suppose a $_____ per car per day entrance fee was proposed from *April to August* for the Mt. Major recreation area. No services would change in the recreation area.

   If this fee were the only issue on the next public ballot, would you vote in favor of it?

   ☐ Yes ☐ No

2. If you answered "no" to the previous question why?
   _____
   _____
   _____

3. If you answered "no" to question 1, would you be willing to pay $_____? Why or why not?
   _____
   _____
   _____

4. If you answered "yes" to question 1, why?
   _____
   _____
   _____

Fall Months (Peak Foliage)

1. Suppose a $_____ per car per day entrance fee was proposed for *September and October* for the Mt. Major recreation area. No services would change in the recreation area.

   If this fee were the only issue on the next public ballot, would you vote in favor of it?

   ☐ Yes ☐ No

2. If you answered "no" to the previous question why?
   _____
   _____
   _____

3. If you answered "no" to question 1, would you be willing to pay $_____? Why or why not?
   _____
   _____
   _____

4. If you answered "yes" to question 1, why?
   _____
   _____
   _____

Section 4: About You (Demographics)

Please fill in/circle the following demographic questions below
These questions will help us evaluate our sample representativeness. Your answers will be kept confidential and are for research purposes only. You will not be identified in any way.

Age	_____
Gender (circle one number)	1 ------ Male 2 ------ Female 3 ------ Not listed 4 ------ Prefer not to answer
Ethnicity (circle one number)	1 ------ Caucasian 2 ------ Hispanic 3 ------ Asian 4 ------ African 5 ------ Other
Marital status (circle one number)	1 ------ Married 2 ------ Not Married
Education level (completed)	1 ------ High school diploma or lower 2 ------ Associate's Degree 3 ------ Bachelor's Degree 4 ------ Master's Degree 5 ------ PhD
Work Status	1 ------ Unemployed 2 ------ Employed/ Student 3 ------ Retiree
Number of dependents	_____
Zip code where you reside	_____
Appalachian Mountain Club member?	1 ------ Yes 2 ------ No
Income (circle one number) *(your approximate income last year before taxes)*	1 ------ $0 - $24,999 2 ------ $25,000 - $49,999 3 ------ $50,000 – 74,999 4 ------ $75,000 - $99,999 5 ------ $100,000 – 149,999 6 -------$150,000 or more

Survey Conclusion

Thank you for Completing the Survey!

If you have any additional thoughts on the management of Mt. Major, please feel free to write them in the space below. When you are finished, please return the survey to a research volunteer.

Appendix 2: Focus Group Questions

1. Is it easy to see what is being paid for and why?
2. It was tricky to develop a WTP question and scenario where climate change was factored in. Is the link between climate change and the payment proposal understandable?
3. Anyone that said no to questions in section 3, what was the proposed payment, and why did you say no?
4. Is Mt. Major a good place for a survey like this?
5. Would it be better if the parking fee collectors were administered by a government agency or non-profit?
6. Any questions you would rather not answer?
7. Were there any multiple choice where you did not see a fitting response?
8. Are there any other distinctions or improvements you think could be made within the survey?
9. Any other comments?