Economic Values of Wolves in Denali National Park and Preserve (DNPP): Concepts, Literature Synthesis, Data Gaps and Study Plan

October 14, 2016

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*Views expressed in this report are those of the author and do not necessarily represent the views of Colorado State University.

Acknowledgements: I wish to thank Bridget Borg, Rose Keller, Dave Schirokauer, Patricia Owen, Lynne Koontz, Bret Meldrum and Leslie Richardson, National Park Service for the many references provided as well as valuable comments and suggestions on the draft report. Any errors or omissions are the sole responsibility of the author.

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EXECUTIVE SUMMARY

This report identifies what is currently known about economic values of wolves in Denali National Park and Preserve (DNPP) to visitors, Alaska residents and residents of the rest of the United States (U.S.). Our literature review and synthesis found that little is known specifically about the economic value of wolf viewing in DNPP and about visitors that come to DNPP primarily to view wolves (Iverson and Borg, 2012).

However, wildlife viewing is clearly a source of socio-economic value in the state of Alaska. Wildlife viewing is a driver of tourism for DNPP (Stynes and Ackerman 2010) and the state of Alaska. For example, wildlife viewing activities in Alaska supported over $2.7 billion in economic activity in 2011 (ECONorthwest 2014a). In 1997, non-resident visitors who came to Alaska primarily to view wildlife had average expenditures of $6,000 per trip (Miller and McCollum, 1997). The benefits per trip in excess of their expenditures were on the order of $700 to $900 (Miller and McCollum, 1997). From economic valuation questions found in Alaska wildlife viewing literature, it can be inferred that a non-resident visitor may have an additional value in the range of $200-$300 per wildlife viewing trip to Alaska if a wolf is seen on their trip.

Based on our literature review, there is currently nothing known about the non-use/passive-use values (sometimes called existence and bequest values) of wolves in Alaska to Alaskan and other U.S. residents. What little literature exists on the passive-use values of wolves pertains to reintroduction of wolves in Yellowstone National Park (YNP) and wolf habitat protection in Minnesota (Chambers and Whitehead, 2003). Surveys of U.S. households indicated passive-use values were about $14 per U.S. household for wolf reintroduction into YNP (Duffield, et al. 1993). Similar values were published in the United States Fish and Wildlife Service Environmental Impact Statement on wolf reintroduction into YNP and Central Idaho (U.S. Fish and Wildlife Service, 1994). Minnesota household's passive-use values for wolf habitat protection range from $7 to $31 per household, with the value depending on the region of Minnesota. With millions of households in the U.S., these small passive-use values per household add up to a sizeable amount of total economic value.

The state of Alaska is mandated to provide for consumptive uses of wildlife, and harvest of wolves can provide significant economic benefits as well (National Research Council 1997). However, there is minimal information on the economic value of consumptive uses of wolves, including the value procured from hunting and trapping (harvest) in the region surrounding DNPP (Borg, personal communication). However, in 2011, hunting throughout Alaska supported over $1.3 billion dollars in economic activity (ECONorthwest 2014a).

Managers tasked with making decisions regarding wildlife management need accurate information on the economic values of wolves to viewers, hunters, trappers and the general public to make well informed decisions regarding management of wolves and their prey (NRC, 1997). Wolf management is particularly contentious in the areas surround DNPP (Borg 2015) and data are needed on the specific magnitude of revenues and other economic values derived from wolf harvest around DNPP. Specifically, data is needed that will support an analysis of the passive (or non-use) value of wolves in DNPP area that can be brought in as a direct comparison to the values received by local subsistence and sport hunters. In Alaskan culture, hunting and trapping have a high cultural value, as these practices underpin the conceptualization of a frontier landscape and lifestyle. Trapping practices of wolves also acts to maintain traditional and modern trapping knowledge specifically ("Alaska Trappers Association" 2015). Additionally, there are associated costs of limiting wolf harvest, given not only the revenue generated from hunting (Treves 2009; ECONorthwest 2014a) but also the potential of wolf harvest to increase land owner's acceptance of large carnivores (Treves 2009). Likewise, the non-consumptive economic value of wolf viewing in DNPP and the existence values of wolves in DNPP to the U.S. and wider public are predicted to bring significant "alternative" wolf value to bear on the market, given the findings of other wolf viewing valuation studies (Duffield, 1991; Duffield, et al, 1993) and ongoing social science research in DNPP regarding wolf viewing tourism.

Luckily, there are well established methods for filling all these data gaps regarding hunter and viewer use values, as well as the general public's passive-use values of wolves in and around DNPP. In 1997, the NRC (1997) suggested a coordinated social science research program to address similar data gaps regarding consumptive and non-consumptive uses of wolves in Alaska. Our report provides many of the details of such a research program. In particular, our report provides details and examples of the economic methods for quantifying wolf related visitor spending and benefits, hunter spending and benefits, and passive-use values. This report also outlines several study plans to provide these values that are needed for informing local and regional wolf management strategies.

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I. Study Purpose

Wolf management has proven controversial, whether in Alaska or in the lower 48 states of the U.S. (Huey, 2016). The controversy in Alaska resulted in the Natural Research Council (part of the National Academy of Sciences), evaluating wildlife management in Alaska in the 1990s with particular attention to wolves and their prey (NRC, 1997). The overall conclusion of the committee with regard to economics was that there are several information gaps that need to be filled before a complete economic analysis of wolf management can be performed. In the intervening years, wolf management has continued to be a source of often heated debate with many different stakeholders. Specifically, management of wolves at the boundaries of protected areas, such as National Parks and Preserves, has been subject to on-going debate and attention with ample rhetoric, but there has been a lack of quantitative evidence regarding economic valuation to inform management decisions (Borg 2015). The purpose of this study is to define specific data gaps related to wolf economic values in and around Denali National Park and Preserve and present a plan for addressing the current data gaps. Therefore, this study does the following: (1) describes the types of economic values associated with wolves in the Denali National Park and Preserve area (DNPP) area; (2) describes the methods available to measure these values; (3) defines the current state of empirical knowledge on these values; (4) identifies data gaps that need to be filled in order to quantify economic trade offs in wolf management in and adjacent to DNPP, and (5) proposes study plans to estimate the most relevant economic values of wolves in DNPP and the surrounding area.

II. Types of Economic Values and Methods for Quantifying Them

A. Types of Economic Values

Willingness to pay and Consumer Surplus

Benefits are defined in benefit-cost analysis as what a consumer or producer would pay to have or retain access to a private or public good. Economists call this *net willingness to pay* (WTP), or willingness to pay over and above costs. This concept is also known as *consumer surplus* and *producer surplus* (USWRC, 1983; OMB, 1992; 2000; EPA, 2000; Freeman, 2003). *Price* is the willingness to pay for one more unit of the good. The absence of price does not mean absence of value; if a good provides a person (not necessarily everybody) with enjoyment/satisfaction and is scarce, it has an economic value (Schuhmann and Schwabe, 2000:4). As Office of Management and Budget (1992:7) notes, "[P]rices sometimes do not adequately reflect the true value of a good to society." This is certainly the case of many natural resources, which are purposely non-marketed. For example, the fact that wildlife is not privately owned but held in public trust by government agencies does not diminish the fact that these species have an economic value to people. In the case of wildlife, the general concept of net WTP or consumer surplus applies, since the market price is zero for many species, or prices exist for just one attribute of the species (e.g., meat or fur or license).

While WTP is the measure of benefits to the user (hunter, viewer), there may also be spin-off economic effects in terms of jobs in a local community related to wildlife viewing, hunting, or trapping. Economists refer to these as local or regional *economic impacts*. The term local can be a community, county or borough when the data are available at that level of detail. In some cases, the term regional indicates a substantial part of a state. In some cases, economic impact analysis can be conducted for an entire state.

While much past economic analysis performed by federal agencies such as the United States Department of Agriculture Forest Service (USFS) or National Park Service (NPS) has emphasized economic impacts, these agencies are broadening their analysis to include net WTP for non-market resources as well. One of the reasons for this has been an increasing emphasis on valuing ecosystem services. The economic value of ecosystem services is the consumer surplus or cost savings arising from the benefits that an ecosystem provides people. Wildlife viewing and harvest of wildlife (hunting and trapping) are considered ecosystem services of wildlife. A complete economic analysis will consider an economic impact analysis to a regional or state economy **and** a benefit cost analysis of the benefits to the users themselves. In a sense there are two beneficiaries of wildlife management: (a) tourism related businesses—guides, hotels, etc. and (b) the hunters/trappers and viewers themselves. A complete economic analysis will include both.

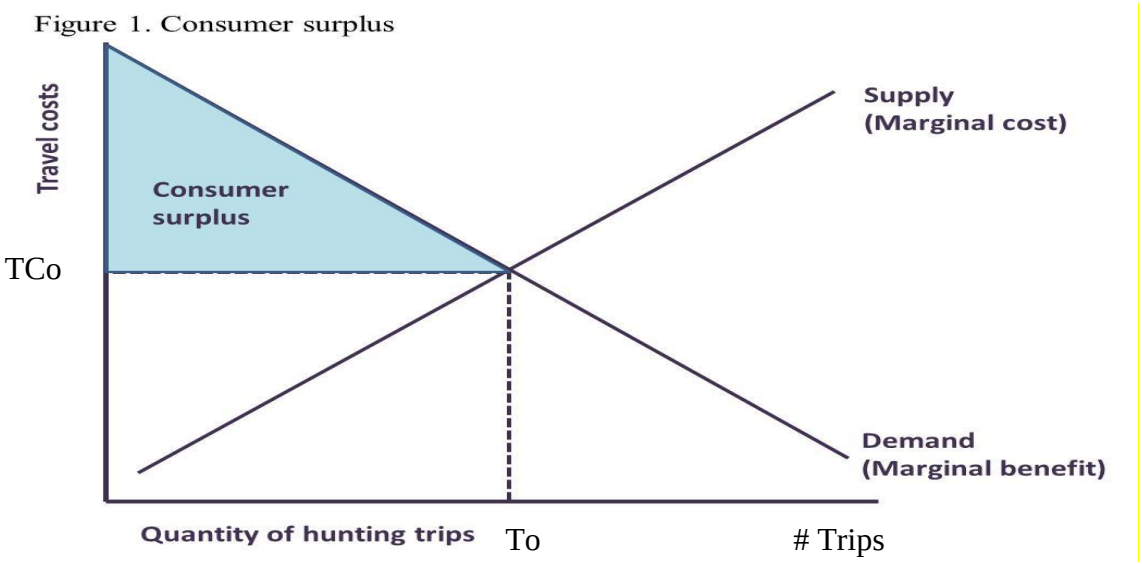
Use Values: The economic value of market goods and recreational resources

For decades, people have recognized that many wildlife species provide direct use values to hunters and non-consumptive wildlife viewers (Loomis, et al. 1984). These benefits are measured by their net WTP or consumer surplus. As can be seen in Figure 1, which uses hunting as an example, the demand curve represents the incremental or marginal benefits to a hunter from additional hunting trips. As described in the methods section below, the major "price" of a trip is the travel costs to the site (especially for residents where the license cost is low and the license allows for numerous trips).

The amount the hunter would pay over and above the actual travel costs incurred is a measure of their consumer surplus. Essentially, they would have been willing to pay a higher cost on the first trip rather than not go hunting (much like most coffee drinkers would pay a great

deal more than the price for the first cup of coffee in the morning than for the second or third cup). Each additional trip has less and less consumer surplus, until the travel cost of the trip equals the incremental (marginal) benefit of another trip. At that point they stop taking trips as the cost of another trip exceeds their benefit.

Figure 1. Consumer surplus



The amount the hunter actually spends (travel cost (TCo) times the number of trips (To)), is the expenditure used in a regional economic model to estimate jobs and wages resulting from the hunter expenditures. [1]

Existence/Passive-Use/Non-Use Values

As first noted in 1967 (Krutilla, 1967) and empirically demonstrated beginning in the early 1980s (Brookshire, et al. 1983), wildlife also has an *existence value* to people who may

[1] The regional economic model used to convert hunter/viewer spending into regional income and employment is known as an input-output model. A commonly used input-output model is named IMPLAN for Impact Planning since estimating regional income and employment is known as economic impact analysis as distinct from economic efficiency analysis which is used in benefit-cost analysis.

never see the species in the wild. These people are often willing to pay for protection of these species. Other people would pay for protection of habitats for wildlife species to keep the wildlife species protected for future generations. This is known as *bequest value*. Evidence of existence and bequest values may be expressed in donations to conservation groups such as the World Wildlife Fund as well as donations to numerous state "Non-Game Wildlife check-offs" on State Income Tax forms. These *passive-use values* are recognized in federal natural resource damage assessment, when the U.S. District Court of Appeals in 1997 termed existence and bequest values "*passive-use values*" (*Ohio v. U.S. Department of Interior*, 880 F. 2d. 432, 444 (D.C. Cir. 1989)). Also called *non-use values*, these values are considered compensable damages arising from environmental damages (e.g., old hardrock mines) under the Superfund legislation as well as oil spills under the Oil Pollution Act of 1990.

In the case of wolves, research summarized below, indicates that people living hundreds of miles away from wolf habitat (e.g., southeastern U.S.) would still pay something to know there is a viable population of wolves today and that protection of this population and its habitat would provide wolf populations for future generations.

B. Methods for Quantifying Economic Values

Travel Cost and Valuation Methods

Economists have developed several methods for estimating the use and passive-use values of wildlife. In this section we review each of these methods in detail. The first method reviewed (*the travel cost method*) is based on actual visitor travel behavior and is used to estimate recreation use benefits. Specifically, the travel cost method (TCM) uses variations in visitor travel costs and their associated trips taken to trace out a demand curve like the one

shown in Figure 1. Once the demand curve is estimated, the net WTP or consumer surplus is calculated. TCM is a preferred method for estimating **current** use values because it is based on visitors actual travel behavior (travel cost and travel time incurred) to obtain their **current** wildlife experience. However, future visitor benefits might change with potential wildlife management alternatives that have not yet been implemented. The benefits of the future scenarios are difficult to quantify with TCM. In this case the *contingent valuation method* (CVM) may be a better tool in these cases where management actions may change the populations of wildlife and hence the magnitude of use value of wildlife. This method (described in more detail below) constructs a simulated market to ask visitors what the maximum amount they would pay (WTP) for each scenario associated with a potential management alternative. For example, visitors might be presented a "payment card" that has ten alternative increases in trip costs to visit an area where they could view twice as many wolves as they might typically see now. The visitor would be asked to circle the dollar amount that represents the maximum additional amount they would pay to visit this area where they could see twice as many wolves. Although the TCM and CVM approaches are very different techniques for estimating WTP, both TCM and CVM provide comparable estimates of WTP. In a review of more than a hundred recreation studies where both TCM and CVM were used, Carson, et al. 1996 found that the WTP derived from TCM and CVM were not statistically different from one another.

Details of the Travel Cost Method (TCM) for Estimating Recreation Benefits

Travel Cost Method (TCM) is a method that uses variations in travel costs incurred by visitors living at different distances from the site and their corresponding number of trips taken

to statistically estimate a *demand curve* like that shown in Figure 1. From the demand curve, the consumer surplus or net WTP beyond the current cost is calculated (see Loomis and Walsh, 1997 for details). The strength of this method is that it uses actual trips taken and actual travel costs to trace out the demand curve. Hence the measures of net WTP reflect actual behavior. Application of TCM can sometimes be accomplished using existing data (e.g. hunter zip codes found on hunting permits), but is typically performed using a short survey of hunters or viewers. This survey can be administered by the state fish and game agency during its post-season hunter survey. For example, in Idaho, this interagency approach was implemented by the Idaho Fish and Game in cooperation with the U.S. Forest Service (Donnelly, et al. 1985). TCM is a well established methodology as it has been used in nearly a hundred valuation studies of hunting and wildlife viewing conducted in the U.S., including many by state fish and game agencies, such as those in Alaska, California, and Idaho (Peterson, et al. 1992; Loomis, et al. 1989; Donnelly, et al. 1985).

Details of the Contingent Valuation Method (CVM)

CVM can provide information about the potential economic consequences of alternative possible management plans. CVM (and choice experiments) are the only methods that can estimate the non-visiting public's WTP for existence/non-use or passive-use values. Since those not visiting have no trips and incur no travel costs, their WTP has to be ascertained by asking them in a constructed market or simulated voter referendum.

CVM measures the use values of hunting, trapping and viewing of wildlife by employing simulated or constructed market. The simulated or constructed market provides a well defined description of the good to be valued (e.g., a specific increase in harvest success rate or a specific

increase in number of animals a viewer would see) and a means by which the hunter or viewer would pay for this improvement. The simulated or constructed market then gives the hunter or viewer an opportunity to "use the market" and indicate their willingness to pay (if any) for the improvement. Using the example of the payment card described above, a hunter would circle the maximum amount they would pay for a specific increase in harvest success rate next year. Likewise a wildlife viewer would circle the maximum they would pay to see a specific increase in the number of animals. The dollar amount circled would reflect their maximum WTP or consumer surplus for the specific increase presented in the survey.

CVM is also more appropriate than TCM if visitors are on multiple destination trips in Alaska, where the travel cost to Alaska is not attributable to visiting just a single site or activity. In fact, most non-resident wildlife viewing tourists to Alaska may visit many different areas during their trip from home. This is especially true of visitors from the lower 48 states. Trying to attribute the travel cost to Alaska to any one site becomes problematic and hence the TCM is difficult to apply to wildlife viewing trips in Alaska.[2]

Thus, in the case of multiple destination trips a CVM scenario can be developed that allows the researcher to focus on just the wildlife viewing experience for a particular species in a specific area. For example, a visitor to DNPP could be asked if they would pay a given amount more for the trip they have taken to DNPP if they could see twice as many wolves as they saw on their current trip. This could be asked using the payment card that was described above, or a more preferred method the *dichotomous choice* approach. With this approach the dollar amount of the increase in trip cost is varied across the sample of visitors. For example, 10% of the

[2] However, for big game hunting, many hunters do come to Alaska to hunt a specific species in a particular area. In this case the TCM would be applicable since the entire travel costs of the trip are attributable to hunting a particular species in a particular area. For hunters that come to Alaska to hunt multiple species in several different locations, then the CVM as described for wildlife viewing would be equally applicable to these multi-species hunters.

sample could be asked if they would pay $10 more for a trip where they would see twice as many wolves, a different 10% of the sample could be asked $15 more per trip, and so on, until the last 10% of the sample might be asked $150 more per trip. The range of the dollar amounts presented would be pretested to make sure it covered the likely range of the visitor's maximum WTP. By analyzing the percentage of visitors that would pay the differing dollar amounts, a quasi-demand curve or marginal benefit function similar to Figure 1 can be estimated. From this curve, the net WTP or consumer surplus can be calculated. The reason the dichotomous choice method is the preferred method is that a dichotomous choice WTP question format mimics a market: the person is simply asked if they would "buy" the good at the price stated like people actually do in nearly all markets in the U.S. Asking a person to circle the most they would pay for a good, as is done in a payment card format, is unusual in most markets, although it is used by many charities such as United Way, or conservation organizations.

Methods for estimating Existence Values

Another strong feature of CVM is its ability to measure the monetary amount of existence values for maintaining a specific number of animals in a particular location. With CVM, a simulated or constructed referendum is often used to ask non-visiting households whether they would vote to pay for a well-defined change in the population of a given wildlife species. The general public is sampled usually via a mail survey using an USPS address based sample to ensure a random sample of whatever geographic area is being sampled.[3] The reason that a mail survey is needed is that individuals must be provided with sufficient information on the species

[3] A combination mail and internet survey is also used, where the address based sample is given the option of filling out the survey on-line via a URL in their letter. Our experience in two different surveys (one of the U.S. population and one of New Jersey households with solar panels) indicates that only about 20% of the households offered the option of both survey modes choose the internet survey option.

they are being asked about so as to provide an informed valuation. This information would include a map showing where the species of interest is located, and what the management action would be to "produce" an increase in the number of animals or to reverse a decline in their population. How wide a geographic area of households to sample is often determined by whether the species is only of state significance (i.e., it is found in many other states) or of national significance (i.e., it is found in few other places in the U.S.). Species that are federally listed T&E species or found on federal public lands suggest that a survey of the entire U.S. be done because the resource "belongs" to everyone in the U.S. Further, management of the species will likely be paid from federal appropriations financed by national taxes such as an income tax. Loomis (2000) summarizes several empirical studies that estimate how WTP values change with increasing distance to where the wildlife resource is located. This research suggests that WTP can be significant even at a distance of 1,000 miles from the resource.

Even though the dollar amounts stated by people in response to a CVM survey are not actually paid, the method has shown to be reliable in test-retest reliability studies (Loomis, 1990; Reiling et al., 1990). Richardson and Loomis (2009) provide a listing of these passive-use value studies of wildlife and a meta-analysis of them as well.

Chambers and Whitehead (2003) provide an example of using a CVM scenario to estimate the existence value of preserving wolves. In their survey a Wolf Management Plan (WMP) is described to the household in the following way: the plan "…*would include monitoring the population and health of wolves and preserving their habitat and that of their primary prey.*" The respondents were informed that if the plan was passed, a stable wolf population goal of 1600 wolves would be sustained, and wolves would not be returned to the

Threatened and Endangered species list in the near future. Respondents were asked if they would pay a one-time tax increase (of specified amount, $A) to fund this plan:

> *"These management activities are expensive. New state money would be needed to fund the management plan. Suppose that a one-time tax increase of $A would be required from each Minnesota household to support and fund the wolf management plan. Would you be willing to pay the one-time tax increase of $A to fund the Wolf Management Plan?"*

As the researchers described in the study:

> *"The values of this tax increase were varied across surveys. Some respondents were asked if they would be willing to pay $5, others $25, $50, $75 or $100. The question was followed by three answer categories: yes, no, and don't know."*

Past research has shown recoding the "don't know responses" to 'no responses" increases the accuracy of the resulting WTP estimates (Loomis, 2014; Champ, et al. 1997; Champ et al. 2009). Chambers and Whitehead estimated the benefits to two different communities in Minnesota within the range of the wolves. Ely households would pay between $4.43 and $4.77 (about $7 in $2014). St. Cloud residents were willing to pay between $20.15 and $21.49 (about $31 in $2014).

Details of Choice Experiments

In the last 15 years a number of economists have embraced a method called *Choice Modeling* (CM) or *Choice Experiments* (CE) or *Attribute Based Modeling* (Holmes and Adamowicz, 2003). The method originated in the marketing literature, where it was called *Conjoint Analysis*. Conjoint Analysis had been used for more than three decades by market researchers to determine which characteristics of proposed products were most desired by

consumers. Jordan Louviere was one of the pioneers in the marketing field, and his expertise has been applied in the application of non-market valuation as well (see Louviere, et al. 2000).

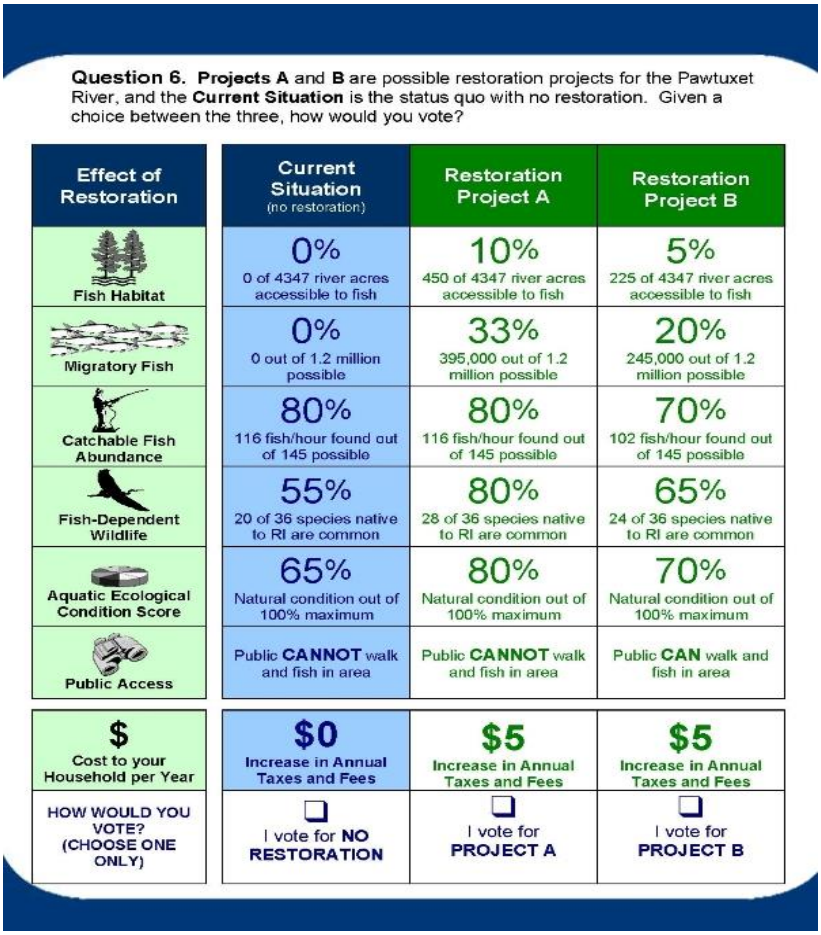
The primary distinction between CE and CVM is how respondents are asked about their WTP. In contrast to a CVM survey where a WTP question is asked for a single "management action" program or policy, a CE survey presents the respondent with a set of alternative programs or management actions, each characterized by multiple attributes or characteristics (which can be thought of as different features) of a particular program. One characteristic of each alternative program is the cost of that program. Each respondent is typically asked to choose their most preferred alternative from a set of management alternatives. Each choice set has a "no change/current condition/status quo" alternative usually placed adjacent to one or more proposed management action alternatives. The alternative chosen by the respondent is assumed to yield the highest benefits to the respondent. Much like CVM, the range of program costs or "prices" varies across the sample. However, unlike CVM, in a CE survey, the non-price characteristics or attributes of each alternative management program also changes across the sample. Because one of the attributes included in each alternative management program is a price or cost for the management program, the monetary value for each of the program's attributes can be calculated. Thus with a CE survey, the analyst knows not only the total WTP for a possible management action but also how each feature (attribute or characteristic) is valued by the respondent.

It is easiest to visualize the CE approach with an example. Figure 2 presents an example of a CE for valuation of river restoration on the Pawtuxet River in the state of Rhode Island. It is a single choice task that would be presented to the respondent. A single survey might have two or three individual choice tasks. There are seven attributes for the choice task illustrated in Figure 2 (which is probably the upper limit on the number that most general public respondents

can handle). Prior to this choice task, each of these attributes were explained to the respondent in more detail than is shown in the choice task table (Figure 2). Maps were provided to show what stretches of the river could be restored.

The first alternative is to maintain the current status of the river with no restoration and has zero cost to the household. The other two alternatives show different levels of restoration and annual taxes and fees that a household would pay for the action.

Figure 2. Example of a Choice Task for River Restoration



Question 6. **Projects A** and **B** are possible restoration projects for the Pawtuxet River, and the **Current Situation** is the status quo with no restoration. Given a choice between the three, how would you vote?

Effect of Restoration	Current Situation (no restoration)	Restoration Project A	Restoration Project B
Fish Habitat	0% 0 of 4347 river acres accessible to fish	10% 450 of 4347 river acres accessible to fish	5% 225 of 4347 river acres accessible to fish
Migratory Fish	0% 0 out of 1.2 million possible	33% 395,000 out of 1.2 million possible	20% 245,000 out of 1.2 million possible
Catchable Fish Abundance	80% 116 fish/hour found out of 145 possible	80% 116 fish/hour found out of 145 possible	70% 102 fish/hour found out of 145 possible
Fish-Dependent Wildlife	55% 20 of 36 species native to RI are common	80% 28 of 36 species native to RI are common	65% 24 of 36 species native to RI are common
Aquatic Ecological Condition Score	65% Natural condition out of 100% maximum	80% Natural condition out of 100% maximum	70% Natural condition out of 100% maximum
Public Access	Public **CANNOT** walk and fish in area	Public **CANNOT** walk and fish in area	Public **CAN** walk and fish in area
$ Cost to your Household per Year	**$0** Increase in Annual Taxes and Fees	**$5** Increase in Annual Taxes and Fees	**$5** Increase in Annual Taxes and Fees
HOW WOULD YOU VOTE? (CHOOSE ONE ONLY)	❑ I vote for **NO RESTORATION**	❑ I vote for **PROJECT A**	❑ I vote for **PROJECT B**

Johnston, Robert. "Enhancing the Content Validity of Stated Preference Valuation." Originally published in *Land Economics* Issue 88.1 (2012): 102-120. © 2012 by the Board of Regents of the University of Wisconsin System. Reproduced by the permission of the University of Wisconsin Press.

While this example has three alternatives (one "no action"—referred to as the Current Situation", and two "action" alternatives—Project A or Project B), there are some advantages of having just one "action" alternative paired with the "no action" alternative. The levels assigned to each attribute reflect a realistic range of that attribute for the location and management actions being proposed. This range is determined by discussion with scientists and managers to encompass what is feasible to attain, and what is credible to respondents (as determined in focus groups and pretests). The number of levels for each attribute are chosen to allow for estimation

of a regression coefficient of the attribute. However, there is a trade-off between the number of levels desired and the associated number of survey versions required. For example, if there are three non-price attributes with five levels each, seven levels of the cost attribute then there are 24 survey versions that have to be printed and tracked. However, having a large number of cost levels is often critical to ensure enough variation in cost to estimate a statistically significant cost coefficient. If the cost coefficient is not significant, then the monetary values of the other attributes are non meaningful. Thus for survey implementation, 24 different versions of a survey would be printed.

Printing costs may influence how the choice experiment is designed, whether to use CVM and the type of CVM WTP question to be used. For example, printing 24 versions of a choice experiment survey can be expensive (especially if color is used) as compared to printing just seven versions of a CVM dichotomous choice survey or just one version of the survey if a CVM payment card is used. With the payment card everyone gets the same survey, so the economies of scale at the printer lower the cost of printing surveys as well as simplifying the mailing process. With a choice experiment not only must 24 versions of the survey be printed but there is complexity of tracking which person got which of the 24 choice experiment versions when doing follow up/repeat mailing to non-respondents.

Advantages and Disadvantages of CE versus CVM

The primary advantage of CE for non-market environmental valuation is its ability to provide more detail of respondents' valuation of the components of a particular policy or program than with CVM. CE can show the relative importance assigned to characteristics and derive estimated values associated with various levels of characteristics. The total value of a particular policy or

program can also be calculated from a CE. This flexibility is particularly useful when policy makers or resource managers are uncertain about the final details of the program or policy at the time the survey is designed and implemented. As long as the likely range of the attribute levels are included in the survey versions, the value for any particular program can be calculated after the fact. There are two primary disadvantages of the CE approach: (a) survey implementation is more costly and complex due to the number of versions of the survey that need to be produced; (b) the available empirical evidence suggests that estimates of WTP from CE are greater than from CVM, a potentially worrisome problem (Stevens, et al. 2000; Richardson and Loomis, 2009).

III. Uses and Users of DNPP

A. Visitor Use of DNPP

In 2014, over a half million visitors (531,315) came to DNPP. This is a significant increase in the last few years over the slightly more than 400,000 visits recorded in 2011 (Stynes and Ackerman 2011). About 2% of the visitors were local Alaskans living in the area, 7% were Alaska residents living elsewhere and 91% were non-residents (U.S. and International).

B. Visitor Interest in Wildlife Viewing in General and Wolves

Wildlife Viewing

Wildlife viewing is one of the two primary reasons people come to DNPP. The exact percentages vary from study to study and depend on the residence of the visitors. According to Fix, et al. (2013), only 20% of Alaskan residents cited wildlife viewing as the main reason for visiting DNPP (sightseeing and hiking were equally important at about 20% each). In comparison, they found that over half of the rest of U.S. visitors and international tourists cited wildlife viewing as the main purpose of their trip. When analyzing NPS Visitor Services Project (VSP) data Mani, et al. (2012) found that the most common activities in DNPP were viewing scenery (88%) and viewing wildlife (80%). These two percentages are similar for first time and repeat visitors, indicating that wildlife is a factor drawing people back to DNPP. Manning and Hallo (2010) found that the single most important experience for visitors on the Denali National Park road was seeing wildlife (70%). Related to this, visitors thought not seeing "enough wildlife" and "too few animals along the road" were a problem (50%, and 53%, respectively). This suggests that the quality of the visitor experience ***is*** influenced by the number of animals seen regardless of

whether the animals seen were one of the "Big 5" species (grizzly bears, wolves, caribou, Dall sheep and moose).

Wolves

Just how important is wolf viewing to visitor satisfaction? A 2012 survey in DNPP found that, while wolves were seen by about 26% of the visitors, seeing a wolf was a statistically significant contribution to wildlife viewing satisfaction (Skibins, et al. 2012). However, the contribution of wolves toward wildlife viewing satisfaction was not statistically different than was the contribution of moose, despite the fact that moose were seen two-thirds of the time. Based on a backcountry hiking study of Keller (2016), an increasing sub-demographic of international visitors is apparent in DNPP, and these visitors are very interested in wolf viewing. Visitors in this study are asked to allot preferences to wildlife viewing across a list of ungulates and carnivores, as well as rank these species importance to experiencing the "wilderness character" of DNPP backcountry. Keller's qualitative content analysis of these backcountry visitors yields a primary theme of dissatisfaction of *not* seeing wolves. In particular, deploying this theme as a factor in ANOVA she found very significant loadings ($r = .77$; $p < 0.1$) with individual's relative rating of the importance of wolves for their overall DNPP wilderness experience (Keller, 2016:7). This preliminary study points to the need of including visitors to DNPP both on and off the shuttle and tour buses in a wolf viewing valuation study.

IV. Economic Impacts Associated with DNPP and Wildlife Viewing

Economic impact analyses evaluate the direct and indirect effects of spending by visitors living outside the economic impact area. Specifically, positive economic impacts arise when visitors living outside the geographic impact area, visit the economic impact area and spend money inside the economic impact area. In essence, these visitors living outside the impact area inject "new" money into the impact area by their spending in the impact area.

There have been two economic impact studies of DNPP in recent years. The first was the economic impact study by Stynes and Ackerman (2010) which was based on 2008 visitation data (432,309 visitors). This study evaluated two impact areas: (a) the State of Alaska as a whole; (b) the DNPP region. To evaluate the positive economic impact that visitors to DNPP have on the State of Alaska economy as a whole, the study focused on the spending of non-Alaskan resident visitors (rest of the U.S. and international) while visiting DNPP. In 2008 these non-resident visitors' spending supported 2,319 jobs with $77.4 million in wages and an additional $48.52 million in other income (profits, rents and indirect business taxes) in the State of Alaska.

Stynes and Ackerman also estimated the economic impact of DNPP visitor spending to just the Denali Region (defined as the Denali Borough). For this analysis, Alaska resident spending inside the Denali Region represents new money injected into the Denali Region because nearly all Alaska residents live outside the Denali Region. In 2008, spending by Alaskan residents, rest of U.S. residents and international tourists supported an estimated 1,491 jobs in the Denali Region. This was associated with $45.4 million in wages and $26 million in other income (profits, rents and indirect business taxes).

A more recent study using the much higher 2014 visitation rate to DNPP numbers (531,315 visits)[4] and improved economic impact modeling calculated significantly higher positive economic impacts. Specifically, the results indicated that visitor spending supported 6,800 jobs with $249.4 million in labor income and an additional $231 million in other income (profits, rents and indirect business taxes (Cullinane, et al. 2015).

Total Economic Impacts Attributable to Wolves

As noted by Iverson and Borg, "Currently, there is no accurate assessment of how many people visit the park primarily for the purpose of viewing wolves". This is an important data gap to fill because even if a few percentage points of the Denali Borough jobs or the State of Alaska jobs were directly related to visitors coming primarily to see wolves, it could amount to several hundred jobs.

[4] 2014 visitation data from http://www.nps.gov/dena/learn/management/statistics.htm

V. Economic Benefits (WTP) Associated with DNPP Wildlife Viewing

In terms of economic values, McCollum, et al. (1998) found that visitor benefits (as measured by WTP) increased with wildlife viewing success. In particular, WTP rose from $47.58 per person per day trip ($70 in $2014) to $63.49 ($94 in $2014) when a trip involved the visitor seeing all of the Big 5 species **(**Grizzly bear, caribou, Dall Sheep, moose and wolf), and when the number of individual Big 5 animals seen increased from an average of 6 individual Big 5 animals to 21 individual Big 5 animals. This suggests that the probability of seeing a species such as a wolf and the number of wolves seen likely has a significant effect on wildlife viewing benefits.

VI. The Importance of Wildlife and Wolves in Alaska

Given the very limited information on the economic impacts and values of wolves in DNPP we synthesized the economic information on wolf values in the entire state of Alaska.

A. Uses of Wildlife in Alaska

ECONorthwest (2014b) surveyed Alaskan residents and found that well over 50% of respondents felt that wildlife was either "extremely important or very important" to their reason for living in Alaska and their quality of life. Alaskans interact with wildlife through hunting (about 100,000 participants) and wildlife viewing (about 200,000 participants). Of the residents that hunt, slightly less than 10% hunt wolves (moose are the most commonly hunted species). Of the visitors coming to hunt in Alaska, about 20% come to hunt wolves (ECONorthwest, 2014b). However, the vast majority of visitors (90%) that come to Alaska do so to view rather than hunt wildlife. Among Alaska residents and visitors to Alaska, 25% of residents and 40% of non-residents wanted to see wolves on their wildlife viewing trips.

The ECONorthwest (2014b) report briefly summarized what is known from secondary sources about trapping in Alaska, as too few residents participated in trapping to make a survey feasible. In particular, less than 1% of hunters in Alaska are trappers (ECONorthwest, 2014b:29). The ECONorthwest (2014b:30) report also indicates that Alaska contains plentiful areas for traplines. Data obtained by ECONorthwest (2014b:30) indicated that the total estimated value of fur trapping in Alaska in 2010-2011 was $1.54 million with lynx representing about half the value, and wolves representing about $175,000.

Dorendorf (2015) conducted a mail survey of trappers in the interior of Alaska (the geographic area spanning Delta Junction, McGrath, Fairbanks and Fort Yukon). Across the entire sample of 344 active trappers who returned surveys Dorendorf (2015:30) noted that "Outdoor recreation formed the most important motivation to trap in interior Alaska." He also noted that "…economic and subsistence uses of wildlife scored the least important motivations to trap in this study." (Dorendorf, 2015:31). In contrast to EcoNW (2014b), perceptions of interior Alaska trappers in Dorendorf's survey reported that finding access to land for trapping was difficult.

To further investigate the motivations of trappers, Dorendorf performed a cluster analysis of his data. This analysis statistically grouped trappers based on their primary motivations for trapping. Dorendorf found there were four types of trappers: (1) a recreation group (by far the largest group at 40% of the sample); (2) a solitary group (the second largest group); (3) a subsistence group; (4) a wildlife management group. The recreation group is distinguished by their desire to participate in trapping as a way to get exercise and appreciate nature. In contrast, trapping was part of a lifestyle to the subsistence trappers. Dorendorf (2015: 34) noted that in small remote villages, fur was used for "…cultural crafts and ceremonies as well as a source of income in the winter". The "solitary" trappers were distinguished by trapping as an individual activity (as opposed to group or social activity) with

solitude as the primary motivating factor. Finally, the wildlife management group of trappers was motivated in part by the desire to reduce predators for the species the trappers hunted (e.g., moose and caribou). In sum, trappers are not a homogenous group. For many, trapping is a means to other ends, is not heavily dependent on the abundance of the target species.

B. Economic Impacts of Wildlife Viewing and Hunting in Alaska

Miller and McCollum (1997) studied non-resident visitor expenditures and net WTP of visitors beyond their expenses. These authors used a diary survey of non-resident visitors including those that were taking trips for multiple purposes (i.e., for some visitors wildlife viewing was only a secondary trip purpose). Given the topic of our study, we focused on the subset of non-resident visitors that came to Alaska primarily to view wildlife. The total trip expenditures of non-resident visitors who came to Alaska primarily to view wildlife were $3,982 in 1994 ($6,361 in $2014).

ECONorthwest (2014a,b) performed a survey of both Alaska residents and non-resident visitors to Alaska about their use and spending related to hunting and wildlife viewing. The economic activity associated with wildlife viewing and hunting was measured in these studies by resident and non-resident visitor spending. Economic impacts were measured by jobs supported by the activity. Hunting expenditures by residents and non-resident visitors supports $457 million in wages associated with 8,400 jobs statewide (Table 1). This hunting activity also provides $112 million in various types of revenue to local and state governments in Alaska. Wildlife viewing provides $976 million in wages to 18,820 workers statewide (Table 1). In addition $231 million in revenues are provided to various levels of government in the State of Alaska.

Table 1. Economic Activity Associated with Wildlife Viewing and Hunting in Alaska and Denali National Park and Preserve (Denali NP&P), Alaska. There are several blank cells as not all the studies reported economic activity or economic impacts consistently.

Area/Activity	Per Visitor Spending per Trip	Total Jobs	Reference
Alaska			
Wildlife Viewing		18,820	(ECONorthwest, 2014a)
Wildlife Viewing	$6,361		Miller & McCollum (1997)
Hunting		8,400	(ECONorthwest, 2014a)
Denali NP & P			
Wildlife Viewing		2,319	Stynes & Ackerman (2010)

C. Economic Values of Non-Resident's Wildlife Viewing and Hunting in Alaska

Miller and McCollum (1997) surveyed non-resident visitors after their trips to Alaska were completed and asked if the trip was worth more than what they spent. The average additional WTP of a primary purpose wildlife viewing trip in Alaska was estimated (Miller and McCollum (1997: page C-21) at $422 in 1997 ($674 in 2014 dollars). The net WTP dropped to $310 ($495 in $2014) for those that saw no big game (but did see other species such as birds). For those that saw at least one wolf, the net WTP was $539 ($861 in $2014). A simplified comparison of the value of seeing a wolf might be the difference in trip value from seeing a wolf and not seeing any big game. Using this simplified comparison, the additional value from seeing a wolf on a non-resident trip taken primarily for wildlife viewing would be $238 ($366 in $2014).

The survey also asked non-residents about the economic value of a future trip *"…where you could expect to see a pack of wolves either from the ground or from an airplane."* (Miller and McCollum, 1997: page E-11). A dichotomous choice CVM WTP question was designed to elicit an *ex-ante* future

WTP, similar to what economists would call an option price for future viewing use. The net WTP per trip to see a pack of wolves on a future trip was $212 ($339 in $2014). The authors termed this value a gross WTP and used it to measure the potential demand for future wildlife viewing activity. This value per trip is similar to what was calculated above as the additional value of seeing a wolf on a wildlife viewing trip. Using a CVM survey, ECONorthwest, (2014b) estimated that non-residents' net WTP was $765 for a hunting trip and $858 for a wildlife viewing trip to Alaska.

D. Economic Values of Alaska Residents for Wildlife Viewing and Hunting in Alaska

ECONorthwest (2014b) used CVM to estimate residents' net WTP of $438 per trip for hunting trips and $268 per trip for viewing trips. While the value per trip to Alaska residents is smaller than for non-residents cited in the prior section, the larger number of trips taken by Alaska residents results in annual resident hunting benefits of $4,828 and $8,050 for viewing, quite a bit larger than non-resident's annual values. The National Research Council (NRC, 1997: 150), using unpublished data, reports that Alaskan residents' net WTP specifically for wolf hunting was $1500 ($2,212 in $2014). This is notably greater than the value of moose hunting of $181 ($273 in $2014) and $168 ($253 in $2014) for caribou hunting.

An additional CVM question was asked by ECONorthwest (2014b) to estimate how much respondents' economic value of a wildlife viewing trip would increase if they could visit an area specifically managed for wildlife, such that they would be assured of seeing one or more species particularly important to them. While the authors of the report indicate the question was not as precise and concrete as would have been desirable, they felt it was indicative of the extra value of a "successful" wildlife viewing trip for species of importance to the respondent. The additional WTP beyond the current trip was $400 per household for non-resident visitors and $150 more for Alaskan

residents. It would seem that this type of question is particularly relevant for valuing improved wildlife viewing in Denali NP & Preserve. While the specific question scenario and wording could be improved, the refined question could be included in future Visitor Service Project (VSP) surveys in Alaska national parks.

As part of the survey, ECONorthwest (2014b) asked about general willingness to pay into a wildlife conservation fund to maintain current wildlife populations and their habitat in Alaska. Their report acknowledged that the question did not specify the decline in wildlife populations that would occur in absence of this payment. But the authors felt the results nevertheless provided some sense of the values of wildlife conservation in general. The survey responses indicated that Alaskan residents would pay $59 per year to maintain wildlife in general, while non-resident visitors would pay $32 per year. Alaska residents were also asked if they would pay for wildlife conservation to maintain the current population and habitat for four types of wildlife (Brown Bears, Seabirds, Caribou and Moose). Alaska residents indicated they would pay $40 a year for Brown bears, $90 a year for seabirds, $53 per year for caribou, and $46 per year for moose. The results provide some information on relative values of these four different types of wildlife. To increase the usefulness for economic analysis the WTP questions could be improved upon, and wolves included as a species in future surveys.

E. Summary of Resident and Non-resident Values for Viewing and Hunting in Alaska

Table 2 summarizes studies to date on economic values of viewing wildlife and wolves, as well as big game hunting, and wolf hunting. While non-resident hunting and viewing values are similar, resident hunting values per trip are substantially larger (Table 2). However, as noted in the text, there are twice as many wildlife viewers than hunters (ECONorthwest, 2014b:15). Wolf hunting by residents has a very high value per trip, but the total number of hunters is quite limited.

Table 2. Economic Values of Wildlife or Wolf Viewing and Hunting in the State of Alaska and Denali National Park and Preserve, Alaska, USA. ($2014)

Area/Activity	Per Visitor WTP/Trip	Reference
Alaska		
Non-resident Viewing	$674	Miller & McCollum
Non-resident Viewing	$858	(ECONorthwest, 2014b)
Resident Viewing	$268	(ECONorthwest, 2014b)
Residents Wolf Viewing	$288	NRC Report
Non-resident Wolf Viewing	$339	Miller & McCollum
Resident Hunting	$438	(ECONorthwest, 2014b)
Resident Hunting	$247	NRC Report
Non-resident Hunting	$765	(ECONorthwest, 2014b)
Non-resident Hunting	$650	NRC Report
Residents Wolf Hunting	$2,212	NRC Report
Non-resident Wolf Hunting	$518	NRC Report
Denali NP & P		
Wildlife Viewing	$94	McCollum, et al

VII. Visitation and Economic Impacts of Wolf Viewing in Yellowstone National Park (YNP)

The only studies that have estimated the economic impacts associated with wolf viewing itself (as distinct from wildlife viewing in general) have taken place in Yellowstone National Park (YNP). Duffield, et al (2008) estimated that 1.5% of spring visitors to YNP and 5% of fall visitors specifically came to view wolves in YNP. Applying this percentage of visitor use to YNP total visitation and multiplying by average visitor spending in YNP yields $35 million annually. However, even among visitors who come to YNP for reasons other than to view wolves, Duffield et al's (2008) visitor data from the summer of 2005 indicates that 44% of the general visitors stated that wolves were one of the animals they most wanted to see on a trip to YNP. Wolves ranked as the second most important species to view (slightly below grizzly bears).

In a 1993 U.S. Fish and Wildlife Service (USFWS) study for the Final EIS on wolf reintroduction, a contingent behavior or intended behavior question was used to estimate the increase in visitation (if any) from a recovered wolf population in YNP. The study found that reintroduction would result in an estimated 10% average increase in visitation to YNP by residents of MT, ID and WY and 4.8% increase in visitation among those visitors living outside of the three states.

VIII. Visitors' Use and Existence Value of Wolves in YNP

Duffield et al (1991) and Duffield (1992) conducted surveys of visitors to estimate their Total Economic Value (composed of use and existence values) for wolves in YNP. This section reviews the Total Economic Value (TEV) of visitors and the next section reviews the TEV of non-visiting households. Duffield's two studies utilized the contingent valuation method (CVM) to estimate the existence value portion of a visitor's value. He used visitors' willingness to pay (WTP) for a lifetime membership in a trust fund (what he also refers to as a donation) to support wolf reintroduction in YNP. The visitors are told that wolf recovery may reduce populations of deer, elk, bison and moose in YNP so they are informed of this trade off when answering the CVM WTP question for wolves.

The particular type of CVM used was a dichotomous choice method, where a visitor answers either "Yes, I would pay that amount for a membership" or "No, I would not". The dollar amount of the membership was varied across the sample, so essentially a quasi-demand curve for wolf recovery was estimated. The use of the dichotomous choice method was a strong feature of this study. However as was common at the time, the survey told respondents that the scenario was a hypothetical situation. In the last 10 years CVM researchers no longer use the term hypothetical, but rather emphasize that the respondent's answer could have real consequences to policy decisions made and the likelihood of actual payment in the future. Telling respondents that the survey is hypothetical has the potential to result in increased hypothetical bias in the form of inflated WTP estimates (Carson and Groves, 2007). Thus the reader should keep in mind this concern when interpreting the absolute magnitude of the WTP estimates.

The results of the Duffield et al. (1991) study estimated that median WTP (the amount that 50% of the visitors would pay) was $15.38 ($27.86 in $2014) for visitors living in MT, ID and WY and $20.27 ($36.71 in $2014) for visitors living in the rest of U.S. However, some of these visitors have

relatively higher values for wolf reintroduction, and this is reflected in a higher mean WTP. Even truncating the upper end of the WTP distribution at the highest dollar amount asked in the survey ($300), the mean WTP was $62 ($112 in $2014) for visitors from MT, ID and WY and $97 ($176 in $2014) for visitors from the rest of the U.S.

Using two different innovative methods to separate TEV into use and existence value, Duffield et al. (1991) found that MT, ID, and WY visitors' existence value for wolves ranged between 46% and 61% of their TEV. Using the same procedures, the existence value of out-of-region visitors ranged from 74% to 75% of their TEV for wolves. The fact that much of the TEV is existence value, even for visitors, suggests the importance of including existence value for wolves and not just focusing on visitor use values when calculating the societal or national benefits of maintaining and protecting wolf populations.

Duffield (1992) did a follow up CVM study of visitors to YNP the following year using basically the same procedure as the year before except for one important difference. An innovative feature of the Duffield (1992) study of the divisive issue of wolf reintroduction was to the tailor the CVM WTP question to whether the respondent initially indicated they were in favor of or opposed wolf reintroduction. If they favored it, they were asked what they would pay into a trust fund to **support** wolf recovery. If they opposed it, the respondent was asked what they would pay into a trust fund where the money would be used to **oppose** wolf reintroduction.

In this CVM study Duffield (1992) estimated that YNP visitors **favoring** wolf recovery/reintroduction have a median WTP into the trust fund of $23 ($40 in $2014) to aid wolf recovery. Those visitors **opposed** to wolf recovery/reintroduction had a median donation of $1.68 ($2.82 in $2014) to a trust fund for a policy effort to stop wolf reintroduction. Given that there were nearly three times as many visitors that would purchase a wolf recovery membership (i.e., donate to

the pro-wolf trust fund) as there were visitors who opposed, the overall median WTP is quite similar to the $40 in 2014 dollars. Once again, the mean WTP was substantially higher than the median WTP. In particular, those favoring wolf reintroduction would pay on average $65 ($113 in $2014) while those opposing would pay $21.24 ($37 in $2014). Consistent with the previous summer survey, about three-quarters of the overall visitor TEV was existence value, once again illustrating the importance of including existence values. The conclusion of these economic studies that ask respondents either WTP to support wolf recovery or WTP to oppose wolf recovery is that while there is certainly a segment of visitors that do not favor wolves, in the aggregate, the benefits to those that want wolves are substantially large than those that do not. Specifically, the mean WTP of visitors favoring wolves is three times larger compared to those opposed to wolves ($65 versus $21), and there are three times as many visitors favoring wolves than opposing wolves. Taken together, the aggregate WTP of visitors favoring wolves is nine times that of those opposed to wolves. Thus the benefits to those visitors favoring wolves outweigh the reduction in benefits to those visitors opposed to wolves.

IX. Use and Existence Value of U.S. Households for Wolves

A. Yellowstone NP Wolf Reintroduction Program

Duffield, et al. (1993) conducted a phone CVM survey of households in the Greater Yellowstone Area (GYA)—made up of the counties in ID, MT and WY contiguous to YNP (the primary area of the wolf reintroduction). As part of the same study, the same CVM survey was conducted on a sample of U.S. households living outsides of the GYA. The same structure of CVM WTP questions were asked of households as was done for visitors: those who stated they were in favor of wolf reintroduction were asked their WTP for it, and those opposed were asked what they would pay to prevent wolf reintroduction. As in the visitor survey, households were told the CVM WTP questions were hypothetical, something no longer done in CVM surveys. Thus, the reader should keep in mind that there is a potential for the absolute magnitude of the WTP estimates to be somewhat higher than would otherwise be the case had respondents not been told the survey was hypothetical.

Given this CVM study design with two geographic areas (GYA and rest of the U.S.) and two WTP questions (one for those respondents favoring wolf reintroduction and one for those opposing wolf reintroduction), there are four WTP estimates. The estimates are:

a. GYA local residents WTP **for** wolf reintroduction of $22.69 ($38 in $2014), with an n=189.

b. GYA local resident WTP to **oppose** wolf reintroduction of $2.63 ($4.45 in $2014), with an n=212.

c. Rest of U.S. households WTP **for** wolf reintroduction of $8 ($13.50 in $2014), with an n=753.

d. Rest of U.S. households WTP to **oppose** wolf reintroduction of 16 cents with an n=368.

As can be seen in these four estimates of WTP, those in favor of wolf reintroduction have a WTP that is nearly ten times higher than those opposed. While the number of households in the GYA are nearly evenly split for and against, in the rest of the U.S. there is nearly a two to one split in favor of wolf reintroduction. Combining the respective WTP's and sample proportions, the aggregate benefits

are overwhelmingly positive. The aggregate benefits range from at least $12 million ($20 million in $2014) to $38 million ($64 million in $2014), with the range dependent on different aggregation assumptions made by Duffield, et al.

A slight re-analysis of the Duffield et al. (1993) CVM study results were used by the USFWS in its Final EIS on the reintroduction of gray wolves into Yellowstone National Park and Central Idaho. The inclusion of households use and passive-use/non-use values in the EIS provides evidence that federal agencies feel the CVM methodology in general, and its specific implementation in the wolf study, contributes valuable information to the wolf management policy decisions.

B. Wolf Habitat Protection in Minnesota

Chambers and Whitehead (2003) estimated the benefits of protecting wolf habitat for two different communities in Minnesota within the range of the wolves by using a CVM survey of households (this study was described in detail in the prior section entitled Methods for Quantifying Economic Values). The results indicated that Ely, Minnesota households would pay between $4.43 and $4.77 (about $7 in $2014) "… *for protecting wolf habitat and that of wolves primary prey."* St. Cloud, Minnesota residents were willing to pay between $20.15 and $21.49 (about $31 in $2014) for the same public good.

C. Summary of Use and Existence Values

Table 3 summarizes the Total Economic Values in the literature reviewed above. As might be expected, visitor values are substantially about household values. Values of households that live nearer wolves are higher than households that live away from wolves.

Table 3. Total Economic Values (use and non-use/existence and bequest values) that the visitors and households would pay to either reintroduce wolves into the GYE or protect wolf habitat and their prey to maintain stable wolf populations in Minnesota **($2014)**

Location	One time WTP	Authors
Yellowstone NP		
Visitors living near GYE*	$112	Duffield, et al. 1991
Visitors living in rest of US	$176	Duffield, et al. 1991
Visitors living in rest of US	$113	Duffield 1993
Households living near GYE	$38	Duffield, et al. 1993
Households in living in rest of US	$13.50	Duffield, et al. 1993
Minnesota		
Ely MN Households	$7	Chambers & Whitehead
St. Cloud Households	$31	Chambers & Whitehead

***** GYE is Greater Yellowstone Ecosystem, generally counties in Idaho, Montana and Wyoming contiguous to Yellowstone National Park.

X. Summary of Data Gaps

While the report to this point indicates that some information exists on the economic value of wolves in 2 areas in the lower 48, and for Alaska in general, little is known about the economic value of wolves in and around DNPP. Wolves in and around DNPP are likely to provide economic benefits to: (a) an unknown number of visitors coming to the DNPP primarily to view wolves; (b) the general public of the U.S. through existence values of a self sustaining wolf population in DNPP; (c) wolf hunters around DNPP and (d) trappers around DNPP. In the following sections we identify the types of studies needed to quantify the economic benefits that wolves provide to these four different stakeholder groups.

A. Data Gaps About Visitors to Denali NP and Preserve (DNPP)

i. What percent and how many visitors to DNPP come for the primary purpose of viewing wolves?

ii. What expectations did people bring to DNPP about viewing wolves?

iii. What basic knowledge do visitors have regarding the wolf population in DNPP and in Alaska in general?

iv. What are the expenditures of these visitors in the DNPP region and State of Alaska?

v. Did these visitors see a wolf, and if yes, how many?

vi. If they saw a wolf, what are these visitors' net WTP for their experience?

vii. If they did not see a wolf, what are these visitors' net WTP to be certain they would see at least one wolf?

viii. How would their trips to DNPP change if they could see a specific increase in the number of wolves?

ix. How would their net WTP increase if they could see a specific increase in the number of wolves?

x. What are the similarities and differences in visitor preferences for wolf and other wildlife viewing?

xi. How do visitors perceive the notion of *paying* for wolf conservation and protection in DNPP?

xii. What are non-use or passive use values of wolves for visitors to DNPP and Alaska?

D. Data Gaps about Big Game Hunting and Trapping around DNPP

Hunters

As noted by NRC (1997) little is known about big game (caribou and moose) hunters around DNPP. In particular it would be important to know what percentages of hunters' motivations are primarily: (1) harvesting for meat; (2) trophy hunts; (3) to be with family and friends; or (4) to be in the out of doors. This information would provide insights into how important the abundance of big game is for the decision to (1) purchase a big game hunting license; and (2) make multiple hunting trips.

Trappers

While ECONorthwest (2014b) indicated that not a great deal is known about Alaska trappers, that data gap has narrowed with the thesis of Dorendorf (2015) in August of 2015. This thesis provides significant amounts of information on motivations for trapping and determinants of trappers' behavior. However, this effort covers Interior Alaska broadly, so segmenting Dorendorf's data down to the geographic areas of interest (around the boundaries, particularly eastern boundary of DNPP would be needed to determine if the thesis contains sufficient data or a more localized survey is required).

C. Data Gaps about Household Use and Existence Values

In its review of the Alaska predator control program the National Research Council (NRC is part of the National Academy of Sciences), stated that values of wolves include not only use values such as viewing, hunting, and fur but also non-use or passive-use or existence values to households that may never see a wolf in the wild (NRC, 1997:9). The NRC (1997: 9) states that the current magnitude of the existence values for wolves is not known because the necessary studies have not been conducted in Alaska or for the Alaskan wildlife species. The NRC indicates that the Contingent Valuation Method (CVM) is one of the only methods capable of estimating these existence values. The absence of information on existence values of wolves is an important gap to fill to improve wildlife management in Alaska. Along these lines the NRC (1997:12) recommends more social science research in Alaska is needed to support management decisions related to wolves.

XI. Study Plan to Fill Data Gaps

A. Visitor Surveys at Denali NP and Preserve

The most straightforward approach to address existing data gaps would be to conduct a survey of visitors to DNPP. This survey will target three major visitor groups: those on a tour, those using a shuttle bus to camp or day hike, and those trekking overnight in the backcountry. The shuttle buses should be canvassed, to capture the diversity of day hikers, wildlife viewers, bikers, and international groups that populate the shuttles. The overnight backcountry users should be sampled due to the different expectations, especially regarding wilderness experience, they bring to DNPP. Finally, the tour buses should be canvassed as the dominant tour user demographic appears different than the shuttle bus and overnight backcountry user. Following the design of prior DNPP wildlife surveys (McCollum, et al. 1998), we recommend distributing surveys during the last leg of the bus tour back to the entrance Visitor Center. This time of survey distribution would: (a) minimize inconvenience to visitors' experience; (b) provide the most reliable responses since they will have just experienced their trip so that recall bias would be at a minimum; (c) obtain a very high response rate (which is necessary if this survey must go through OMB); (d) be a relatively cost effective survey approach (as more than a dozen surveys, one to each group/family of visitors, could be obtained at one time on a single bus); (e) allow some degree of external validity of the surveys by comparison with wildlife viewing records kept by the bus driver. Ideally the surveys would be conducted throughout the summer, including weekdays and weekends (to increase the odds of intercepting an Alaskan resident).

1. The type of questions to be asked to fill data gaps

a. What were the primary and secondary purposes of their trip to DNPP? One of the response categories for primary purpose and secondary purposes would be "viewing wolves".

Collectively responses to this question would provide data on what percent and how many visitors to DNPP come for the primary purpose and secondary purposes of viewing wolves.

b. Whether they saw a wolf, and if yes, how many.

c. What is the visitor's WTP for their current trip. To obtain WTP, a dichotomous choice CVM question for the visitor's current trip into DNPP would be asked. We would statistically test if the economic value of a trip to DNPP is significantly affected by whether they saw a wolf, and if yes, by the number of wolves they saw. An increase in trip cost would be the payment vehicle.

d. For visitors who reported they did not see a wolf, they would be asked a second CVM WTP question to estimate their value of a trip in which they would be certain to see a wolf. This question will test the relative importance of wolves in the visitor's economic benefits from a trip to DNPP. We would also ask if they would take more trips if they could be certain they would see a wolf on each trip. This question tests the responsiveness of trips taken (and hence visitor spending) to presence of wolves in DNPP.

e. For visitors who reported they did see at least one wolf, they would be asked their WTP to see some reasonable (to be determined) increase in the number of wolves. This would allow us to estimate how the benefits of the trip change with the abundance of wolves seen. We would also ask if they would take more trips if they would see some reasonable increase in the number of wolves. To obtain a better understanding of whether wolves play a critical role in determining whether to visit DNPP, we could ask if they would have made their trip to DNPP if they did not expect to see any wolves.

f. Trip expenditures in and around DNPP (disaggregated by spending category) would be asked so that we would know if the visitor spending is significantly different among those visitors who came to view wolves versus general DNPP visitors.

g. Attitude questions regarding wildlife, wolves, hunting, and trapping would be asked to obtain an understanding of what DNPP visitors think of consumptive uses of wildlife in general, and wolves in particular.

h. Demographics (zip code, age, education, membership in conservation organization, race/ethnicity, and income). This information will help provide a demographic profile of visitors who came to view wolves in contrast to the general DNPP visitors.

i. One other factor that may be worth recording are weather conditions, which may influence visitor satisfaction.

2. Prepare Office of Management and Budget (OMB) Survey Clearance Package

If the survey is funded by an agency of the Federal government (e.g., NPS) then Office of Management and Budget (OMB) clearance would be needed even before conducting pretests. The clearance process begins with filling out two packages of information for OMB for approval. The two packages include the agency's need for the information to be obtained by the study, and the entire study design. The study design and survey design would start with the prior survey of McCollum, et al. 1998. The study team would revise the survey with feedback from Dr. McCollum, and input from NPS staff at DNPP. Specifically, the study design would address procedures for implementing the survey, the survey design (with justification for each question being asked), sample design including sample size determination, and statistical analysis procedure. Several months of review and revision is typically required before OMB usually approves the survey.

3. Pre-test the survey

The approved survey would be pretested over the course of two weeks with a total of 30 people completing their bus tour. The pre-test would occur at a NPS facility such as the Visitor Center at the end of their trip. A monetary incentive (typically $80 per person) is usually required to get people to

sit down and take about an hour to go over the survey. In order to have a good representation of visitors, one person from each returning bus would be invited to participate in the pre-test. The selection of buses would alternate between the Shuttle Bus going only to Eielson Visitor Center and those buses going to Wonder Lake, as well as a bus from the Tundra Wilderness Tour. Each section of the questionnaire would be read, questions answered and then discussed to ensure that the visitor interpreted the questions as they were intended by the survey designers. A complete "debriefing" would also be conducted to obtain feedback on the skip patterns, question response categories, and overall layout of the survey.

4. Revise the survey with feedback from the pre-test

A second small pretest of 10 people (also paid $80) would be required to make sure any issues raised in the original pre-test have been completely resolved and that no new issues have arisen.

5. Sample frame and selecting a representative sample

Before discussing the sample size, it is important to discuss how the sample would be selected in order to ensure the sample is representative of visitors at DNPP. First, we define the sample frame as "those visitors riding buses into the park" as these are visitors most likely engaged in sightseeing and wildlife viewing in DNPP. In particular, visitors on the Shuttle Bus, the Tundra Wilderness Tour and Kantishna Experience Tour will all be sampled. However, they will be sampled in proportion to their share of the total amount of visitor use. In addition, one adult person from each group/family will be sampled so as not to double-count trip expenditures. This person can of course consult with other family or group members to determine their answers. The group size will be reported as part of the survey. One weekend day (alternating between Saturday and Sunday) and four week days (selected at random) would be sampled.

6. Sample size

A relatively large sample is needed because a dichotomous choice WTP question will be used, and because visitors who do not see wolves will get a different WTP question from those who did see wolves. Guidance from Dillman (2000) for surveys in general, and Champ (2003:68) for CVM, suggests that a population of 100,000 requires a minimum of 383 completed surveys would be sufficient to obtain a ±5% sampling error (95% confidence interval in a conservative 50/50 population split). Given that there are three major types of buses (shuttle bus, and two types of tour buses) each of which have different prices and may attract different types of visitors, I recommend 380 surveys be collected from each of the three types of buses. This will ensure the composition of the final combined sample will represent a cross section of the three different types of bus visitors to DNPP. Special attention should be given to the tour bus, Tundra Wilderness Tour, because it is set aside from the other tour and shuttle bus offerings as a specifically "wildlife viewing safari" tour.

As previously mentioned, visitors to DNPP that are trekking overnight into the Park must be surveyed to capture the effective variance of visitor demographics, and their assumed divergent recreation goals and expectations.

7. Printing final survey booklets

Following Dillman (2000), the survey questions would be contained in an eight page survey booklet. The booklet would consist of an interesting cover, 6 pages of questions (with demographics being the last inside page), and a blank back cover for the visitor to write comments. The surveyors will conduct non-response checks, especially focused on residency, so as to develop an appropriate weighting mechanism regarding the oversampling that will occur of non-Alaskans.

8. Implement survey over the summer season

Starting Memorial Day weekend and going through Labor Day, 2 people would be employed to hand out surveys on the return trip back to the visitor entrance. One employee would ride the Shuttle Bus and one would ride one of the Tour Buses each sampling day. Each employee would also maintain a count of the types of wildlife and number of wildlife seen to corroborate visitor counts of wildlife sightings. Each employee would work 4 week days and 1 weekend day. One person from each group or family on the bus would be selected to answer the survey for their family or group. A target of 10 visitors per bus per day to hand out surveys to would be ideal.

9. Data Entry and Error Checking

Data entry would occur via spreadsheet for compatibility with statistical packages. Two forms of data error checking would occur: (a) screening data for maximum and minimum values to ensure data is within ranges allowed for in surveys (e.g., 0, 1 for dichotomous variables like gender), and that there are no outliers; and (b) a small subsample of surveys would be re-keyed and compared to the original surveys to determine the accuracy of the original coding. The non-response checks mentioned above will be coded and combined with the compiled visitor survey dataset.

10. Statistical analysis

Descriptive statistics for the three types of bus trips and for the overall sample for all variables would be presented either in tabular form in the main report or in an appendix. The dichotomous WTP questions would be analyzed using logistic regression model. The mean and median WTP would be calculated for the three types of bus trips and the overall sample. The sample WTP results would be scaled up to the population using the number of visitors riding each type of bus over the summer.

11. Draft report writing

A draft report presenting the methodology employed, sample design, sample implementation, descriptive statistics, WTP results, and providing interpretation of what these results imply about wolf viewing would be written.

12. NPS review of draft report

13. Report revision in response to NPS review comments and final report.

Costs Associated with the Visitor Study

There are two major types of costs associated with this study:

Fixed costs to design, prepare OMB package and pretest the survey

This would require Ph.D. level social scientist/economist with training and experience in conducting visitor non-market valuation surveys. Depending on whether the person is an NPS employee or external to NPS (e.g., academic's or consulting firm employees), the labor costs would be on the order of $45,000. The travel costs for scoping out the logistics of the survey and pretesting would be in the range of $10,000 given the high expense in traveling to and staying in the area around DNPP. The actual pre-testing participant costs would be $3,200. I assume a NPS facility would be available free of charge to conduct the pre-test interviews.

Variable costs of conducting the survey

Printing: about 1200 survey booklets, cover letter and envelopes: $3,600

Labor for sampling days: Assume a GS-9 level employee working 10 hours a day (due to the length of typical bus rides) and being paid $28 an hour for eight hours and $40 an hour for two hours overtime, the cost per day would be $304. With 60 sampling days this would be $18,240 without benefits.

Data entry: Assume the same GS-9 level employee for data entry, 20 minutes to input data for each survey and 1200 surveys is 400 hours for a total data entry cost of $10,400.

Statistical analysis: this would be conducted by a Ph.D. social scientist/economist. The cost is estimated to be $30,000 given there are three sub-samples to analyze plus a total sample.

Draft report writing: this would be conducted by a Ph.D. social scientist/economist. The cost is estimated to be $30,000.

Final report writing: this would be conducted by the same Ph.D. social scientist/economist who wrote the draft report. The cost is estimated to be $15,000 to make the revisions and finalize the report.

Thus an estimated direct cost of the entire effort would be $165,440 without employee benefits and any overhead. Table 4 summarizes the budgetary costs of the study.

Table 4. Summary of Estimated Costs for DNPP Visitor Survey

Cost Element	Est. Cost
Labor	
Study/Survey Design	$ 11,250
Prepare OMB Pkg	$ 11,250
Pretesting Survey in AK	$ 11,250
Revise & Finalize Survey	$ 11,250
Visitor Sampling	$ 18,240
Data Entry	$ 10,400
Statistical Analysis	$ 30,000
Draft Report Writing	$ 30,000
Revise & Finalize Survey	$ 15,000
Subtotal Labor	**$ 148,640**
Travel	
Pretesting travel to DNPP	$ 10,000
Other Expenses	
Participant Incentives	$ 3,200
Survey Printing	$ 3,600
Total Study Costs	$ 165,440

Study Timeframe

The time from needed for the initial overall study design, initial survey design, and preparation of OMB package would be three months. There would be about 4 months of waiting for and engaging with OMB to obtain their approval (only about 1 work month required during this time for engaging with OMB and revising study plan and OMB package). Depending on the timing of the OMB approval, this could determine whether the survey would be implemented during the summer of 2017 or 2018. The actual survey pre-testing, implementation, analysis and report writing would be about 8 months. Thus the total work time would be about 11 months with an additional 1 month of conference calls and OMB package revisions for a total of 12 months of work if all goes well at OMB. These 12 work months might stretch over two years however, depending on the timing of the OMB review relative to the summer visitor sampling season.

B. Hunter Surveys

To fill the data gaps identified for hunting we would ideally work with Alaska Dept of Fish and Game (ADFG) to obtain a list of big game hunters (caribou, moose) in Game Management Unit #20. The particular units to sample are 20A (on the eastern boundary of the Denali National Park), and 20C (which includes Denali National Park and areas to the north of the Park). In addition, a list of hunters engaged in wolf hunting would need to be obtained. Then a mail survey of hunters in the region around DNPP would be undertaken to fill the data gaps identified by NRC. In particular, the surveys would ask about their harvest success rate, expenditures and net WTP for their current hunt. Then questions would be asked regarding how their number of trips and net WTP would change with a

specified (perhaps varying across the sample) lower harvest success rate. In addition, a question would be asked regarding whether the possible lower harvest success rates would reduce their likelihood of buying a hunting license for the next season (e.g., if the lower success rate were expected next hunting season for their target species, would that influence their decision to buy a license?).

If it is not possible to obtain licensing information for these two Game Management Units directly from ADFG in the near term, there are two other options that are possible (pers comm T. Brinkman):

1. Partner with Dr. Todd Brinkman to develop a proposal to ADFG to perform the survey described above as Dr. Brinkman has good working relationships with ADFG.

2. Develop a working relationship with the local Advisory Committee (AC) made up of local hunters (and anglers) who develop recommendations for the Alaska Board of Game. In particular, the Minto/Nenana Advisory Committee would be the relevant one for the Game Management Units around DNPP. The goal would be to develop a shared vision of the types of data gaps that need to be filled by the survey, types of questions to be asked to fill those data gaps, and the mechanics of performing the survey. If the Advisory Committee were to recommend hunters surveys for Game Management Units 20A and 20C, Dr. Brinkman suggested that the Alaska Board of Game and then ADFG might honor that request and provide hunter license lists for those two Game Management Units. Such a collaboration with the Minto/Nenana Advisory Committee is a long term option. This hunter survey would also need to be coordinated with ADFG's post harvest season surveys to clearly differentiate them in the minds of hunters and not have the surveys go out at the same time.

At this time it is premature to go into details on sample size and other study details. We do know that if a survey can be accomplished it would likely be a mail survey given that we want hunters to:
(a) indicate on a map of the Game Management Unit roughly the general area where they hunt;
(b) provide detailed information on hunter expenditures in and around the Denali Borough;

(c) respond to willingness to pay questions.

C. Household Total Economic Value Surveys (TEV)

A survey of a random sample of Alaskan and rest of the U.S. households regarding the amount they would pay to maintain a stable population of wolves in DNPP would be a more significant undertaking than the visitor and hunter surveys. While nearly all households in Alaska and the rest of the U.S. are certainly aware of wolves, it can be challenging to communicate with the lay public the ecological importance of wolves to the DNPP ecosystem, a possible management plan, and an equitable means of paying for the management plan. The study design would involve 11 steps.

1. Draft Initial Survey

A team of Ph.D. economists and social scientists would start with the prior TEV surveys for wolf reintroduction in YNP, and re-orient the survey to fit the situation in DNPP with input from Dr. Duffield who conducted the YNP surveys (and who is recommended to serve as a consultant on this study). The general survey outline would include: (a) background on DNPP, wildlife and wolves; (b) questions about attitudes toward National Parks, wildlife, hunting, wildlife viewing, and wolves; (c) current wildlife management issues; (d) proposed management program to address the problem (e.g., land acquisition, easements, compensation payments, etc); (e) how the Program would be funded (e.g., federal income tax); (f) willingness to pay question, protest response question for those stating they would not pay their "bid amount"; (g) demographics including gender, age, education, ethnicity, zip code, whether they hunt, membership in wildlife, conservation and environmental organizations and income.

2. *Circulate the survey to NPS DNPP staff and wolf biologists, conduct conference calls and revise the survey accordingly*.

3. Prepare Office of Management and Budget (OMB) Package

Since the survey is funded by an agency of the Federal government (e.g., NPS) then Office of Management Budget clearance would be needed even before conducting the focus groups with the general public. This involves filling out two packages of information for OMB for approval. The two packages include the agency need for the information contained in the survey, and the entire study design. Specifically, the OMB package would present procedures for conducting the focus groups, the survey design (with justification for each question being asked), sample design including sample size determination, and statistical analysis procedure. Several months of review and revision is typically required before OMB usually provides approval.

4. Conduct Focus Groups

Organize two focus groups of the general public in Alaska, and 4 general household focus groups in the lower 48. These focus groups are essential to establish face validity of the survey. Specifically, to determine whether respondents understand the survey materials and questions they are reading as intended by the researcher. This face validity check can be done in the focus group by introducing each section of the survey separately, having the participant read that section, and answer the questions, and then a group discussion of the material. This is repeated until all the pages of the survey have been reviewed. The team then takes the marked up survey sheets and points from the discussion (as recorded on flip charts) and revises the survey. This process repeats itself sequentially through the series of focus groups over the course of several months. Usually, it is most effective to start the focus group process with a relatively knowledgeable population, in this case, Alaska

residents. If the survey is not clear to knowledgeable Alaska residents it will not be clear to those in the lower 48 who are less familiar with wolves and Denali NP and Preserve. Scheduling of the focus groups would be sequential with 1-2 weeks between each focus group to allow the team to revise the survey prior to the next focus group.

5. Survey Pretesting

6. After the focus groups, formal pre-tests can be conducted to refine the range of the dollar amounts households will be asked to pay in the survey. The pre-tests can be a phone recruitment followed by a mailed survey followed by a phone discussion of each part of the survey. About 30 of these are needed in different places in the U.S. After the first 10 pre-tests refinement of the survey could be made, then the other 20 pre-tests conducted. *Finalize Mail Survey Package*

(a) draw an address-based sample (total n=6,000); I would propose that a minimum sample of 2,000 Alaska residents be made so that we have an adequate subsample of Alaska residents to compare to the lower 48 states where n=4,000; with an expected 25% response rate, this would provide 500 Alaska resident responses and 1,000 lower 48 responses. Both of these samples are over the n=380 recommended by Dillman (2000) and Champ (2003) to provide ±5% error; (b) write an advanced cover letter; (c) finalize survey booklet mailing with new cover letter, postage paid return envelope and a $2 bill; (d) write reminder postcard; (e) write second survey mailing cover letter to non respondents of survey, print replacement surveys and postage paid return envelope; (f) do phone reminders for the portion of the non respondents with phone #'s; (g) perform non-response follow up check questions of a sample of non-respondents using added survey incentive.

7. Data Entry and Error Checking

Data entry would occur via spreadsheet for compatibility with statistical packages. Two forms of data error checking would occur: (a) screening data for maximum and minimum values to ensure data is

within ranges allowed for in survey questions (e.g., 0, 1 for dichotomous variables like gender), and there are no outliers; (b) a small subsample of surveys would be re-keyed and compared to the original surveys to determine accuracy of original coding.

8. Statistical analysis

Calculate descriptive statistics for the subset of Alaska residents and the lower 48 sample for all the variables. The results would either be presented in a tabular format in the main report or in an appendix. The dichotomous choice WTP questions would be analyzed with a logistic regression model. The mean and median WTP would be calculated for Alaska residents and the lower 48. The sample WTP results would be scaled up to the population using the total number of households in the respective populations.

9. Draft Report Writing

A draft report presenting the methodology employed, sample design, sample implementation, descriptive statistics, WTP results, and providing interpretation of what these results imply about wolf management options would be made.

10. NPS Review of draft report

11. Report Revision in response to NPS comments and final report.

Costs Associated with the TEV Study

1. Survey Development Costs

a. Personnel Costs: There are fixed costs to design the survey, develop the OMB package and respond to OMB, conduct six focus groups, revise surveys after each focus group, and conduct pretests of the survey. The personnel involved in these tasks should ideally be Ph.D. level social scientists and economists with training and experience in conducting household non-market valuation surveys. The

labor costs can range from $60,000 to $80,000 depending on the number of people involved and their pay rate (GS level, academic rank, etc.).

b. Six Focus Group Costs: Focus groups can be held at hotels or professional focus group facilities. When the focus groups are held at a hotel conference room and each respondent is paid a $90 participation fee then the total "out of pocket" cost is about $2,500 per focus group. This covers focus group participant recruitment, conference room fees, coffee, and focus group supplies (flip charts). Focus groups at professional facilities cost about $5,000 each but they recruit and pay participants, provide light refreshments, flip charts, etc. These professional facilities offer the possibility of video links for off-site observers or recording the focus group on DVD's. Thus the decision of whether to use a "do it yourself" focus group in a hotel or a professional facility depends on how involved the other members of the team want to be in the focus groups and the available budget. Thus the costs of six focus groups range from $15,000 for hotel focus groups to $30,000 for professional facilities. Of course half the focus groups could be at hotels and half at professional facilities, which would make the costs $22,500. Travel for the two focus group moderators is a total of $2,000 to $3,000 per focus group depending on the location, so total travel cost for six focus groups is $12,000 to $18,000.

c. Pre-test Costs: The primary costs are participant incentives ($90 per person), minimal printing and mailing costs ($10 per survey express mail).

d. Peer review of survey and report: About $10,000 should be budgeted for a peer reviewer to help in developing and peer reviewing the survey and the results in the report.

2. Variable Costs of Conducting the Survey

a. Printing: printing the 5,000 surveys for the initial mailing of the color 8 page survey booklets, cover letters and outgoing and return envelopes would be $30,000 for the first mailing.

b. Survey response incentive: A $2 survey participant response incentive has been found to be very effective at increasing survey response rates and is recommended by Dillman (2000). The survey participant incentive would cost $12,000.

c. Postage: First class postage out 10x12 envelope and first class back ($3.60) so first mailing postage is $20,000.

d. Follow up mailings: Second mailing to 85% of the initial sample (assumes a 15% initial response rate) is $25,500. Postage is A third mailing for a survey non-response check to a subset of 500 non-respondents by special mail (USPS Express Mail @$6.50 plus first class return of $1.50, for a total of $8) is $4,000.

e. Data entry: Assuming 20 minutes to input data for each survey and 1,500 returned surveys is about 500 hours for a total data entry cost of $10,000 based on $20 per hour wages.

3. Statistical Analysis

This would be conducted by a Ph.D. social scientist/economist. Given the two subsamples (one for Alaska, one for lower 48), the cost is estimated to be $20,000 to $30,000 depending on GS level or academic rank of analyst.

4. Draft report writing

Writing would be conducted by a Ph.D. social scientist/economist. The cost is estimated to be $30,000 to $40,000 depending on GS level or academic rank of writer.

5. *Final report*

A final report would be written which incorporates responses to NPS comments. The cost is estimated to be $15,000 to $25,000 depending on the GS level or academic rank of writer.

Thus an estimated cost of the entire effort would range from $270,800 to $346,800 without employee benefits and any overhead. The lower range assumes two Ph.D. social scientists/economists leading

the design and the OMB submission as well as all six focus groups at hotels without video streaming or DVD. The upper level assumes three Ph.D. social scientists/economists and all six focus groups at professional focus group facility with video streaming or DVD of focus group. Table 5, presents a summary of the TEV study costs.

Table 5. Estimated Costs of TEV Study

Cost Element	Min Estimate	Max Estimate
Labor		
Study/Initial Survey Design	$ 7,750	$ 11,000
Prepare OMB Package	$ 7,750	$ 11,000
Conduct 6 Focus Groups	$ 14,400	$ 21,600
Revise survey after Focus Groups	$ 5,400	$ 7,200
Pretesting Survey	$ 13,500	$ 18,000
Revise & Finalize Survey	$ 11,200	$ 11,200
Data Entry	$ 10,000	$ 15,000
Statistical Analysis	$ 20,000	$ 30,000
Draft Report Writing	$ 30,000	$ 40,000
Revise and Finalize Report	$ 15,000	$ 25,000
Labor Subtotal	$ 135,000	$ 190,000
Travel		
6 Focus Group	$ 12,000	$ 18,000
Presentation of Results	$ 3,000	$ 3,000
Travel Subtotal	$ 15,000	$ 21,000
Other Expenses		
Focus Group Cost (facility, fees)	$ 15,000	$ 30,000
30 Pre-tests Participant Fees	$ 2,700	$ 2,700
30 Survey Express Mail	$ 300	$ 300
Peer Review of survey, analysis	$ 10,000	$ 10,000
Printing surveys, envelopes	$ 59,500	$ 59,500
Postage 1st & 2nd mailings	$ 33,300	$ 33,300
Other Expenses Subtotal	$ 120,800	$ 135,800
Estimated Total Costs	$ 270,800	$ 346,800

Time Needed for the TEV Study

The time for initial study design would be about three months to do initial survey design and sample design, one month to develop OMB package for submission, four months waiting and responding to OMB (only about one month of work), six months of final survey development work (focus groups and pretesting), four months of data collection (with data entry occurring as surveys are returned), two months data analysis and two months of reporting, one month report review and one month report

revision. Thus a total of a minimum of 21 months of work spread over as much as 24 months (two years) from start to finish.

XII. Conclusion

There is no doubt that wolves are a high profile species, and one whose management has been controversial (Huey, 2016). Yet, at present there is insufficient economic information to inform wolf management decisions at a regional level (National Research Council--NRC, 1997; Iverson and Borg, 2012). While there is data and literature about the economic values of general wildlife viewing in Alaska, there is little known about wolf viewers' economic benefits and their trip spending in the DNPP region specifically. Likewise, little is known about wolf, caribou and moose hunter and wolf trapper expenditures. To my knowledge there is nothing known about wolf trapper economic benefits. This may be due in part, to the possibility there are very few wolf trappers, especially in the region near DNPP. Nothing is known about the non-use (existence and bequest) values of wolves in DNPP to Alaska residents and to lower 48 populations.

A coordinated social science research program is needed to fill the data gaps related to wolf management in Alaska (NRC 1997) and inform management of wolves in and around DNPP specifically (Iverson and Borg, 2012). Established methods exist to fill all of these data gaps and have been used in other regions of the U.S. for economic valuation of wolves and for other species in Alaska. Our report detailed the types of methods and studies that would need to be conducted to fill the identified data gaps.

Visitor surveys of wolf viewers and hunters can be conducted in a fairly straightforward manner. Nonetheless, survey development, the OMB approval process, pretesting, data collection, and statistical/economic analysis require careful thought, adequate time (8-14 months for viewer survey) and budget for implementation (about $165,000 for viewer survey—see text for detailed budget). The U.S. (Alaska and lower 48) household non-use value surveys are more challenging in terms of time and budget

to design and implement, and would take up to two years from start to finish, and cost in the range of $270,800 to $346,800 . However the general household survey can be done at any point in the year. The visitor surveys would need to be implemented during the summer season. The hunter surveys would need to be implemented after the hunting season, and no doubt after, Alaska Department of Fish and Game does its post-harvest survey. In sum, filling the economic data gaps to inform wolf management in and around Denali National Park and Preserve is amenable to research and can help provide a quantifiable comparison of the economic values of wolf viewing, hunting, wolf trapping and passive-use/non-use benefits.

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