Determining the Extent of Market and Extent of Resource for Stated Preference Survey Design Using Mapping Methods

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Abstract

Determining the appropriate survey population and the commodity to be valued are among the most fundamental design decisions for stated preference (SP) surveys. However, often little information is available about who in the population holds measurable value for the resource (the extent of the market) and their perceptions regarding the scope of the resource to be valued (the extent of the resource). In this paper, we present a novel approach using cognitive mapping interview techniques to shed light on these design questions. The method also provides ancillary information that assists in the interpretation of information collected during focus groups and through SP survey administration. The approach was developed and tested as part of an ongoing study on environmental degradation associated with acidification in the Southern Appalachian Mountain region. Although damage from acidification in the study region is broad, it is not clear whether residents of this region care, in both a use and nonuse sense, about resources in their states of residence, in neighboring states, on public lands, or more broadly across the region. From a pilot study, we found that participants show a significant home-state preference in the number and size of natural areas that they value within the larger Southern Appalachian Mountain region. However, this preference is not strong enough to suggest that the market for improving these resources is solely constrained to residents of the state in which the resource is located.

Key Words: Stated preference, cognitive mapping, extent of market, extent of resource, definition of commodity

Subject Matter Classifications: Valuation Methods, Existence/Nonuse Values, Economic Damages/Benefits

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1. Introduction

Identifying the appropriate survey population and defining the resource to be valued are among the most fundamental design decisions for stated preference (SP) surveys. However, a researcher does not necessarily know the spatial distribution of those who hold measurable value for the resource (the extent of the market) or the part of the resource worth focusing on (the definition of the commodity or extent of the resource).[1] Limited sampling resources preclude casting a large net and capturing every individual or household that may value the resource in question. Furthermore, the information available on the perceptions of the general population regarding the relevant scope of the resource to be valued is often limited. These challenges are particularly true for resources associated with significant nonuse values. These drivers, along with the desire for a credible payment vehicle and the preferences of the survey sponsor, often result in the use of convenient, implicit, or ad hoc definitions of the extent of the market and the extent of the resource in SP surveys.

In this paper, we present a novel approach using cognitive mapping interview techniques from the geography and psychology literature as a complement to traditional

[1] We use the terms *extent of the resource* and *definition of the commodity* interchangeably to refer to the geographic boundaries of a resource that could experience a relatively small change in quality (the commodity described in an SP survey).

focus group interviews for the development of SP surveys that assess willingness to pay (WTP) for reducing environmental damages over large regions. The goal of this exercise is both methodological—in that it demonstrates how to incorporate mapping into SP studies—and applied. We develop and test the approach as part of an ongoing study on environmental degradation associated with acidification in the Southern Appalachian Mountains (SAM) (Krupnick 2004; Evans et al. 2008). Because the SAM region covers parts of eight different states, it does not have clear jurisdictional boundaries that correspond with the relevant ecological and economic ones. Further, even though damages from acidification in the study region are broad, it is not clear how concerned residents of this region are about improvements to degraded resources in their states of residence or in neighboring states (extent of the market). In addition, it is also unclear if residents care whether improvements are made on specific public lands or more broadly distributed across the region (extent of the resource). This mapping study is designed help answer these questions by informing survey design choices about the subpopulation(s) to be interviewed and the resource(s) for which changes should be presented in the valuation exercise.

Current methods to define the extent of the market and the extent of the resource typically rely on convenient administrative boundaries and/or sample populations. These approaches could fail to adequately address ambiguity surrounding the definition of the market or the resource in the case of very large resources where individuals' prior perceptions are poorly understood. We discuss the shortcomings of current approaches in detail in the next section.

In this study, we focus on the practical challenge posed by study constraints that preclude broad survey strategies to learn the extent of the market for goods with important nonuse values. In these cases, one could use an opened ended approach to solicit unbiased preferences from individuals in a broad geographical area to learn the extent of the market (e.g., "Tell me the natural resources you care about and where they are."), but without careful framing this would be an inefficient exercise. Alternatively, one could ask these individuals if they cared about improvements to a particular resource, either through focus groups or a brief pilot SP survey. However, such an approach would likely solicit either uninformative confirmations or require the costly development of a credible and incentive compatible survey. Furthermore, one could not easily apply this approach determining an appropriate extent of the resource for a survey addressing changes over a broad area of interest, particularly when ambiguity of the extent of the market and resource are confounded. We argue that mapping is a useful intermediate method for identifying an appropriate extent of *both* the market and resource. A mapping approach is more likely than these other approaches to determine whether preferences are provincial in nature as it does not require the description of a particular payment or management method to determine which resources respondents care about, but it offers useful framing and limits the number of areas that a respondent can identify as those they care about.[2]

[2] Schlager and Ostrom (1992) highlight a similar challenge in the context of property rights regimes for common property resources (using the example of inshore fisheries). They emphasize that research definitions of property rights and the rules for their enforcement "shape perceptions of resource degradation problems and the prescriptions recommended to solve such problems." They further note that ambiguity in

Using a semi-structured format, our mapping protocol begins by providing study participants with a base map of the region in a one-on-one interview format. Participants are asked to add information to the maps about their use of the region and indicate their preferences over particular areas or resources within the region. Respondents indicate features including 1) places that they visited regularly while living in the region, 2) the natural areas in the region that they cared about and/or were important to them, and 3) any areas they perceived as degraded. The maps resulting from each interview are then coded (in a process similar to transcribing an interview) to develop descriptive statistics and allow for quantitative comparison of the sizes, types, and locations of the areas or resources marked on participants' maps.

This information can be used to discern which natural areas are most salient to individuals from different parts of the larger region and to characterize variations in the sizes and locations of those areas. The mapping method is not a valuation exercise that yields a cardinal measure that can be used in benefit–cost analysis; instead, the protocol is designed to generate informative ordinal rankings of preferences that can be used to inform the survey design. Furthermore, the mapping exercise does not require a large information treatment or the use of a relatively inefficient (but unbiased and precise) choice question for measuring value. In addition, because the protocol allows respondents to report nonuse values, it is also preferable to relying on extent data describing resource use. By providing spatial characterization of both the extent of the market and the extent

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the understanding and definition of institutional arrangements surrounding a natural resource could undermine the "analytical or prescriptive clarity" of research studies.

of the resource, this approach demonstrates how mapping can inform the design of SP surveys of both contingent valuation and conjoint forms.

In the next section, we review the economics literature on determining the extent of the market and defining the commodity in an SP study, and describe in detail the motivation for using mapping analysis as an introductory component of SP survey instrument design. We then provide a review of the mapping literature and outline the potential contributions of this method to the economics literature and to SP research (Section 3). Next, we detail the elements of our methodological approach and mapping study design (Section 4). We then present a pilot application evaluating the extent of the market and the extent of the resource for damages from acidification in the SAM region (Section 5), and highlight our analyses and findings and compare our results to the extent of the market suggested by a well-known national recreational use survey (Section 6). Finally, we conclude with a discussion of the strengths and weaknesses of the method for wider application to different resources and regions, highlighting several areas for further study (Sections 7 and 8).

2. Spatial Design Decisions in SP Surveys

Two parallel questions in SP survey design are (a) how to determine the extent of the market (and thus whom to survey) and (b) how to define the commodity of interest. These decisions must be made jointly because a respondent's preference concerning a resource could depend on its size, quality, and location. In contrast to the question of the appropriate extent of the market, the definition of the appropriate commodity receives relatively limited treatment in the SP literature and is discussed largely as a design feature

that is at the discretion of the researcher.[3] We review each of these design questions separately in this section, and consider issues related to their joint determination in our discussion of the pilot application.

The Extent of the Market

Well-known studies have demonstrated the importance of the choice of the sample population in estimating total WTP (Smith, 1993a). Nevertheless, reviews of SP design methods provide little detail on how to identify the relevant population from which to estimate WTP other than to encourage the researcher to carefully consider the issue (Bateman et al. 2002; Champ and Welsh 2007; Freeman 2003; Mitchell and Carson 1989). The limited guidance provided is often simply a suggestion to consult data from existing surveys that encompass the entire potential population of interest. Such data are unavailable in many cases and could prove to be unreliable when extrapolated to different applications in other surveys. To demonstrate this, we show how the mapping study reveals significantly greater interest in a resource than is indicated by a large-scale recreational use survey. This suggests that the mapping survey can be used to identify the presence of significant non-use (or perhaps latent use) values.

Loomis (2000) summarizes the issues surrounding the determination of the relevant population for an SP study. His starting point is the well-known Samuelson

[3] The importance of the definition of the commodity has received some attention regarding the effects of the completeness of its description in SP surveys (Boyle 2003) and considerable treatment in analyses of scope responsiveness (Smith and Osborne 1996). However, here we are interested in it as a survey design choice.

condition for the optimal level of a public good. But the Samuelson condition alone is an insufficient guide because individual use and existence values for different environmental resources are not confined to geographic or political boundaries, and almost anyone could conceivably have some value for a resource in question. This is particularly true for resources with significant nonuse benefits, given that physical proximity is relatively unimportant for their enjoyment.[4] Also, our interest in nonuse values essentially precludes the use of traditional methods of identifying the boundaries of a market by exploiting changes in the prices of substitutes and complements (Whinston 2007; Smith 1993b).

Loomis (2000) further identifies a number of SP studies that use a convenient population sample where the extent of the market is assumed to be generally proximate to the resource itself. Often such a convenient design choice is made for good reasons. A researcher typically has little information about who values the resource ex ante and therefore develops a definition of the extent of the market (at least for sampling purposes) based on other objectives and study constraints. For example, Banzhaf et al. (2006) define their survey population as all New York State households to allow for the use of an incentive-compatible payment vehicle (state income tax) that corresponded with a credible management agency (New York State) for the resource in question (ecosystem

[4] More limiting is the legal question of who has standing with respect to managing the commodity in question and who might have to pay for that commodity. But such legal distinctions do not provide a guide in many WTP estimates associated with benefit–cost analysis. See Schlager and Ostrom (1992) for examples of overlaps in management of common property natural resources.

quality in the Adirondack Park).[5] Although New York State residents are likely to have considerable WTP for improvements to this resource, residents of neighboring states are also likely to receive similarly significant benefits from improvements to the resource. Given the sampling budget and the design complexities associated with surveying a larger population, it was decided that estimating the WTP of the residents of neighboring states was outside the scope of the study.

In his empirical analysis, Loomis (2000) demonstrates that an important bias may be introduced by limiting the geographical extent of the market to convenient jurisdictional boundaries, particularly when considering nonuse values (see also Loomis 1996). Mitchell and Carson (1989) call this problem *population choice bias*. Others have found a significant reduction in WTP with increasing distance from the resource, indicating the importance of the assumed choice of the spatial extent of the market for surveying purposes (Banzhaf et al. 2006; Johnson et al. 2001; Bateman et al. 2006; Hanley et al. 2003). Many of these investigators also found a discrete drop in the distance gradient of WTP at the political boundary of the jurisdiction in which the resource lies. Note that these studies have the benefit of using data from an SP survey cast over a broad area; the drop in WTP found by these studies could be the result of provincial preferences for resources and may, therefore, stand as a true description of WTP. Alternatively, the

[5] Although this study only estimated the WTP for improvements to the Adirondacks from reduced acid deposition from New York State residents, the information gathered by the survey is still relevant when conducting a benefit–cost analysis for the reduction of acid deposition precursors. The total WTP of all New York residents can be viewed as a lower bound of the total value of the improvement to the resource.

drop could be caused by a lack of credibility of the payment vehicle or the described method of resource management.

Overall, studies that find a WTP price gradient over space have the advantage of a pre-existing survey. In the absence of such data, the mapping approach can be used ex ante to improve the researcher's understanding of the potential extent of the market for focus group testing, survey construction, and sampling protocol, and also to avoid potential pitfalls like the sampling bias that Loomis (2000) describes. Furthermore, by not being bound to a particular resource management regime, the open-ended approach of the mapping protocol could allow the researcher to identify a population that may benefit from the policy intervention which might otherwise be hidden by other components of an SP survey.

The Extent of the Resource

Most SP studies take the definition of the commodity, which technically is the change in the quality of a particular resource, as given. This is typically a sensible approach as the motivation for conducting the survey is to understand the economic welfare consequences of the changes resulting from a particular course of action. However, those changes may be realized over a large geographical area, and describing the entire extent of the change could be impractical or undesirable for a particular survey. For example, the boundaries of the natural resource in question might not correspond to the administrative and jurisdictional boundaries under which resource management

decisions are made.[6] Thus, other elements of the survey design, such as the choice of a credible payment vehicle, may be compromised by the use of an excessively broad geographic description of the resource.[7] In these cases, the best option could be to partition the resource into components and have separate surveys eliciting WTP for the improvements to each component.[8] For the purposes of this study, defining the extent of large resources refers to formally evaluating (a) whether potential survey participants identify with the resource in its entirety or with specific features or subregions within the resource, (b) where they perceive the boundaries of the resource to be within the larger region, and (c) how these boundaries compare with other established political or geographic boundaries, such as state or national park borders.

Even with a particular geographic description of a resource, the extent to which individuals are able to identify with very large-scale resources is unclear. With very large resources, research has shown significant embedding effects, where respondents to SP

[6] Overlaps in management by different state and federal authorities could mean that a specific resource is encompassed by a jurisdictional boundary at one level of government but is managed by a higher level of government. As described below, this is the case with respect to measuring WTP for reductions in acidic deposition in the SAM region. See Schlager and Ostrom (1992) for a detailed discussion of the different bundles of management rights (among other types of rights) associated with common property natural resources.

[7] When we refer to a credible payment vehicle, we mean one that, in addition to providing an incentive to reveal one's true WTP for the resource improvements described in the survey, is associated with a credible method of managing and funding the program that achieves those improvements.

[8] In this case it may even be worthwhile to administer each survey to the subpopulation that finds changes to the particular component of the resource salient. However, such an approach may come at the cost of statistical power in estimating WTP bounds or for survey reliability and validity tests. More fundamentally, one might object to partitioning the entire commodity this way (whether or not a common population is used) as the qualities of neighboring or similar resources may affect the WTP for a particular change in another resource. This problem is common to most methods for valuing changes that result from policies that affect a large region. The mapping method we describe in this paper provides a sense for how important partitioning the commodity may be to estimating the welfare effects of such policies.

surveys are incongruently willing to pay the same amount for improvements to a large resource as they are for improvements to a smaller component of the same resource. Fischhoff et al. (1993) describe several different methodological reasons for these effects and outline strategies for overcoming such biases. Problems can arise if respondents consider only a limited subregion that they associate with the larger resource or if they cognitively truncate a larger area based on their prior experiences and perceptions (Fischhoff et al. 1993). Therefore, even if the extent of the resource is predetermined by other considerations of the study, survey respondents' prior perceptions of the commodity must be understood to ensure correct interpretation and evaluation of the reliability of WTP responses from the survey.

3. An Introduction to Mapping

Mapping is a technique widely applied and tested both in geography and psychology literature that has the potential to reduce ambiguity about the extent of the market and the extent of the resource in valuation research. In psychology, the process of cognitive mapping has been examined over many decades. Beginning in the 1940s with Tolman's (1948) landmark study that first recognized the term cognitive mapping, both geographers and psychologists have conducted experiments and studies to understand how individuals perceive different types and scales of spaces and to characterize systematic biases and distortions in map representations (Tversky 1981, 1991, 1992). The approaches of these two fields to mapping can be distinguished primarily by the focus on internal maps in psychology versus external maps or representations of spaces in geography (Downs and Stea 1973, 1977; Golledge and Zannaras 1973; Golledge 1976).

More recently, these fields have coalesced around research on defining the theoretical underpinning of digital mapping tools, such as Geographic Information Systems (GIS), to develop and evaluate whether the tools are responsive to how individuals navigate and think about spaces (Kaplan 1976; Tversky 1993; Mark and Frank 1996). Although significant research has been conducted on variations in spatial perceptions and comprehension at different scales—from the very small (a single room) to the very large (continent-level)—little spatial cognition research to date has focused on perceptions of large-scale natural resources (Klett and Alpaugh 1976; Evans et al. 1981; Brown 2004). For this reason, we bring together elements from both the geography and psychology literature on natural resources to develop an interview method to elicit a cognitive map of a large, natural environment.[9]

The method applied here extends traditional participatory mapping techniques using a semi-structured interview format to elicit survey respondents' individual maps of a region and their perceptions and preferences over particular areas or resources within a region (Lynch 1960; Chambers 1994); thus, the method provides a quantifiable justification for follow-on SP instrument design. This method is proposed for determining which areas are valued within a larger, shared natural resource and for identifying any

[9] Cognitive maps, cognitive collages, participatory maps, and spatial mental models are all terms that have been used in the geography and psychology literature to describe maps (spatial representations) created using interview- or survey-based methods for eliciting and recording spatial data. Specific examples include sketch mapping, scale mapping, and transect walking. Maps resulting from these and related processes vary greatly in form, content, and detail, ranging from basic diagrams of spatial relationships, drawings on the ground with sticks or chalk, paper sketches, base maps marked with stickers, three-dimensional physical site models, and GIS- and computer-generated images (Lynch 1960; Downs and Stea 1977; Chambers 1994; Craig et al. 2002; Tversky 1993).

systematic variations, preferences, or biases in how different subsets of a survey population might differentially perceive or value parts of a larger resource. Using mapping as a complement to traditional SP methods provides an opportunity to elicit perceptions of the resource from a subset of the largest potential survey population. This, in turn, provides a way to develop a baseline spatial characterization and assessment of both use and nonuse values that allow the researcher make more informed decisions about the commodity to describe and the population to survey.[10]

As we demonstrate, information from the mapping interviews provides more general (ordinal, not cardinal) data than would typically be gathered from an SP survey focused on a specific researcher-defined resource. However, because the mapping protocol questions are not structured around questions assessing WTP (e.g., a referendum) nor limited to a single type or cause of environmental damages, they offer additional flexibility in eliciting information on the extent of the market for a particular resource. This method is also an improvement over the use of recreational and market data to understand the extent of the resource as it does not preclude the identification of nonuse values.

[10] Although the mapping protocol identifies the presence of use and non-use values, it does not clarify the tradeoff the respondent is willing to make for the benefits associated with any particular policy intervention. We are not suggesting the mapping approach as a method for measuring welfare changes.

4. Study Design and Methodological Approach

As a whole, our mapping pilot study consists of the following phases: defining research questions; developing a base map; designing an interview protocol to elicit (a) patterns of travel in the region, (b) areas that respondents care about, and (c) areas of perceived environmental deterioration; designing a debriefing survey. Because this approach is intended to be streamlined, the focus is on gathering essential baseline information from a small subset of the potential survey population as early in the survey design process as possible. To most effectively contribute to the larger SP survey, we take a mental models interview approach (Morgan et al. 2001) and use a semi-structured format with selected open-ended questions to elicit responses regarding the sizes, types, and locations of the natural resources that individuals value within a large region. The pilot application described here is not a freestanding research effort. Although the instrument design framework outlined in this section can be used for full mapping studies, here we have modified the approach and tailored it for application to SP survey design.

Within an integrated mapping–SP methodology, some basic research questions will probably be consistent across all studies, including the following: Who cares about the resource? Where do individuals perceive the boundaries of the resource? Is this perception consistent across the survey population, or do subpopulations differ systematically in how they view and value the resource? Do people value parts or subregions within a resource, and are embedding biases and related biases likely when considering these areas? Many additional questions could be asked, and the proposed

approach is simply intended to serve as an outline for a wider range of applications. These questions are intended to complement insights from other sources of existing data (as with the design of any survey) to elicit information on how residents of a large region might value a shared resource. For example, in some regions, recreation data might suggest that individuals use resources close to home most frequently or, conversely, that a single highly visited or high-profile area dominates a larger region. In contrast, mapping provides an independent verification of these data that also incorporates nonuse values.

The next steps in the design of the mapping study are to develop a base map and a mapping interview protocol that build on the main hypothesis of the larger study. There are a wide range of studies that provide examples of how spatial information can be elicited and recorded on base maps with varying levels of detail, ranging from blank sheets of paper and simple line drawings to complex GIS maps (see Lynch 1960; Downs and Stea 1973, 1977; Francescato and Mebane 1973; Orleans 1973; Saarinen 1973; Golledge 1976; Tversky 1991; Chambers 1994; Craig et al. 2002; Brown 2004; and Vajjhala 2005 for examples). Because the base map is the main focus of the mapping interview and the primary medium through which interview responses will be recorded, it is crucial that the map and protocol be developed in parallel. Critically, the base map must be sparse and must serve primarily as a broad frame of reference. The map should not have so much information or text that it appears to be complete, leading participants to re-create features already on the map or to refrain from adding information altogether because they assume it is already there.

The framing of the base map (which features are included and at what scales) is highly likely to influence the scale of participants' responses (Downs and Stea 1977). For this reason, the overall area should be defined broadly enough to encompass the resource being studied and relevant surrounding areas while still leaving room for new information, such as areas and boundaries at the edges of a study region that participants might identify. Similarly, the printed maps used in interviews should be sufficiently large, such as 18 by 24 inches, to allow participants to add information clearly at different scales. We cannot emphasize enough that, to be effective, each base map must be tailored to the questions being asked, the region being evaluated, and the context of the larger study; each base map must also be extensively pretested.[11]

As a complement to the base map, the interview protocol contains three main sections (see Appendix A for complete protocol). In the first section of the interview, participants are asked about patterns of use and travel in the study region to elicit basic spatial information and allow individuals to grow accustomed to the process of adding information to the base map in response to interview questions. This information reveals whether the areas that respondents care about are also areas that they frequently use or visit. In the second section of the protocol, the main focus of the study, individuals are asked to think about natural areas that they value (in a colloquial sense). This set of questions asks respondents to identify areas that they care about, whether or not they

[11] For this study, pretests were conducted with a small set of participants to evaluate survey responses given different features (with and without major highways or shading for reference) and levels of detail on the base map.

actively use those areas. All questions are designed to be broad enough to allow for early identification of key resources and areas that may have nonuse values, but not so broad that the information of primary concern (i.e., preferences related to natural areas) would not be mentioned. The responses to this set of questions provide the key results described below.

In the third section of the protocol, respondents are asked whether they are aware of any areas and causes of environmental deterioration in the region. These questions are intended to determine whether respondents are aware that areas in the region have been affected by specific environmental threats as well as the extent to which they perceive that these threats are affecting the areas they marked on their maps as areas that they care about. Furthermore, we may identify the presence of any common scientific misconceptions about the status or quality of the resource or any threats to it that could complicate the interpretation of focus group or survey results (Fischhoff et al. 1993).

A number of different, valid approaches can be used to structure these three sets of questions and, depending on the goal of the larger study, questions could focus on eliciting (a) a boundary for the region as a whole, (b) specific points people care about within the region, or (c) broader areas or subparts of the region. To allow for more efficient coding of the collected data, differently colored markers and pens can also be used to differentiate types of places added to the maps. In all cases, the questions should be sufficiently broad to allow for follow-up once the participant has responded. The interview process and protocol are discussed further in the context of our application to the SAM region.

The final element of the proposed methodology is a short written debriefing survey including demographic questions as well as basic ranking and follow-on questions relevant for the larger SP study (see Appendix B for complete debriefing survey). The data from the survey are intended to validate and complement the results of the mapping interview and allow for comparative analysis of differences in preferences based on demographic characteristics of the population. For example, do individuals who lived in the study region for the longest mark the areas that they value as larger regions on their maps than those who have lived in the region for less time?

Taken as a whole, this methodology, consisting of research question identification, base map design, mapping interview implementation, and debriefing survey completion, is intended to be part of a larger effort, and the methods can be applied with as much or as little detail as a project requires. Because the goal of this approach is to provide a structured framework for informing the survey design and interpreting the results of focus groups used to evaluate draft surveys and the actual survey administration, this section deliberately presents a very basic, streamlined approach to integrating mapping and an SP survey design to inform, without duplicating, information elicited in the larger survey about natural resources, perceived damages, and WTP for improvements. In the next section, we place the proposed methodology in context and discuss an application focused on the SAM.

5. Acidification in the Southern Appalachians: An Application

The SAM region is a large, mountainous area surrounding the Appalachian Mountain chain that stretches from Alabama and Georgia in the south to Virginia and

West Virginia in the north. The full region covers approximately 37 million acres (SAMAB 1996), encompassing parts of eight different states and multiple ecosystems, land uses, and management authorities, including National Park Service and Forest Service lands, state parks, public recreation areas, private property, and agriculture land, among others. The region is anchored by—Great Smoky Mountain National Park (GSMNP) in North Carolina and Tennessee and Shenandoah National Park (SNP) in Virginia. These two parks and the surrounding high-elevation forest and stream resources in the region are currently at risk for significant damages from acid deposition; this issue has emerged as a policy priority for the affected states and the region as a whole (SAMI 2002; Mische John et al. in preparation).[12]

The scale of this resource makes both environmental evaluation and policymaking difficult. The absence of estimates of the economic value of improvements in ecological systems to date has hindered policymakers' attempts to set efficient environmental regulation and policy goals. The larger SP study (to which this mapping pilot study is designed to contribute) is intended to characterize the potential damages to forests and streams from acid deposition based on the best available science, produce WTP estimates for environmental improvements that can be achieved with further reduction in acid deposition across the region, and provide sufficiently robust and detailed results to inform

[12] The SP surveys to be informed by this pilot study will not necessarily be limited to describing improvements in these parks. Indeed, the mapping interviews are also intended to determine whether it is necessary to estimate the WTP for improvements to ecosystems in national, state, and private forests as well as national parks.

future regulatory analysis.[13] The multiple jurisdictional boundaries within the SAM region pose the greatest challenge for survey implementation in this region. Because the affected resources are distributed across multiple states and management authorities, there is no single convenient, well-defined, and widely-used description of the affected area that clearly identifies the primary survey population from which to sample or corresponds to how people might perceive the resource.

Figure 1 is the base map used in this pilot study. The extent of the map was defined based on existing data on the ecosystems, acidification, and recreational patterns in the SAM region. This base map provides very basic information, including state borders and names, major highways, and light shading highlighting publicly managed forests and water resources in the region (participants are not told what the shaded areas represent and any respondents who asked during the course of the mapping interview were simply told that the shading indicated some forest and water features). The map was deliberately designed to minimize the amount of text and to avoid serious framing and anchoring effects.[14] Additionally, the map is titled "Interior Southeastern United States" to avoid (a) leading participants to focus too narrowly on the Appalachian Mountains or any social, cultural, or political association with that term and (b) shifting the focus to competing resources that are less relevant to the study, such as the Atlantic Coast.

[13] This study builds off of the Banzhaf et al. (2006) study, which estimated WTP for ecological improvements from reduced acidification in the Adirondacks. The benefits-transfer components of the study will evaluate the transfer of WTP estimates between the SAM and Adirondack Mountains regions.

[14] See Kahneman et al. (1982) for a general discussion of these effects and Tversky (1981, 1991, 1992) for specific examples of distortions in perceptions of space and spatial information.

Survey Population

In this pilot application and test of the methodology, our interview protocol focused on eliciting and characterizing responses regarding the types, sizes, and locations of places that individuals value in the larger SAM region. Given the limited time and resources for this effort within the larger study, we chose to sample from two states in the SAM region, North Carolina and Virginia. These two states were selected for three main reasons. First, each state contains a large portion of the high-elevation resources affected by acid deposition and a large share of the population in the states that compose the region. Second, they are separated by sufficient geographic distance to sample and evaluate distinct survey subpopulations. Third, each state encloses part of a large national park affected by acid deposition—constituting a sufficiently large portion of the SAM region to provide different characterizations of the full region and resource—as well as other state and federal lands.

Comparing individuals from these two states allowed us to evaluate whether they (a) cared most about the resources within their own state of residence, (b) valued the SAM area in its entirety, or (c) valued multiple subregions across the entire resource. We hypothesized, first, that current and former residents of the region would focus on the GSMNP and the SNP as high-profile resources and, second, that residents of the state containing a particular resource would value that resource more than residents of other states in the region. To test these hypotheses, we recruited a convenience sample of current and former residents of North Carolina and Virginia currently living in the Washington, DC, area.

Participants were recruited through online advertisements; 16 participants from North Carolina and 15 from Virginia were chosen from approximately 135 responses to our solicitation.[15] All respondents were screened to select participants who had lived in the study region for a minimum of 5 years since the age of 16. Additionally, to avoid overlap between groups of participants from the two states, candidates were screened to eliminate any prospective volunteers who had lived in both North Carolina and Virginia. Gender balance and geographic distribution within each state were also considered when recruiting participants. All interviews were conducted from October 2006 to January 2007.

The final sample included approximately equal numbers of men and women from each state; participants were 23 to 66 years old, with an average age of approximately 34 years. The sample included participants from a wide range of educational backgrounds, ranging from "some college, but no degree" to "postgraduate degree," with the majority of participants holding bachelor's or associate's degrees. Median household income across all participants was in the $50,000 to $84,999 bracket.

Interview Process

Each mapping interview was scheduled and conducted individually. The process was described as a "mapping interview" and no mention was ever made of the Appalachian Mountains, environmental degradation, or acid deposition in soliciting

[15] Morgan et al. (2001) note that typical sample sizes for exploratory mental model studies similar to this pilot study range from 20 to 30 when interviews are conducted within population groups expected to share relatively similar beliefs.

participants or conducting interviews. Each interview began with a brief, general introduction to the goals of the study (to make a map of natural resources in the region that were important to the respondent) as outlined in detail in the protocol. Study participants were provided with colored markers and the base map shown in Figure 1.[16] Significant emphasis was placed on the process of demarcating visited and valued areas on the map. Participants were repeatedly reminded to carefully consider the sizes and shapes of locations that they added to their maps as well as the relationships among the locations.

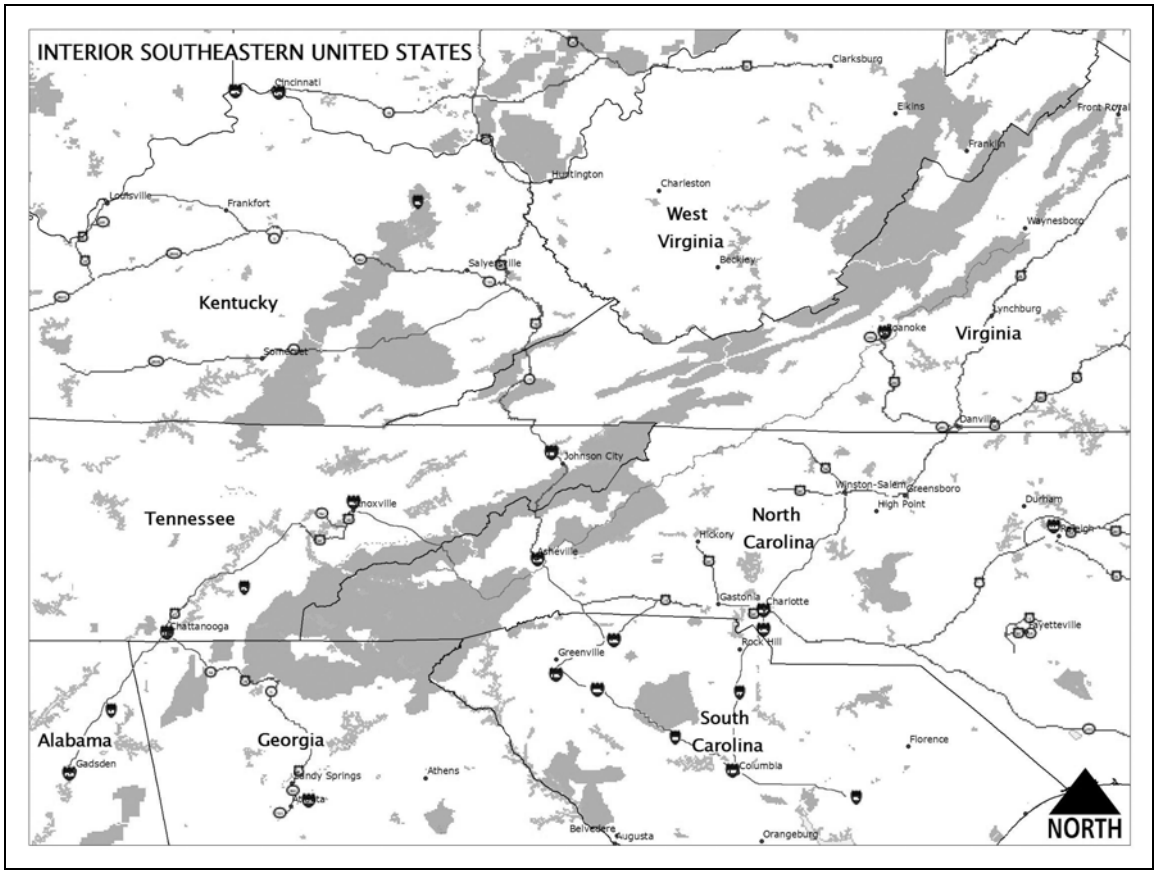
Interviews were typically between 45 minutes and 1 hour in duration. In the semi-structured interview protocol, participants were first asked to 1) identify places on the map that they visited regularly or thought of as a significant destination while living in the region, 2) add to their maps the center points and boundaries of five natural areas in the region that they cared about most, and 3) identify any areas in the region that have experienced environmental deterioration or improvement and to identify the cause of these changes.[17] After adding the center point for a valued natural area, participants were prompted to carefully examine and explain what defined the size and boundary of the marked area. For example, prompts included "I noticed that you didn't include this

[16] The interviewer handed each participant one colored marker at the beginning of each section of questions, corresponding with a pre-established coding system. This system was used to avoid confusion and prevent participants from demarcating visited and valued areas in the wrong color-coded categories.

[17] Participants were required to demarcate exactly five areas that they care about on their maps. Respondents were not explicitly asked to rank these areas during the mapping interview; however, the order in which places were added served as an implicit ranking. Explicit rankings were elicited in the debriefing survey to allow for comparison with these implicit rankings elicited during the mapping interviews. No requirements were placed on the minimum or maximum number of degraded areas that could be added to each map.

(town/highway/etc.) in the area you marked, do you consider it part of this resource? If not, what defines the start of this edge for you?" Respondents were given time after adding each area to consider its size, boundary, location, and relationship to other areas and were allowed to make any corrections or changes. At all points during the interview, participants were asked to respond to questions both by adding information to their maps and by explaining their responses verbally; this allowed the interviewer to follow up, record relevant details, and add prompts for clarification or greater detail. Finally, each interview was followed by a short written survey with demographic questions and additional questions about places they marked on their maps.

Figure 1. Base Map of the Southern Appalachian Mountain (SAM) Region



The pairing of the mapping interview and debriefing survey also allowed for quantitative evaluation of respondents' preferences for maintaining or improving the environmental quality of different valued resources using implicit (by order of addition on their maps) and explicit rankings (written survey questions). While not sufficiently explicit to measure the tradeoffs individuals would be willing to make for improvements to any of the resources included on the map, the mapping protocol provides an empirical basis for choices made regarding the extent of the market and extent of the resource imposed in a SP survey design and sampling protocol.

6. Maps, Data Analysis, and Study Results

Results from the 30 mapping interviews and written surveys were transcribed and coded after all interviews were completed.[18] Data compiled from the maps included counts of places visited and valued by state, type of resource (forest, water, or other), size of resource, and order in which places were added to the maps, among other more specific attributes. Figures 2 and 3 are examples of the types of maps collected during the study that show the diversity in the types and sizes of natural areas that individuals marked as places that they cared about.

[18] All interviews and map coding for this study were completed by a single interviewer/transcriber. Because this methodology is intended to be applied as an exploratory study with a small sample size, we do not address any issues of intercoder reliability that might emerge in larger applications of the approach.

Figure 2. Virginia Participant Map Showing Major Areas Visited and Traveled (Black), Five Most Valued Natural Areas (Multiple Colors), and Degraded Areas (Red)

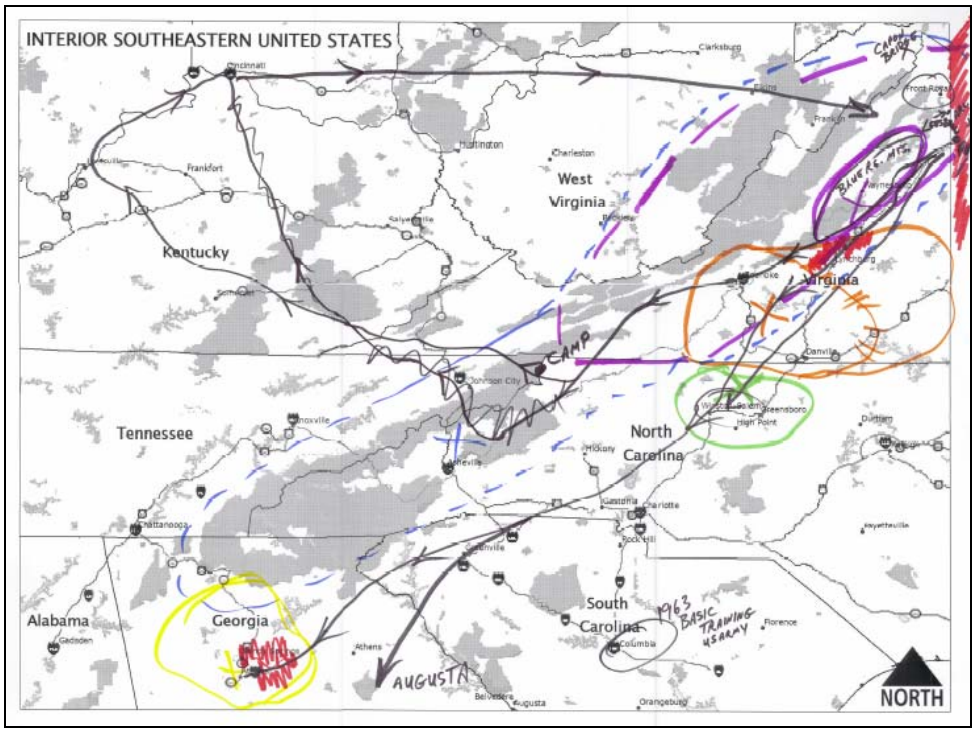
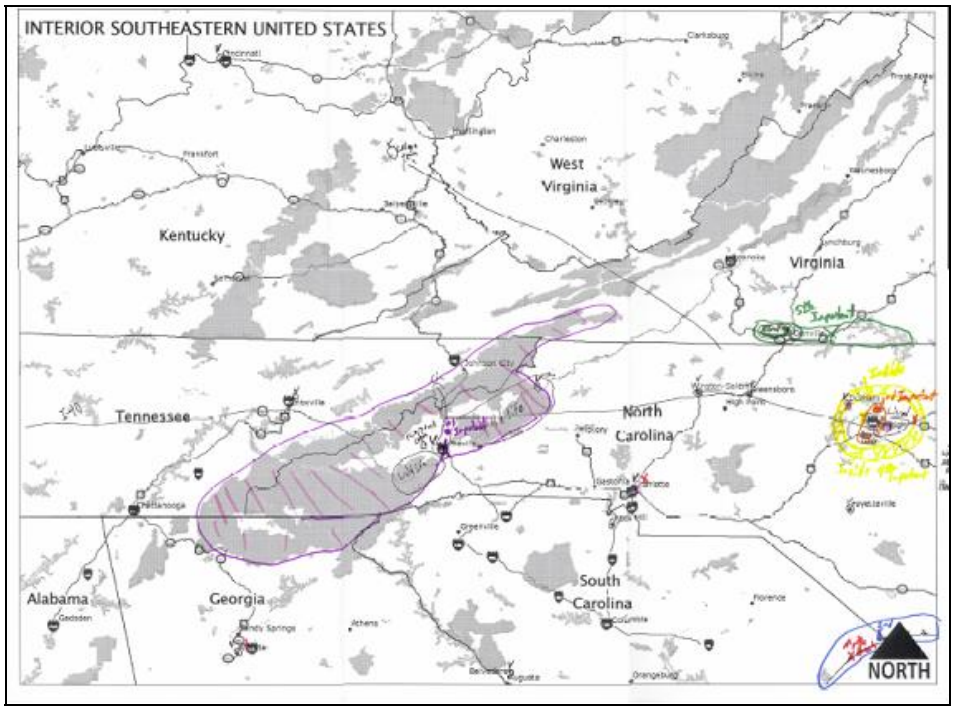


Figure 3. North Carolina Participant Map Showing Major Areas Visited and Traveled (Black), Five Most Valued Natural Areas (Multiple Colors), and Degraded Areas (Red)



At prompts to consider what defined the boundary of an area they cared about, participants highlighted a wide variety of defining characteristics for specific resources and areas. For example, a large majority of participants demarcated a natural area overlapping (in part or whole) the GSMNP or SNP and/or referred to an area specifically as “the Smokies” or “the Shenandoah.” However, the sizes and shapes of the resources varied significantly. Figures 4 and 5 illustrate these differences and respectively show the SNP and the GSMNP (hatched areas) overlaid with the boundaries drawn by three selected participants (dashed outlines) for valued areas, which they generally marked as overlapping either national park and/or specifically labeled as “the Smokies” or “the Shenandoah.”

In defining the boundaries of these areas, some participants referenced ecosystem characteristics or some other feature that identifies a specific “type” of environment, such as the sandhills of North Carolina, which one participant stated “are a separate area because the topography and vegetation are different from the area around it.” Still other participants marked the borders of their valued areas based on locations where changes in natural features occur, such as the increasing “hilliness” west of Asheville, North Carolina, marking the start of the Smoky Mountains. Participants also used distances from cities, highways, and state boundaries to denote the start or edge of a natural area, or the ownership or management (public versus private) to clarify why they had drawn a boundary at a specific location. In several cases, valued areas overlapped one another partially or completely (like the two areas in Figure 3 near GSMNP), highlighting the potential for mapping to help with early identification of potential embedding problems.

Figure 4. Sizes and Locations of Valued Areas Marked as Overlapping the SNP or Labeled as "the Shenandoah" on Three Selected Participants' Maps (Dashed Lines) Relative to the Actual SNP Boundaries (Hatched Area)

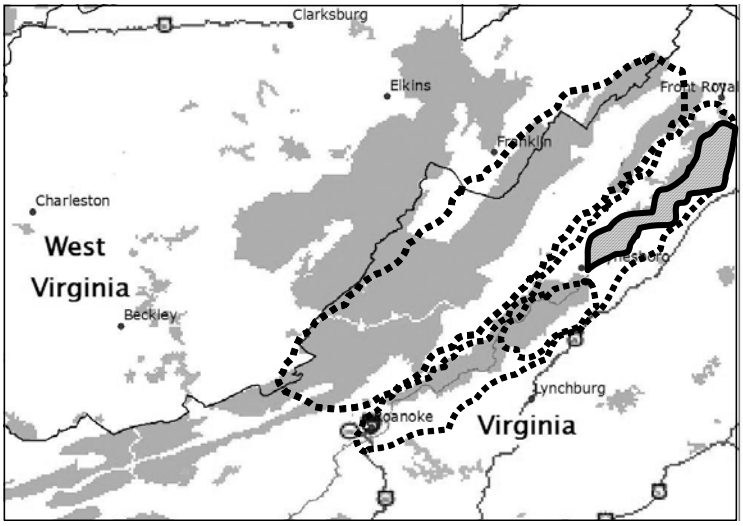
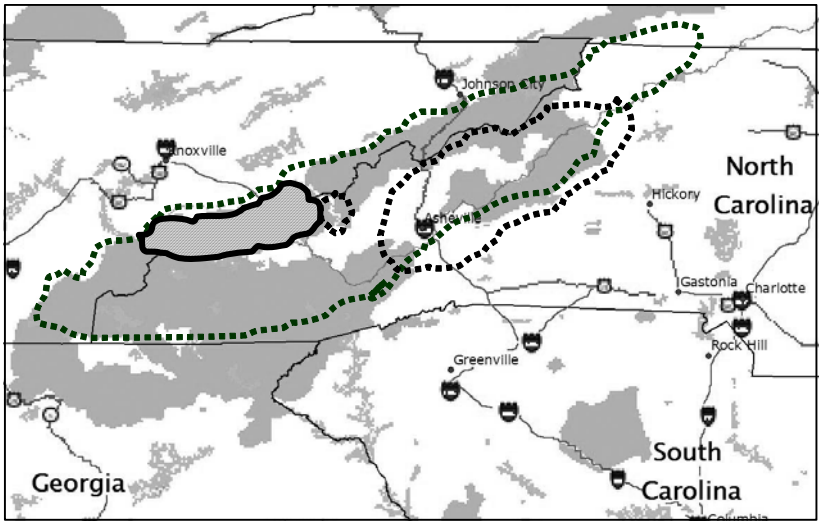


Figure 5. Sizes and Locations of Valued Areas Marked as Overlapping the GSMNP or Labeled as "the Smokies" on Three Selected Participants' Maps (Dashed Lines) Relative to the Actual GSMNP Boundaries (Hatched Area)

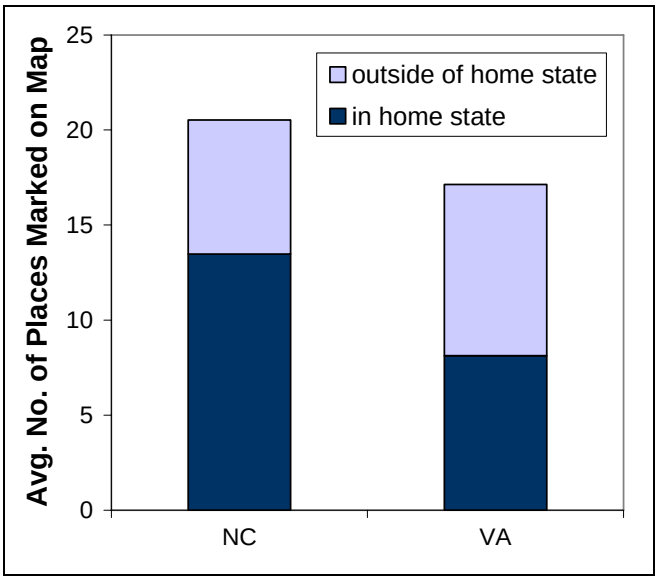


The Extent of the Market

To examine how participants' valued areas vary by state, coded data from all maps were used to conduct basic statistical analyses, such as comparing the counts of

visited and valued places added across all maps. Participants from both North Carolina and Virginia added an average of 18 places that they cared about or had visited in the study region. As Figure 6 shows, North Carolinians added more places to their maps, on average, and a majority of these places were within North Carolina. Former Virginia residents marked fewer places, on average, and their maps also reflected greater out-of-state travel for the areas marked. Because the population surveyed includes only former residents of either state, we expect that, as individuals who have moved out of state, study participants are likely to be more highly traveled than other residents of the region. As a result, the balance between within-state and out-of-state additions to each map likely represents an upper bound for out-of-state additions, and we would expect a stronger home-state preference to emerge among current residents of the region.

Figure 6. Number and Locations of Valued and Visited Areas on Respondents' Maps



The home-state preference is even stronger when we focus exclusively on the five natural areas respondents marked on their maps. Across all participants, more than 60

percent of the center points and areas of the valued natural places were located entirely within the participant's home state. This average was slightly higher for respondents from North Carolina who, on average, indicated that four of their five valued places were within North Carolina.

Participants were also far more likely to demarcate and/or label (as either the "Shenandoah" or the "Smokies" or similar label) an area corresponding to the national park in their home states than the park outside their states. Across all participants, 53 percent of North Carolinians and 67 percent of Virginians only included an area corresponding to the park in their home states (see Figure 7), and one-third of all participants included both parks. The participants who included both park areas on their maps always ranked the park area within their own state higher than the other park.[19] None of the participants marked only the park outside of their home state, and all but one participant from each state included an area that encompassed part or all of the national park in their home states among the five areas that they valued.

These results support the hypothesis that people are more likely to value natural resources in their own states than those located in other states; this is consistent with findings from the SP literature on the appropriate extent of the market discussed above. This suggests that the extent of the market in the SAM region is affected by state

[19] Although we emphasized to respondents that they should refer to their preferences, perspectives, and behavior when they were living in the study region when responding to interview questions, a higher percentage of North Carolinians may have marked both parks because they now live closer to the resources in Virginia.

boundaries, but not to the extent that values for natural resources held by residents in the region are limited solely to the resources in their home states.

Another way to identify the extent of the market for a resource for a stated preference survey is to review other sources of survey data (e.g., Bateman et al., 2002). However, often the only relevant surveys available collect recreational use data. By definition these are limited to users and therefore cannot identify the extent of the market for goods with nonuse values. In order for the mapping approach to be useful in determining the extent of the market for a resource for which there are significant nonuse values, it must provide more actionable information than is available from use data. By comparing the mapping results to information gathered from a sophisticated recreation survey, we provide evidence that the mapping approach identifies potential nonuse, or latent use values, and thus provides a better picture of the extent of the market.

A candidate recreational survey for the SAM area is the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (FHWAR). The FHWAR is based on a nationally representative sample of households and is conducted by the U.S. Census Bureau on behalf of the U.S. Fish and Wildlife Service (U.S. DOI 2001).

Figure 7. Percentage of Participants Who Marked a Valued Area That Included the GSMNP and/or SNP on Their Maps

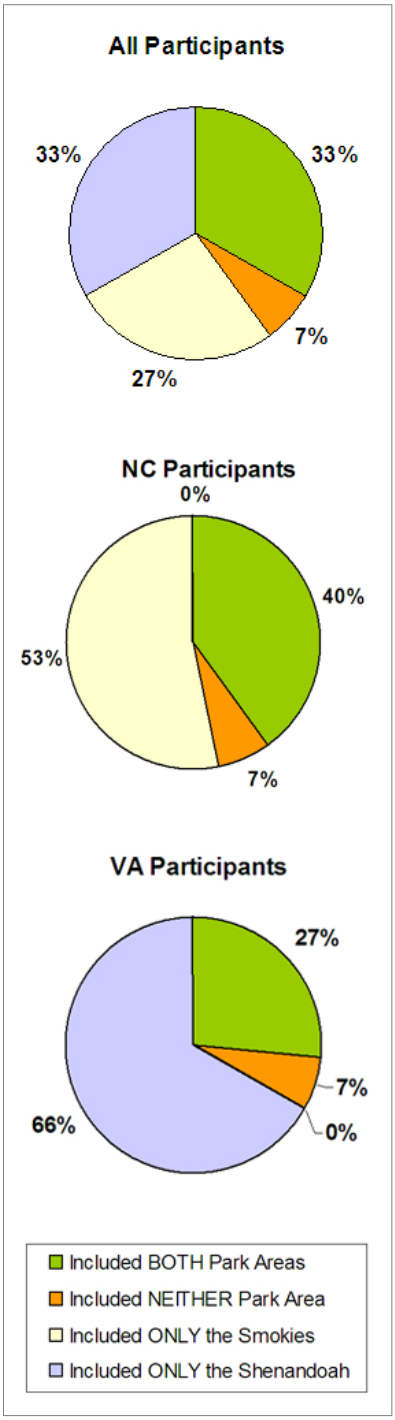


Table 1 reports the total number of respondents to the FHWAR survey from North Carolina and Virginia, as well as the number of those respondents who "hunted," "fished," or "took trips to observe wildlife," in these states in 2001. We see that, regardless of the activity, the percentage of respondents in each state that recreate in the other state is small. Furthermore, these values are much smaller than the percentage of respondents to the mapping survey who value an area outside their home state. As we see in Figure 7, 40 percent of respondents from North Carolina valued a natural area corresponding to the SNP in Virginia, and 27 percent of respondents from Virginia valued a natural area corresponding to the GSMNP in North Carolina.[20] This may be because there are important nonuse values that the mapping survey is picking up. It also may be because the mapping survey does not limit the respondent to a particular time period when asking if which resources are valued. The values expressed on

[20] For our purposes one limitation of the FHWAR survey is that it does not ask about recreation in specific areas within states (e.g., a particular park) or types of areas (e.g., mountainous regions). However, one could interpret the share of residents of a state that recreate in another state as an upper bound on the percentage of that state's residents that recreate in the resource of interest (in our application, the parts of the SAM region in either North Carolina or Virginia).

the mapping survey may reflect anticipated use of out-of-state resources. In contrast, the FHWAR data only captures use over the previous year and therefore does not provide this information.[21]

Table 1: Recreation by State

State of residence	Number of respondents**	Activity	Number of recreators that recreate in:		Total recreators*	Percent of total days recreated in:	
			NC	VA		NC	VA
			FHWAR survey				
NC	2123	Fishing	118	9	119	98%	2%
		Hunting	76	4	77	97%	3%
		Wildlife	37	3	37	98%	2%
VA	2044	Fishing	33	123	140	4%	96%
		Hunting	4	86	87	3%	97%
		Wildlife	18	65	72	9%	91%
			Mapping survey				
NC	17	Fishing	14	0	14	100%	0%
		Hunting	4	0	4	100%	0%
		Wildlife	15	5	15	94%	6%
VA	14	Fishing	0	7	7	0%	100%
		Hunting	1	2	2	2%	98%
		Wildlife	4	11	11	4%	96%

*A recreator is one that engages in the associated activity in either state. In the mapping survey respondents were asked their recreation in a typical year, while in the FHWAR study they were asked about their recreation in 2001.

**For the FHWAR, this is the total number of individuals for which data was collected (as opposed to households, which was the survey unit for the first wave).

It is possible that the mapping respondents are not representative in their recreation activities compared to the FHWAR sample. If the members of our convenience

[21] One could estimate a model of likely visitation frequency using observed data on recreators and non-recreators collected as part of the FHWAR survey to predict the number of potential users of out-of-state resource use by members of a particular state. However, there presumably are significant unobserved differences between those observed recreating and those who are not and so it may be difficult to extrapolate the recreating sample to the non-recreating sample in the survey.

sample are more apt to recreate out-of-state, then this may be explaining their preferences for out-of-state resources. As part of the written debriefing survey, we asked respondents the average number of days in a typical year that they recreated in their home states and in their neighboring states.[22] We see in Table 1 that the respondents to the mapping survey are more avid recreators than those in the FHWAR survey sample. However, with the important exception of wildlife watching, they are not more likely to engage in these activities outside their home state. Furthermore, we see in the rightmost columns of Table 1 that the percentage of days recreated in the home state is comparable between the respondents to the FHWAR survey and to the mapping survey for each activity. For the wildlife watching activity, we may then be seeing that the typically number of days of wildlife watching out-of-state occurs in concentrated periods (say over a week) at infrequent intervals. In either case, the recreation data appear to miss non-use values, infrequent use values, or both.[23] The disparity between the percentage of days recreated in each state and the percentage of respondents who care about a resource outside their state provides further evidence that the mapping protocol provides nonuse and latent use value information that may not be apparent from recreation use data. Even more directly, we see that the percentage of respondents in our sample who recreate out-of-state in the

[22] We asked about recreation in a typical year rather than a particular year like in the FHWAR survey because some of our respondents no longer live in their home state. Otherwise the recreation questions in the debriefing survey are very similar to those in the FHWAR survey.

[23] Admittedly the FHWAR could be structured to ask about recreation in a typical year which would address the infrequency of use issue. Such an approach would come with other problems, such as recall bias, and so is understandably inappropriate given the purposes of the FHWAR survey.

convenience sample is smaller than the percentage that values an out of state resource corresponding to the GSMNP or the SNP.

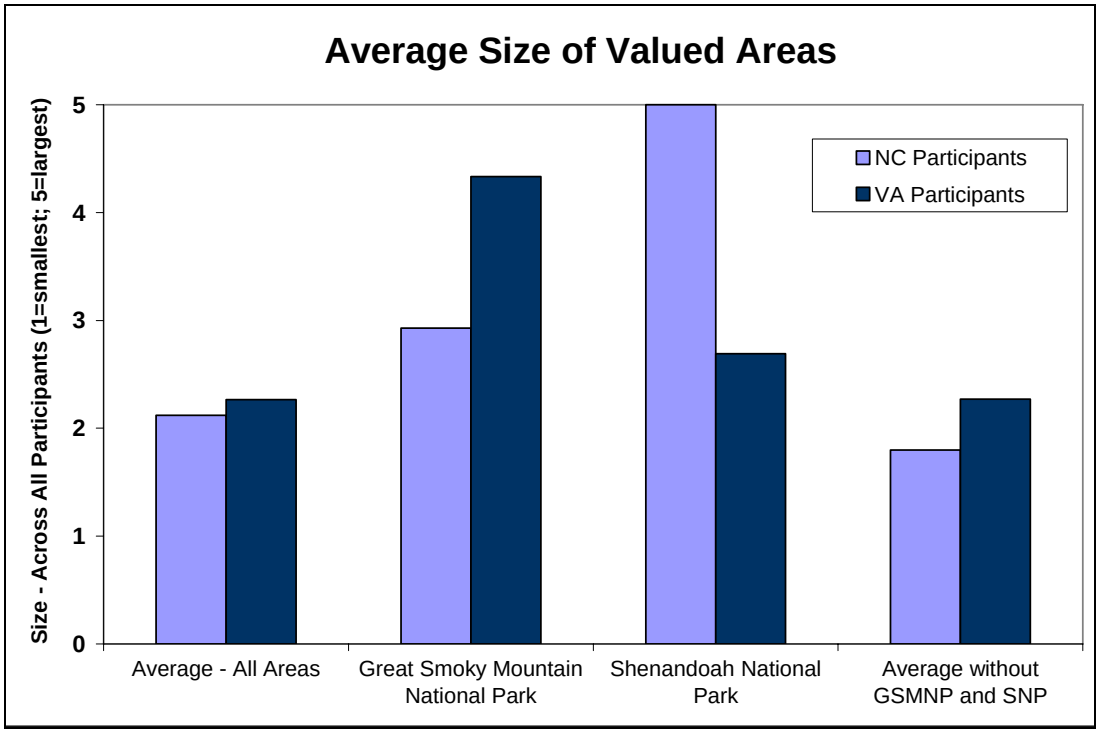
The Extent of the Resource

Similar to the counts and locations of valued areas used to evaluate the extent of the market, we use the sizes of the mapped valued areas to examine the extent of the resource. Defining five size categories based on the approximate sizes of areas on all maps, with 1 corresponding to the smallest area (less than 500 square miles) and 5 corresponding to the largest areas (those greater than 8,000 square miles), the sizes of all valued areas were estimated for each map and were assigned codes denoting their size categories. A majority of valued areas across all maps and participants were in the smallest two size categories, 1 or 2; however, most participants included a variety of area sizes on their maps.

Of those participants who marked a natural area partially or entirely overlapping the GSMNP or SNP and/or referred to an area specifically as “the Smokies” or “the Shenandoah” on their maps, most drew the area such that it was significantly larger than the GSMNP or SNP boundaries, as illustrated by Figures 4 and 5. Interestingly, of those participants who included both parks on their maps, participants delimited the area representing or including the park outside their home states such that it was significantly larger than the corresponding park within their home states. Of Virginians who included an area corresponding to the GSMNP on their maps, 75 percent drew it larger than the park boundaries compared with 50 percent of North Carolinians; 100 percent of North Carolinians who included an area corresponding to the SNP on their maps drew it larger than the park boundaries compared with 77 percent of Virginians. Additionally, as Figure

8 illustrates, the average sizes of both the GSMNP and the SNP areas marked on participants' maps were substantially larger than the average size of all other valued areas that respondents marked on their maps.

Figure 8. Average Sizes of Valued Areas Demarcated or Labeled as GSMNP or SNP



This relationship between the distance from a resource and its perceived size raises the hypothesis that respondents may assign disproportionate value to a less familiar and more distant resource (based on a skewed perception of scale and assuming that scale is correlated with WTP). This may even be true if researchers feel that they have clearly defined the extent of a resource to be valued if the information in the survey is not completely accepted by the respondent. This hypothesis contrasts with findings that WTP for improvements to such resources typically drops with distance; however, further research is required to evaluate potential confounding effects of map distortions and spatial

biases. Together, these initial analyses and results suggest that the extent of the resource for the SAM region is significantly larger than current national park boundaries; however, residents do not necessarily value the region as a single large, contiguous resource. Instead it appears that, although a majority of residents assign a greater value to resources within their home states, a significant percentage of residents value other subparts of the resource of interest, such as the GSMNP and the SNP; thus, further exploration of the extent of the resource through focus groups for the acidification WTP study is warranted.

7. Application of Mapping Results to SP Survey Design

The mapping analysis has informed the ongoing design of the larger SP survey for the SAM region in a number of ways. Although the mapping exercise does not provide a particular decision rule as to the appropriate extent of the market or resource, it does suggest that resource improvements outside of one's home state are much more important than the recreational demand data suggest. Therefore, as it stands, the survey will probably be administered in the four-state region where damages from acidification are the most extensive (Virginia, North Carolina, Tennessee, and West Virginia) and describe improvements to high-elevation forests and streams over this entire area. Fortunately, focus group testing has dispelled one of our more significant concerns—that respondents might not find a multistate compact for intervening and improving the quality of forests and streams credible.[24] Focus group participants were asked to vote on a program for reducing the effects of acidification; this program would raise their income taxes and

[24] Juha Siikamäki, Alan Krupnick, and Susie Chung of Resources for the Future have led these focus groups.

would require a simple majority in each state to go into effect.[25] During this process, participants also voiced concerns about ecological connectivity and strongly felt that, absent improvements over the entire resource, no improvement in any single area would be sustainable. Therefore, even if they only cared for part of the resource, they felt that it would not be possible for the area they cared about to improve absent improvements elsewhere. These results, in combination with the results of the mapping study, motivated an expansive definition of the extent of the resource.

8. Conclusions

Taken as a whole, this pilot application develops and illustrates a methodology for integrating mapping into SP survey design. Application of the proposed methodology to the SAM region reveals that the method does allow for a preliminary analysis of the extent of the market and the extent of the resource when the resources of interest have important nonuse values; however, the scope of this study would need to be significantly expanded to further test the efficacy of the method for other applications and locations. In this pilot application, initial results reveal that individuals value a greater number of resources in their home states and assign higher rankings to home-state resources than to those in other states in the region. Based on this finding, we would expect that an SP instrument that focuses only on resources or damages in a single state would generate higher average WTP values from residents of that state than from residents of other states.

[25] Similar to Banzhaf et al. (2006), the intervention that leads to improvements in resource quality is a program to add lime to streams and forests. A program that would directly reduce emissions raises issues of who should pay and the incentive compatibility of the payment vehicle.

Other analyses also show that using only national park or national forest boundaries in an SP survey may underestimate the extent of the resource people value. Participants who indicated that they valued a mountainous area in North Carolina or Virginia overwhelmingly identified areas larger than corresponding national park boundaries for the GSMNP and SNP, respectively. Finally, participants from both states showed a consistent pattern of marking more distant valued areas as geographically larger than more proximate ones. This suggests an interesting avenue for further research on the spatial perceptions associated with drops in distance-weighted WTP.

Although this mapping exercise is clearly useful for understanding the market for resources that have important nonuse values, we also feel that this method would easily transfer to a choice among alternative recreational sites in a recreational demand model (Parsons and Hauber, 1998). This pilot study also suggests avenues for new experimental research to examine, for example, the effect of conducting an SP survey on respondents' perceptions of the sizes and boundaries of the resources they value, or conversely, the effect of a prior mapping exercise on respondents' WTP in a follow-on SP survey. Overall, the results presented here are based on a pilot study, and the conclusions with respect to perceptions of large resources warrant further study. At this stage, by providing a preliminary spatial characterization of both the extent of the market and the extent of the resource, this approach demonstrates how mapping can both inform the design of SP surveys and aid in the interpretation of WTP results.

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Appendix A: Mapping Interview Protocol

Survey number

INTERIOR SOUTHEASTERN U.S. MAPPING INTERVIEW

Briefly introduce the project to the subject. Begin with a description of the type of maps the project is trying to collect and how the subjects' participation is important. The process should take less than 60 minutes. Participants will add information onto the base map in response to a series of interview questions. The primary goal is to gather information about the areas individuals "value" in the region. Emphasize that drawing skills or map-making skills are not required; however, the subject should carefully consider the sizes, shapes, and boundaries of the areas they add to the map and how they relate to one another.

Hello my name is Anna. I'm here today from Resources for the Future. We are conducting a study on the Interior Southeastern U.S. We would like you to help us by taking part in a mapping exercise. You don't have to have any experience with drawing or map-making, so please don't worry! What I would like you to think carefully about is the natural places you care about in this region. I'm going to ask you to add information onto the base map in front of you, and I'd like you to think about the sizes, shapes, and boundaries of these areas as you add them to your map and also how they relate to one another.

The goal of this whole interview is for you to create a map of the areas you care about, the places that are important to you, and spaces that you value in the Interior Southeastern United States. The base map in front of you shows parts of 8 states in this region, and there are colored markers here for you to use. First, take a minute to look over this base map. Do you have any questions?

As I ask you questions I'd like you to answer each out loud (there is a tape recorder here) and also to answer each question by adding the areas and locations that you identify on to your map. If you aren't sure about a specific answer – don't worry- you can always go back and add places, change your map, or make corrections. The point is just for you to carefully identify the natural areas that are important to you in this region and draw these areas on your map. Do you have any questions about the project? Okay, let's begin.

Places You Go [Black]

1. The first few things I am going to ask you are general questions about where you used to live in this region and any major places you went to regularly. For all of these questions, I would like you to focus only on the time during which you lived in this region. This is very important, so I really want to emphasize that I would like you to you think only about places you went when you lived in this area.

2. First, I'd like you to start by taking a look at the base map in front of you and begin by finding the general location for where you used to live (this doesn't have to be exact, just take your best guess). Here is a BLACK marker. Using this marker, mark the location of your home (when you lived in the region) on the map. You can use any symbol you would like to identify your home, and please write the name of the town and your former zip-code (if you remember it) next to your symbol.

3. *Have you lived in other places in this region? If so add these "homes" to the map as well and label them too.*

4. Now I am going to ask you a few questions about some of your activities and trips in this region during the time you lived here.

5. Think carefully about where you used to go outside of the town or city where you used to live in the region. These are places that you might have gone somewhat frequently, that were not part of your everyday routine, like work or the grocery store. *Please mark each place and label it. (Give the subject time to add a few places)* For example, are there any specific places you used to go at least once a month or a few times a year?

How about places you might have gone for *(say these prompts one at a time, give the subject enough time to think about it between each prompt and either add places or say "no")…*

- General recreation / outdoor activities? Parks? Campsites? Hunting? Fishing? Hiking?
- Observing wildlife/photography
- Vacations or other travel?
- Trips to visit family/friends?
- Seasonal activities? White water rafting? Fruit picking?

6. Look back on the places that you already have drawn on your map. Would you like to add any places in any of these **other states** *(point generally to blank areas on the subject's map)*?

   Is there any place that you went to often or think is important that is not already on the map? If there is, add it now.

Places You Value [Multiple Markers]

Ok, now I'm going to ask you to switch markers. Don't worry if there are places that you've forgotten to add up to this point, you can always go back and add these places. Remember this process is not about finding

exact locations, instead its more important for you to think carefully about the size of each area you add to the map and where the edges are relative to the other points you've drawn on your map

Now I would like you to think about the areas that you cared about in this region during the time you lived here. I would like you to focus on ***natural places****, not cities or man-made destinations like a family farm or friend's home. Instead I would like you to think about any type of natural environment or area that was personally important to you.* ***This can include places you like and value even if you never went there often or at all. It can even include places that you wanted to go to, but haven't visited.***

I am going to ask you to add your five most important areas to the map ***one at a time****. Before you add any information to your map, try to think about how these spaces relate to one another. Each area can be as big or as small as is important to you.*

7. Now I'd like you to use the RED marker, and start by thinking about the first of these places you value. Begin by marking the center of this place on your map with an **X and labeling it**.

8. Now think carefully about the size of this whole "place" on your map. How big is the area that you cared about and think is important? What defines this area around the center point you selected? Now I want you now to draw a boundary of this space and explain what features define or form the edges or boundaries of this area. *What makes up the edge of this area?*

9. Why did you choose to add this area as a natural place you cared about?

10. Now here is a BLUE marker. I would like you to repeat this same process for the next place you care about and think is important. Start again by marking the center of this second natural place that you value on your map with an **X and label it**.

11. Again I'd like you to think carefully about the size of this place on your map and also how it relates to the first area you added. Draw the boundary of this area.

    What defines this boundary? (Take notes here at each of these explanations)

12. Why did you choose to add this area as a natural place you cared about?

Continue with the third (ORANGE), fourth (YELLOW) and fifth (GREEN) places, always asking the subject to mark the center of each place on your map with an ***X and a label****. Remind the subject to consider how each new place relates to the others already on the map, and then ask the subject to carefully draw the boundary of each area.*

13. With the orange/yellow/green marker mark the center/boundary of a third/fourth/fifth natural area that you most care about, even if you never visited it.

    Why did you choose that as the center?

    I noticed that you included/avoided

    Does that overlapping area include this other area you've marked over here?

14. Excellent. Now I want you to take a minute to look over your whole map. Is there anything you would like to add or to change about these places you value or their boundaries? Do you think that anything should be bigger or smaller? Are the center points where you would like them to be?

15. Have you visited any of these places on your map? If so, when/what for/how often? *(Take notes here)*

Negative and Deteriorated Places

1. For the last drawing section I would like you to use this PURPLE marker. Look closely at the region on your map and the five places that are important to you, and think about any major changes you saw during your time in the region. Are there any areas that you think were degraded or have deteriorated significantly while you lived in the region? If so, mark these areas on the map, and explain why you think these areas are degraded and what the causes are?

Okay, Congratulations- you're almost finished! I would like you to just take one final look at your map, and see if there is anything missing or anything you would like to change. Do you have any questions for me?

As a final wrap up, I have a brief written survey that I would like you to complete about the places on your map and some general demographic questions. This shouldn't take more than 5 minutes. As you go through the survey feel free to ask me any questions you might have, and you can just hand it to me when you are finished.

Once they've handed in their survey, explain the payment, etc.

Give them the letter and let them know that if they have any questions or would like to follow-up they can contact us at the email/phone on the letter, and thank them very much for their time…

Appendix B: Debriefing Survey

INTERIOR SOUTHEASTERN UNITED STATES

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1. **Of the five important natural places that you marked on your map, please rank these places in order of importance from 1 being most important to 5 least important. (Please write your answers in the spaces below using the same names that you used on your map. Feel free to refer back to your map.)**

   1. _____

   2. _____

   3. _____

   4. _____

   5. _____

2. **If you were to add any other natural place outside of this map region to the list of natural places that you care about, what would it be?** *(Please write your answer in the space below)*

   _____

3. **How would you rank this place relative to the other natural places you ranked above?** *(Check only one box.)*

   - ❑ Above number 1
   - ❑ Between numbers 1 and 2
   - ❑ Between numbers 2 and 3
   - ❑ Between numbers 3 and 4
   - ❑ Between numbers 4 and 5
   - ❑ Below number 5

4. **How many years did you live in the entire region represented on your map <u>since you were 16 years old</u>?**

   - ❑ Less than 5 years
   - ❑ 5-15 years
   - ❑ 16-30 years
   - ❑ More than 30 years

5. **Please write the name of your home state (from the map) in the space below.**

   _____

6. **How many years has it been since you last lived in this state?**

   _____ **years** *(Please write the total number of years in the space to the left.)*

7. **How many years <u>total</u> did you live in this state only?**

   - ❑ Less than 5 years
   - ❑ 5-15 years
   - ❑ 16-30 years
   - ❑ More than 30 years

8. **If you were given $100 to distribute for making environmental improvements in the region on your map, how would you divide this money across the 8 states in the region shown on your map?** ***(Please write a number in the blank next to each state, the total for all states should add up to $100.)***

_____ Alabama

_____ Georgia

_____ Kentucky

_____ North Carolina

_____ South Carolina

_____ Tennessee

_____ Virginia

_____ West Virginia

9. **When you lived in the area on your map, did you ever <u>hunt</u> in your home state?**

- ❑ No **(SKIP TO Question 11)**
- ❑ Yes (Continue to Question 10)

10. **If yes, on average about how many <u>days per year</u> (from 1 day to 365 days) did you <u>hunt</u> in your home state?** *(Write your answer in average number of days per year in the blank to the left.)*

_____ Days

11. **When you lived in this area, did you ever <u>hunt</u> in any of the other states in the region *outside* of your home state?**

- ❑ No **(SKIP TO Question 13)**
- ❑ Yes (Continue to Question 12)

12. If yes, on average about how many <u>days per year</u> (from 1 day to 365 days) did you <u>hunt</u> in each of the areas below? *(Write your answers in average number of days per year in the blanks below.)*

_____ in the <u>entire region</u> outside of your home state

_____ in Virginia only

_____ in North Carolina only

_____ in Tennessee only

13. When you lived in the area on your map, did you ever <u>fish</u> in your home state?

- ❑ No **(SKIP TO Question 15)**
- ❑ Yes (Continue to Question 14)

14. If yes, on average about how many <u>days per year</u> (from 1 day to 365 days) did you <u>fish</u> in your home state? *(Write your answer in average number of days per year in the blank below.)*

_____ days

15. When you lived in this area, did you ever <u>fish</u> in any of the other states in the region *outside* of your home state?

- ❑ No **(SKIP TO Question 17)**
- ❑ Yes (Continue to Question 16)

16. If yes, on average how many <u>days per year</u> (from 1 day to 365 days) did you <u>fish</u> in each of the areas below? *(Write your answers in average number of days per year in the blanks to the left.)*

_____ in the <u>entire region</u> outside of your home state

_____ in Virginia only

_____ in North Carolina only

_____ in Tennessee only

17. When you lived in the area represented on the map, did you ever <u>take</u> any trips at least one mile from your home to <u>observe wildlife</u> in your home state?

- ❑ No **(SKIP TO Question 19)**
- ❑ Yes (Continue to Question 18)

18. If yes, on average about how many trips at least one mile from your home did you make to <u>observe wildlife</u> in your home state? *(Write your answer in number of trips in the blank below.)*

_____ Trips per year

19. When you lived in this area, did you ever <u>take any trips to observe wildlife</u> in any of the other states in the region *outside* of your home state?

- ❑ No **(SKIP TO Question 21)**
- ❑ Yes (Continue to Question 20)

20. If yes, on average how many <u>trips per year</u> did you make to <u>observe wildlife</u> in each of the areas below? *(Write your answers in trips per year in the blanks to the left.)*

_____ in the <u>entire region</u> outside of your home state

_____ in Virginia only

_____ in North Carolina only

_____ in Tennessee only

21. Would you describe yourself as an environmentalist?

- ❑ Yes, definitely
- ❑ Yes, somewhat
- ❑ No

22. What is the maximum tax increase for your household that you would accept to pay for making improvements to parks and the natural environment in the entire area represented on your map? *(Write your answer in the box below.)*

I would accept a tax increase of at most $ _____ per year for the next 10 years to pay for this program.

23. Please write your age in the space to the right. _____ years

24. What is your gender?

- ❑ Male
- ❑ Female

25. What is the highest degree or level of education that you have completed?

- ❑ Less than high school
- ❑ Graduated from high school - Diploma or Equivalent (GED)
- ❑ Some college, no degree
- ❑ Bachelor's degree or Associate degree
- ❑ Postgraduate degree

26. Please indicate the category that best represents your total household income in the past 12 months before taxes. Was it...

- ❑ Less than $19,999
- ❑ $20,000-$34,999
- ❑ $35,000-$49,999
- ❑ $50,000-$84,999
- ❑ $85,000-$124,999
- ❑ $125,000 or more

Thank you for completing this survey!

Please hand-in your completed survey to your map interviewer.