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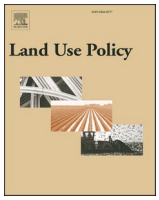

Conservation motivations and willingness to pay for wildlife management areas among recreational user groups

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ABSTRACT

Conservation agencies routinely evaluate the costs and benefits of land management and land acquisition options for wildlife management areas (WMAs). Non-market values, for example visitors' consumer surplus, are often absent from these comparisons. Better estimates of willingness to pay (WTP) for WMAs will allow managers to quantify consumer surpluses for different user groups, identify opportunities to generate additional conservation funding, and improve communication with users. We used the contingent valuation method to estimate the WTP for conservation of WMAs by different user groups. We used interval censored regression to estimate WTP for each user group and modeled how WTP varied with visitation frequency, demographics, and type of use. Dual users, those who participated in both licensed (hunting, angling, or trapping) and non-licensed (all other) activities, had greater WTP ($200.07, 95% CI [$161.18, $238.95]) than users who exclusively participated in either a single non-licensed ($74.74, 95% CI [$50.45, $99.02]) or a single licensed activity ($68.21, 95% CI [$48.41, $88.00]). Willingness-to-pay increased with the number of visits to WMAs per year, college education, and income. The most popular donation motivations were that respondents cared about WMA conservation (72%), wanted WMAs to be around for future generations (70%) and personally benefited from the conservation of WMAs (64%). Similar to a scope test, this study demonstrated greater WTP by users who participate in more diverse recreation types on WMAs. Additionally, our findings show that WMA users, particularly users who engage in multiple activities including at least one that does not require a license, enjoy large consumer surpluses and thus could be drawn on for additional financial support for WMA conservation.

1. Introduction

Wildlife management areas (WMAs) are a primary tool for conserving wildlife habitat, provide public access for wildlife related recreation, and represent one of the largest and fastest growing categories of protected public lands globally (Jenkins et al., 2004; Lerner et al., 2007; UNEP-WCMC, 2018). Under the IUCN classification system, WMAs are typically designated type IV Habitat/Species Management Areas because they are established and managed to protect particular species or habitats. Type IV areas are typically managed by national ministries or agencies and are funded through a combination of tourism revenues (e.g., entrance fees), direct appropriations (e.g., from taxes), and non-profit grants (Eagles, 2002). In the United States, state conservation agencies oversee WMAs with the goal of protecting fish and wildlife populations and their habitats while also providing hunting, fishing, and other recreational opportunities to the public (Florida Fish and Wildlife Conservation Commission, 2021; North Carolina Wildlife Resources Commission, 2021; Wildlife Management Institute, 1987). Although WMAs are valuable to local economies (Casola et al., 2022; Caudill and Carver, 2019; Poudyal et al., 2020) and nearby residents (Casola et al., 2021b; Liu et al., 2013), as well as for wildlife conservation (Lee, 2018), they face funding challenges.

Additional funding for the purchase and management of WMAs is critical because their historical funding model is severely stressed by socio-structural changes and new costs. Wildlife conservation in the United States historically has been supported with matching federal and state funds. The federal funding has been provided by excise taxes on hunting and fishing equipment established in 1937 (Federal Aid in Wildlife Restoration Act, 1937). Revenue from hunting and fishing licenses was typically used by states as the mandated match. Declining

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and stagnating licenses sales (U.S. Department of the Interior et al., 2016) threaten to undermine this funding strategy (Jewell et al., 2021; Moscovici et al., 2020). Funding shortfalls may be further exacerbated by projected increases in WMA use by nature-based recreationists who are not required to purchase hunting or fishing licenses (Balmford et al., 2009; Ziesler, 2020). Increased use by these recreationists increases maintenance and management costs (e.g., for parking lots, trails, and waste) by increasing total visitation, so some states have extended user fees beyond hunting, fishing, and trapping (Colorado Parks and Wildlife, 2021; Moscovici et al., 2020; Virginia Department of Wildlife Resources, 2021). Previous research has found that many users who currently do not pay for access are in fact willing to financially contribute to WMA management, highlighting a possible opportunity for agencies to raise revenue through permits or passes (Boston and Herr, 2020; Dalrymple et al., 2012; Lee Jenni, 2020).

The increasing management costs and decreasing traditional revenue streams could be further compounded by mandated payments in lieu of property taxes not collected on WMAs. Federal legislation offsetting presumed losses in property taxes due to the existence of WMAs within the jurisdictional boundaries of local governments was first established in 1935 under the Refuge Revenue Sharing Act (Refuge Revenue Sharing Act, 1935). Payments for all tax-exempt federal lands administered by Department of the Interior were codified in 1982 (Payment for Entitlement Land, 1982) and have been proposed at the state level for state owned properties such as WMAs (North Carolina General Assembly, 2019). In conjunction, these funding pressures make it critical for state management agencies to understand how their users value WMAs, what motivates users' willingness to pay for WMA conservation (hereafter motivations), and how additional conservation funds could be generated.

1.1. Patterns in willingness to pay

Although there has been little research on the value of WMAs specifically, extensive non-market valuation research has demonstrated important patterns in the public's willingness to pay (WTP) for natural areas. Understanding WTP is important because visitors may value the recreation, aesthetic, ecosystem service, and conservation benefits provided by natural areas despite these benefits lacking markets where transactions can be observed (Stein et al., 2003). Prior non-market valuation research typically found positive associations between higher levels of WTP for natural areas and higher levels of income, education, and age (Kotchen and Reiling, 2000; Latinopoulos et al., 2016; Lee and Han, 2002; Ressurreição et al., 2011; Zydroń et al., 2021). Research particularly relevant to valuation of WMAs has demonstrated that recreation types (Dahal et al., 2018; Frew et al., 2018; White et al., 2001) and visit attributes (e.g., frequency, distance) are related to WTP (Dahal et al., 2018; Dalrymple et al., 2012; Loomis and White, 1996; Zydroń et al., 2021), as well as discussing motivations for WTP (Kotchen and Reiling, 2000; Ressurreição et al., 2012).

Wildlife and recreation studies highlighted significant differences in WTP between different types of users (Dahal et al., 2018; Frew et al., 2018; Rollins and Dumitras, 2005; White et al., 2001). For example, Frew et al. (2018) showed annual WTP for tundra swan (*Cygnus columbianus*) conservation was greater for wildlife watchers ($35.20) than hunters ($30.53) participating in tundra swan dependent recreation. This heterogeneity among users is also evident in WMAs. WMAs typically allow fishing, hunting and trapping under a licensing system, in addition to other recreational activities (e.g., hiking, birding; Moscovici et al., 2020). Management agencies have used recreational activities to categorize users, historically applying the terms consumptive user for those who are hunting, fishing, or trapping and non-consumptive user for other groups (Duffus and Dearden, 1990; Organ and Fritzell, 2000). However, these terms are falling out of favor as agencies move to monetize non-hunting/fishing/trapping activities (e.g., through access permits), particularly given the fact that many activities that traditionally do not require licenses are in fact consumptive (e.g., mushroom collecting, berry picking), and all user groups impact the resource (e.g., crowding, trail damage, litter). Additionally, many WMA users participate in more than one type of activity (Caudill and Carver, 2019), further complicating the traditional categorization. For this paper, we label hunting, angling, and trapping as 'licensed' activities, and all other activities that are not hunting, angling, or trapping (e.g., hikers, birders, bikers, campers, horseback riders, and geocachers) as 'non-licensed' activities. We define dual users as those participating in both licensed (e.g., hunting) and non-licensed activities (e.g., birdwatching). Cooper et al. (2015) found that such dual users exhibit stronger conservation support (e.g., donations, memberships) than their single activity counterparts. However, hunting, fishing, and trapping have unique relationships to cultural identity (Chitwood et al., 2011), and may produce correspondingly unique valuations of WMAs compared to other natural areas.

A growing area of research has identified important relationships between WTP for natural areas and visitation characteristics (Dahal et al., 2018; Dalrymple et al., 2012; Loomis and White, 1996; Nunes and van den Bergh, 2004; Rollins and Dumitras, 2005; Zydroń et al., 2021). For example, studies have found both annual and per visit WTP was greater for users that took longer trips, and annual WTP was greatest among users whose trips occurred on weekends (Nunes and van den Bergh, 2004; Rollins and Dumitras, 2005). Researchers have also found that annual, per visit, and one-time WTP were greater with more frequent visits (Dahal et al., 2018; Dalrymple et al., 2012; Loomis and White, 1996; Nunes and van den Bergh, 2004; Zydroń et al., 2021). The degree to which this relationship between WTP and visitation frequency (i.e., the number of trips taken in a given time period) applies to WMAs is unclear because WMA visitation is seasonal and highly concentrated around the opening and closing of hunting seasons. Additionally, research has not compared the relative importance of activity group and visitation frequency to determine which factor(s) are ultimately the most important in predicting WTP for WMA conservation.

A number of natural resource related non-market valuation studies have explored the underlying motivations driving WTP. These include studies focused on improving public land access and conservation (Dahal et al., 2018; Dalrymple et al., 2012; Halkos et al., 2022; Shrestha et al., 2007; Witt, 2019), National Park preservation (Nunes, 2002; Zydroń et al., 2021), endangered species conservation (Kotchen and Reiling, 2000), and hunting quality (Zhang et al., 2004). These studies define motivations as the reasons why people are willing to pay outside of the costs or benefits described in the question setup (e.g., reasons not explicitly outlined in the contingent valuation prompt). This approach allows for the separation of *fundamental* motivations (which reflect the ends individuals are trying to achieve) and *means* motivation (which are important ways of achieving them). Fundamental and means motivations both influence how someone responds to a contingent valuation prompt; however, fundamental motivations are rarely explicitly outlined within the contingent valuation prompt. Understanding both types of motivations is critical in understanding WTP responses. This literature has documented that the most common motivations underlying WTP included direct use (e.g., "The marine biodiversity of this region provides an option for leisure/recreation and food provision") and preservation for future generations (e.g., "I enjoy knowing future generations will be able to enjoy _ in Maine"), but it is unknown if these motivations also apply to WMA visitors (Kotchen and Reiling, 2000; Ressurreição et al., 2012).

1.2. Objectives

We built on prior WTP research by evaluating how activity group, visitation frequency, and demographic characteristics affect WTP for WMA conservation in North Carolina, USA and what motivations underlie WTP responses. We tested three research questions: (1) How did WTP vary among users engaged in different activities on WMAs? Our

novel approach segmented users into two overarching categories (single activity users and multi-activity users) and then into more specific groups based on the types of activities they participated in. We investigated how WTP varied among various single activity users, multi-activity users engaged exclusively in licensed activities (activities that require a state agency license such as hunting, fishing, and trapping), multi-activity users who exclusively participated in non-licensed activities (e.g., hiking, birding, and biking), and multi-activity dual users who participate in both licensed and non-licensed activities. We also calculated the annualized value of WTP because this may be especially informative for agencies that raise revenue through annual licenses or permits. (2) How are visitation frequency and demographic attributes associated with WTP? Estimating the relationship between WTP and visitation frequency and demographic attributes allows for the relative comparison of how these factors associate with the effect of activity group. (3) What motivations were underlying WTP responses? Identifying the underlying motivations allows conservation agencies to engage with constituents in ways that promote WTP for WMAs. Determining what motivations were underlying WTP responses has the ancillary benefit of assessing sensitivity to initial bid size in WTP for WMA research.

2. Methods

2.1. Study area

State WMAs in North Carolina fall under the management of the North Carolina Wildlife Resources Commission (WRC). The WRC manages 94 WMAs totaling 845,000 ha, known locally as 'game lands'; however, only 216,000 ha are owned by the WRC. Some WMAs are owned by the US Forest Service (506,000 ha) while others (123,000 ha) are owned by public or private partners (e.g., Duke Energy, US Army Corps of Engineers, The Nature Conservancy) that choose to enroll their properties in the WMA system. The WRC spends about $8 million annually (USD in 2020) on the management of these properties, $2 million coming from WRC agency funds, and $6 million from the US Fish and Wildlife Service Wildlife Restoration Program funds generated by excise taxes on hunting and fishing equipment (Casola et al., 2022). Hunting, trapping, or fishing on WMAs in North Carolina requires a license from the WRC, whereas other recreational uses such as hiking, biking, and birding do not require a license or access permit. The WRC actively manages portions of most WMAs using logging, prescribed fire, and other practices to promote early successional plant communities, seasonally flooded wetlands, and forage crops for focal wildlife species. For administrative and management purposes, users are broken into two groups. Anyone who hunts, fishes, or traps on WMAs is referred to as a licensed user, because they are required to purchase a WRC hunting, fishing or trapping license. Users who do not hunt, fish, or trap are referred to as non-licensed users. Although the WRC does not collect visitation data, recent studies of WMA visitation in the southeastern US indicate WMAs in North Carolina receive over 2 million visits per year, the majority of which are from users participating in unlicensed activities, and National Forests designated as WMAs tend to receive the greatest annual visitation for individual properties (Casola et al., 2022; Poudyal et al., 2020) Fig. 1.

2.2. Sampling

Between September 2017 and May 2019, we administered intercept surveys at nine WMAs across North Carolina (Frew et al., 2018; Hox and De Leeuw, 1994; Vaske, 2008). The nine WMAs were chosen in partnership with the WRC to ensure representation from each geographic region in North Carolina (mountains, piedmont, and coastal plain), as well as a diversity of sizes (i.e., acreages), locations (e.g., urban proximity), amenities (e.g., hiking trails, fishing access points, boat ramps), and recreational activities (e.g., fishing, biking, hiking, horseback riding). The survey period covered two full hunting seasons, the busiest time of year for WMA use in North Carolina, as well as an entire summer. This allowed us to survey both licensed and a diversity of non-licensed users (Casola et al., 2021a). Survey administration was focused around the opening days of hunting seasons and Saturdays; however, we also included randomly selected Sundays, and weekdays during both hunting and non-hunting seasons (Casola et al., 2022). We intercepted users at major access points, along internal and external WMA roads and at amenities (e.g., trail heads, hunting blinds, parking lots, camping areas, boating access areas, public fishing access areas). Across the entire survey period, respondents completed 2034 survey packets. Approximately 60% of users asked to complete a survey did so. We experienced minimal 'recapture' as only 7% of users who were asked had already completed a survey within the past year. The North Carolina State University Institutional Review Board approved this study (IRB#11690; Johnston et al., 2017).

2.3. Questionnaire development

The questionnaire was pre-tested during the summer of 2017 using in-person intercept surveying at four WMAs (N = 53; Hunt et al., 1982). Issues with question wording, comprehension, and skip patterns were corrected based on detailed field notes collected during pre-test administration. In the final questionnaire, respondents were asked to indicate all of the activities they participated in on all WMAs. Activity options were Hunting, Trapping, Fishing, Hiking/Walking, Camping,

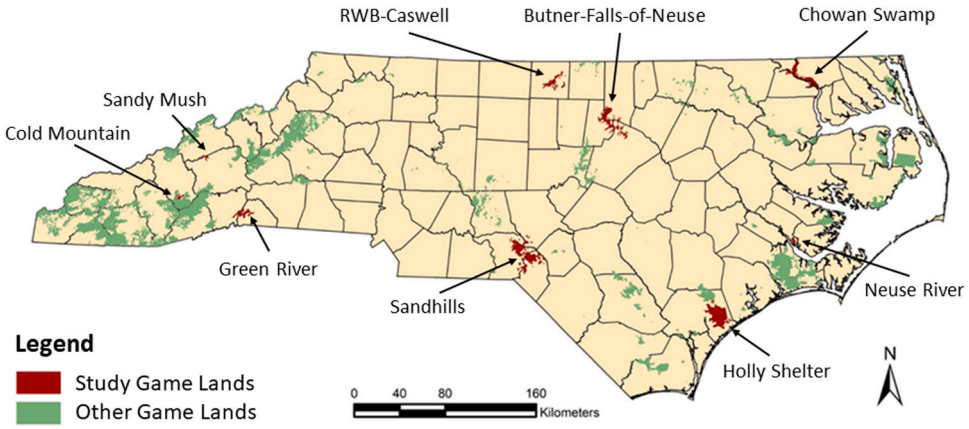

Fig. 1. Wildlife management areas (WMAs) in North Carolina managed by the Wildlife Resources Commission and the select nine study WMAs. Figure adapted from Casola et al. (2022).

Birdwatching, Biking, Boating-motorized, Canoeing/Kayaking, Horseback Riding, Shooting Range, Field Trials (i.e., hunting dog competitions), and Other. Respondents also reported the number of days spent visiting any WMA in North Carolina during the past year. Answer options were 1–5 Days, 6–10 Days, 11–15 Days, 16–20 Days, More than 20 Days, and Unsure. Based on which activities the user participated in, they were categorized into one of five activity groups. Respondents who only participated in one activity on WMAs were labeled as either (1) single activity licensed users, if they exclusively participated in hunting, fishing, or trapping, or (2) single activity non-licensed users, if they exclusively participated in any one other activity. Respondents who participated in multiple activities on WMAs were labeled as either (3) multi-activity licensed users, if they participated in a combination of hunting, fishing, and trapping, (4) multi-activity non-licensed users, if they participated in multiple activities but not hunting, fishing, and trapping, or (5) multi-activity dual users if they participated in hunting, fishing, and/or trapping plus at least one non-licensed activity.

To estimate the non-market value of WMAs (both use and non-use values), we used a double-bounded, dichotomous choice contingent valuation approach (Hanemann et al., 1991), with a clearly defined baseline scenario (Johnston et al., 2017). Within the survey questionnaire, we presented users with the following hypothetical scenario:

> "Imagine that the state of North Carolina was considering cutting the budget for game lands by selling 20% of each game land acreage in the state in order to create a trust fund to manage the remaining game lands acreage. This situation could be avoided if enough money were collected through donations. Please indicate whether you would be willing to make a one-time donation of $__ this year to avoid the sale of 20% of game land acreage for every game land in the state. Assume that your donation would be refunded if enough money were not raised to keep game lands at their current size."

Initial bid amounts within the prompt were randomly presented from a pre-selected set of values between $5 and $150. If the respondent said yes to the initial bid, a second randomly selected bid from the available larger values was presented in a follow up question. If the respondent said no to the initial bid, the randomly selected follow up bid was lower. Rather than observing the exact response amount, this methodology produced intervals within which the respondent's true WTP fell. For example, if the respondent said yes to an initial bid of $25 and no to a follow-up bid of $75, then their true WTP fell between $25 and $75 dollars. A donation-based contingent valuation scenario was chosen as a previous wildlife-focused study in North Carolina reported that tax-based payment formats elicited systematically lower willingness to pay for wildlife conservation due to strategic bias against taxes (Dalrymple et al., 2012). Substitutes were not mentioned in the scenario because WMAs are the only form of public hunting land available throughout most of North Carolina. We referenced a provision point mechanism in the scenario, because they have been shown to improve the demand-revealing properties of donation mechanisms (Alston and Nowell, 1996; Johnston et al., 2017; Marwell and Ames, 1980; Poe et al., 2002; Rondeau et al., 1999; Rose et al., 2002).

Depending on their response to the initial bid, users were also asked why they were willing or unwilling to donate. If respondents said yes to the initial bid, they were asked "Which of the following describes why you would be willing to donate this amount? (Check all that apply)." Answer options were "It's a small amount of money", "I care about the conservation of game lands", "I benefit from the conservation of game lands", "I like to contribute to the conservation of game lands", "I want game lands to be around for future generations", and "Other." Respondents who said no to the initial bid were instead asked "Which of the following describes why you would not be willing to donate this amount? (Check all that apply)." Answer options were "It is too expensive", "The money should come from somewhere or someone else", "I do not care about the conservation of game lands", "I do not benefit from the conservation of game lands", "There would still be enough land for my activity after a 20% reduction", "Other."

All respondents were asked to indicate their age, sex (male or female), highest education level achieved (less than high school, high school/GED, vocational or trade school, associate's degree, bachelor's degree, graduate or professional degree), and their annual household income before taxes (Less than $25,000; $25,000 - $50,000; $50,001 - $75,000; $75,001 – 100,000; $100,001 – $125,000; $125,001 - $150,000; Greater than $150,001).

2.4. Analysis

We estimated WTP among all respondents except those providing protest zero responses (Navrud et al., 2008; Nunes, 2002; Nunes and van den Bergh, 2004; Ressurreição et al., 2012, 2011). Protest zero responses reflect disagreement with a feature of the hypothetical scenario or funding mechanism and are not considered a valid reflection of an individual's WTP (Ressurreição et al., 2011). Specifically, we removed data from respondents who selected 'no' to both the first and second bid ("no-no" respondents) and who selected "The money should come from somewhere or someone else" as their reason for not being willing to pay either amount. We also excluded respondents who provided no-no answers followed by a write in other reason reflecting protest (e.g., "I already pay for this."). To confirm validity of the WTP responses, we used summary statistics to examine the relationship between initial bid size and willingness to pay among all respondents, and to confirm the first test for consistent decisions and that the weak monotonicity condition was satisfied (Bishop et al., 2017; U.S. Department of the Interior, 2016).

To investigate research questions (1) How did WTP vary among users engaged in different activities? and (2) How did visitation frequency and demographic attributes impact WTP?, we fit a parametric accelerated failure time model using the 'survival' package accessed through R (R Core Team, 2021; Therneau, 2021). This allowed for the creation of an interval censored regression model, which estimated parameters by maximum likelihood. Identical models with a normal distribution and a lognormal distribution were compared using deviance and Akaike's Information Criteria (AIC) (Navrud et al., 2008; Nunes, 2002). The lognormal distribution was used in the final analysis because it had a strong theoretical foundation within WTP studies and produced the smallest AIC values (Dalrymple et al., 2012; Hadisoemarto and Castro, 2013; Nunes, 2002; Ressurreição et al., 2011; Simpson and Hanna, 2010). The natural log of the WTP interval was modeled as the function of activity group (categorical, reference level = single activity licensed users), visits per year (continuous: midpoints of visit ranges), age (continuous), education (indicator: college = 1, no-college = 0), income (continuous: midpoints of income groups, measured in thousands of $US), and sex (indicator: male = 1, female = 0). Assuming WTP is a function of preferences (represented by individual behavioral and sociodemographic characteristics) and income, then the WTP of respondent i may be modeled as a function of a vector of individual behavioral characteristics X_k, and a vector of individual sociodemographic characteristics Y_j, including income. σ denotes the scale parameter for the distribution, and e_i is a vector of error terms assumed to be normally distributed (Eq. 1).

$$\ln(WTP_i) = \beta_0 + \boldsymbol{X_k}\boldsymbol{\beta_k} + \boldsymbol{Y_j}\boldsymbol{\beta_j} + \sigma e_i \quad (1)$$

We tested models with fixed effects for the year and season of intercept and the WMA most often visited. Because none of those fixed effects were statistically significant, we did not retain them in the final model. Given the small number of missing demographic responses (3% of respondents failed to report their age, and 6% of respondents failed to report their income) and the random nature of the missing data, we used global mean imputation for all missing continuous variables (Kalton and Kasprzyk, 1986; Khan et al., 2018; Waal et al., 2011). By including sociodemographic characteristics as controls in the model, we provide

face validity and isolate the effect of user categories. Using the aforementioned interval censored regression model, we predicted mean WTP for each activity group using the average demographic attributes and visitation frequency of the respondents within each activity group. We measured statistical differences in predicted mean WTP among activity groups by comparing 95% confidence intervals. We used the model to predict the marginal impacts of visitation frequency and demographic factors on mean WTP. The contingent valuation prompt used in this study asked for a one-time donation. We calculated an annualized value of the predicted one-time mean WTP estimates based on a 10-year annuity with a discount rate of 3% (English et al., 2018; Gioglio et al., 2019).

To investigate research question (3), What motivations were underlying WTP responses?, we calculated summary statistics and margins of error (95% confidence level) to identify the most common motivations underlying WTP responses for each activity group. Responses to motivation questions were analyzed separately for two groups of respondents, those who said yes to the initial bid in the contingent valuation prompt, and those who said no to the initial bid in the contingent valuation prompt. This division reflects the questionnaire design as respondents who said yes to the initial dollar amount exclusively received follow up questions related to why they were willing to donate whereas respondents who said no to the initial dollar amount exclusively received follow up questions related to why they were unwilling to donate. For the motivations related to budget constraints (i.e., "It is too expensive" or "It is a small amount of money"), we tested sensitivity to initial bid size using Welch's T-Tests.

3. Results

We obtained WTP data from 2034 respondents, including 287 from single activity licensed users, 238 from single activity non-licensed users, 143 from multi-activity licensed users, 379 from multi-activity non-licensed users and 987 from multi-activity dual users. Single activity licensed users included 231 hunters and 56 anglers. Single activity non-licensed users included 87 target shooters, 45 hikers, 33 field trial users, 28 kayakers/canoers, 17 horseback riders, and 28 people participating in other activities. In the overall sample, the average respondent was male (85%), white (92%), 43.9 years old (SD = 15.3), held a college degree (59%; Associates degree or higher), had a household income of $74,800 (SD = $41,300), and took 15 WMA trips per year (SD = 8; Table 1). Broken down by activity group, multi-activity non-licensed users were the oldest (M = 47, SD = 15.5) and most educated (83% held college degrees), had the largest annual household income (M = $81,900, SD = $42,300), and had the largest percentage of female respondents (35%; Table 1). Multi-activity dual users took the most WMA trips per year (M = 16, SD = 7; Table 1).

Summary statistics confirmed that the first test for consistent decisions and the weak monotonicity condition were satisfied, as the percentage of respondents who said yes to initial bid did not increase as bid size increased (Table 2). Protest zero responses (n = 123) were evenly distributed among the five activity groups and ranged from 5% to 8% of responses.

Table 2
Contingent valuation responses across all initial bid sizes. As initial bid size increased, the percentage of respondents willing to donate decreased for users on nine North Carolina wildlife management areas, 2017–2019 (N = 2034).

	Initial Bid Size				
	$5	$10	$25	$75	$150
Percent "Yes"	89%	81%	78%	63%	54%
Sample Size	142	599	510	632	151

Conditional on the demographic characteristics of each activity group (Table 1), predicted point estimates of mean WTP (i.e., mean consumer surplus) were largest among multi-activity dual users (M = $200.07, SE = $19.84) and multi-activity non-licensed users (M = $180.55, SD = $26.42). Based on overlapping 95% confidence intervals, multi-activity dual users and multi-activity non-licensed users had statistically similar mean WTP estimates, and statistically greater WTP compared to multi-activity licensed users (M = $86.08, SE = $17.82), single activity non-licensed users (M = $74.74, SE = $12.39), and single activity licensed users (M = $68.21, SE = $10.10; Table 3). Likewise, annualized predicted WTP values were largest among multi-activity dual users at $23.45 per year and smallest among single activity licensed users ($8.00 per year; Table 3).

Regression results indicated WTP increased with visitation frequency ($\widehat{\beta}$ = 0.047, SE = 0.007, p < 0.001), income ($\widehat{\beta}$ = 0.004, SE = 0.001, p = 0.004) and education ($\widehat{\beta}$ = 0.439, SE = 0.121, p < 0.001; Table 4). For the average respondent, each additional WMA visit was associated with greater mean predicted WTP by $9.24 (~4.8%). Mean predicted WTP increased by $67.76 (~35.5%) if the respondent was college educated. For every additional $10,000 in gross annual income, WTP increased by $7.77 (~4%).

Approximately 73% (n = 1492) of respondents said yes to the initial dollar amount presented in the CV prompt. "I care about the conservation of game lands" (72%, +/– 2.28%) was the top motivation selected by these respondents (Table 5). This was followed by "I want game lands to be around for future generations" (70%, +/– 2.33%), "I benefit from the conservation of game lands" (62%, +/– 2.46%), "It is a small amount of money" (51%, +/– 2.54%), and "I like to contribute to the conservation of game lands" (47%, +/– 2.46%; Table 5). The order of these motivations was consistent across all five activity groups. Approximately 27% (n = 542) of respondents said no to the initial dollar amount presented in the CV prompt. "It is too expensive" was the top motivation selected by these respondents (30%, +/– 3.86%; Table 6). This was followed by "The money should come from somewhere or someone else" (22%, +/– 3.49%), "There would still be enough land for my activity after a 20% reduction" (18%, +/– 3.23%), "I do not benefit from the conservation of game lands" (4%, +/– 1.65%), and "I do not care about the conservation of game lands" (2%, +/– 1.18%; Table 6).

On average, respondents who selected "It is a small amount of money" had received a smaller initial bid amount ($31.54) than the average respondent who said yes to the initial bid amount ($38.63; Welch's T-Test: T = 4.594, p < 0.0001). Conversely, respondents who

Table 1
Respondent demographics, broken down by activity group, within a sample of visitors from nine North Carolina wildlife management areas. Collected 2017–2019 (*N* = 2034).

	Multi Activity Non-Licensed	Multi Activity Licensed	Multi Activity Dual	Single Licensed	Single Non-Licensed	All Users Combined
Age	47.0 (15.5)	40.3 (15.0)	42.8 (14.6)	43.0 (16.2)	46.8 (16.2)	43.9 (15.3)
Income[a]	81.9 (42.3)	63.3 (33.9)	75.5 (41.5)	67.7 (41.5)	75.7 (40.1)	74.8 (41.3)
College Education	83%	35%	58%	40%	67%	59%
Sex (%Male)	65%	96%	92%	93%	74%	85%
Annual Visits	15 (8)	14 (8)	16 (7)	11 (8)	13 (8)	15 (8)
Sample Size	379	143	987	287	238	2034

Note: Standard deviations displayed in parentheses.
[a] In thousands of USD

Table 3
Mean willingness to pay (WTP) and annualized WTP values by activity group for licensed and non-licensed users on nine North Carolina wildlife management areas. Collected 2017–2019 (N = 1785).

Activity	Mean WTP	SE	Lower 95% CI	Upper 95% CI	Annualized Value[a]	Sample Size
Single Activity Users						
Single Activity Licensed	$68.21	$10.10	$48.41	$88.00	$8.00	252
Single Activity Non-licensed	$74.74	$8.76	$50.45	$99.02	$8.76	205
Multi Activity Users						
Multi Activity Non-licensed	$180.55	$26.42	$128.77	$232.33	$21.17	331
Multi Activity Licensed	$86.08	$17.82	$51.51	$121.00	$10.09	121
Multi Activity Dual Users	$200.07	$19.84	$161.18	$238.95	$23.45	876

[a] Based on the value of a 10-year annuity with a 3% discount rate.

Table 4
Interval censored regression results estimating willingness to pay based on activity group, visitation frequency, and demographics for users on nine North Carolina wildlife management area, 2017–2019 (Dependent variable: natural log of willingness to pay; N = 1785).

Parameter	Estimate	Std. Error
Multi Activity Dual Users	0.370 *	0.167
Multi Activity Licensed	0.115	0.247
Multi Activity Non-licensed	0.280	0.204
Single Activity Non-licensed	-0.482 *	0.213
Visitation Frequency	0.047 * **	0.007
Age	0.002	0.004
College (1 = college degree)	0.439 * **	0.121
Income (thousands of USD)	0.004 * *	0.001
Sex (1 = male)	0.247	0.159
Intercept	3.090 * **	0.263
Log(scale)	0.674 * **	0.291
Scale = 1.96		
Log-likelihood model: − 1937.3		
Log-likelihood intercept: − 2001.8		
$X^2 = 129.01$ D.F = 9 $p < 0.001$		

Reference Level: Single Activity Licensed Users
Note: * $p < 0.05$, * * $p < 0.01$, * ** $p < 0.001$

Table 5
Reported reasons for saying yes to the initial dollar amount in the contingent valuation prompt for users on nine North Carolina wildlife management areas, 2017–2019 (N = 1492).

Which of the following describes why you would be willing to donate this amount? (Check all that apply)	
It is a small amount of money	51% (+/– 2.54%)
I care about the conservation of game lands	72% (+/– 2.28%)
I benefit from the conservation of game lands	62% (+/– 2.46%)
I like to contribute to the conservation of game lands	47% (+/– 2.53%)
I want game lands to be around for future generations	70% (+/– 2.33%)
Other	2% (+/– 0.71%)

Table 6
Reported reasons for saying no to the initial dollar amount in the contingent valuation prompt for users on nine North Carolina wildlife management areas, 2017–2019 (N = 542).

Which of the following describes why you would not be willing to donate this amount? (Check all that apply)	
It is too expensive	30% (+/– 3.86%)
The money should come from somewhere or someone else	22% (+/– 3.49%)
I do not care about the conservation of game lands	2% (+/– 1.18%)
I do not benefit from the conservation of game lands	4% (+/– 1.65%)
There would still be enough land for my activity after a 20% reduction	18% (+/– 3.23%)
Other	10% (+/– 2.53%)

selected "It is too expensive" had received a larger initial bid amount ($75.95) than the average respondent who said no to the initial bid amount ($58.85; Welch's T-Test: T = 4.193, $p < 0.0001$).

4. Discussion

This study builds on an emerging consensus that non-licensed users have greater WTP, and therefore a larger consumer surplus, for wildlife conservation than their licensed counterparts (Boyle et al., 1996; Frew et al., 2018; White et al., 2001). Frew et al. (2018) documented WTP per year for tundra swan conservation to be approximately $4.67 greater among wildlife watchers than among hunters, and Boyle et al. (1995) reported that the maximum annual net economic value (consumer surplus) for bass and trout fishers, and deer, moose, and elk hunters, was less than that of wildlife watchers. In our specific context, licensed users might be expected to have higher WTP because WMAs are designed specifically for licensed recreation (i.e., hunting and fishing). Conversely, licensed users are already paying annual license fees required to participate in hunting, fishing, and/or trapping, as well as investing in activity-specific durable goods (e.g., guns, fishing rods, boats; Dalrymple et al., 2010; Grado et al., 2007). In combination, the total costs incurred by licensed users are significantly greater than for those using WMAs for hiking, the most common activity reported among non-licensed users in this study. This would be consistent with lower additional WTP of licensed users, which is in fact what we documented: licensed users had meaningfully lower WTP than non-licensed users, even after accounting for whether those users engaged in secondary activities, how often they visited WMAs, and socioeconomic characteristics such as age and income. Dual users incur similar costs as licensed users but had the highest WTP, possibly because dual users are uniquely positioned to derive net economic benefits (both use and non-use value) from both types of activities due to some synergies or complementarities between those activities.

We documented that WTP is sensitive to the 'scope' of recreational activities pursued on WMAs. An additive effect of recreation has been previously reported in the recreation literature. Cooper et al. (2015) suggested that an additive effect between licensed and non-licensed recreation might explain why people who hunt and birdwatch are more likely to participate in market-based conservation behaviors (i.e., donate money to support local environmental protection) than people who only hunt or only birdwatch. In our study, the WTP of respondents who engage in different types of activities does not exactly "add up" to the WTP of multi-activity dual users, but we do find that multi-activity users have significantly higher WTP, especially among those who participate in at least one non-licensed activity. This serves as a type of scope test, demonstrating the expected relationships between WTP and the 'scope' of different uses of the WMA (Whitehead, 2016). We demonstrated that this sensitivity to scope extends beyond the dichotomous combination of licensed recreation (e.g., hunting) and non-licensed recreation (e.g., birding), to include incremental increases in WTP associated with participation in diverse recreation types. Szczytko et al. (2020) reported that participating in multiple recreational activities was essential for promoting strong connections to nature

among children, indicating a diversity of recreational pursuits may predict a broad array of values for nature including willingness to pay for its conservation (this study) and affinity for and comfort in nature. Although a dichotomous breakdown of users (licensed vs non-licensed) is important, the distinction is insufficient for WMA valuation because it does not reflect the benefits enjoyed by multi-activity users involved in non-licensed activities, and by multi-activity dual users. Future studies should determine if the relationships observed in this study and Cooper et al. (2015) hold true in other non-market contexts because non-market contingent valuation studies are notoriously context dependent (Bergstrom and Randall, 2016).

Model predictions indicated increasing visitation frequency among WMA users may yield increases in WTP, but even larger increases in WTP could be achieved through diversifying the activities of users. This is because after controlling for socioeconomic characteristics, we find that multi-activity dual users have higher WTP than similar single-activity users. Our results confirm previous studies that have found visitation frequency is positively related to WTP (Dahal et al., 2018; Dalrymple et al., 2012; Loomis and White, 1996; Nunes and van den Bergh, 2004; Zydroń et al., 2021), even after controlling for activity group. Because few studies reported the marginal effect of visitation frequency, cross study comparisons are challenging. Additionally, similar research exploring the drivers of pro-environmental behavior also showed a positive effect of visitation frequency, but the marginal value was not reported (Larson et al., 2018a, 2011). Our results indicated that visitation frequency may be a more important component of WTP for WMA conservation ($9.24 per trip in this study) than for other forms of protected land. For example, similar work in the context of national parks demonstrated the marginal value of visitation frequency to be approximately $2 per visit up to four visits at which point additional visits had no effect on WTP (Zydroń et al., 2021). These differences in WTP may be driven by specialized recreational opportunities available on WMAs. Previous research reported that visitors who participate in specialized forms of recreation (e.g., surfing) have greater trip frequency, stronger place attachment, and are more likely to engage in pro-environmental behaviors (e.g., donating money to support conservation) than visitors not engaged in specialized recreation (Larson et al., 2018b). This same phenomenon may directly apply to WMAs (both state and federal) because WMAs are the only form of public land that allows hunting and trapping, in addition to providing specialized opportunities for hunting field trials, horseback riding, and specialized water sports (e.g., whitewater kayaking).

An individual's personal connection with public lands and the direct benefits that they and future generations derive from public lands are widely recognized motivations for supporting protected areas. Our results related to underlying motivations for WTP parallel those documented in previous WTP studies, indicating overlap in the motivations underlying WTP for various forms of natural resources (Kotchen and Reiling, 2000; Ressurreição et al., 2012). Research in parallel conservation contexts noted that motivations are likely derived from a respondent's attitudes, values, social norms, and internal 'land ethic' (Han et al., 2018; Rosenberg and Margerum, 2008). Respondents have qualitatively described the land ethic as "the right thing to do", and previous work suggested this concept is comprised of economic, cultural, and ecological components that vary among individuals (Rosenberg and Margerum, 2008). In this context, our findings strengthen the case for strategically targeting motivations related to an individual's personal connection with the land and the associated direct benefits that they and future generations enjoy. This type of communication should resonate with WMA, and other public land, constituents. Additionally, our findings suggest that conservation agencies need not develop separate messaging for various user groups, but instead should develop unified communications that tie together these broadly shared motivations.

4.1. Limitations & Future Directions

Future studies should explicitly investigate potential pricing mechanisms that management agencies might employ to capture more of the consumer surplus quantified in this study and to understand additional underlying motivations. For example, Colorado and Virginia require all visitors to state WMAs to purchase an access permit unless they already own a hunting or fishing license. Future work should evaluate support and WTP for similar passes or permits, and how such mechanisms may influence overall visitation. Such pricing studies should be conducted prior to launching new access/permit fees, because our finding that higher initial bid size leads to more refusals to pay suggests the importance of the initial fee announced by management agencies.

Stated preference choice experiments may be especially helpful for future WTP research because the non-market value of recreation areas derives from the specific amenities available (Hasan-Basri et al., 2015) as well as the types of recreationists accessing those amenities (this study). Choice experiments could be used to identify instances where small investments in access to specific amenities may result in large visitation increases in recreation groups with the highest WTP, while accounting for possible substitutes (e.g., in other states). Alternatively, future studies could explore different contingent valuation scenarios (e.g. opportunities to expand rather than preventing contraction of WMAs). Further, future research could explore latent motivations such as wildlife value orientations or the Environmental Portrait Value Questionnaire (Bouman et al., 2018). Finally, management agencies should invest in surveys conducted across both multiple years and seasons to ensure that season-specific users are well-represented. Our survey was implemented over 20 months, including only one summer season. In our case, this is unlikely to have omitted any user groups because most respondents participated in numerous activities on the WMAs and visited throughout the year over multiple seasons.

5. Conclusion

This study documented willingness to pay for conserving WMAs, showing that all visitor types using WMAs derive benefits (both use and non-use value) from WMA conservation, well in excess of typical license fees (i.e., a consumer surplus). Conservation agencies may be able to increase these benefits by promoting non-licensed forms of recreation (e.g., biking and hiking) among traditional constituents who primarily hunt and fish. Promoting multiple activities may have the ancillary benefit of increasing visitation frequency, which could further increase WTP. This study identified shared motivations underlying WTP across all types of WMA users. Conservation agencies should leverage these motivations with communications that resonate with an audience of all WMA users. We recommend further research on how to design new licenses or fees to capture more of the consumer surplus enjoyed by WMA visitors while not deterring their use of WMAs for both licensed and non-licensed activities.

CRediT authorship contribution statement

Christopher Moorman: Writing – review & editing, Supervision, Methodology. **Erin Sills:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization. **Pacifici Krishna:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization. **Peterson M. Nils:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Casola William R:** Writing – original draft, Visualization, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare the following financial interests/personal

relationships which may be considered as potential competing interests: William Casola, Nils Peterson, Krishna Pacifici, & Erin Sills report financial support was provided by the North Carolina Wildlife Resources Commission.

Data Availability

Data will be made available on request.

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