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Does Proximity to Wetlands Matter? A Landscape-Level Analysis of the Influence of Local Wetlands on the Public's Concern for Ecosystem Services and Conservation Involvement

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Abstract

Understanding public perceptions can enhance the success of landscape-level conservation by helping recognize how to gather public support. However, perceptions of wetlands' importance may differ based on proximity to a wetland. This study used a mail-out survey across the entire U.S. ($n = 1030$) to investigate the public's knowledge of local wetlands, visitation to wetlands, concern over losing ecosystem services provided by wetlands, and involvement in wetlands conservation. Regression models were run to explore the impact of proximity to the nearest wetland on wetlands visitation, concern, and conservation involvement. Additionally, sociodemographics and outdoor recreation participation were tested as predictors. While proximity to wetlands did impact knowledge of wetlands in the local area and wetlands visitation, it was not directly a significant predictor of concern for wetlands ecosystem services or conservation involvement. However, wetlands visitation did increase concern for ecosystem services and conservation involvement. Furthermore, participation in birdwatching, wildlife viewing, and fishing were correlated with higher concern for ecosystems services provided by wetlands and involvement in wetlands/waterfowl conservation. Results suggest that fostering awareness of wetlands, encouraging visitation, and promoting non-consumptive outdoor recreation opportunities may increase support for wetlands regardless of individuals' proximity to wetlands.

Keywords Demographics · Ecosystem services · Environmental attitudes · Outdoor recreation · Public perceptions · United States

Introduction

Wetlands provide many critical ecosystem services, including improved air and water quality, flood and erosion protection, carbon sequestration, biodiversity support, and recreation opportunities (Clarkson et al. 2013). However, it is estimated that over half of global wetlands have been lost due to human activities and development (Zedler and Kercher 2005). In the U.S. alone, 53% of wetlands were lost from the 1780s to the 1980s, primarily due to urbanization and agriculture (Dahl 1990). While the rate of wetlands loss has declined recently, the U.S. is still seeing a net decrease in wetlands area (Dahl 2011). Since landscape-level conservation may be more successful with public and local support (e.g., Underwood 2011; Doyle-Capitman et al. 2018), it would be beneficial to better understand what factors impact public concern for wetlands ecosystem services and involvement in conservation.

However, the U.S. public is not one homogenous entity, and individuals may have very dissimilar views towards wetlands and their ecosystem service values. Investigating the factors that contribute to differing public perceptions of wetlands is important to better understand how to foster public valuation of these landscapes and increase engagement in conservation behaviors. Although some studies have investigated public perceptions of wetlands (e.g. Azevedo et al. 2000; Kaplowitz and Kerr 2003; Manuel 2003; Dobbie and Green 2013), none have considered proximity to wetlands specifically as an explanatory factor of perceptions. If proximity to

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wetlands engenders concern about their condition, then ensuring a broad distribution of wetlands across a landscape becomes more important for encouraging public support to conserve wetlands. If proximity is not significant, then other approaches may be more successful.

Consequently, our research questions are (1) Does proximity to a wetland influence knowledge of local wetlands and wetland visitation? (2) How do proximity to a wetland, knowledge of local wetlands, wetlands visitation, outdoor recreation participation, and demographics impact concern for the potential loss of ecosystem services provided by wetlands in general? and (3) Which of these factors influence wetlands conservation behavior?

Literature Review

The research questions were informed by a variety of previous studies on topics ranging from general environmental attitudes to proximity of environmental features. Studies in Victoria, Australia, and Nova Scotia, Canada show that the public most often identified aesthetic and ecological values when describing wetlands (Manuel 2003; Dobbie and Green 2013). However, people have varying experiences with wetlands, and therefore see and value different attributes when viewing wetland landscapes (Dobbie and Green 2013). One factor that is found to consistently influence environmental attitudes and perceptions is sociodemographics. Gender, age, education, income, political affiliation, and race have all been found to impact environmental concern, although conclusions may vary depending upon the location and time of the survey, as well as how concern is measured (Scott and Willits 1994; Newell and Green 1997; Klineberg et al. 1998). For wetlands specifically, a study across Michigan found that younger and more educated people valued wetlands more highly, while community type (rural, urban, suburban) was not significant (Kaplowitz and Kerr 2003). Additionally, a study in Slovenia found that members of the public with higher education were more likely to be aware of wetlands (Polajnar 2008). However, sociodemographics usually only account for a small amount of the variance in the data (Buttel 1987; Klineberg et al. 1998). This indicates other factors are also impacting environmental attitudes.

In addition to sociodemograhic variables, outdoor recreation participation can impact environmental attitudes and behaviors, although results have been mixed (Berns and Simpson 2009). Previous studies have suggested that outdoor recreation is an influential predictor of environmental attitudes, and that the associations are still significant when controlling for demographic variables (Nord et al. 1998; Theodori et al. 1998). However, a different study by Geisler et al. (1977) found that outdoor recreation was not significant when controlling for demographics. Other studies have found that the effects depend on the type of recreation (Dunlap and Heffernan 1975; Jackson 1986; Bjerke and Kleiven 2006). There are differences in environmental attitudes among those who participate in appreciative outdoor activities (e.g. camping, hiking), consumptive (e.g. fishing, hunting), and motorized (e.g. snowmobiling, ATVs) (Tarrant and Green 1999). However, research by Teisl and O'Brien (2003) suggests that the associations between various outdoor activities and environmental attitudes depend on what types of environmental attitudes are measured, so findings may be different for wetlands perceptions specifically. Hunters/anglers in the state of Iowa perceive the same benefits from wetlands as the general Iowa population (Azevedo et al. 2000). However, this study clustered hunters and anglers together, and did not look at how participation in other outdoor recreational activities may affect perceptions of wetlands.

Much of past research on environmental perceptions has indeed focused on demographics and outdoor recreation participation. However, perceptions and behavior can also be influenced by physical location (Brody et al. 2004). For example, physical location can affect risk perceptions of hazards (Biel and Dahlstrand 1995) and attitudes towards tourism (Jurowski and Gursoy 2004). Therefore, proximity to a feature of interest may be an important factor in explaining attitudinal differences.

Previous research has found that proximity to environmental features does impact opinions and awareness. One study found that the driving distance from creeks in San Antonio, Texas, did affect the public's familiarity with and views of water safety in the watershed (Brody et al. 2004). Similarly, residents who lived near the Chicago River were more likely to be aware of it, and general perceptions of the river differed greatly based on where people lived (Gobster 1998). Furthermore, Brown et al. (2002) found that ecosystem values were not spatially random across people living near Chugach National Forest, Alaska; values varied based on physical location and community of residence.

Additionally, nearness to a feature can impact environmental concern and support for policies. For example, proximity to wind farms can influence support for wind energy, with those who lived closer to wind farms having more negative attitudes toward wind energy (Swofford and Slattery 2010). In Hamilton, Ontario, people who lived in areas with greater air pollution had higher concerns for air quality and black soot, indicating again that location may impact environmental perceptions (Elliott et al. 1999). Another study investigated the impact of proximity to water on attitudes towards resource protection in the Johnson Creek watershed, in Portland, Oregon (Larson and Santelmann 2007). The authors found that distance to water was significant for predicting economic attitudes towards resource protection, but not attitudes towards the government or regulations (Larson and Santelmann 2007). Collectively, this research suggests that physical proximity may influence the public's perceptions of wetlands. However, all of these aforementioned studies took place at relatively small spatial scales, so this study adds to the literature by investigating the effects of proximity to a feature

on perceptions across an entire country. This research focuses on wetlands as a general resource across a large scale rather than examining the impact of a specific wetland.

Methods

Survey Instrument

The survey was developed to help inform the 2018 update of the North American Waterfowl Management Plan and was broadly titled the "Nature and wetlands survey." The full survey instrument can be found as a supplementary file. It consisted of four sections: (1) nature and wetlands activities, (2) sources of information about conservation issues, (3) opinions about wetlands, and (4) demographics. The focus of this paper is the public's responses to opinions about wetlands. Because this was a public survey and not everyone may be familiar with wetlands, people were provided the following definition: "Wetlands include swamps, marshes, bogs, shallow ponds (less than 6 feet deep), and shallow areas on lakeshores and seashores. Some wetlands are only wet some of the year, while others are wet year-round. They can be in cities or in rural areas and can be smaller than a basketball court or cover several square miles." After this description, people were asked if they knew of any wetlands in their local area or community, and whether or not they had visited any wetlands in the last 12 months.

To assess concern over losing ecosystem services provided by wetlands, people were prompted that "wetlands perform a variety of functions which are beneficial to people. When wetlands are lost or degraded, these benefits can be reduced or disappear altogether." This prompt was provided because we wanted respondents to be aware that wetlands do provide services, and then measure how concerned they would be about losing the services, rather than measuring if they believe the service exists. People were asked to rate how concerned they would be if 10 different benefits were substantially reduced in their community due to a loss in wetlands, on a scale from 0 (not at all concerned) to 3 (very concerned). This list of 10 was chosen to include provisioning (i.e., clean water, clean air), regulating (i.e., erosion protection, flooding protection, storage of greenhouse gases), cultural (i.e., scenic places for inspiration or spiritual renewal, wildlife viewing and birdwatching, hunting opportunities), and supporting (i.e., habitat for pollinators, habitat for wildlife) ecosystem services (Millennium Ecosystem Assessment 2005).

Additionally, 10 nature-related recreational activities were listed, and respondents were asked to report whether or not they had participated in each activity in the previous 12 months. The question's phrasing and dichotomous scale were adopted from Tarrant and Green (1999). Two of the activities listed in the survey were not analyzed for this paper because they did not represent away-from-home outdoor recreation (backyard/at-home nature activities and learning about nature).

People were also asked to indicate their level of involvement in 6 wetlands/waterfowl conservation activities in the last 12 months, on a scale from 0 (never) to 4 (very often).[1] The activities listed were working on land improvement projects related to wetlands/waterfowl conservation, attending meetings about wetlands/waterfowl conservation, volunteering personal time and effort to conserve wetlands/waterfowl, contacting elected officials or government agencies about wetlands/waterfowl conservation, voting for candidates or ballot issues to support wetlands/waterfowl conservation, and advocating for political action to conserve wetlands/waterfowl. These 6 measures for conservation involvement were based on questions used by Cooper et al. (2015), but adapted for wetlands/waterfowl conservation specifically.

Data Collection

Data were collected via a mail-out survey from January through March of 2017. The survey was sent to 5000 addresses in the U.S., which were obtained through a stratified random sample from Survey Sampling International. The sample was stratified by state, and addresses were chosen in proportion to the population of each state. Therefore, states with large populations had equally large representation in the sample. We utilized a tailored design method, sending up to four mailings per address (Dillman et al. 2014). The first mailing included the survey, the second mailing was a reminder postcard, the third mailing was a replacement survey for those who had not responded, and the last mailing was a shorter non-response bias questionnaire. Raw data collected from this survey can be accessed on sciencebase.gov; however, addresses and GPS coordinates of respondents have been removed for participant confidentiality (Wilkins et al. 2017).

Data Analysis

Data were first analyzed to determine the distance each individual lived from the nearest wetland. A GIS layer of all wetlands in the U.S. was obtained from the National Spatial Data Infrastructure (U.S Fish and Wildlife Service 2018). All mailing addresses associated with completed surveys were converted to GPS coordinates. Surveys sent to P.O. boxes rather than physical addresses were excluded from analysis. Survey coordinates were plotted and compared to the wetlands layer. Distances from each respondent to the nearest wetland (in

[1] Although this paper is focused on wetlands, the scope of the larger survey also included waterfowl. However, it is likely that anyone who participated in waterfowl conservation is either directly or indirectly involved in wetlands conservation as well, since waterfowl conservation largely revolves around protecting their habitat (wetlands) ("North American Waterfowl Management Plan 2012", 2012).

kilometers) were generated using a proximity analysis feature of ArcGIS. This represented the straight-line distance to the nearest wetland of any type.

To see whether distance to the nearest wetland influenced people's awareness of wetlands in their community, knowledge of wetlands in the local community was compared based on distance from a wetland using chi-square. Then, to explore what factors influenced wetlands visitation, we conducted a binary logistic regression. Independent variables entered included distance to nearest wetland, knowledge of wetlands in the area, age, gender, education level, race, and ethnicity.

Multivariate linear regression was used to determine predictors for concern about losing ecosystem services provided by wetlands. A single index variable of concern over ecosystem services loss was created from the ten benefits listed by using a Cronbach's alpha to test for internal consistency; this was then the dependent variable. Four different regression models were tested. Demographics were entered as independent variables in an initial model because previous literature states that demographics impact environmental concern (e.g. Klineberg et al. 1998). The second model examines the impact of participation in various outdoor recreational activities because previous research indicates that outdoor recreation behavior may influence environmental attitudes (Berns and Simpson 2009). Additionally, outdoor recreation activities were entered separately rather than a composite index because different types of activities have been shown to have varying effects on environmental attitudes (e.g. Bjerke and Kleiven 2006; Dunlap and Heffernan 1975). The third model includes distance to a wetland, prior wetlands visitation, and knowledge of wetlands in the community as predictor variables to test our research questions of whether or not proximity and relationship to wetlands influences concern for their ecosystem services. Finally, the fourth model combines all three models for comparing across all predictors.

Lastly, multivariate regression was also used to predict involvement in wetlands and waterfowl conservation. A single index variable of involvement was created from the six measures of conservation involvement by using a Cronbach's alpha to test for internal consistency. All of the independent variables in the previous models were again entered as four separate regression models. Concern for ecosystem services provided by wetlands was also added as a predictor because level of concern for wetlands ecosystem services may impact wetlands/waterfowl conservation behavior.

Results

Profile of Respondents

The survey response rate was 23.4%, with a total of 1030 surveys being returned (595 were undeliverable). In total, individuals from 49 states responded (Fig. 1). The Midwest was slightly overrepresented, and the South was slightly underrepresented (Table 1). Additionally, the sample is somewhat biased, with a higher response from males, older people, highly educated people, people who are not Hispanic or Latino, and white people.

Over half of the respondents lived within 0.200 km (km) of a wetland, as the median is 0.194 km (Table 2). The greatest distance anyone lived from a wetland was 3.023 km. Additionally, a majority of people knew of wetlands in their local communities (78%) and had visited wetlands within the last 12 months (57%).

Knowledge of Wetlands in the Local Community

There is an association between distance from a wetland and people's knowledge of wetlands in their local areas or communities (Spearman's Rho = 0.099; $p = 0.002$). People who live within 0.100 km of a wetland are more likely to be aware of wetlands in their local community than average; however, 8.6% of these people are still unaware of wetlands in their local community (Table 3). People who live 0.601 km or greater away from a wetland are less likely to be aware of wetlands in their local communities; however, over half still report that they know of wetlands in their local areas.

Wetlands Visitation

Of those who knew of wetlands in their local communities, 69.9% had visited wetlands within the last 12 months, while only 16.1% of people who did not know of wetlands in their local communities visited one in the last 12 months. Distance to the nearest wetland, knowledge of wetlands in the local area, age, and education were all significant predictors of whether or not someone has visited a wetland in the last 12 months (Table 4). As distance to the nearest wetland increased, people were less likely to have visited a wetland. People who did not know of wetlands in their community were also less likely to have visited wetlands. Additionally, younger people and those with more education were more likely to have visited a wetland.

Concern for Wetlands Ecosystem Services

Over half of the sample reported they were somewhat or very concerned about nine out of ten listed ecosystem services being reduced in their community due to a loss of wetlands (Fig. 2). The only ecosystem service provided by wetlands that the majority were not concerned about losing was hunting opportunities. Reductions in clean air, clean water, and homes for pollinators elicited the most concern.

The ten ecosystem services listed had a high internal consistency, with a Cronbach's alpha of 0.900. Hunting

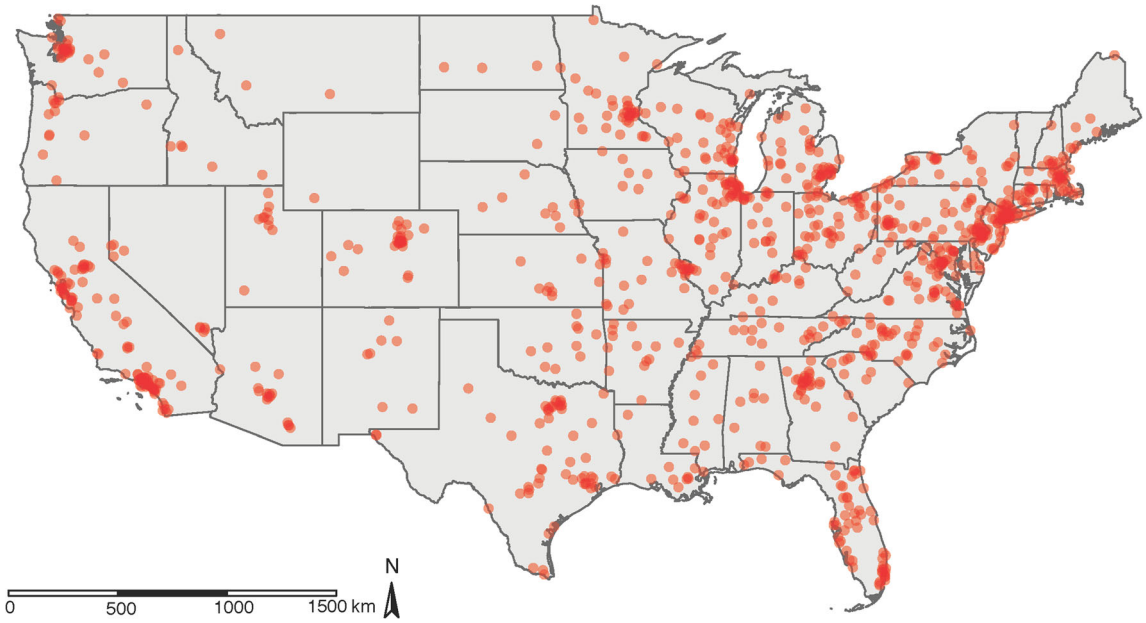

Fig. 1 Locations of survey respondents throughout the U.S. Map does not show three respondents located in Hawaii. Figure created in R using the package tmap (Tennekes 2018)

opportunities was deleted from the scale as its removal increased the Cronbach's alpha to 0.925. The remaining nine services were averaged for a composite score of concern for losing ecosystem services provided by wetlands. Regression models show the impact of demographics, outdoor recreation participation, and relationship to wetlands on concern for wetlands ecosystem services (Table 5). Model assumptions were met, and there was no evidence of multicollinearity among predictors (all variance inflation factors <2). Demographics only accounted for 3.2% of the variation in the data, with education and gender being significant predictors of concern. Those who participated in birdwatching, wildlife viewing, non-motorized outdoor recreation, or spending time in nature away from home were more likely to report concern over wetlands ecosystem services. Those who had hunted within the last year were less likely to report concern.

Distance to the nearest wetland was not a statistically significant predictor of concern over the loss of ecosystem services provided by wetlands. However, past wetlands visitation and knowledge of wetlands in the local community were significant predictors, with those who knew about wetlands in

Table 1 Demographics of the sample

Category	Sample *n*	Sample %	U.S. Census
Census Region			
Northeast	203	19.7%	17.5%
Midwest	285	27.7%	21.1%
South	320	31.1%	37.7%
West	222	21.6%	23.7%
Gender			
Male	659	65.1%	49.2%
Female	353	34.9%	50.8%
Age			
18–44	214	21.4%	48.1%
45–65	458	45.8%	34.7%
65+	327	32.7%	17.2%
Education			
High school degree or less	177	17.4%	41.1%
Some college or Associates	308	30.3%	26.4%
Bachelor's degree	272	26.8%	20.5%
Graduate degree	259	25.5%	12.0%
Ethnicity			
Hispanic or Latino	55	5.6%	17.1%
Not Hispanic or Latino	921	94.4%	82.9%
Race			
People of color/multiracial	138	13.9%	26.4%
White	852	86.1%	73.6%

Table 2 Characteristics of the sample in relation to wetlands

Distance from nearest wetland	
Mean	0.284 km
Median	0.194 km
Knowledge of wetlands in the local community	
Yes	78.3%
No	11.8%
Don't know	9.9%
Visitation to wetlands in the last 12 months	
Yes	57.4%
No	42.6%

Table 3 Knowledge of wetlands in the local area/community based on distance from the nearest wetland

Distance from wetland (km)	n	Know of wetlands in local community (%)			X^2	P
		Yes	No	Don't know		
0–0.100	279	83.5*	8.6*	7.9	28.214	0.002
0.101–0.200	226	77.4	12.8	9.7		
0.201–0.300	140	80.0	11.4	8.6		
0.301–0.400	115	77.4	8.7	13.9		
0.401–0.600	117	80.3	8.5	11.1		
0.601 +	107	64.5*	25.2*	10.3		
Total	**984**	**78.5**	**11.8**	**9.8**		

*Indicates adjusted standardized residual >1.96

their community and those who had visited in the last 12 months more likely to have high concern for the loss of ecosystem services provided by wetlands.

Involvement in Wetlands Conservation

The Cronbach's alpha for all six of the items measuring involvement in wetlands/waterfowl conservation was 0.843, indicating high internal consistency. Regression assumptions were again met, and there was no evidence of multicollinearity among predictors (all variance inflation factors <2). Demographic variables were not largely influential for predicting involvement in wetlands/waterfowl conservation; only education was significant, and the overall R-square was 0.015 (Table 6). The R-square for the outdoor recreation model was slightly higher, at 0.117. Those who had gone birdwatching, wildlife viewing, or fishing in the last 12 months were more likely to have participated in wetlands/waterfowl conservation.

Although distance to the nearest wetland and knowledge of wetlands in the local community were not significant predictors of wetlands/waterfowl conservation behavior, prior wetlands visitation and concern for wetlands ecosystem services being lost were significant predictors. Those who had visited wetlands in the last 12 months and who had higher concern for reductions in their ecosystem services were more likely to be involved in wetlands/waterfowl conservation.

Discussion

These data show that proximity to wetlands does relate to both increased knowledge of local wetlands and likelihood of wetlands visitation. However, proximity was only weakly related to these variables. Only those who live very close or more than 0.600 km away from a wetland showed a difference in knowledge of local wetlands. One reason for these relatively weak relationships may be that proximity was represented by the distance between where people lived and the nearest wetland of any type. Proximity to certain types of wetlands, such as those that are large, wet year-round, and/or have good access and recreation opportunities, may be more predictive. It is likely that some of the nearby wetlands are on private lands and may be inaccessible and unknown to the general public. This would also help to explain why knowledge of wetlands in the community was more influential in predicting visitation

Table 4 Logistic regression results predicting the likelihood that someone would have visited a wetland within the last 12 months

Variable	B	SE	Wald	Sig.	Odds ratio
Constant	1.520	0.418	13.207	<0.001	4.571
Distance to nearest wetland (kilometers)	−0.847	0.279	9.225	0.002	0.429
Knowledge of wetlands (reference = yes)			111.102	<0.001	
No	−2.175	0.274	62.797	<0.001	0.114
Don't know	−3.080	0.409	56.641	<0.001	0.046
Age	−0.019	0.006	11.462	0.001	0.982
Education	0.152	0.052	8.461	0.004	1.164
Gender (reference = male)	−0.119	0.168	0.508	0.476	0.887
Ethnicity (reference = not Hispanic/Latino)	−0.218	0.395	0.304	0.581	0.804
Race (reference = white)	−0.239	0.239	0.995	0.319	0.788
Nagelkerke R-square = 0.310					

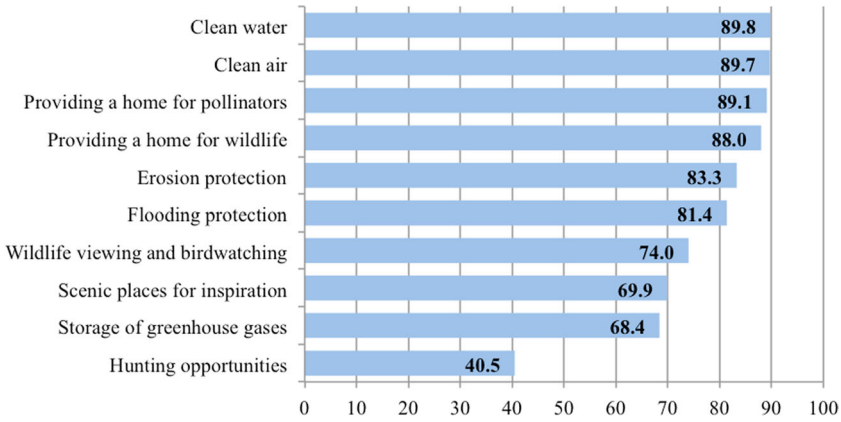

Fig. 2 Percentage of the sample somewhat or very concerned about various benefits being reduced in their community due to a loss of wetlands. Figure created in Microsoft Excel

than proximity. Those who knew of wetlands may or may not have been thinking of the wetlands nearest to their residence. It is likely they were thinking of a wetland they had visited, given that 70% of those with knowledge of local wetlands had visited a wetland in the last 12 months.

Though knowledge of wetlands and wetlands visitation were positively related to concern for the loss of wetlands ecosystem services, proximity did not have a directly significant impact. This may be because, despite a diverse, nationwide sample of over 1000 people, our entire sample lived within relatively close proximity to a wetland (3.0 km). Therefore, when analyzing proximity, we were comparing fairly small magnitudes of differences. This suggests a potential opportunity to engage communities with their local

Table 5 Multiple regression results predicting concern over the loss of local ecosystem services due to the loss of wetlands[a]

Variables	Model 1: Demographics		Model 2: Outdoor recreation		Model 3: Relationship to wetlands		Model 4: Combined	
	β	Sig	β	Sig	β	Sig	β	Sig
Age	0.013	0.691					0.074	0.033
Education	0.124	<0.001					0.043	0.203
Gender (reference = male)	0.146	<0.001					0.136	<0.001
Ethnicity (reference = not Hispanic/Latino)	0.046	0.155					0.075	0.021
Race (reference = white)	−0.032	0.325					0.018	0.575
Outdoor rec (reference = did not participate)								
Birdwatching			0.138	<0.001			0.096	0.013
Wildlife viewing			0.145	<0.001			0.112	0.007
Fishing			0.067	0.064			0.101	0.008
Hunting			−0.115	0.001			−0.106	0.004
Non-motorized			0.075	0.042			0.066	0.097
Motorized			−0.035	0.319			−0.013	0.732
Time in nature away from home			0.124	0.001			0.062	0.118
Distance to nearest wetland (kilometers)					0.006	0.848	0.012	0.712
Visited wetlands (reference = no)					0.153	<0.001	0.049	0.214
Knowledge of wetlands in community								
No					−0.077	0.022	−0.077	0.027
Don't know					−0.174	<0.001	−0.134	<0.001
Adjusted R-square	0.032		0.126		0.077		0.151	

[a] Dependent variable is on a scale from 0 to 3, with 3 being very concerned. It is the average concern over losing 9 ecosystem services provided by wetlands (Cronbach's alpha = 0.925)

Table 6 Multiple regression results predicting involvement in wetlands/waterfowl conservation behavior within the last 12 months[a]

Variables	Model 1: Demographics		Model 2: Outdoor recreation		Model 3: Relationship to wetlands		Model 4: Combined	
	β	Sig	β	Sig	β	Sig	β	Sig
Age	0.042	0.205					0.078	<0.001
Education	0.136	<0.001					0.061	0.022
Gender (reference = male)	0.022	0.502					0.023	0.497
Ethnicity (reference = not Hispanic/Latino)	0.038	0.249					0.046	0.140
Race (reference = white)	−0.015	0.640					0.043	0.178
Outdoor rec (reference = did not participate)								
Birdwatching			0.139	<0.001			0.067	0.077
Wildlife viewing			0.139	<0.001			0.081	0.046
Fishing			0.129	<0.001			0.126	0.001
Hunting			0.058	0.085			0.050	0.161
Non-motorized			0.069	0.062			0.040	0.299
Motorized			−0.063	0.070			−0.035	0.323
Time in nature away from home			0.056	0.125			0.001	0.989
Distance to nearest wetland (kilometers)					−0.015	0.629	−0.011	0.730
Visited wetlands (reference = no)					0.248	<0.001	0.172	<0.001
Knowledge of wetlands in community								
No					−0.051	0.117	−0.047	0.171
Don't know					−0.022	0.501	−0.009	0.794
Concern for losing wetlands eco. services					0.240	<0.001	0.211	<0.001
Adjusted R-square	0.015		0.117		0.162		0.205	

[a] Dependent variable is on a scale from 0 to 4, with 4 being very often. It is the average of participation in 6 wetlands/waterfowl conservation behaviors within the last 12 months (Cronbach's alpha = 0.843)

wetlands. Since a large portion of the U.S. population lives within just a few kilometers of a wetland, natural resource managers could spread information about local wetlands to communities and promote visitation to the publicly accessible wetlands. These results indicate that some people who live within 0.5 km of a wetland are still unaware of the wetland in their community.

Although the focus on this paper was to explore how proximity, knowledge, and visitation impact concern for wetlands' ecosystem services and conservation behavior, we first modeled the influence of demographics and outdoor recreation behavior since these are known to impact environmental attitudes and behavior (Berns and Simpson 2009; Kaplowitz and Kerr 2003). This helps us better understand how proximity, knowledge, and visitation influence concern and involvement in comparison to other predictors.

Our results found that demographics only accounted for a small proportion of the variance in the data when predicting concern over wetlands ecosystem services and conservation involvement. This is consistent with the small impact of demographics found by others (Klineberg et al. 1998). Education was positively associated with both wetlands' ecosystem services concern and conservation involvement, which fits with previous literature (Kaplowitz and Kerr 2003). Gender was also associated with concern for wetlands' ecosystem services, with women more likely to be concerned than men.

The regression models with outdoor recreation participation as predictors explained more of the variation in the response variables than the models with only demographics as predictors. Some of the outdoor recreation variables were significant in predicting concern over wetlands ecosystem services or conservation behaviors, but the results did vary. Birdwatching, wildlife viewing, non-motorized recreation, and spending time in nature were all positively associated with concern over losing wetlands' ecosystem services, while those who hunted were less concerned about wetlands' ecosystem services. This fits with prior research that found people who

participate in what has been termed "consumptive recreation" may have different attitudes than those who participate in appreciative recreation (Tarrant and Green 1999). The only significant recreation behaviors for predicting conservation involvement were birdwatching, wildlife viewing, and fishing. This supports the idea that the impact of outdoor recreation on environmental attitudes and behaviors likely depends on the specific attitude or behavior measured (Teisl and O'Brien 2003). Since this survey measured wetlands/waterfowl conservation specifically, it is not surprising that birdwatching, wildlife viewing, and fishing would be the strongest predictors. These data suggest that encouraging the public's participation in these activities would foster increased involvement in wetlands conservation, but increasing participation rates in other outdoor activities, such as hiking, motorized recreation, or spending time in nature, may not have an effect on wetlands conservation behavior.

The models that combine all of the predictors indicate that gender and participation in wildlife viewing are the strongest predictors of wetlands' ecosystem services concern, while wetlands visitation and ecosystem services concern are the strongest predictors of wetlands/waterfowl conservation. These results suggest that fostering concern for wetlands ecosystem services, coupled by promoting wetlands visitation, may increase wetlands/waterfowl conservation involvement. An interesting finding of this research is that wetlands visitation is more influential than proximity to a wetland. This indicates that getting people to wetlands is more important for conservation than their proximity to a wetland, although those near wetlands are more likely to have visited one. Consequently, it may be beneficial to promote and advertise the presence of wetlands in areas that many people already visit.

Limitations and Future Research

More research is needed to fully understand how proximity interacts with other variables. The type, characteristics, and accessibility of proximate wetlands were not taken into account in this analysis due to data availability. The characteristics of nearby wetlands may be more important that proximity alone. Consequently, future research could explore whether certain attributes of nearby wetlands foster increased concern and conservation involvement. Many recreation activities require a wetland of a certain type, and the closest wetland may not provide opportunities, access, or sufficient room to engage in those activities. A survey in the state of Iowa found that the general public believes water quality, the variety of wildlife, the lack of congestion, and ease of access are some of the most important wetland attributes, while hunting success and the size of the wetland are the least important attributes (Azevedo et al. 2000).

Although we did ask about outdoor recreation participation, we did not ask which of the activities participated in took place on a wetland. Outdoor recreation that specifically relates to wetlands may help foster place attachment to wetlands, which could alter concern for that specific resource (Jackson 1986). Furthermore, future research could investigate how the driving time to the nearest accessible wetland impacts wetlands perceptions and conservation behaviors. This study investigated straight-line distance proximity to any wetland, but the travel time to get to a wetland may be more important than, or complementary to, absolute proximity.

Additionally, when interpreting the results, it is important to consider the sample biases. This sample is more male, white, highly educated, and older than the general U.S. population. Furthermore, this sample has higher participation in outdoor activities than found by a national survey in 2011 (U.S. Fish and Wildlife Service and U.S. Census Bureau 2014). This means that raw results, such as those presented in Fig. 2, should be interpreted with caution, as these represent the sample but not the population. It is likely that more people in this sample were aware of wetlands and visited wetlands at higher rates than what would be found in the population. Since demographics and outdoor recreation behaviors were added as predictors to the models, this bias should not impact the regression results.

Conclusions

Public support is beneficial for achieving landscape-level conservation goals. Therefore, it is useful to understand factors that increase the public's conservation involvement. Proximity to wetlands may be important to consider in landscape conservation of wetlands. It affects whether people visit wetlands which, in turn, impacts their concern over the loss of ecosystem services and participation in conservation behaviors. However, proximity was not directly a significant predictor of concern over wetlands ecosystem services or conservation participation, but wetlands visitation was a significant predictor. These findings suggest that encouraging the public to visit wetlands may be more important regardless of peoples' proximity to wetlands. Our data indicate that most of the U.S. public lives within close proximity to a wetland (within 3 km). The frequent occurrence of wetlands across the U.S. suggests an opportunity for land managers to engage surrounding communities and promote wetlands visitation. This research investigated proximity to a wetland of any type, and future research could explore how the type, ease of access, and recreational opportunities provided by the nearest wetlands impacts public concern for wetlands.

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