
Revealing the Pro-Conservation Impacts of Participation in Nature-Dependent Activities on a Local National Wildlife Refuge



January 2017

HDRU Series No. 17-6

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HUMAN DIMENSIONS RESEARCH UNIT PUBLICATION SERIES

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TO CITE THIS REPORT

Doyle-Capitman, C.E., Siemer, W.F. and Decker, D.J. 2017. Revealing the Pro-Conservation Impacts of Participation in Nature-Dependent Activities on a Local National Wildlife Refuge. Human Dimensions Research Unit Publ. Series 17-6. Dept. of Nat. Resources., Coll. Agric. and Life Sci., Cornell Univ., Ithaca, NY.

This report is available electronically at <https://hdru.dnr.cornell.edu/publication>

EXECUTIVE SUMMARY

Background

Conserved natural spaces close to communities create opportunities for local residents to participate in nature-dependent activities (NDAs), through which they can learn about and interact with natural resources. For the purposes of our research, NDAs include nature-dependent recreation and environmentally related volunteerism and interpretation. Studies have shown participation in NDAs can enhance participants' knowledge and awareness of natural resources, increase public interest and involvement in environmental stewardship, and expand participants' social networks with like-minded, environmentally oriented individuals. As land administrators are increasingly reliant on civic engagement to meet on-site and transboundary resource conservation goals, the pro-conservation impacts and increased social connectivity resulting from engagement in NDAs may help resource administrators meet their management objectives. Notwithstanding these potential benefits, to date little is known about the incidence of, motivations for, or impacts resulting from public participation in nature-dependent activities on publically managed, conserved lands.

Purpose

This study examined how local residents' participation in NDAs, and especially environmental volunteerism, on a National Wildlife Refuge influenced participants' pro-conservation attitudes and behaviors, as well as their relationships with other NDA participants. We also sought to characterize mechanisms used to engage local residents in NDAs, and to understand how participation in NDAs impacted participants' willingness to protect resources within the Refuge and in surrounding areas.

Methods

Our study focused on participation in NDAs at Wertheim National Wildlife Refuge (NWR), an urban Refuge in Brookhaven, NY. Semi-structured, face-to-face and telephone interviews were conducted with 37 individuals. Interviewees included Refuge officials, Refuge volunteers from the local area, Refuge partners, and external stakeholders with knowledge of the Refuge and nearby environments. Volunteers and other NDA participants were considered "local" if they lived within 30 miles of the Refuge. The majority of interviewed volunteers were members of the Friends of Wertheim NWR, the Refuge's associated 501(c)3, while the remainder volunteered directly with the Refuge, independent of any organization. During the Spring of 2016 interviews were transcribed and coded using both open and summative coding to reveal underlying themes and gain insight into our specific research questions.

Results and Discussion

How and why do local residents become involved in NDAs at Wertheim NWR?

- Refuge officials and volunteers reported local residents regularly participated in wildlife watching, hiking, kayaking, family-oriented educational and recreational events, and school programs at Wertheim.
- Interviews with Refuge officials, volunteers, and partners indicated that many NDA opportunities were deliberately marketed to communities near the Refuge. NDA opportunities were advertised through signage, fliers and pamphlets left at local public libraries and schools, advertisements in local newspapers, and through social media. Engaging people from local communities in NDAs on the Refuge was a stated priority of many interviewees.
- The Refuge's Visitor Services Managers played an integral role in promoting local residents' participation in NDAs and engaging local communities with the Refuge.
- Many volunteers began their volunteership as a means of filling time and performing charitable work. Over time, their motivations for remaining engaged were reportedly more influenced by a sense of personal investment in the administration of the Refuge and conservation of its resources, a greater interest in enhancing the experience of Refuge visitors, and a deepened sense of personal fulfillment as a result of volunteering.

Does participation in NDAs at Wertheim NWR influence local residents' awareness and knowledge of local environments?

- NDAs at Wertheim provided opportunities for participants to interact directly with natural resources and have hands-on learning experiences facilitated by environmental professionals (i.e., Refuge officials and partners). Many interview participants reported access to these types of opportunities were relatively unique in the area.
- All interviewed volunteers reported their knowledge and awareness of local natural resources had increased as a result of their time at Wertheim. Volunteers reported they had learned about or had become more aware of endemic species, wildlife habitats on the Refuge and in neighboring areas, and resource management issues on and surrounding the Refuge. Volunteers' enhanced environmental awareness and knowledge was a result of direct observation of flora and fauna on the Refuge, research conducted to answer Refuge visitors' questions, observation of Refuge staff, and participating in Refuge programming.
- Based on anecdotal evidence and their personal observations, interviewees believed local residents' participation in nature-dependent educational and recreational activities at Wertheim enhanced these residents' environmental awareness and knowledge of local natural resources. Interviewees who engaged with repeat visitors from the local area observed NDA participants' familiarity with and knowledge of local resources increased over time. Many interviewees reported nature-dependent programming geared towards

children had a particularly significant influence on these children's and their families' environmental awareness and knowledge.

- Programming that brought Refuge partners and other local conservation-oriented organizations to Wertheim raised awareness of these entities, and enhanced local NDA participants' access to them. Wertheim thus acted as a bridging entity, providing a space for the local conservation community to come together and helping Refuge visitors learn about and access alternative conservation groups and organizations in the area.

Does participation in NDAs at Wertheim NWR promote the formation or strengthening of local residents' interpersonal relationships?

- Interviewees consistently identified access to NDAs at Wertheim as a factor contributing to the formation and strengthening of relationships among local NDA participants. For local community members, the Refuge headquarters provided a space for gathering, and through participation in NDAs, communicating about common environmentally focused interests and concerns.
- Social ties formed among Refuge volunteers were particularly strong. All interviewed volunteers reported that, as a result of their involvement with Wertheim, they had developed friendships or social networks with Refuge staff and other volunteers. These relationships were reportedly formed in part because volunteers enjoyed spending time with "like-minded" individuals who were interested in the environment.
- Some volunteers indicated their involvement with Wertheim impacted their relationships with local community members, who viewed these volunteers as a source of knowledge about local natural resources and programming at Wertheim.

Does participation in NDAs at Wertheim NWR promote residents' willingness to protect valued natural resources, both within and beyond the Refuge?

- Interviews indicated engagement in NDAs on Wertheim led to increased interest in stewardship and protection of resources found within the Refuge. Refuge officials reported that participation in NDAs often motivated local residents to remain engaged with the Refuge and promoted public interest in volunteering.
- Volunteers' protective attitudes towards the Refuge increased their willingness to take action to safeguard Refuge resources. Multiple volunteers gave examples of pro-conservation efforts they had made or would be willing to make within Refuge boundaries.
- Volunteers also claimed engagement in NDAs enhanced their willingness to promote the health of environments and resources beyond the Refuge. Nevertheless, little evidence emerged to indicate that participation in NDAs fostered engagement in environmentally protective activities off the Refuge.

Conclusion

Our results suggest that local residents' participation in NDAs at Wertheim, a publically administered, conserved property, enhanced these participants' capacity to be aware of, steward, and protect resources within the site. Provision and facilitation of NDAs could thus contribute to public land administrators' ability to meet their on-site management objectives and foster public support for their properties' resources and facilities. The causal link between participation in on-site NDAs and engagement in pro-conservation activities off-site is, however, weak at best. Interviewees reported participation in these activities did increase their willingness to protect off-site resources and their awareness of these resources. Yet ultimately little evidence emerged indicating local residents' participation in NDAs promoted engagement in resource conservation off-site.

We suggest future research further examine the relationship between local residents' participation in NDAs on publically administered, conserved lands and these individuals' pro-conservation attitudes and behaviors. Specifically, future inquiries might seek to ascertain the generalizability of our findings, and assess whether participation in some forms of NDAs result in greater pro-conservation outcomes than others. Research might also seek to examine how the socio-demographic context of a formally conserved property impacts local NDA participants' emergent environmental awareness and conservation-oriented attitudes and behaviors. Finally, researchers might examine the role formally conserved, public lands such as Refuges play in enhancing the connectivity of local environmental organizations and increasing local residents' access to these organizations.

ACKNOWLEDGMENTS

We express our thanks to the staff of Wertheim National Wildlife Refuge, who provided permits for this inquiry, and to all interviewees who were involved in this study. Thanks to Cornell University's Human Dimensions Graduate Seminar group, who took time to provide feedback on our analysis of data from this study. We also extend our gratitude to Natalie Sexton, Chief of the Human Dimensions Branch of the National Wildlife Refuge System, who helped us communicate with Wertheim Refuge officials.

Cover Photo: Retrieved December 26, 2016 from: <http://refugeassociation.org/2016/03/funding-challenges-facing-the-refuge-system/>

This report is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under NYC-147815 [Hatch Multi-state project NE1962]. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

TABLE OF CONTENTS

Executive Summary i
Acknowledgments v
Table of Contents vi
Introduction 1
Literature Review 2
 Pro-Conservation Benefits Associated with Nature-Dependent Activities 2
 Environmental Volunteerism and National Wildlife Refuges 3
Methods 5
 Study Site 5
 Data Collection and Analysis 6
Results & Discussion 7
 How and Why Do Local Residents Become Involved in NDAs at Wertheim NWR? 8
 Local residents’ participation in NDAs at Wertheim 8
 Local residents’ motivation for becoming and remaining engaged in NDAs 9
 Does participation in NDAs at Wertheim influence local residents’ awareness and knowledge of local environments? 11
 Impacts on volunteers’ environmental awareness and knowledge 11
 Impacts on local residents’ environmental awareness and knowledge 13
 Building bridges to the local conservation community 15
 Does participation in NDAs at Wertheim promote the formation or strengthening of local residents’ interpersonal relationships? 16
 Does participation in NDAs at Wertheim promote residents’ willingness to protect valued natural resources, both on and off the Refuge? 18
 Non-volunteer NDA participants and pro-conservation behaviors 18
 Volunteers and pro-conservation behaviors 19
Implications and Future Research 20
Conclusion 22
Literature Cited 23
Appendix A: Interview Guides 28

TABLES

Table 1. Comprehensive list of study objectives. 2
Table 2. Number of interviews completed with different categories of informants. 7

FIGURES

Figure 1. The location of Wertheim National Wildlife Refuge and other Long Island National Wildlife Refuge Complex units. 6

INTRODUCTION

Formally conserved, natural spaces proximate to communities serve diverse, beneficial purposes (Chiesura, 2004; Cohen et al., 2007; Howe et al., 2012). From a social-ecological perspective, these spaces provide opportunities for local residents to participate in nature-dependent activities (NDAs), through which they can learn about and interact with local natural resources. For the purposes of our research, NDAs include nature-dependent recreation and environmentally related volunteerism and interpretation. Studies have indicated that participation in NDAs has, under some circumstances, been associated with a variety of social and environmental benefits. These benefits include heightened knowledge and awareness of local natural resources (Disinger Roth, 1992; Decker et al., 2012), increased interest in resource conservation and involvement in environmental stewardship (Tarrant & Green, 1999; Manfredo, 2008; Stern et al., 2008; Zaradic et al., 2009), and opportunities for participants to meet and form social networks with like-minded, environmentally focused individuals in their community (Grese 2000; Ryan et al., 2001; Measham & Barnett, 2008). This increased environmental awareness and social connectivity has, in some instances, been leveraged to help land and resource administrators meet their management goals, both within and beyond the boundaries of formally conserved lands (Jensen, 2003; Hunsberger et al., 2005).

Notwithstanding these potential benefits, to date little research has focused on community benefits associated with participation in NDAs on publically managed, conserved lands. The full potential of these sites to connect people with nature and encourage pro-conservation attitudes and behaviors may therefore not be realized.

In 2013, the authors were awarded funding through the Cornell University Agricultural Experiment Station, for research that contributes to USDA NIFA Multi-State Project NE1962 (“Outdoor Recreation, Parks and Other Green Environments: Understanding Human and Community Benefits and Mechanisms”). The overall goal of our research was to demonstrate and expand evidence of the role of natural areas and nature-based outdoor recreation in promoting resilient, pro-conservation communities.

Our project included six study objectives (Table 1). This report focuses on an inquiry investigating portions of objectives 1, 3, 4, and 5. We operationalized these objectives by examining how local residents’ participation in NDAs, and especially environmental volunteerism, on an urban National Wildlife Refuge influenced local residents’ pro-conservation attitudes and behaviors, as well as their willingness to protect resources within and near the Refuge. We sought to characterize mechanisms Refuge officials used to engage local communities in NDAs. Recognizing that interpersonal relationships are instrumental to promoting and achieving natural resource conservation on and off conserved lands, we also sought to understand the impact participation in NDAs had on local participants’ interpersonal relationships.

Table 1. Comprehensive list of study objectives.¹

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1. Characterize current levels and types of nature-dependent activities occurring in two study areas in Suffolk County, NY.
 2. Pilot test and refine scales to measure concepts in a model of nature-dependent recreation and community resilience.
 3. Clarify the relationships between participation in nature-dependent activities on conserved lands and: conservation attitudes, degree of place attachment developed, and participation in conservation-oriented volunteer activities.
 4. Clarify the processes/mechanisms by which participation in nature-dependent activities on conserved lands contribute to local community resilience.
 5. Characterize stakeholder and community engagement processes land managers use to engage local communities in nature-dependent activities and environmental conservation endeavors, both on the study's conserved sites and on proximate private and municipal lands.
 6. Identify barriers to and opportunities for USFWS, NYSDEC, and local community collaborations to promote sustainable nature-dependent activities.
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¹Hatch/Multi-State Project NYC-147824 (Title: Revealing the Potential of National Wildlife Refuges to Foster Conservation Recreation and Resilience in Local Communities).

LITERATURE REVIEW

Pro-Conservation Benefits Associated with Nature-Dependent Activities

Studies have found that participation in NDAs can produce a broad range of social-ecological benefits. Participation in nature-dependent recreation, for example, has been shown to have both short- and long-term impacts on individuals' attitudes toward the natural world. Studies found exposure to positive outdoor recreation experiences among adults was correlated with enhanced environmental awareness, support for resource stewardship and conservation, and pro-environmental attitudes, especially regarding areas where recreational activities took place (Kareiva, 2008; Tarrant & Green, 1999; Kareiva, 2008; Wells & Lekies, 2006). Positive associations have also been shown between participation in outdoor recreation during childhood and an increased affinity towards nature-based and outdoor activities (Bixler et al. 2002) and expressions of pro-environmental attitudes and behaviors later in life (Chawla, 2007; Wells & Lekies, 2006; Larson et al., 2011). Studies examining the formation of sense of place (i.e., emotional, functional, and cognitive attachments to natural spaces; Stedman, 2002) have also found spending time in natural settings and participating in nature-dependent recreation can increase individuals' interest in protecting natural areas they value or depend on (Walker and Chapman, 2003; Ryan, 2005; Halpenny, 2010).

Participation in environmental education has been associated with increased environmental knowledge and pro-environmental attitudes and behaviors. Vaughan et al. (2003) showed species-specific environmental education programs significantly increased participants' knowledge of conservation principles. This knowledge was also passed from participants to their families and broader communities through information transfer. Environmental education programs conducted outdoors and through experiential learning opportunities have also been

shown to have both immediate and long-lasting impacts on participants' environmental attitudes and behaviors. Stern et al. (2008), for example, found that a multi-day outdoor education program held at Great Smoky Mountains National Park led to both immediate and long-lasting increases in participants' environmental awareness and commitment to resource stewardship. Stern et al. (2010), in evaluating a residential environmental education program held on the shores of the Chesapeake Bay in Maryland, found high-school participants also experienced both short- and long-term increases in their sense of responsibility toward the environment. These increases were significantly greater among urban students when compared with non-urban students, in part because urban students had less access to outdoor education in natural settings, so their pre-program base of knowledge was lower. Engagement in environmental education can also potentially enhance participants' capacity to help resource conservation agencies and organizations achieve their conservation missions. Heimlich (2010), for example, suggests that strategic design and iterative evaluation of environmental education programs can promote conservation-oriented attitudes and knowledge that help further environmental organization's conservation goals.

Environmental volunteerism, which may include unpaid activism, fundraising, outreach, education, research, monitoring, or resource restoration undertaken to promote a positive environmental outcome (Measham & Barnett, 2008; Liarakou et al. 2011), has also been associated with a diversity of environmental and social benefits. Volunteerism has been found to promote environmental awareness, both among volunteers and their communities, as well as pro-conservation outcomes (Measham & Barnett, 2008). Multiple studies have found gaining and applying new environmental knowledge and skills, and being able to exercise these skills, are primary motivations for initial involvement in environmental volunteerism (Schroeder, 2000; Guiney & Oberhauser, 2009; Liarakou et al., 2011; Jacobsen et al., 2012). Participation in this NDA has also been associated with a sense of commitment to stewardship of natural areas that volunteers work to support (Gooch, 2002; Measham & Barnett, 2008), and an ethic of care for natural areas more generally (Gilmour and Saunders, 1995).

Beyond these nature-oriented outcomes, participation in environmental volunteerism can help participants build and expand social networks and become members of interest-based communities (Grese 2000; Ryan et al., 2001; Measham & Barnett, 2008). These relationships can be leveraged to build capacity for management implemented across jurisdictional boundaries. They can also promote social capital (i.e., networks of connected individuals with capacity to cooperate to achieve common ends; Field, 2008) necessary to supports resource conservation (Pretty, 2003; Berkes, 2009). Strengthened and broadened social networks resulting from participation in environmental volunteerism can therefore be instrumental to resource conservation efforts within complex social-ecological landscapes.

Environmental Volunteerism and National Wildlife Refuges

Cumulatively, past studies indicate that engagement in NDAs can enhance participants' capacity and willingness to promote resource conservation. This is a valuable insight, as the conservation community is increasingly reliant on lay citizens to achieve management objectives (Savan et al., 2003; Jensen, 2003; Hunsberger et al., 2005). Due to the transjurisdictional nature of resource conservation and the funding constraints of federal and state agencies, administrators of public

lands are heavily dependent on civic support to meet management goals (Jensen, 2003; Hunsberger et al., 2005). Volunteers can help natural resource agencies achieve their conservation missions to the extent that their efforts compensate for budgetary and capacity-based gaps (Savan et al., 2003; Jensen, 2003; Hunsberger et al., 2005). Of particular value to land administrators is support by local communities—or what are termed gateway communities—surrounding conserved lands. Reliance on gateway communities stems from the fact that the health and quality of natural resources generally depend on the social-ecological setting in which they are situated (McMahon, 1999). The management of resources adjacent to conserved areas can directly impact the quality and connectivity of natural systems (Lindenmayer & Hobbs, 2008). As a result, administrators of conserved lands are reliant on surrounding communities who formally or informally steward resources connected to, but beyond the jurisdictional boundaries of formally conserved properties.

Administrators of National Wildlife Refuges (NWRs) are particularly interested in enhancing collaboration with neighboring communities. With over 560 units encompassing more than 150 million acres of land and waters throughout the United States, the National Wildlife Refuge System's (NWRS's) mission is to “conserve, manage, and where appropriate, restore fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (USFWS, 2011). Given their budgetary and staffing constraints (Jensen, 2003; Hale, 2006; USFWS, 2011), and the fact that the majority of Refuges are embedded within or proximate to human communities whose actions impact local environmental quality, Refuge officials are increasingly seeking opportunities to collaborate with neighboring communities to achieve Refuges' conservation missions (Jensen, 2003; USFWS, 2011; USFWS, 2013). In their analysis of 185 Refuges' Comprehensive Conservation Plans developed between 2005 and 2011, Meretsky & Fischman (2012) found that over 63% of Refuges indicated the need for conservation actions that extended beyond Refuge boundaries in order to promote habitat and species conservation. Driven by a need to remain relevant within an ever-urbanizing society, Refuge officials are also actively promoting opportunities to engage and form partnerships with urban communities (USFWS 2011). Promoting opportunities for neighboring residents to participate in NDAs could therefore be strategic for Refuge officials, as it could promote environmental awareness, engagement with local communities, and interest in local resource conservation.

Opportunities for the public to participate in NDAs, such as environmental volunteerism, interpretation, and recreation on NWRs have increased significantly over the past 20 years (Fishman, 2003). With the passage of the National Wildlife Refuge System Improvement Act of 1997, human uses have become management priorities on the majority of Refuges. With the Volunteer and Community Partnership Enhancement Act of 1998, Refuges were also permitted to foster volunteer and partnership opportunities—especially with local communities—that could help Refuge officials meet their administrative goals. What has yet to be examined is how local residents become involved in NDAs on NWRs, the impacts of these activities on local participants, and how these activities influence local participants' knowledge of and interest in protecting resources both on and off Refuges. To begin addressing these gaps in knowledge, we investigated the following research questions at Wertheim National Wildlife Refuge in New York State:

- Q1.** How and why do local residents become involved in NDAs at Wertheim NWR?
- Q2.** Does participation in NDAs at Wertheim NWR influence local residents' awareness and knowledge of local environments?
- Q3.** Does participation in NDAs at Wertheim NWR promote the formation or strengthening of local residents' interpersonal relationships?
- Q4.** Does participation in NDAs at Wertheim NWR promote local residents' willingness to protect valued natural resources, both on and off the Refuge?

METHODS

Study Site

Our study focused on participation in NDAs at Wertheim NWR (hereafter “Wertheim” or “the Refuge”) in Brookhaven, NY. Located on the central southern shore of Long Island, Wertheim is the largest of nine Refuge Units and one management area that make up the Long Island NWR Complex (Fig. 1). The site houses the Complex’s Headquarters, a 13,000-square-foot building with a visitor’s center and ample space for programming (such as educational events) and group meetings. The Refuge sits within the Long Island Pine Barrens, a state protected natural area, and borders portions of the Carmans River and Carmans River Estuary, the largest contiguous wetland remaining on Long Island. The refuge consists of 2,572 acres of managed oak-pine forests, grasslands, and brackish and salt water wetlands.

Wertheim is situated within a densely populated area of Suffolk County. The township of Brookhaven has a human density of 1,800 people/sq mi., while Shirley, the hamlet that encompasses the majority of the Refuge, has a human density of 2,300 people/sq mi. The NWR considers Wertheim an Urban Refuge, meaning that at least 250,000 people live within a 25-mile distance of the Refuge’s boundary (USFWS, 2013).

Wertheim allows and facilitates a range of human uses. These include hunting, fishing, wildlife watching, interpretation, photography, and environmental education. Conservation-oriented volunteer opportunities are offered through the Friends of Wertheim NWR (hereafter “Friends of Wertheim”), the Refuge’s associated 501(c)3 organization, and directly through the Refuge.

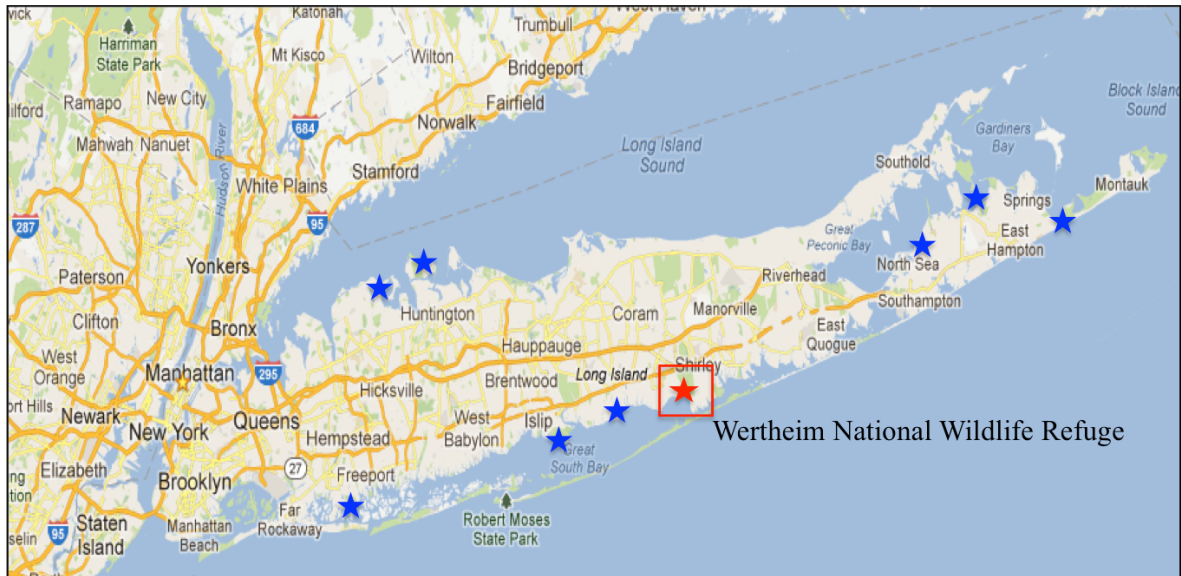


Figure 1. The location of Wertheim National Wildlife Refuge (marked with a star inside a box) and other Long Island National Wildlife Refuge Complex units.

Data Collection and Analysis

Between June 2015 and January 2016 we conducted 37 semi-structured, face-to-face and telephone interviews. Interviewees included Refuge officials, Refuge volunteers (both Friends of Wertheim members and individuals who volunteered directly with the Refuge), and external stakeholders with knowledge of the Refuge and local environments (Table 2). External stakeholders included environmental activists, local public officials, and Refuge partners who facilitated nature-dependent programs at the Refuge. Interviewees were selected purposively; some key informants were identified during study preparation while others were identified through chain referral.

Interview questions (Appendix A) varied by interviewee category. Refuge officials were asked what types of NDAs they offered at the Refuge and to whom and how these NDA opportunities were advertised, the role local residents played in developing and administering NDAs, and what barriers impacted local residents engagement in developing, administering, and participating in NDAs. Volunteers were asked what motivated them to become and remain volunteers on the Refuge, if and how local residents participated in developing and administering NDAs on the Refuge, and how their work as volunteers impacted their pro-conservation attitudes and behaviors and their knowledge of the local environment. Refuge partners were asked what types of NDAs they helped administer on-site and what role these interviewees felt the Refuge played in the local community. External stakeholders were asked about their experiences with local residents surrounding the Refuge, what role they felt the Refuge played in the local community, and how NDAs offered at Wertheim compared to others offered in Suffolk County. All interviewees were asked how participation in NDAs on the Refuge impacted local residents' environmental knowledge and pro-conservation attitudes and behaviors.

Table 2. Number of interviews completed with different categories of informants.

Interviewees	Number of Participants
Refuge Officials	7
Refuge Volunteers	17
Local Environmental Activists	6
Local Public Officials	5
Refuge Partners	2

We chose to interview Refuge volunteers because they were a discrete subpopulation of local NDA participants, had direct experience with nature-dependent programming on the Refuge, and most volunteers interacted regularly with Refuge visitors. Members of this group could thus provide insights into the experiences of other local NDA participants. We considered volunteers and other NDA participants “local” if they lived within 30 miles of the Refuge. Interviews were transcribed and coded using both open and summative coding to reveal underlying themes and gain insight into our specific research questions.

Study Limitations

As our inquiry focused on a single Refuge and drew on a limited sampling frame, the generalizability and conclusiveness of our findings are limited. We also did not collect data from a representative sample of members of the local community who participated in NDAs on Wertheim. As a result, we are limited in our ability to assess the true community-level impacts associated with access to these activities.

RESULTS & DISCUSSION

Volunteer interviewees were involved in a range of activities on the Refuge, including visitor services, nature-dependent program development and administration, and on-site resource stewardship. Of the 17 volunteers interviewed, 14 were or had been highly active, volunteering at the Refuge on a regular basis or working closely with the administration of the Friends of Wertheim. The other three volunteers worked with the Refuge more sporadically during special events.

The following section includes an analysis of our results combined with discussion of these results. While traditionally results and discussion sections are reported separately, we felt this was the most effective approach to presenting our findings.

How and Why Do Local Residents Become Involved in NDAs at Wertheim NWR?

Local residents' participation in NDAs at Wertheim

The first question we explored was how Wertheim engaged local residents in NDAs, and what motivated some local NDA participants to be involved in these activities. Many interviewees mentioned there were people in the local community who were unaware of Wertheim. Volunteers reported, for example, that they regularly had visitors who said, "I only live down the road and I have never been here before" or "I didn't know this was here until I saw the (Headquarters) building!" There is also no systematic data gathered on Refuge visitors' place of residence, so the exact proportion of visitors from neighboring communities is unknown. However, Refuge officials and volunteers (both of whom have direct contact with Refuge visitors, and often speak with and know repeat visitors) reported local residents regularly participated in wildlife watching, hiking, kayaking, family-oriented educational and recreational programs, and school programs at Wertheim. Some NDAs attracted participants that were almost exclusively from local communities. Refuge officials and partners, for example, reported that volunteers who worked regularly at the Refuge and children who participated in the Refuge's educational programs and summer camp were almost exclusively from local areas.

Our interviews indicated that targeting NDA opportunities to and drawing in people from local communities was a priority of many Refuge officials, volunteers, and partners. Refuge staff made concerted efforts to raise local awareness of the Refuge and its amenities, advertising Refuge programs through rotating signage on the residential road outside the Refuge's entrance and through social media. The Refuge's page on Facebook was identified as one of the primary ways Refuge staff, volunteers, and partner organizations advertised Refuge programming and kept the local community apprised of activities and events on the site. Refuge volunteers and partners, such as the Central Pine Barrens Commission, also left programming and activity-related fliers and pamphlets at the heavily-used local library, advertised these events in local newspapers, mailed informational fliers to local schools, and communicated information about these programs through word-of-mouth. In the words of one Refuge official who spoke about how and why Refuge events were advertised at local public libraries:

"Wertheim promotes local use largely through advertising at the local library system on Long Island. We send our flyers for upcoming programs to the libraries. They advertise them on their bulletin board and then some libraries will even allow us to have a stack of them there to give out to local residents. These local libraries really are the hub of the communities. It's where folks of all age brackets go to get their information about what's happening in the local area."

Emphasis on targeting Refuge programming and NDAs to local residents was born in-part out of a need to enhance the Refuge's local utility and demonstrate its social value. Considering Americans' increasing alienation from nature (Pyle, 1979, 1998; Kellert, 2005; Louv, 2008) and the Refuge System's budgetary constraints, some interviewees expressed concern about Wertheim's ability to remain relevant to local, urban communities and maintaining sufficient funds to retain staff and facilitate programming. Some Refuge officials felt drawing in a diverse

group of local residents could help circumvent a decline in the Refuge's social relevance and help bolster local support for the Refuge's continued funding. As one Refuge Official put it:

“Unless we're getting the local community out here and they're doing fun things, right around the corner from their house, free of charge... you know that's going to be the way that we're going to keep moving forward and keep being relevant... If we don't engage different types of people and different spectrums of age, we're going to be irrelevant. And funding is already really tight... Thank goodness for the Friends group (and the support they provide). We have the National Wildlife Association, that is the Refuge association that's lobbying on our behalf... But if they (Congress) cut our budget we need the local population to really be upset about that and start complaining.”

To enhance the diversity of local residents engaged in NDAs, some Refuge programs targeted specific demographic groups within local communities. For example, a grant received by the Friends of Wertheim and dedicated to education about birds and birding was used to develop and implement an English as a Second Language program for local Hispanic residents. Refuge officials had observed local Hispanic communities preferred to participate in activities with their whole family, and thus were less inclined to leave their children at youth-targeted NDA events. Hispanic residents were also at times inhibited from engaging in NDAs at the Refuge because of language barriers. Refuge staff and Friends of Wertheim members therefore sought to provide bilingual, multi-generational programming that would help attract Hispanic residents to the Refuge.

While some Refuge officials and partners indicated the Refuge's targeting of local residents was purposive, other interviewees believed the Refuge targeted local residents because this was simply the most easily reached audience, given the Refuge's limited staffing and funding. One volunteer pointed out that because the Refuge is not high profile, or what they called “big name and nationally known,” awareness of the site and its NDAs were inherently more localized. Some interviewees also felt that because the Refuge only had signage in the local vicinity, knowledge of Wertheim was limited to local residents. Thus while NWRs are federal properties, intended to serve a national-level audience, intentionally and inadvertently Wertheim tends to serve a more local population.

Some Refuge partner organizations, such as Ducks Unlimited (DU), reported that their nature-dependent programs held at the Refuge were not targeted at the local community. This was because the intended audience was defined by DU membership, not by geographic proximity to the Refuge. The degree to which Refuge programs promoted local engagement in NDAs was therefore partly influenced by the mission of the facilitating organization and the intended audience of the NDA.

Local residents' motivation for becoming and remaining engaged in NDAs

Beyond the question of whether members of local communities participated in NDAs at Wertheim, we sought to understand what motivated Refuge volunteers to become and remain involved in this particular activity. Of the 17 volunteers we interviewed, the majority (13 of 17)

had visited the Refuge previous to becoming engaged as a volunteer. These visits fostered awareness of and interest in the Refuge and its resources. Encouraged either by other volunteers or the Refuge's Visitor Services Manager, many volunteers began their dedicated volunteerism as a means of filling their time, contributing to the local community, and having regular social contact after they retired. Some volunteers also mentioned that they had been motivated to volunteer for a public land system, and the Refuge provided a convenient, accessible opportunity to volunteer locally. To draw on a few illustrative quotes from volunteers about their initial motivations for participating in this NDA:

"I always remembered the Refuge and when I retired I went there for a walk with my husband and I bumped into a neighbor who lives here who was a volunteer behind the desk... I felt like 'well this is something that I can help out with.'"

"I live in this area and for many years we have been coming to the Wertheim....It was just a very nice place to come. I saw this building being built when I was retiring and I was like 'oh that would be a wonderful place to maybe go and try to do some volunteering.'"

"I liked the interaction. As I said I'm retired so it's nice to get out and have some interaction with my coworkers and with the public...it is an interesting place to be."

Most volunteers reported that their motivations for volunteering changed over the course of their tenure with the Refuge. Many indicated that their motivations were originally founded in self-interest. However, over time their motivations for remaining engaged as volunteers were influenced more by a sense of personal investment in contributing to the administration of the Refuge and the conservation of its resources, a heightened interest in enhancing the experience of Refuge visitors, and a deepened sense of personal fulfillment as a result of being a volunteer. As one volunteer described his/her changing motivations:

"Initially it was more about me, what I was going to get out of the experience. Now when I see people come here and enjoy the environment and especially when we have Tri-hamlet Day (a community-focused festival held partially at the Refuge) with all the kids, it's more about them. It's more about helping provide a place for them to learn about nature."

In speaking with the Refuge's Visitor Services Managers, who also coordinated the volunteer program, it seemed these changing motivations were in part a result of the significant role many volunteers played in developing and administering Refuge programs. Volunteers were encouraged to present new ideas for or inform the revision of nature-dependent programming on the Refuge. Refuge volunteers were also given extensive opportunities to help administer Refuge programs and lead other NDAs, which were reported as increasing volunteers sense of personal responsibility for and investment in these programs. In the words of one Visitor Services Manager:

“The more that I could engage them (the volunteers) and the more that they could take ownership in what they were doing, the longer they would continue to volunteer with us and it seemed the better they would feel about volunteering.”

An interesting emergent theme of our interviews was what an important role the Visitor Services Manager played in promoting local residents’ participation in NDAs. Many volunteers said that encouragement from the Visitor Services Manager was a main motivator for their becoming and remaining volunteers. As one volunteer said “they (the Visitor Services Managers) were so engaging and positive and encouraging.... You always felt like you mattered to (them).” The Visitor Services Manager also acted as a bridge to the local community, visiting schools and participating in nature-oriented programming at the local library. These Refuge officials thus played an integral role in connecting local communities with the Refuge and local natural resources, and promoting local residents’ interest in participating in NDAs on Wertheim.

Considering the values associated with the Visitor Services Manager and other Refuge officials, such as educators and biologists who interacted with NDA participants, the Refuge’s staff turnover created challenges. Refuge staff and volunteers reported turnover reduced volunteers’ morale, the continuity of programming, and the potential for new nature-dependent program development and implementation. Loss and replacement of Refuge staff may therefore create barriers to promoting local residents’ participation in NDAs, and NDA participants’ motivations for continuing to be engaged in these activities.

Does participation in NDAs at Wertheim influence local residents’ awareness and knowledge of local environments?

Impacts on volunteers’ environmental awareness and knowledge

The next question we addressed was whether participation in NDAs at Wertheim influenced local residents’ awareness and knowledge of local environments, both on the Refuge and off. Supporting the findings of past studies ((Kareiva, 2008; Tarrant & Green, 1999; Manfreda, 2008; Stern et al., 2008), our results indicate that participation in NDAs, especially by local volunteers, repeat visitors, and school children, was at least reportedly effective at increasing awareness and knowledge of local natural resources.

All interviewed volunteers, even those with a background in ecology, reported their knowledge and awareness of local environments had increased as a result of their time at Wertheim. They reported, for example, that because of their experiences as Refuge volunteers they had learned about or become more aware of endemic species on Long Island, wildlife habitats on the Refuge and in neighboring areas, and resource management issues on the Refuge. Volunteers had become more informed about sources of environmental threats throughout Long Island, including water pollution, invasive species, and wildlife overpopulation. Some also reported that their experiences as volunteers motivated them to independently seek out information related to local environmental problems, such as water pollution and wildlife overpopulation. The following quotes from Refuge volunteers illustrate how their environmental awareness and knowledge changed as a result of volunteering:

“I learn something every time I go (to Wertheim). I have a pretty good background in the ecology of Long Island. I can apply what I know to Wertheim and keep adding new information I learn at the Refuge to the information that I have.”

“Being a volunteer, you find you become more attuned to the things that are going on the Refuge, like the invasive species problems, the deer management problem. So whether you like it or not— you might sign up as a volunteer just to sit at the desk and answer the phone and give people a map— but you become more involved in what’s happening on the island and what’s going on with nature around here. I think everybody that sits at that desk becomes more involved and aware of the environment to different degrees.”

Volunteers’ enhanced environmental awareness and knowledge was a result of direct observation of flora and fauna on the Refuge, research on answers to Refuge visitors’ questions, observation of Refuge officials, exposure to technical information about how Refuge officials make resource management decisions, and participating in Refuge programming. A Refuge official gave the example of how volunteers’ knowledge of the Refuges’ white-tailed deer management program had changed. Initially when front desk volunteers received calls regarding the Refuge’s deer management program, they would immediately forward these calls to Refuge officials, who volunteers felt could more adequately address callers questions and concerns. Over time, however, volunteers’ environmental awareness and knowledge of the management issue grew. They demonstrated more capacity and willingness to respond to callers’ questions, and were more comfortable with communicating information about the negative impacts of deer overpopulation and the benefits associated with deer management. Volunteers’ exposure to information about the Refuge’s ecological conditions and administrative process, and the need to respond to inquiries from the public, were thus reportedly effective at increasing their environmental awareness and knowledge. As one Refuge volunteer stated, speaking about his/her tenure with Wertheim:

“The longer I stayed (at Wertheim) the more questions I’d have as people came in and asked questions regarding the Refuge, regarding the wildlife at the Refuge, the ecology of the Refuge. I’d have to call the ranger to come out and talk to them and then I would begin to hear what the ranger was saying to them. So it increased my knowledge of what’s going on here and the implications of what’s going on in the surrounding community.”

In the words of two Refuge Officials who had watched the environmental awareness and knowledge of volunteers develop:

“You know there’s a lot of things (volunteers) are exposed to here that they wouldn’t know about if they weren’t volunteering at the Refuge. They have the inside story on the Southern Pine Beetle (an invasive species) issue. If they weren’t working here and they were living in the community they might just be hearing what’s on the TV or what they’re hearing in their

neighborhood. (Volunteering) definitely increases their knowledge of what's going on in the environment."

"At first some (volunteers) weren't very conservation-minded. But then they kept coming back and as we began to teach them more about what we're doing and why we're doing it, the interest level increased."

Multiple volunteers even said their time spent on the Refuge and conversing with Refuge visitors increased their interest in and knowledge of birds, and had in fact turned them into birders. Volunteerism can therefore not only enhance awareness and knowledge of local resources, but also inspire interest in participating in alternative NDAs.

Impacts on local residents' environmental awareness and knowledge

Impacts on adults. During this inquiry we only interviewed one group of NDA participants—Refuge volunteers. As a result, we only gathered indirect information about how participation in nature-dependent education and recreation at Wertheim impacted local residents' environmental awareness and knowledge. Based on anecdotal evidence and their personal observations, however, interviewees overwhelmingly perceived that local residents' participation in nature-dependent education and recreation at Wertheim enhanced these residents' environmental awareness and knowledge of local natural resources, especially those found on the Refuge. NDAs at Wertheim provided participants with opportunities to interact directly with natural resources, and have hands-on learning experiences facilitated by environmental professionals (i.e., Refuge officials and partners). Many interviewees reported access to these types of environmental education opportunities were relatively unique on Long Island, and especially in South Central Suffolk County. Interviewees reported that unlike Wertheim, state and county lands in the area did not offer regular educational programs, nor did they necessarily have staff on-site to facilitate programming or help with interpretation. During the scoping period of our inquiry, we found that local county parks, State parks, and Department of Environmental Conservation-managed properties did in fact provide environmental education opportunities. However, these were in some cases infrequent and seasonally dependent, many state and county properties did not house interpretive centers, and in some cases these properties did not have environmental educators or biologists on-site. The Refuge's facilities, year-round programming, and on-site staff therefore created relatively unique local opportunities for environmental education on publically administered land. In the words of one public official who commented on the contextual uniqueness of Wertheim and its programming:

"I don't think there's an education center quite like it (Wertheim) that really focuses on our local ecosystem. I don't think any of the other parks or facilities close by really offer that so that's certainly unique...The bird watching and those kind of tours, and other educational programs that they (the Refuge) do, those are unique services that I don't think the county's really doing in any of our local parks ... those kind of activities really aren't offered in County or State parks in the area, so I think it's definitely unique in the area."

Interviewees who engaged with repeat visitors from the local area observed NDA participants' familiarity with and knowledge of local resources increased over time. For example, a local environmental activist who led nature walks on the Refuge reported that, over the course of their visits, repeat visitors demonstrated a heightened awareness and knowledge of flora and fauna on the Refuge and became more adept at identifying wildlife species. Access to the Carmens River and opportunities to learn about the river were seen as making a particularly large impact on local NDA participants' environmental awareness and interest in the local ecology.

The Carmens is a rare freshwater amenity on Long Island and there is a history of fishing and hunting on the portion of the Carmens that runs through Wertheim. Despite heavy development throughout Long Island, conservation efforts like the creation of Wertheim have left portions of the Carmens in a relatively ecologically intact, historic state. Opportunities to kayak, canoe, fish, and watch wildlife on the River, and programming that helped participants learn about the River's ecology and history therefore appeared to have various impacts. They were educational, but may have also helped local residents connect with their communities' environmental history. In the words of one public official, who highlighted the value of the Carmens River to local communities:

"There's something about the Carmans and the preservation of the river that brings (people) out and engages them....They might not actively use it or visit for years at a time, but there's something about its simple existence and history that seems to be comforting to them and exciting at the same time. Exciting in that you have a place that for Long Island is almost as wild as you can get. And just knowing that it's there seems to be quite important to communities. "

Impacts on children. Of the NDA opportunities facilitated at Wertheim, nature-dependent programming geared towards children reportedly had a particularly significant influence on participants' environmental awareness and knowledge. Family programming held at the Refuge during weekends and school holidays, as well as the environmental summer camp held in the visitors' center, Scout programs held on-site, and school programs hosted by the Refuge were reported as providing children with unique, hands-on educational experiences. Some interviewees believed this exposure fostered a "stewardship ethic" among children, helping them become "better stewards" of the environment. (This outcome was not substantiated and may have represented an assumption or extrapolation on the part of the interviewees. Some respondents did, however, have anecdotal evidence that participation in environmental education programs fostered children's interest in being naturalists and scientists later in life.) The following quotes by a local environmental activist and a Refuge partner, respectively, help illustrate the perceived impacts NDA opportunities had on children:

"Wertheim provides the opportunity for school kids to come and do some real nature studies, some real science and get a real sense of how nature works. The youngest school kids, it gets them a grounding early in life in the importance of this kind of thing. In the case of high school groups, it has launched some real serious naturalists. (Wertheim) helps young adults

go off into their productive life with some notion that maybe this is an avenue that they should be pursuing one way or another. "

"One thing that comes out of the summer camp is that kids learn ways that they can help the environment.... These kids are learning first-hand about water quality, environmental quality, plants and animals. You know, they're becoming invested in their backyard. So they're going to want to protect it and conserve it, become better stewards."

An interesting impact of children's programming was that it helped draw children's families to the Refuge. During pick-up times and at the end of week-long camp sessions, interviewees said they had witnessed children showing their parents and guardians around the Refuge's Visitors' Center and grounds, and relaying information they'd learned about the local ecology. As a Refuge official and partner, respectively, described children's interactions with their guardians after NDAs:

"Parents are coming and picking their kids up and dropping them off and the kids are saying 'let's go to this event, mom,' 'can we go on the trail?' 'I want to show you what I saw.' You know you see it happening every day."

"When we have school programs or programs for children, these kids get excited and they want to bring their mother and father back. What they're learning they end up bringing it back to their community."

Local children's participation in NDAs on Wertheim may thus have ripple effects, indirectly increasing local residents' exposure to and potentially their knowledge of the Refuge and local natural resources. Further inquiry would be necessary to determine what, if any, pro-conservation impacts these experiences had on children's guardians. However, our results indicate that this enhanced environmental awareness and knowledge could, in some cases, be transferred, a finding that would support those reported by Vaughan et al. (1999).

Building bridges to the local conservation community

Interviews revealed events that brought Refuge partners and other local conservation-oriented organizations to Wertheim also helped raise awareness of these environmentally focused groups. During Wertheim's annual International Migratory Bird Day celebrations, for example, Refuge officials hosted about twenty local environmental organizations, including local aquariums, nature centers, wildlife rescue groups, and state and local parks. These organizations erected booths around the Refuge, facilitated educational and nature-themed games and events, and gave out information about their organizations. Wertheim thus acted as a bridging agent, providing a space for the local conservation community to come together and helping local community members learn about and gain access to alternative environmentally oriented groups in the area.

Does participation in NDAs at Wertheim promote the formation or strengthening of local residents' interpersonal relationships?

The next question we sought to investigate was whether participation in NDAs at Wertheim created or strengthened participants' interpersonal relationships. Social connectivity facilitated by networks of social ties are instrumental to promoting and achieving environmental conservation across social-ecological systems (Pretty, 2003; Berkes, 2009). This is especially true when resources targeted for conservation (such as waterways and wildlife) cross property and jurisdictional boundaries (Pretty, 2003). Like many formally conserved areas, Wertheim's ability to achieve its conservation goals will ultimately require transboundary management efforts, including the conservation of broad-ranging wildlife species and habitats. In pursuit of these goals, Refuge officials and local residents will need to work together to plan and implement complementary management actions on properties adjacent or ecologically connected to the Refuge. Understanding how engagement in NDAs impacts local participants' social networks may provide insight into how engagement in NDAs impact these actors' capacity to work together to conserve resources, both within and beyond the Refuge.

Interviewees consistently attributed access to NDAs at Wertheim as contributing to the formation and strengthening of relationships among local NDA participants. These outcomes parallel those of past studies, which demonstrated that formation and strengthening of interpersonal relationships was an identified outcome of engagement in environmentally focused volunteerism (Measham & Barnett, 2008). For local community members, the Refuge headquarters provided a space for gathering, and through participation in NDAs, communicating about common environmentally focused interests and concerns. Annual festivals and weekly programming targeted at the local community created opportunities for local residents to meet regularly and spend time with one another while participating in NDAs. Local residents were also reported as coming together at the Refuge to learn about and work to mitigate the impacts of invasive species, such as Southern Pine Beetle, in the process meeting other local residents and spending time with acquaintances who were also concerned about local environmental integrity. Beyond this, Refuge officials reported that the Visitors' Center's back porch was used daily by local photographers and birders who socialize as they observed wildlife and flora. One Refuge official also mentioned that participants in the Refuge's annual deer hunt, many of whom were from Long Island, if not the communities directly surrounding the Refuge, often socialized with other hunters, and even with Refuge officials at the hunter check station. NDAs such as wildlife watching, photography, and hunting thus reportedly provided local Refuge visitors opportunities to meet and spend time with people from local communities who shared common, environmentally focused interests.

Due to the fact that admission to NDAs on the Refuge are low-cost or free, a diversity of people from neighboring communities were able to participate in them. Since communities surrounding the Refuge are characterized by distinctly different socio-demographic compositions and economic conditions (U.S. Census Bureau, 2010), these types of interactions would not necessarily have occurred were it not for the Refuge. Wertheim's facilities and the NDAs the Refuge hosts therefore created opportunities for local community members from diverse backgrounds and circumstances to interact and potentially form relationships. As one public official described the social impacts of the Refuge:

“Wertheim cuts across social boundaries, you can enjoy the Refuge and the river for a pretty modest cost, especially when you compare it to other recreational activities. It’s quite inexpensive and there’s a lot of area... So in my experience and with meeting people in the Refuge and around it, it does cut across those social boundaries...It’s just like anything else where people who have like-minded concerns and hobbies get together and I think that provides for good social interaction and facilitates relationship-building.”

Social ties formed among Refuge volunteers were particularly strong. While volunteers did not indicate that they felt more connected to the local community in general as a result of their experiences at Wertheim, all those interviewed said that they had developed friendships or social networks with other volunteers and Refuge staff. These relationships were formed in part because volunteers enjoyed spending time with “like-minded” individuals who were interested in the environment, and were commonly interested in conserving resources on and surrounding the Refuge. One younger volunteer mentioned that other Refuge volunteers and officials had created a valuable social network for her as she searched for, and eventually attained an environmentally focused job in the area. Some volunteers even reported that their bonds with Refuge staff and volunteers were so strong they felt they were part of a Refuge “family.” Interestingly, one volunteer reported that her involvement with Wertheim influenced the role she played in her interactions with local acquaintances. This volunteer described being approached by neighbors and friends and being asked about events at the Refuge and local environmental issues. While these types of exchanges did not necessarily change the strength of local social ties, they do indicate that some volunteers may be seen as a resource and source of eco-centric and Refuge-centric knowledge for local community members. As this volunteer explained her experience:

“People will stop me in the neighborhood, whether it be Shirley, Brookhaven, or Bellport. If you go somewhere you’re always meeting somebody and they’ll say, ‘I last saw you at Wertheim. What’s happening at the Refuge?’, ‘What’s happening with the Friends?’. Questions come up about any number of related subjects and I used to tell my husband that it would take me an hour to go grocery shopping in town when it should have taken me 15 minutes because I would run into different people and they always ask, ‘What’s happened with this event?’ ‘What’s going on with the local dump site (which was causing environmental contamination)? Are they going to shut it down?’”

Evidence thus emerged that access to Wertheim’s facilities and involvement in NDAs at Wertheim did, at least reportedly, change participant’s social ties, and increase participants’ access to environmentally focused social networks. In some cases, NDA participants even became resources to local residents, and enhanced these residents’ access to environmentally focused information. We did not investigate whether these relationships directly impacted local residents’ ability or willingness to participate in collaborative resource conservation. However, the newly formed and strengthened social ties reportedly resulting from participation in NDAs may contribute to local residents’ and Refuge officials’ capacity to plan and implement collaborative resource management. Further inquiry should seek to ascertain whether this causal

relationship exists and what types of conservation efforts are facilitated by access to these expanded social networks.

Does participation in NDAs at Wertheim promote local residents' willingness to protect valued natural resources, both on and off the Refuge?

The final objective of our inquiry was to ascertain whether and how participation in NDAs on Wertheim impacted local residents' willingness to protect local natural resources. Some Refuge officials felt NDA participants, because they chose to spend their time at the Refuge, were likely already interested in resource conservation. Despite this, our interviews revealed that engagement in NDAs on Wertheim did in some cases (at least reportedly) increase participants' interests and engagement in environmental stewardship and resource protection.

Non-volunteer NDA participants and pro-conservation behaviors

Refuge officials reported participation in some NDAs, such as community events and educational programming, often motivated local residents to remain engaged with the Refuge and promoted public interest in volunteering. There was in fact so much interest in volunteerism after some events (e.g., Scout jamborees and community-targeted festivals) that the Refuge did not have enough staff or projects to provide volunteer opportunities for all who were interested. A Refuge official also reported that, as a result of good relations developed between Refuge officials and hunters, and hunters' dependence on the Refuge's wildlife and habitats, these NDA participants were more willing to report unlawful or environmentally damaging activities they witnessed. Further research would, however, be necessary to reveal whether these hunters' behaviors were a direct result of their experiences at Wertheim, or a result of pre-existing environmental ethics.

One Refuge partner believed participation in educational NDAs allowed children to better understand what environmental issues were important to their teachers. This exposure reportedly helped form children's' pro-conservation attitudes, and inspired them to reflect on and enhance their own pro-conservation behaviors. Follow-up interviews would again be necessary to assess whether these children's' pro-conservation sentiments and behaviors did in fact develop as a direct result of participation in NDAs at Wertheim. Nevertheless, this interviewee's observations are insightful in that they highlight a potential avenue through which participation in NDAs motivate pro-conservation proclivities. To draw on the Refuge partners' experience of the phenomenon:

"I think going to Wertheim and places like Wertheim establishes (for the students) what's important to the adults around them...During environmental programs kids read clues from adults about what environmental issues are important... that is much more important than having kids lectured and just telling them 'oh we have to save the environment, we have to clean up our garbage.' They know it's something I care about so they're anxious to share and show me things that they've done and will do to help protect nature."

Volunteers and pro-conservation behaviors

Interviews with volunteers revealed that, largely motivated by their enhanced protective attitudes, these NDA participants were increasingly willing help promote the wellbeing of the Refuge and its resources. One longstanding volunteer, for example, reported his/her dedication to the Refuge and its continued operation had motivated him/her to lobby Congress on behalf of the Refuge on a number of occasions. Multiple volunteers also reported they were or had been willing to intercede if they saw a Refuge visitor damaging Refuge resources. Some volunteers also expressed a heightened sense of ownership over the Refuge, meaning that they felt an obligation to help with the upkeep of amenities, such as trails and managed areas, they had personally contributed to creating, as well as the natural resources around these amenities. To draw on two illustrative quotes from volunteers regarding their willingness to protect Refuge resources:

“You learn about the resources on the Refuge and it helps you want to protect them... If I saw somebody doing something wrong on the Refuge would I open my mouth? Absolutely freaking would!”

"When I first started I wouldn't necessarily have made efforts to help conserve resources. But now I feel a commitment to the Refuge. After doing the trails ourselves and working on these overlooks to get people out there to see the river, I feel an obligation to help take care of those things."

Volunteers also claimed engagement in NDAs enhanced their willingness to promote the health of environments and resources beyond the Refuge. Given the opportunity, for example, some volunteers said they would participate in off-site conservation efforts. One volunteer even reported that as a result of his/her time at Wertheim, he/she was “more willing to contact legislators to help support local environmental conservation.”

Intentions aside, little evidence emerged to indicate that engagement in NDAs promoted participation in environmentally protective activities off site of the Refuge. Volunteers had inquired about the biological health of resources in their backyards. For example, after learning about the Southern Pine Beetle outbreak on Long Island during an educational program on the Refuge, one volunteer said he/she had asked a Refuge biologist about the presence of Southern Pine Beetle on his/her own property. Another volunteer claimed that as a result of what he/she had learned at the Refuge he/she was only willing to plant native species on his/her property. Another mentioned he/she was a member of an environmentally oriented citizens' advisory council, and in his/her position leveraged knowledge gained through participation in NDAs on Wertheim. This volunteer had, however, been involved in environmentally focused initiatives throughout his/her adulthood, and had trouble discerning whether his/her involvement with Wertheim led directly to his/her participation in the advisory council. Local environmental activists and volunteers also spoke about protesting the development of a big-box store adjacent to the Refuge's property in the mid 1990s. Yet arguments against the development included concerns about increased traffic congestion, changed neighborhood character, and threats to local businesses, as well as concerns about increased pollution in the Carmens river and impacts on wildlife.

The causal link between participation in NDAs on Wertheim and protection of off-site resources is thus weak at best. No volunteers reported they had actually participated in off-site pro-conservation activities as a direct result of their engagement in NDAs on the Refuge. Nor were other interview participants able to provide observed or anecdotal evidence of this link. Thus, despite some participants' increased willingness to engage in pro-conservation activities, and their involvement in resource protection on the Refuge, participation in NDAs did not demonstrably result in pro-conservation behaviors beyond the Refuge's boundaries.

IMPLICATIONS AND FUTURE RESEARCH

The purpose of this inquiry was to shed light on some of the social and ecological benefits associated with local communities' access to natural-resource focused activities on formally conserved, public lands. National Wildlife Refuges are a public land system that is pervasive throughout the United States, with at least one Refuge in every state, and the majority of Refuges either facilitate or permit NDAs on their properties. Despite this, few studies have assessed the non-economic, local impacts created by access to and participation in NDAs made available by Refuges. To begin addressing this gap in knowledge, we sought to examine the local environmental and social benefits associated with participation in NDAs on a single National Wildlife Refuge in Long Island, NY.

Potential study limitations notwithstanding, overall our results suggest that some local residents' participation in NDAs, and especially volunteerism, enhanced their capacity to be aware of, steward, and protect resources within the Refuge. As a result of their involvement with Wertheim, volunteers reported they had learned about or become more aware of endemic species, wildlife habitats on the Refuge and in neighboring areas, and local resource management issues. Interviewees who engaged with repeat visitors from the local area observed NDA participants' familiarity with and knowledge of local resources increased over time. Many interviewees also reported nature-dependent programming geared towards children had a particularly significant influence on these children's and their families' environmental awareness and knowledge. Engagement in NDAs on Wertheim was also reported to have led to increased interests in protection of resources found within the Refuge. For example, Refuge officials reported that participation in NDAs often motivated local residents to remain engaged with the Refuge and promoted public interest in volunteering.

Facilitating opportunities for NDAs that foster deeper knowledge of and attachment to formally protected lands may help managers meet their on-site management objectives and promote community support of resources and facilities on those lands. However, little evidence was found to suggest the environmental and social benefits associated with participation in NDAs resulted in pro-environmental behaviors extending beyond the boundaries of the conserved property. This is consistent with Kim et al. (2011), who found that pro-environmental attitudes and behaviors associated with participation in place-based NDAs were directed towards resources where these activities took place. Thus, our findings emphasize an administrative challenge to expanding conservation beyond conserved lands to properties whose stewardship is critical to the health of resources found within formally conserved properties.

Achieving transboundary resource conservation will require the support of local communities and their engagement in pro-conservation activities. Efforts to promote collaborative resource conservation might therefore benefit from a strategic approach to NDA development and administration. For example, facilitating NDAs associated with formally conserved lands, but which take place off-site or which are focused on resources in surrounding areas might enhance awareness of and interest in supporting local resources more generally. Some efforts to facilitate this type of engagement are already underway. The Urban Wildlife Refuge Initiative, for example, focuses on resource stewardship and environmental education on properties both owned and administered by the US Fish and Wildlife Service, as well as green spaces outside Refuge boundaries (USFWS 2014). Considering their potential to promote residents' pro-conservation behaviors outside formally protected areas, these types of programs might be enhanced and expanded.

We suggest future research further examine the relationship between local residents' participation in NDAs on conserved lands and these individuals' pro-conservation attitudes and behaviors. A first research objective might be to ascertain the generalizability of our findings, and assess whether participation in some forms of NDAs result in greater pro-conservation outcomes than others. Land managers and partners could use these data to promote NDA opportunities that have been associated with the greatest environmental and social benefits, and which can most effectively contribute to public land administrators' ability to meet their on-site and transboundary resource management goals.

Future researchers might also seek to examine how the socio-demographic context of a formally conserved property impacts local NDA participants' environmental awareness and conservation-oriented attitudes and behaviors. Wertheim NWR, for example, sits within a relatively urbanized area where access to public, conserved land is limited. Wertheim's provision and facilitation of low-cost NDAs was also relatively unique within South Central Suffolk County. The associations we found between participation in NDAs and pro-conservation attitudes and behaviors may, therefore, have been artificially amplified. By this we mean that the uniqueness of the site and its environmentally focused, often expert-led activities might have increased NDA participants' affinity and concern for Wertheim. This in turn could have increased NDA participants' protectionist attitudes in ways that would not have been found in other, less urbanized Refuge settings. Future research might compare pro-conservation impacts associated with local residents' participation in NDAs on formally conserved, publically accessible properties in urban, exurban, and rural areas. Such a study might evince whether scarcity of access to alternative sites where NDAs can be facilitated and performed influences pro-conservation impacts. Given our inconclusive findings relating participation in NDAs with local residents' engagement in off-site pro-conservation behaviors, future research might also seek to better understand the carry-over effects associated with participation in NDAs. This research might examine what, if any, NDA activities tend to promote engagement in environmental conservation beyond the boundaries of the site where these activities take place.

Finally, future researchers might examine the role formally conserved, public lands such as Refuges play in enhancing the connectivity of local environmental organizations and increasing local residents' access to these organizations. In this study, Wertheim's facilities provided a venue for environmentally focused groups to congregate. The Refuge's facilities and

programming thus enabled contact between distinct but commonly focused organizations and provided local residents opportunities to learn about and potentially become engaged with these organizations. Since many Refuges, parks, and preserves have on-site facilities where these types of events might be held, understanding more about the role these properties play as bridging entities that facilitate conservation awareness and organizational connectivity could be a worthwhile and interesting line of inquiry.

CONCLUSION

In light of the increasingly complex, transboundary nature of modern environmental challenges, understanding the role public, conserved lands can play in fostering environmental awareness and natural resource stewardship will be essential. Results of this study indicate participation in NDAs on a publicly owned and administered property contributed to local residents' pro-conservation attitudes and behaviors. Participation in these activities also reportedly enhanced local participants' interpersonal relationships with like-minded, environmentally concerned individuals. Together these results may indicate that access to NDAs on public lands can promote interest in and social capacity to conserve valued natural resources. While little evidence emerged indicating that local residents' participation in NDAs promoted resource conservation off-site, interviewees reported involvement in these activities did increase their engagement in pro-conservation behaviors within the property, and their awareness of environmental threats in surrounding areas. Local residents' access to NDAs on a formally conserved, public property thus reportedly had a variety of social and ecological benefits. While further research will be needed to understand the generalizability of our findings, this study begins to highlight the benefits associated with access to formally conserved, publically administered lands and the NDAs land administrators, partners, and volunteers help facilitate at these sites.

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APPENDIX A: INTERVIEW GUIDES

Refuge Volunteers

B1

1. Why did you chose to become a volunteer at Wertheim NWR? Have your reasons for participating as a volunteer changed since you joined?
2. What duties do you perform as a volunteer with Wertheim NWR? Do these duties ever extend beyond the boundaries of the Refuge?

B2

3. Are you familiar with local areas surrounding Wertheim NWR? (How far away from the Refuge do you live?)

O1

4. Has your work as a volunteer (or engagement in other nature-dependent activities) at Wertheim influenced your relationship with people in the local community (whether other local volunteers or members of the local public)? For example, has it made you feel more connected to the local community?
 - a. If so, how and why?
5. Has your participation as a volunteer (or engagement in other nature-dependent activities) at Wertheim influenced your interest in or knowledge of the local natural environment?
 - a. If so, how and why?
6. Has your participation as a volunteer (or engagement in other nature-dependent activities) at Wertheim influenced your interest in taking action to conserve or protect some aspect of the local natural environment, whether on the Refuge or off?
 - a. If so, can you give me an example of how your engagement with the Refuge lead you to take action on behalf of the local natural environment?

O2

7. In your experience, what activities do local community members tend to participate in when they visit the Refuge?
8. Have you observed that nature-oriented programs and activities on the Refuge are targeted to the local community?
 - a. If so, which ones and how are these programs targeted to the local community?
 - b. Are these efforts effective at drawing local community members to be involved in on-site activities and programs?
9. In your experience, has local community members' participation in nature-dependent activities on the Refuge influenced their interest in the local natural environment, whether on the Refuge or off, or their willingness to help conserve or restore these resource?
 - a. If so, how, and what has drawn you to this conclusion?

O3

10. Are there opportunities for local community members to help develop or implement nature-dependent activities or programs on Wertheim NWR?

- a. If so, what are these programs and what role do local community members play in helping with their administration?
11. In your experience, does the Refuge collaborate with local communities to support nature-dependent activities or conservation-oriented programs off-site?
 - a. If so, what are these programs/activities and what roles do the community and Refuge play?
 - b. If not, to the extent of your knowledge, have there been efforts to facilitate these types of partnerships or collaborative opportunities?
12. (If Yes to 10 or 11) In your experience, do these opportunities for collaboration between the Refuge and local community influence the communities' interest in or concern for local natural resources?
 - a. If so, how, and what has drawn you to this conclusion?
13. In your experience, what may limit the Refuges' and local communities' capacity to collaborate in facilitating nature-oriented activities and programs, whether on the Refuge or off?

Refuge Officials

B1

1. What is your position at Wertheim NWR and what are your duties in this position?
2. How often and for what purpose do you interact with members of the local public?

O2

3. In your experience, do many people from the local community participate in nature-dependent activities on the Refuge?
 - a. If so, what activities do they tend to participate in?
4. How is information about nature-dependent activities and programs hosted at Wertheim NWR disseminated, and who are your target audiences?
5. Are any of these programs and activities targeted specifically at local community members?
 - a. If so, what are these programs/activities, and why and how are they targeted at the local community?
 - b. If so, do these programs draw many local community members to the Refuge and promote their participation in nature-oriented activities and programs?

O1

6. In your experience, does participation in nature-dependent activities or programs at Wertheim NWR lead participants to become more involved in or connected to the local community?
 - a. If so, what have you observed that has led you to this conclusion?
7. In your experience, does participation in nature-dependent activities or programs at Wertheim increase participants' interest in or knowledge of the local natural environment?
 - a. If so, what have you observed that has led you to this conclusion?
8. In your experience, does participation in nature-dependent activities or programs at Wertheim increase participants willingness in taking action to protect or restore aspect of the local natural environment, whether on the Refuge or off?
 - a. If so, can you give me an example of how participation in these activities led to these outcomes?

O3

9. Do local community members play a role in developing or implementing nature-dependent activities or programs *on* Wertheim NWR?
 - a. If so, what are these programs and what role do local community members play in helping with their administration?
10. Does the Refuge collaborate with local communities to support nature-dependent activities or conservation-oriented programs in surrounding areas?
 - a. If so, what are these programs/activities, what role do the community members play, and how many community members are involved?
 - b. If not, to the extent of your knowledge, have there been efforts to facilitate these types of partnerships or collaborative opportunities?

11. (If yes to 10 or 11) In your experience, have these opportunities for collaboration between the Refuge and local community influenced the communities' relationship with local natural resources?
- a. If so, what has drawn you to this conclusion?
12. In your experience, what may limit the Refuges' and local communities' capacity to collaborate in facilitating nature-oriented activities and programs?

Refuge Partners

B1

1. What organization do you represent and what is your role in the organization?
2. How long has your organization been working with Wertheim NWR, and why did this partnership start?

B2

3. Are you familiar with the communities surround Wertheim NWR?
 - a. If so, how?

O2

4. What nature-dependent activities or programs do you help facilitate at Wertheim NWR? Do these activities ever extend beyond the boundaries of the Refuge into neighboring conserved lands or waters?
5. How is information about the nature-dependent activities you are involved with at Wertheim NWR disseminated, and who are your target audiences?
6. Are any of these programs and activities targeted specifically at local community members?
 - a. If so, what are these programs and/or activities, and why and how are they targeted at local community members?
7. In your experience, do the programs you are involved in at Wertheim draw many local communities to the Refuge and promote their participation in nature-oriented activities and programs?

O3

8. Are local community members involved in sponsoring, developing, or implementing nature-dependent activities or programs you are involved in at Wertheim NWR (whether these community members' efforts take place on-site or off)?
 - a. If so, what are these programs and what role do local community members play in helping facilitate them?
9. In your experience, what may limit the Refuges' and local communities' capacity to collaborate in facilitating nature-oriented activities and programs?

O1

10. In your experience, does participation in nature-dependent activities or programs at Wertheim NWR lead participants to become more involved in or connected to the local community?
 - a. If so, what have you observed that has led you to this conclusion?
 - b. If not, what has led you to this conclusion?
11. In your experience, does participation in nature-dependent activities or programs at Wertheim increase participants' interest in or knowledge of the local natural environment?
 - a. If so, what have you observed that has led you to this conclusion?
 - b. If not, have you observed that participation in nature-dependent activities on alternative conserved lands in Suffolk County promote these behaviors?
 - i. If so, please tell me about these programs and what have you observed that has lead

you to this conclusion?

12. In your experience, does participation in nature-dependent activities or programs at Wertheim increase participants willingness in taking action to protect or restore aspect of the local natural environment, whether on the Refuge or off?
 - a. If so, can you give me an example of how participation in these activities led to these outcomes?
 - b. If not, have you observed that participation in nature-dependent activities on alternative conserved lands in Suffolk County promotes these environmentally beneficial behaviors?
 - i. If so, please tell me about these programs and what have you observed that has lead you to this conclusion?

Elected Officials/ Community Representatives/Local Environmental Leaders

B1

1. Tell me about your position as an elected official/community representative/local environmental leader and the responsibilities associated with that position.
2. In your position, what forms of interaction do you have with communities in central southern Suffolk County (such as Shirley, Mastic, Bellport, and Yaphank), and how frequently do you interact with/work on issues related to these communities?

B2

3. Do you interact with community members who participate in nature-dependent activities at Wertheim NWR?
4. In your experience, what role does Wertheim NWR and the nature-dependent activities it facilitates play in the local community?

O1

5. In your experience, does access to nature-dependent activities at Wertheim create positive social impacts in the local community? For instance, have you observed that participation in nature-dependent activities or programs at Wertheim has led participants to be more involved in or connected to the local community?
 - a. If so, what have you observed that has led you to this conclusion?
6. In your experience, does access to nature-dependent activities at Wertheim create positive environmental impacts in the local area? For example, have you observed that participation in nature-dependent activities or programs at Wertheim has led participants to taking action to protect or restore aspect of the local natural environment, whether on the Refuge or off?
 - a. If so, can you give me an example of how participation in these activities led to environmentally beneficial outcomes?
7. Has engagement in these activities on alternative conserved lands in Suffolk County helped promote pro-conservation attitudes, or engagement in protecting or restoring the natural environment?
 - a. If so, please tell me about these programs and what have you observed that has led you to this conclusion?
 - b. If so, how do these opportunities on alternative conserved lands compare to those at Wertheim NWR in terms of promoting pro-conservation attitudes and behaviors?