

COLLABORATIVE GOVERNANCE AS A PRECURSOR TO SUSTAINED
PARTICIPATION IN ANTLERLESS DEER HUNTING ON THE KINZUA QUALITY DEER
COOPERATIVE, PENNSYLVANIA

By

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ABSTRACT

COLLABORATIVE GOVERNANCE AS A PRECURSOR TO SUSTAINED PARTICIPATION IN ANTLERLESS DEER HUNTING ON THE KINZUA QUALITY DEER COOPERATIVE, PENNSYLVANIA

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Harvesting antlerless white-tailed deer (*Odocoileus virginianus*) is one way of managing deer populations to achieve societal goals for the species. Cooperatives bring stakeholders together to meet common conservation goals, and have been a means to achieve desired harvests. The Kinzua Quality Deer Cooperative (KQDC) of Pennsylvania, USA, is an on-going cooperative initiated in 2000 to demonstrate how hunting can be used to meet stakeholder's ecosystem goals. My study used interviews and questionnaires to examine governance factors contributing to the success and sustainability of the KQDC to reduce deer densities. KQDC stakeholders, such as landowners, managers, biologists, local businesses and hunters, reported characteristics such as effective communication, trust, and propensity to accomplish diverse objectives relative to deer and ecosystems as shared resources. To assess motivations and perceived constraints to deer hunting, as well as satisfaction derived from past hunting experience and future willingness to voluntarily hunt in areas with low deer densities such as the KQDC, I surveyed 1,008 hunters who purchased supplemental antlerless deer permits from 2007-2012. A variety of motivations and constraints to hunting of antlerless deer exist on the KQDC. My findings suggest long-term success and sustainability of cooperatives depends in part on 1) consistent recruitment of stakeholders on leadership team 2) hunters' knowledge of, ability and willingness to participate in conservation objectives through outreach opportunities; and 3) stakeholder willingness to cooperate with diverse members and use of management tools available to them.

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CHAPTER 1

COOPERATIVE GOVERNANCE OF COMMON-POOL RESOURCES: KINZUA QUALITY DEER COOPERATIVE AS A CASE STUDY

INTRODUCTION

Natural resource governance aims to generate ecosystem goods and services valued by society which can be economic, aesthetic, or scientific. Under current governance arrangements in the United States, natural resources (e.g., wildlife) are a public resource and managed by local, state, and federal agencies rather than by a single unit of governance. However, within Pennsylvania, 12 million of 16 million acres of forested land is owned by private landowners (Responsive Management, 2004), and species such as white-tailed deer (*Odocoileus virginianus*) are not constrained by political boundaries established by governments or landowners. Deer browsing can alter ecosystem processes like succession (Marquis, 1981), vegetation composition (Alverson, Waller, & Solheim, 1988; Horsley, Stout, & deCalesta, 2003; Royo, Stout, deCalesta, & Pierson, 2010; Tilghman, 1989; Witmer & deCalesta, 1992), and subsequently alter wildlife species diversity and forest regeneration within an area (Marquis, 1981; Witmer & deCalesta, 1992).

Although greater than half of forested land is privately owned in Pennsylvania, there are perceived benefits accruing from publicly accessible land. The reduction in the perceived negative impacts (i.e. vehicle-deer collisions, disease, garden invasions etc.) to various stakeholders is mitigated by the economic values added by hunters to areas they visit (Curtis, Drake, Enck, Julian, & Taylor, 2005; Knoche & Lupi, 2012; Witmer & deCalesta, 1992) and values placed on having deer as part of functioning ecosystem (Lischka et al. 2008). White-tailed deer hunting in Pennsylvania is estimated at \$245 million dollars and \$122 million in wages

annually (Bhandari, Stedman, Luloff, Finley, & Diefenbach, 2006). Additionally, hunter license and equipment sales contribute to natural resource management via excise taxes (Jacobson, Organ, Decker, Batcheller, & Carpenter, 2010).

A component in the evolution of new or improved ways of managing natural resources is assessment in the context of other management efforts. Multi-stakeholder participation and interest in natural resource management has led to collaborative arrangements between public and private entities like the Kinzua Quality Deer Cooperative (KQDC) in northwestern Pennsylvania to manage for desired ecosystems goods and services. This paper provides background and current perspectives on leadership of the KQDC, a public-private demonstration project which self-organized in 2000 to manage natural resources in northwestern Pennsylvania to achieve desired ecosystem services.

Background

In 1895, the Pennsylvania Game Commission (PGC), the state wildlife agency, was created to govern the taking of wildlife populations (Kosack, 1995). Commercialization of wildlife species for market use in Pennsylvania was a contributing factor in the near-extirpation of species such as white-tailed deer (Kosack, 1995). After reintroduction of white-tailed deer to Pennsylvania, deer populations increased during the 1920's, a result of forage produced by timber harvests (Kochel, 2008; Kosack, 1995). However, subsequent mid-successional vegetation types provided reduced forage for deer. Historically in Pennsylvania, deer densities have exceeded 11 deer/km² (Witmer & deCalesta, 1992). When deer densities exceed 8 deer/km² vegetative regeneration is reduced (Alverson, et al., 1998; Horsley et al., 2003; Royo et al., 2010; Tilghman, 1989).

The effects of deer browsing has been linked to large-scale changes in vegetation composition with reduced regeneration of browse-sensitive, shade-intolerant plant species such as witch hobble (*Viburnum lantanoides*), and *Rubus spp.*, (Alverson, et al., 1988; Anacker & Kirschbaum, 2006; Horsley et al., 2003; Marquis, 1981; Royo et al., 2010). A secondary effect of deer browsing was increased abundance of non-preferred browse species such as ferns, beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), and striped maple (*Acer pennsylvanicum*, Marquis, 1981; Horsley et al., 2003; Royo et al., 2010).

The 73,250 acre KQDC (Figure 1.1) is a collaboration of private and federal landowners, non-governmental organizations, U.S. Forest Service Northern Research Station, and local stakeholders organized as a demonstration site for management of ecosystem goods and services (Table 1.1; Kochel, 2008; Reitz, Hille, & Stout, 2004; Stout, Royo, deCalesta, McAleese, & Finley, 2013) utilizing tools made available by PGC to manage deer populations. A tool that was newly available when the KQDC leadership team originated was the Deer Management Assistance Program (DMAP), which allowed taking of additional antlerless deer during the hunting season.

The KQDC is collaboratively managed by the Allegheny National Forest (ANF), the Bradford Watershed Authority, and three private landowners: Collins Pine (CP) /Kane Hardwoods, Forestry Investment Associates (FIA), and RAM Forest Products (RAM). The ANF manages 66% of the KQDC while other landowners own or manage 34% of the land (Table 1.2). Relative to other management efforts, habitat management of the KQDC has been influenced by the PGC's white-tailed deer management over time. It has been difficult for, Pennsylvania land managers in general, and KQDC managers specifically, to achieve land and vegetation management objectives (deCalesta, 2012; Luloff, Finley, Stedman, Matarrita, & Pierson, 2006;

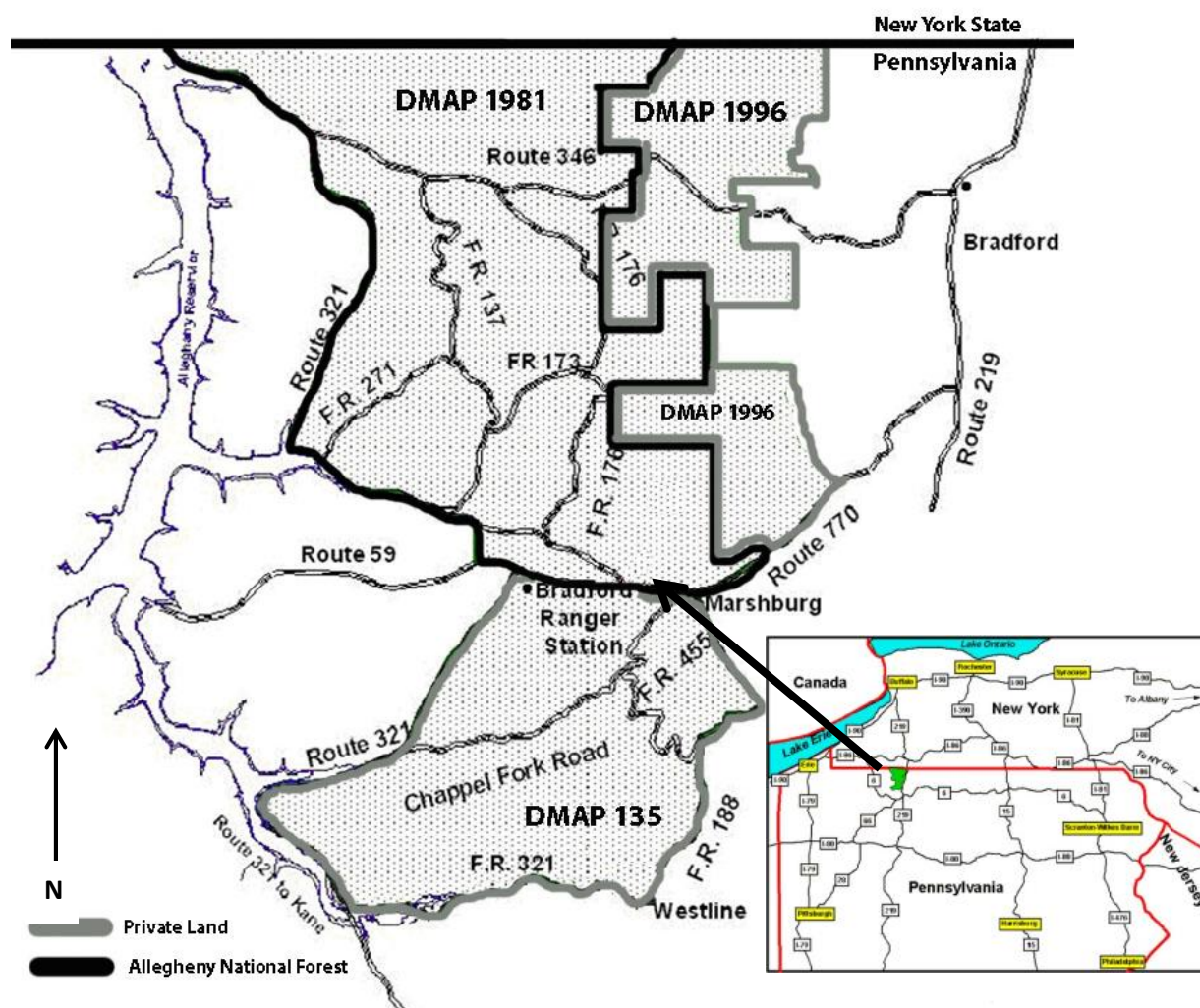


Figure 1.1. Location of the Kinzua Quality Deer Cooperative (in green) along the Pennsylvania/New York border.

Table 1.1. Primary participating landowners and non-landowners of the Kinzua Quality Deer Cooperative.

Name	Acronym
Allegheny National Forest	ANF
ANF Vacation Bureau	—
Bradford Watershed Authority	—
Collins Pine (Kane Hardwoods)	CP
Forestry Investment Associates	FIA
Northern Research Station	NRS
Pennsylvania Game Commission	PGC
RAM Forest Products	RAM
Sand County Foundation	SCF

Table 1.2. The percentage of acreage of the Kinzua Quality Deer Cooperative landowners.

Name	Acreage	Percent
ANF	48, 350	66.0
RAM Forest Products	970	1.3
FIA	9,130	12.5
Bradford Watershed Authority	11,800	16.1
Collins Pine (Kane Hardwood)	3,000	4.1
Total	73, 250	100

Reitz et al., 2004; Stout et al., 2013) when deer densities have exceeded 8 deer/km².

After the first decade, an independent review team (Miller, Madsen, Jacobson, & Snyder, 2010) evaluated the accomplishment of objectives by the KQDC leadership team. A primary goal of the KQDC was to achieve biologically diverse habitats with economically viable forest regeneration (Kochel, 2008; Reitz et al., 2004; Stout et al., 2013). Initially, habitat management on the KQDC involved use of antlerless licenses, 3-point antlered licenses restrictions, public access, and communication between landowners until introducing the Deer Management Assistance Program in 2003 (Nelson, 2014). One objective of a sustained 12-15 deer/mi² was believed necessary to achieve the primary goals of the KQDC (deCalesta, 2011). A second objective was maintaining deer densities on the KQDC that would sustain interest among white-tailed deer hunters, and improve deer health (deCalesta, 2012). The third objective to monitor hunter satisfaction was performed annually at check stations and in a 2004 survey (Luloff et al., 2006; Nelson, 2014). The final objective of increasing buck:doe ratios, and recruitment rates were not achieved during the first decade. Understanding what factors facilitated the processes contributing to the accomplishments of the KQDC leadership team objectives will inform future governance of the KQDC and their management approaches.

How does governance structure affect success?

Governance of public land and wildlife is becoming more participatory and decentralized (Gerlak & Heikkila, 2006; Jacobson & Decker, 2008; Leong, Decker, Lauber, Raik & Siemer, 2009). Governance is how groups organize and delegate processes that are the combined result of rules establishment, policy creation, and law making to address dilemmas (Gerlak & Heikkila, 2006; Kemp, Parto, & Gibson, 2005; Rudolph, Schechter, & Riley, 2012; Vallejo &

Hauselmann, 2004). Governance arrangements are varied and situational rather than universal approaches (Agrawal, 2002). Participatory forms of governance are a reflect the idea held by some professionals that engaging stakeholders is an important component of natural resource management (Berkes, 2004; Dietz, Ostrom & Stern, 2003; Gerlak & Heikkla, 2006; Jacobson & Decker, 2008; Leong et al., 2009).

Participatory forms of management that engage stakeholders to resolve resource dilemmas is known as collaborative governance (Gerlak & Heikkla, 2006; Rudolph, Schechter, & Riley, 2012) or collaborative conservation (Decker, Riley, & Siemer, 2012). Collaborative governance relies on government and citizen input (Plummer & Fitzgibbon, 2006). With increasing fragmentation of land ownership, multi-stakeholder approaches provide coordinated management approaches (Bergmann & Bliss, 2004; Gass, Rickenbach, Schulte, & Zeuli, 2009; Plummer & Fitzgibbon, 2006; Raik, Decker, & Siemer, 2006; Rickenbach, Schulte, Kittredge, Labich, & Shinneman, 2011; Wagner, Kaiser, Kreuter, & Wilkins, 2007). Gerlak & Heikkila (2006) compared four collaborative governance arrangement decision-making processes to ascertain how collaboration occurs and the resulting outcomes. Rather than focusing on how collaborations occurred, I am interested in discerning what characteristics contributed to the governance structure by identifying baseline characteristics contributing to the success and sustainability of the KQDC (Ostrom, 1999). Researchers (Agrawal, 2002; Gruber, 2010; Raik et al., 2006) have identified characteristics within communities addressing natural resource issues. However, due to the breadth of characteristics developed as criteria's for success, I have appropriated the following characteristics from commons literature. Primarily because the following characteristics are the theoretical basis from which effectiveness of community based governance systems are measured (Ostrom, 1999).

Resource system and group system characteristics compiled by Agrawal (2002) are a synthesis of the design principles of Ostrom (1990), the enabling conditions of Wade (1988), and the conclusive conditions that Baland & Platteau (2000) found recurring within multiple institutional arrangements that experienced successful and sustainable natural resource management (Table 1.3). Resource system characteristics are physical conditions which include but are not limited to the resource such as size, the predictability of the resource, or the mobility (that is the movement) of the resource. Group system characteristics are the structural makeup of the people governing a common-pool resource which include but are not limited to social capital, collective action, or interdependence among group members.

Although a consensus does not exist for a universal set of characteristics (Agrawal, 2002; Cox, Arnold, & Tomas, 2010), these resource system and group system characteristics provide a framework for reviewing community-based natural resource management scenarios developed to resolve resource dilemmas. Whether these characteristics predetermine the governance structure of an institution as sustainable and successful may be related to the characteristics' presence, or absence (Agrawal, 2002). Ostrom (1990) and Agrawal (2002) acknowledge that the absence of a single or even a few characteristics does not automatically result in a failed institutional arrangement. Ostrom (1990) determined that communities with clear goals and means of executing their policies would organize for a shared goal.

I identified three characteristics as contributing to institutional development, and governance processes on the KQDC. Social capital is composed of social connections, the cooperation, and trust between and within groups (Bergmann & Bliss, 2004; Carlsson & Sandström, 2007; Green, Grijalva, & Kroll, 2003; Mitterling, Kramer, & Frank, 2013; Plummer & FitzGibbon, 2006; Wagner, Kaiser, Kreuter, & Wilkins, 2006). Formation of a governance

Table 1.3. Portion of the synthesis of resource system and group system characteristics (design principles) by Baland & Platteau (2000), Ostrom (1990), and Wade (1988) from Agrawal (2002) used to evaluate the KQDC leadership team.

Types of characteristics
Resource System Characteristics
i. Small Size (W)
ii. Well-defined boundaries(W, O)
Group System Characteristics
i. Small Size (W, B&P)
ii. Clearly defined boundaries (W, O)
iii. Shared norms (B&P)
iv. Past successful experiences-social capital (W, B&P)
v. Appropriate leadership-young, familiar with changing external environments, connected to local traditional elite (B&P)
Interdependence among group members (W, B&P)
vi. Heterogeneity of endowments, homogeneity of identities and interests (B&P)

structure is contingent on predictability of resources and posits that efforts to restore, protect, or conserve the resource are legitimate and beneficial to the participants (Ostrom, 1999; Poteete & Welch, 2004). Confidence in the ability to restore the resource is supplemented by stakeholder knowledge, and is a factor in determining the extent of participation (Ostrom, 1999). Lastly, collective action, the process of working together to achieve common goals (Cox, et al., 2010; Ishihara & Pascual, 2013; Ostrom, 2004), is necessary to accomplish group objectives to facilitate desirable resource change. Summarily, social capital is the driving mechanism of collective action to manage a resource in a predictable manner (Ishihara & Pascual, 2013; Wagner et al., 2006).

Governance and social networks

Collaborative governance arrangements success and sustainability partially are dependent on the fundamental development of its social network (Crona, Ernstson, Prell, Reed, & Hubacek, 2011; Lauber, Stedman, Decker, Knuth & Simon, 2011). In this context, a social network is the amalgamation of relationships between individual stakeholders and organizations who are interested in collaborating on conservation issues of interest (Carlsson & Sandstrom, 2007; Lauber, et al., 2011; Yaffee & Wondonlleck, 2000). The final objective here is to establish what social connections contributed to the development and success of the KQDC, and the roles that different stakeholders held within the governing structure.

Study Rationale

It is not uncommon in the U.S. for one governing entity to have jurisdictional responsibility for animal populations while another has responsibility for land management, and perhaps another regulates users of natural resources (Leong, et al., 2009; Simoncini, 2011). This has contributed to the development of cooperatives as an alternative form of governance throughout the world (Blinn, Jakes, & Sakai, 2007; Hull & Ashton 2008). The KQDC is one of the longest-standing land and wildlife management cooperatives in the US from which data are available. The KQDC developed management objectives which were evaluated by an independent review team. Another unique attribute of the KQDC, relative to cooperatives in the USA, is the length of time that leadership team members have been working together and the nature of the public and private involvement in natural resource management.

Currently, more than 10 years of data from deer and forest management exist from the KQDC, which has been regarded by an independent review team as sustainable due to its focus on habitat management, and successful through the reduction of white-tailed deer densities (Miller et al., 2010). *Sustainable* is defined as the processes that allow for the continued existence of the resource for future needs (Feeny, Berkes, McCay, & Acheson, 1990; Kemp et al., 2005). *Successful* is the ability of the governing structure of an institution to continue existing in a manner that produces positive outcomes from the collective action of its participating members. Discerning what contributed to the KQDC's achievement of their objectives can inform future management decisions.

OBJECTIVES

1. Document the internal history of the KQDC and interactions of the KQDC leadership team during the first decade through interviews and questionnaires.
2. Assess the governance structure of the KQDC in the context of what would classify the KQDC as a sustainable and successful arrangement, and reveal attributes to make the cooperative more effective.
3. Determine the social connections contributing to the development and success of the KQDC, and the roles stakeholders held within the governing structure.

METHODS

Interviews were conducted with ten key members identified by Dr. Susan Stout, of the U.S. Forest Service Northern Research Station, who were active in the development of the KQDC. Interviewees represented landowners (private and government), the Northern Research Station (NRS), Sand County Foundation (SCF), the Allegheny National Forest Vacation Bureau (ANF Vacation Bureau), PGC, and Pennsylvania State University Extension (PSU-E). Seven interview questions (Table 1.4) were created to discern reason for participation, the presence of social capital, and collective action among the leadership team. Telephone interviews were not timed though most did not last more than 45 minutes. A digital recorder was used during all interviews to supplement hand written notes.

After conducting the interviews, a 26 question survey was mailed to interviewees. The questionnaire focused on gaining knowledge about the shared understanding of resource group system characteristics that contributed to success of the cooperative. Of the 10 questionnaires mailed out, 7 responses were received (Appendix A). Survey questions were divided into five

Table 1.4. List of interview questions for the Kinzua Quality Deer Cooperative leadership team.

1. What were your motives that led you to participate in the creation of the KQDC and to remain involved the first 10 years?
 - 1a. What were your personal goals for the KQDC the first 10 years? (to be asked only if the responder doesn't explicitly state this in question 1).
 2. Think about all the landowners and participants, who have been involved in the KQDC throughout its existence, naming specifically the ones who come to mind, how would you describe your relationship with them prior to the creation of the KQDC? (i.e. Forest Service (National Forest and NRS), Bradford Water Shed, Forest Investment Associates, Collins Pine, RAM Forest Products, Pennsylvania Game Commission, ANF Visitor's Bureau).
 3. Please describe your role in the KQDC over time on the leadership team.
 4. During the first 10 years what have you perceived the role of the Forest Service (ANF & NRS), Bradford Water Shed, Forest Investment Associates, Collins Pine, RAM Forest Products, and Pennsylvania Game Commission, Sand County Foundation, ANF Visitor's Bureau)? (i.e. Certain partners dealing mostly with forest management via silvicultural practices, viewing them as the administrative back bone to KQDC).
 5. Tell me; what were your expectations of the various landowners when you interacted with them in the hopes of creating a cooperative agreement? Are there any specific examples that come to mind? Do you view the Forest Service as being any different in the membership arrangement? If so, how do you view the difference – that is, what is different about Forest Service?
 6. As a result, which led to the creation of the KQDC, what then were your expectations for the KQDC after it was created? (i.e. regeneration of tree species, quality deer, sustainable management etc).
 7. Can you think of times in the past 10 years where communication with other members on the leadership team has been especially effective? (i.e. face to face meetings vs. email communication; how effective members were at communicating).
-

sections: 1) physical size and boundaries 2) white-tailed deer mobility and effects on forest regeneration 3) number of people, roles, and communication 4) previous relationships with leadership team members, comprehension of KQDC goals and expertise representation, and 5) perception of land management, economics, and KQDC leadership team member's view of public perceptions of legitimacy.

A resource and group system characteristics matrix was created based on Agrawal's (2002) synthesis, and I identified presence or absence of each characteristic. Entire interview transcripts were reviewed for responses to the question to develop these matrices. Interview analysis was completed by identifying phrases that aligned with a specific group or resource system characteristic. Characteristics identified as being mentioned were marked as '+' whereas no mention of a characteristic was marked with a '-'. A dual matrix detailed leadership team members' self-perception of their roles versus other members to discern if leadership team members had expectations for roles to be filled. I developed a social network by asking leadership team members about their past associations with other members, and communication between them.

The social network diagram was created using Omnigraffle Professional to depict pre-existing social connections between members, and to determine if social capital accumulated through these connections. Connections between interviewees were based on two premises: 1) unprompted identification of a connection with another interviewee and 2) how the interviewees' defined their connection with other interviewees. In the diagram various shapes were used to represent the different stakeholders involved in the KQDC. Triangles represented government agency (state and federal), rectangles represented private landowners, rounded rectangles represented non-governmental organizations, ovals represented independent stakeholders, and

the diamond represented academia. The bold lines indicated direct recruitment; solid lines represent interaction with another stakeholder; dashed-bold line indicates moderate connection; dashed lines are weak connections. An absence of a line (or a double arrow) does not indicate that a connection did not exist, but that the interviewee did not mention the connection. Hunters were included in the social network diagram to show the connections between leadership team members and these stakeholders.

RESULTS

Social network and roles of leadership team members

Interview data

Past collective actions and ties between leadership team members contributed to initial development of the KQDC governance structure. Interview results conveyed that social capital existed among leadership team members prior to the KQDC after years of communicating and working together. The social network diagram (Figure 1.2) displays connections between leadership team members. The social network of the KQDC represents the pre-existing relationships between leadership team members and hunters. There were two instances of singular connections by ANF Vacation Bureau and SCF. ANF Vacation Bureau and SCF served integral roles in outreach and funding, respectively, as will be explained later. ANF Vacation Bureau's locality contributed to their awareness of other leadership team members; this awareness was not the case for SCF.

Sand County Foundation's non-locality and isolation in the social network was a result of unfamiliarity among leadership team members. However, entry of the SCF into the social

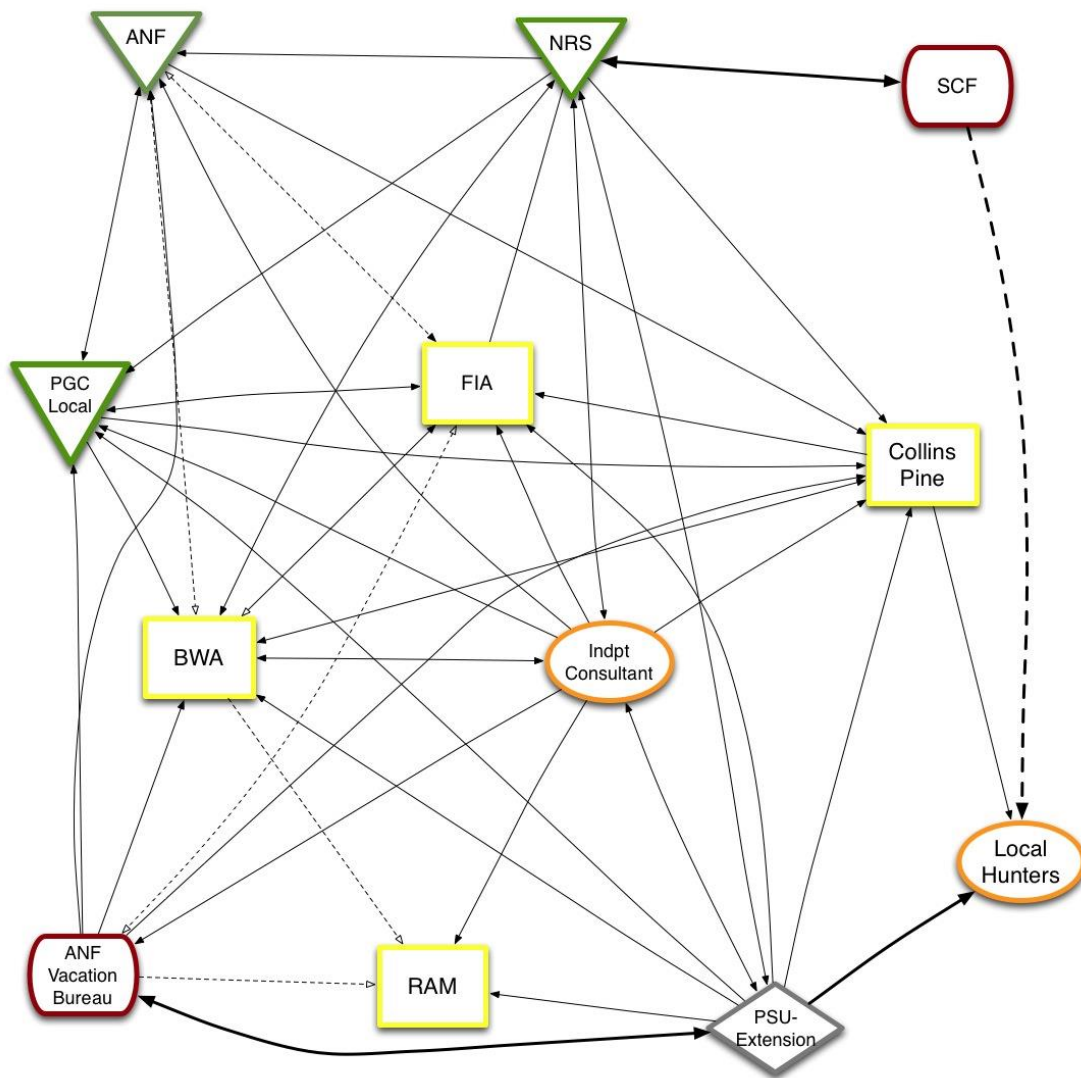


Figure 1.2. Social network diagram of the awareness of leadership team members to other members prior to the conception of the Kinzua Quality Deer Cooperative including connections to hunters based on interviews. Bold lines indicate the strongest connection through direct recruitment; solid lines represent interaction with another stakeholder; dashed lines are weak connections; dashed-bold line indicates moderate connection.

network was a result of risks they were willing to take to invest in the startup of the KQDC through the removal of monetary risk for landowners. There were multiple connections from PSU-E, and NRS to other stakeholders due to their interactions with multiple stakeholder groups. Another result of the social network is that connections between members are numerous and complimentary which led to the adoption of a governance paradigm aimed at achieving diverse ecological objectives.

Working together prior to the KQDC was reported to have contributed to expectations of the roles that would be filled by leadership team members. There was consistency between self-perceptions of roles and how others viewed that individual's role. Roles perception was consistent with survey responses of how well roles of leadership team members were understood (Table 1.5). This table does not differentiate the years when roles shifted, yet provides a view of expectations of duties between KQDC leadership team members. From interview responses, I determined that leadership team members responded to their duties on the KQDC within their range of expertise. Based on their roles, leadership team members were classified into four intermixed committees: data collection, funding, outreach, and management (Figure 1.3). The only committee that has changed since 2011 is outreach, which discontinued annual banquets, and conducted less frequent workshops, forums, and tours hosted by the leadership team.

The change in outreach activities was reported to coincide with several factors: the withdrawal of the KQDC coordinator position by PSU-E in 2006, and changes in personnel involved in the KQDC due to retirement, increased job obligations, or leaving the area. ANF Vacation Bureau, RAM Forest Products, and PGC decreased their active participation through time, and personnel changes occurred within the ANF and Collins Pines between 2006 and 2008. The result was a decrease in frequency of outreach as remaining stakeholders shifted roles

Table 1.5. Kinzua Quality Deer Cooperative leadership team members' perception of their roles compared to other members. PfDC means personnel for data collection; Mgr. means Manager; DMAPD means DMAP Distributor; Road Maint. means Road Maintenance, & L. means Landowner.

	Self-perception	Perceived by others
ANF	ANF Liaison, Event Organizer	Manager
ANF Vacation Bureau	Public Liaison, Illustrator	Public Liaison
Bradford Watershed Authority	Charisma, Funder, Mgr., Lobbyier	Landowner, Tour Guide
Collins Pine	Hunter Outreach, Supporter, Tour Guide, Public Outreach, PfDC	Landowner, Tour Guide
Independent consultant	Deer Expert, Consolidate Data	Consolidate data
FIA	Funder, PfDC	Landowner, Tour Guide
NRS	Researcher, Lobby	Researcher
PGC Local	Educator, PGC Liaison	Liaison, Supporter
PSU Extension	Coordinator, Hunter & Landowner Outreach	Coordinator, Public Outreach
RAM Forest Products	—	Landowner, Tour Guide
SCF	Secretary, Coordinator, Funder, Moderator	Funder, Director

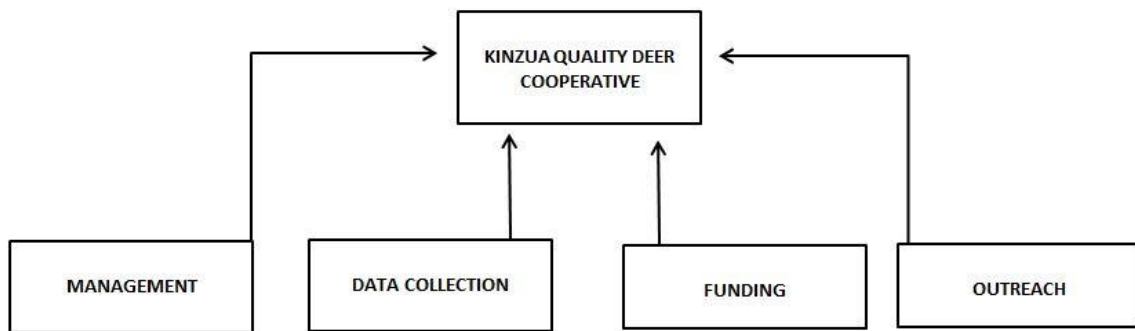


Figure 1.3. A diagram of the four committees of the Kinzua Quality Deer Cooperative.

to accommodate vacant roles, especially the KQDC coordinator position which was funded by SCF. Local hunters' participation on the leadership team also decreased through the years. The shifting of roles did not hinder achievement of management related objectives, and reinforced

Governance structure of the KQDC

Interview data

As mentioned previously, I determined through interviews that the KQDC is composed of four committees. The allocation and dissemination of funds (grants and donations) were handled by SCF. Funding enabled the KQDC to focus on data collection, land management, and outreach efforts. SCF's goal of introducing an alternative management scenario included development of the KQDC as a self-sustaining institution. Support for funding was reinforced by data collection which provided leverage when applying for grants and requesting donations. Data collection techniques, such as pellet group counts and vegetation samplings, were developed by NRS and conducted annually on 26 sites. Three hunter check stations provided data that informed decisions about management options for landowners. Assistance for data collection is carried out by Allegheny National Forest, private land employees, and volunteers for pellet group counts and vegetation samplings to assist in management decisions.

Land management remained the responsibility of respective landowners i.e. timber harvests or fence removals with the exception of applying for DMAP and designating DMAP area boundaries which were coordinated efforts. Vegetation monitoring plots on the KQDC provided evidence of regeneration that occurred with decreased deer densities. Regeneration provided outreach opportunities to invite hunters, Pennsylvania Game Commissioners, and other

stakeholders to recognize changes in ecosystem functioning on the KQDC through increased biological diversity. Through workshops or tours of the properties, stakeholders heard landowner testimonies and witnessed the difference in the forest that occurred over ten years. Additional, outreach opportunities were annual hunter banquets, forums to discuss the goals and purpose of the KQDC, creation of road signs directing people to the KQDC, and the development of a website. Outreach was organized primarily by PSU-E with the assistance of ANF Vacation Bureau. PSU-E also served as the unofficial coordinator of the KQDC for the first five years until the abdication of the position in 2006, which resulted in a short period of disorganization before the role appeared to be picked up by NRS. From interviews, I determined SCF's involvement was not meant to be permanent; the KQDC was intended to become a self-sustaining institution. Additional resource system and group system characteristics were present in the cooperative's operations and its formation. These characteristics are shared norms, homogeneity of interests and endowments, interdependence of group members, and leadership appropriateness (Table 1.6).

Collective action and predictability of the resource

Questionnaire data

Sections three and four of the questionnaire (Appendix A) focused on collective action, its relation to having a small group size, and leadership appropriateness from group system characteristics. Of the leadership team members 85% 'Somewhat Agreed' that their roles within the KQDC were clear, affirming interview responses. One hundred percent strongly agreed or somewhat agreed that there were sufficient people to allow role assignments. Furthermore

Table 1.6. Resource system and group system characteristics of the Kinzua Quality Deer Cooperative. Characteristics that were identified as being mentioned in interviews were marked as ‘+’ whereas no mention of a characteristic was marked with a ‘-’.

	Resource system characteristics					Group System Characteristics					
	Size	Clarity of Boundary	Mobility	Predictability	Storing benefits	Small group size	Clarity of Boundary	Shared Norms	Homogeneity of Interests	Appropriate leadership	Interdependence of Group Members
ANF	+	-	-	+	+	+	+	+	+	+	+
ANF Vacation Bureau	+	-	-	-	-	+	+	+	+	+	+
Bradford Watershed Authority	-	+	-	-	-	-	+	+	+	+	+
Collins Pine	+	-	-	+	+	+	+	+	+	+	+
Consultant	+	-	-	+	-	+	+	+	+	+	+
NRS	+	+	-	+	-	+	+	+	+	+	+
SCF	-	-	-	+	-	+	+	+	+	+	+
FIA	-	-	-	+	+	-	+	+	+	+	+
PGC	-	-	-	-	+	-	+	+	+	+	+
PSU-E	+	+	-	+	+	+	+	+	+	+	-

section four of the survey revealed that 100% ‘Strongly Agreed’ and ‘Somewhat Agreed’ that they shared the same views as their peers about the management of the KQDC. Although there was discrepancy among responses about the sole versus primary purpose of the KQDC, 100% of respondents agreed that they benefited from the output and outcome of the KQDC through the collective action of its participants.

Sections one, two, and five of the questionnaire addressed predictability of resources on the KQDC. Survey responses indicated 85% of leadership team members believed physical size and boundaries were not an issue for hunters, but responses were varied with regard to hunters’ familiarity with the KQDC. During interviews, leadership team members indicated that their motivations for participation in the KQDC were a result of personal recognitions of effects deer were having on regeneration of forests. This sentiment of the changes occurring in the environment due to deer densities was reflected in the questionnaire results when 85% of responses leaned towards ‘Strongly Agree’ for seeing the effects of browsing on the KQDC, and 100% reported an observable link between number of deer on the KQDC and forest regeneration.

Responses were mixed among leadership team members about whether current management on the KQDC will result in “adequate” forest regeneration. Interpretations of the dependency of landowners on non-landowners for land management are varied because two landowners responded to polar ends of the question. Half the landowners ‘Somewhat Disagreed’ or ‘Strongly Disagreed’ that conflicting wildlife and land management practices would make land management difficult. Lastly, relative to collective action, leadership team members ‘Somewhat Agreed’ (71%) that the KQDC has acquired legitimacy among hunters the past decade, but are less certain (42% ‘Somewhat Agreed’) about perceptions among the non-hunting public.

DISCUSSION

The KQDC leadership team organized to effect changes in deer populations that would subsequently affect the forested environment. Based on the governance structure relative to stakeholder participation, the KQDC has a mixed stakeholder approach (Leong et al., 2006) to deer and forest management. Success and sustainability of the KQDC are a result of shared norms for deer and forest management (Miller et al., 2010) and social connections originating from the collective actions of interdependent members to manage natural resources. Continued success and sustainability of the KQDC is dependent on redefining their goal and objectives, and sustained participation through stakeholder recruitment of qualified personnel.

Changes in job expectations and retirement have affected capacity to conduct outreach efforts. For the KQDC to be sustainable, stakeholder engagement that results in recruitment to the leadership as well as participation among hunters will be important (Gerlak & Heikkla, 2006). Remaining outreach opportunities currently operating are revisions to the KQDC website, social media, and hunter check stations. When outreach roles were vacated 5-6 years after the startup of the KQDC adjusted to the vacancies as resources permitted them. Intragroup familiarity with expectations, future directions, and an evolving governance structure (Carlsson & Sandstrom, 2007; Berkes, 2004) prevented the dissolution of the KQDC leadership team during the first ten years. However, continued changes in personnel and societal attitudes can create uncertainty among the participants in complex stakeholder arrangement like the KQDC (Bergmann & Bliss, 2004; Gerlak & Heikkla, 2006). Governing institutions form around a resource whose management is prioritized by participating members (Ostrom, 1999; Yaffee & Wondonlleck, 2000). Reduced white-tailed deer densities, and avoiding the modification of ecosystem functions due to legacy effects (Royo et al., 2010) were objectives shared by

interviewed leadership team members. Social capital contributed to development of a cooperative cast who had individual objectives but shared values for habitat management. Landowners were willing to participate because of the low monetary risk. Landowners and interested stakeholders continue to collectively manage and fund the KQDC (Stout et al., 2013), likely because working together compared to operating separately resulted in being able to achieving their objectives.

The KQDC, in its 14 years as a cooperative, has retained many of the same leadership team members. The flexibility of the intragroup governance structure permitted people to fill multiple roles and collectively to achieve the stated objectives of the KQDC. Encounters between team members on pre-KQDC projects established social connections, which enabled them to engage each other to contribute to the cooperative. Intragroup sense of community and responsibility can be fostered through meetings and programs (Wagner et al. 2006). Participation in the cooperative is voluntary and abdication is free of consequence. Gerlak & Heikkla (2006) found issues within large scale collaborative governance systems were finances, maintaining leadership, management slow to act, and changing governmental administration (i.e. PGC). Future sustainability and success likely will be determined by leadership team member's ability to maintain appropriately involved participation in leadership who are interested in executing timely management actions plus continued ability to use the PGC's DMAP program. Recruitment to the leadership of new personnel is thus crucial for continued success. The KQDC has been a self-sustaining institution as landowners benefitted from their collective efforts, and hunters obtained additional hunting opportunities. Previous research in Pennsylvania suggest hunters neither recognize the connections between deer densities and forest regeneration (Diefenbach, Palmer, & Shope, 1997; Enck & Brown, 2001; Stedman, Bhandari, Luloff,

Diefenbach & Finley, 2008; Ward, Stedman, Luloff, Shortle, & Finley, 2008) nor are hunters satisfied with reduced deer densities (Miller & Graefe, 2001; Luloff et al., 2006). Forest regeneration in some areas of the KQDC coincide with decreased deer densities, which only can be maintained by hunters who harvest appropriate amounts of antlerless deer (Brown, Decker, Riley, Enck, Lauber, Curtis, & Mattfeld, 2000; Nelson, 2014; Stedman et al., 2008; Ward, et al., 2008). Hunter participation in antlerless deer hunting, deer densities, and forest regeneration likely will constitute the most significant future challenge for KQDC governance. However, decreased numbers of hunters are harvesting sufficient numbers of antlerless deer in some areas of the KQDC (deCalesta, 2011; Nelson, 2014).

The reason for this observed decrease in numbers of hunters during recent years is speculated to be either decreased availability of permits or deer densities perceived too low. Perceived constraints, similar to the aforementioned, to hunting affect a hunter's ability to participate in hunting (Backman & Wright, 1993; Barro & Manfredo, 1996; Wright, Rodgers, & Backman, 2001). Assessing what motivates hunters to sustain participation in hunting on the KQDC despite lower densities will follow up Luloff's et al., (2006) study. In addition to assessing motivation, research (Chapters 2 and 3) seeks to provide insight into what constraints hunters perceive, and how their satisfaction affects the likelihood of future participation in hunting in low deer densities. Traditional hunters were identified as most likely continue hunting the KQDC (Luloff et al., 2006). Insight into the type of hunters hunting the KQDC will help the leadership team sustain its desired management outcomes for the ecosystem. The KQDC leadership team is equipped with a dynamic and diverse group of stakeholders willing to continue collaborating to maintain their diverse objectives. As such, the KQDC serves as a valuable case study of natural resource management, in forested ecosystems.

CHAPTER 2

CHARACTERISTICS OF ANTLERLESS DEER HUNTERS ON THE KINZUA QUALITY DEER COOPERATIVE

INTRODUCTION

Since 2001, participation in hunting has decreased in Pennsylvania by approximately 23% whereas participation nationally reportedly increased by approximately 5% (USFWS, 2012). To understand dynamics relevant to white-tailed deer management among Pennsylvania hunters, numerous studies have been conducted to: determine the effects of harvest success on satisfaction (Miller & Grafe, 2001), understand specific hunter field behavior (Diefenbach, Finley, Luloff, Stedman, Swope, Zinn, & San Julian, 2005), assess how hunter behavior relates to hunter characteristics (Stedman, Diefenbach, Swope, Finley, Luloff, Zinn, San Julian, & Wang, 2004), and, ascertain effects of hunting regulations on hunter safety (Conlin, Dickert-Conlin, & Pepper, 2009). Other studies have researched hunters' motivations to hunt antlerless deer (Bhandari, Stedman, Luloff, Finley, Diefenbach, 2006; Decker & Connelly, 1989; Diefenbach, Palmer, & Shope, 1997) and hunters' knowledge of ecological impacts related to white-tailed deer (Bhandari et al., 2006; Diefenbach et al., 1997).

Knowledge about hunter participation as it relates to forest management is important because white-tailed deer (*Odocoileus virginianus*) are believed to function as a keystone species, and one contributing factor which influences forest composition and function (Alverson, Waller, & Solheim, 1988; Horsley, Stout, & deCalesta, 2003; Marquis, 1981; McShea & Rappole, 1992; Royo, Stout, deCalesta, & Pierson, 2003; Tilghman, 1989). In northwestern Pennsylvania, herbivory by deer is reported to cause a shift in composition of understories reduction of species diversity through removal of favored species or creates fern yards (Anacker

& Kirchsbaum, 2006; Horsley et al. 2003). Enclosure studies (Marquis, 1981) and findings of the reduction in species diversity on the Allegheny plateau (Anacker & Kirchsbaum, 2006; Horsley et al., 2003; McGuinness & deCalesta, 1996; Nuttle, Yerger, Stoleson, & Ristau, 2011) reveal the extent to which deer herbivory affect regeneration, other wildlife, and habitats.

The KQDC

The Kinzua Quality Deer Cooperative (KQDC), located in northwestern Pennsylvania, is comprised of public (federal and municipal) and private landowners engaged in a mutualistic relationship aimed at sustaining sufficient harvest of antlerless deer to achieve ecosystem objectives (see Chapter 1; deCalesta, 2011; Reitz, Hille, & Stout, 2004; Royo et al., 2010; Stout, Royo, deCalesta, McAleese, & Finley, 2013). Federal land comprises 66% of the KQDC with the remaining managed by municipal and private land owners. Management is dependent on hunter participation to achieve ecosystem objectives through the Deer Management Assistance Program (DMAP) program, which provides antlerless deer permits to landowners (Kochel, 2009; Reitz et al., 2004). Landowners participating in the KQDC estimated an average of 5-6 deer/km² was necessary to attain biologically diverse habitat with economically viable forest regeneration (Nelson, 2014). White-tailed deer hunting coupled with habitat management, facilitated achievement of ecological objectives (Nelson, 2014; Miller, Madsen, Jacobson, & Snyder, 2010). However, it is less certain how hunter participation will be sustained in conditions of low deer densities.

The rationale for using the KQDC for this project is the availability of 12 years of data from deer and forest management (Nelson, 2014), the public-private governance structure (deCalesta, 2012; Stout et al., 2013), and previous research conducted about hunters who hunted

the KQDC (Luloff, Finley, Stedman, Matarrita, & Pierson, 2006; Ward, Stedman, Luloff, Shortle, & Finley, 2008). Luloff, et al. (2006) identified a dichotomous typology of hunters. Traditional hunters (57%) who would hunt the KQDC regardless of DMAP availability were identified as being more likely to continue hunting the KQDC compared to DMAP hunters (43%) who would hunt the KQDC only because of additional opportunities. These latter hunters were predicted to be more likely to stop hunting antlerless deer once deer densities decreased (Luloff et al., 2006). Since the 2004 survey, deer densities have decreased from 11 deer/km² to 5 deer/km² in line with KQDC objectives. A new challenge for KQDC managers is maintaining deer densities at levels needed to sustain desired conditions of forested ecosystems (Kochel, 2009) while simultaneously continuing to garner hunter participation in periods of low deer densities. Perceived decreases in deer densities may decrease hunting participation if hunting is viewed as not worth the effort (Bhandari et al., 2006; Van deelen & Etter, 2003).

Motivations, Satisfaction, Constraints, & Participation

Hunters' interest in hunting is fostered by personal motivations to hunt before they participate in the activity (Messmer & Enck, 2012). Benson & Decker (2001) theorized motivations vary with individual circumstances and situational specifics. Although a hunter can have more than one motivation for hunting, most tend to align with a single primary motivation (Decker & Connelly, 1989). Decker & Connelly (1989) identified three types of motivations among antlerless deer hunters in New York: achievement (performance, goal-oriented), affiliative (social), and appreciative (belonging). Antlerless deer hunters in that study varied significantly in their demographic characteristics depending on their primary motivation for hunting. For example, older hunters were more likely express an appreciative-oriented motivation (Decker & Connelly,

1989). Other studies reported that hunters were least likely to orient with achievement motivations (Stedman, Bhandari, Luloff, Diefenbach, & Finley, 2008; Grilliot & Armstrong, 2005; Harper, Shaw, Fly, & Beaver, 2012; Decker & Connelly, 1989; Ward et al., 2008) and that affiliative and appreciative motivations were related to antlerless deer harvest (Decker & Connelly, 1989).

Deer harvest has been determined to affect higher levels of hunter satisfaction (Decker & Connelly, 1989; Heberlein, 2002; Shrestha, Burns, Pierskalla, & Selin, 2012), the outcome of hunters' expectations and their hunting experience (Messmer & Enck, 2012). The act of seeing game creates perceptions of abundant populations, which, in some cases, can be more important to hunters' satisfaction than actual harvest (Gigliotti, 2000; Heberlein, 2002; Frey, Conover, Borgo, & Messmer, 2003; Hendee, 1974; Miller & Graefe, 2001). Hunters typically determine the size of the deer herd based on how many they see (Miller & Graefe, 2001; Woods, Guynn, Hammitt & Patterson, 1996). However, there are constraints that can limit or impede the satisfaction derived from hunting or directly affect future behavioral intentions.

Situational (within the control of an agency) or personal constraints (Miller & Vaske, 2003) interfere with a hunters' ability or willingness to participate in hunting as an activity (Barro & Manfredo, 1996; Wright, Rodgers & Backman, 2001). KQDC hunters previously have identified fewer deer, complicated regulations, and access issues as reasons for not hunting on the KQDC in the future (Luloff et al., 2006). In another study former hunters (used to hunt but stopped) perceived personal constraints, such as time costs, which significantly affected their willingness to hunt (Backman & Wright, 1993). In a statewide survey by Pennsylvania Game Commission (2012), constraints identified by hunters as affecting intentions for future hunting were time available to hunt, place to hunt, personal health, hunting expenses and hunting

partners. These variables differed slightly from results of a Responsive Management (2004) survey of Pennsylvania hunters which identified the leading constraints as perceived lack of game, perceived lack of places to hunt, crowding, aging, and work obligations.

PROBLEM STATEMENT

Deer are believed to function as keystone species capable of producing ecosystem change across large scales (Alverson et al., 1988; Diefenbach et al., 1997; Horsley et al., 2003; McShea & Rappole, 1992; Nuttle et al., 2011). The collective effects of increased deer densities causes decreases in desired goods and services such as wildlife diversity, vegetation regeneration and recreational opportunities (Alverson et al., 1988; Campa, Riley, Winterstein, Hiller, Lischka, & Burroughs, 2011; Marquis, 1981; McGuinness & deCalesta, 1996; Reitz et al., 2004; Royo et al., 2011; Tilgman, 1989), and affect the ability of managers to achieve their objectives. Hunting that result in antlerless deer harvests are one of the primary mechanisms used to control deer population throughout their range (Brown et al., 2000; Witmer & deCalesta, 1992). Population control of white-tailed deer is needed to achieve desired ecosystem goods and services (Brown, Decker, Riley, Enck, Lauber, Curtis & Mattfeld, 2002), and requires the sustained participation of willing hunters to effect desirable change through antlerless deer harvests (Van Deelan & Etter, 2003)..

The KQDC was established to achieve ecosystem-oriented goals with antlerless deer hunting as a primary management tool. Sustained participation of hunters across a large enough scale to achieve desired ecosystem objectives may also affect the willingness of hunters to be the agents to effect change (Holsman, 2000; Van Deelan & Etter, 2003; Riley, Decker, Enck, Curtis, Lauber & Brown, 2003). Disconnect often persists broadly between hunters' expectations for

their hunting experiences and land managers objectives (Christoffel & Craven, 2000; Messmer, Dixon, Shields, Barras, & Schroeder, 1998; Woolf & Rosenberry, 1998). Factors affecting hunter participation in situations of low deer densities such as the KQDC is not well known. Currently, the KQDC has achieved their objective of reducing deer densities to 5-6 deer/km². My study focuses on DMAP hunters who previously were predicted to cease hunting in the KQDC due to low deer densities (Luloff et al., 2006). Determining the characteristics of KQDC antlerless deer hunters will provide KQDC landowners with knowledge, and insights to inform management or outreach opportunities aimed at maintaining hunter participation and deer harvest needed to attain ecosystem objectives.

OBJECTIVES

- 1) Summarize characteristics of antlerless deer hunters on the KQDC who hunt or have hunted during times of relatively low deer densities.
- 2) Assess primary motivations and primary perceived constraints to hunting in the KQDC among antlerless deer hunters during times of relatively low deer densities.
- 3) Determine hunter satisfaction with hunting experiences on the KQDC, and the likelihood of future participation in antlerless deer hunting on the KQDC in low deer densities.

STUDY AREA

The KQDC is located in the Allegheny Plateau region of the U.S.A. Pre-settlement forests were composed of species such as white pine (*Pinus strobus*), hemlock (*Tsuga canadensis*), oaks, and American chestnut (*Castanea dentata*) in the over story (Redding, 1995). After clearcuts in the

early 20th century, regenerated forest over stories in the 1960s supported black cherry, white ash (*Fraxinus americana*), and yellow poplar (*Liriodendron tulipifera*, Redding, 1995). Predators in the region are black bear (*Ursus americana*) and coyotes (*Canis latrans*), and the largest herbivore is white-tailed deer. Elevations in the area range from 1500-2500 feet with a cooler climate (Redding, 1995) and soils are primarily podzols. Oil and gas wells are abundant on the KQDC, and contribute to an intricate network of mapped and unmapped roads with various levels of maintenance. The KQDC is 73,250 acres of land collaboratively managed by the Allegheny National Forest (ANF), Bradford Watershed Authority, and three private landowners: Collins Pine (CP)/Kane Hardwoods, Forestry Investment Associates (FIA), and RAM Forest Products (RAM). The ANF manages 66% and the private landowners own 34% of the land.

METHODS

To develop surveys (IRB # x12-1056e; i042187), interviews of hunters who purchased a DMAP for the KQDC in 2012 were conducted in November 2013. A copy of the interview questions, and consent form can be found in Appendix B. The pool of potential respondents for the questionnaire was made up of three groups of hunters: ‘Past’ hunters who purchased DMAP in 2007 or 2008; ‘Recent’ hunters who purchased in 2011 or 2012; and ‘Continuous’ hunters, an exclusive group, of hunters who purchased DMAP in 2007 or 2008, and 2011 or 2012. A random sample generated on Excel was created to choose one hunter from each household. Surveys were sent out during spring 2014 guided by the Dillman (2000) survey method (Appendix B). Surveys were entered and analyzed using Stata 13.1 SE.

Hunters were asked questions about how many years they've hunted, where they had hunted on the KQDC, if they had hunted on the KQDC or elsewhere in 2013, if they had harvested deer, and whether they had a camp on the KQDC in addition to demographical questions. Motivation based questions were developed from interviews and the hunting motivation literature (Bhandari et al., 2006; Decker & Connelly, 1989; Luloff et al., 2006; Responsive Management, 2004). Constraint-based questions were developed from interviews and hunting constraints literature (Backman & Wright, 1993; Barro & Manfredo, 1996; Luloff et al., 2006; Responsive Management, 2004). Questions pertaining to motivations and constraints were created on a 5 point-likert scale ranging from 'Completely Disagree (-2)' to 'Completely Agree (+2)', and an option for 'No Opinion'. The scale for satisfaction with hunting experience ranged from 'Not at all satisfied (1)' to 'Extremely satisfied (5)', and an option for 'Have not hunted the KQDC.' The scale for likelihood of future participation ranged from 'Not likely at all (1)' to 'Extremely likely (5)'. Prior to the factor analysis, I removed some parameters that in hindsight could be perceived as politically biased, double-barreled, or were subjective in nature. These variables were related to trophy hunting, timber harvesting, oil and gas development, clear cuts, predators, violating game laws, and difficult terrain.

Averages and percentages were calculated for every variable. To depict respondent's primary motivations and constraints, I used principle-axis factoring with oblique rotation for its ability to allow correlations between variables (Costello & Osborne, 2005; Johnson & Wichern, 1982). Principle-axis factoring reduces the amount of variables used to measure these concepts but explains the most variance. Only variables with a loading of .4 or greater, and eigenvalues greater than 1 (Costello & Osborne, 2005) were retained in the analysis. Cronbach's alpha reliability was used to calculate scale reliability of .7 or greater for factors. Averaged composite

scores were calculated for each factor to determine hunter's primary motivations and constraints if they scored 1 or higher for a factor. Additionally, bivariate multinomial logistic regression was used to compare past, recent, and continuous hunters to ascertain the probability of differences in responses between hunter groups using relative risk ratio. Multinomial logistic regression uses categorical dependent variables to estimate the probabilities of possible outcomes between the categories for each independent variable.

RESULTS

Of 1,008 potential respondents identified to receive a survey, 36 were identified by the National Change of Address as bad addresses, and 58 were non-deliverable due to incorrectly written addresses, deceased intended respondents, or delivery was not possible. Two surveys were dropped from the sample due to respondents reporting having been less than 18 years old. A total of 489 of 912 possible respondents returned their surveys for a response rate of approximately 54%. Antlerless deer hunters ranged in age from 18 to 86 years (Figure 2.1). Nearly 97% of respondents were male (Table 2.1). Average reported age of KQDC hunters was 56 standard years with an average of 40 standard years of hunting experience. The majority of respondents had either a high school diploma or GED (38%) or a 2/4 year degree (30%). Additionally, 29% of antlerless deer hunters' reported their household income was \$50,000-\$74,999. Of KQDC respondents, 55% reported hunting primarily on private lands; 29% reported they hunt mostly on public lands.

Approximately 71% of hunters live within a 2 hour drive of the KQDC, and 65% did not own, belong to, or use a camp. During the 2013 hunting season 65% of hunters indicated that

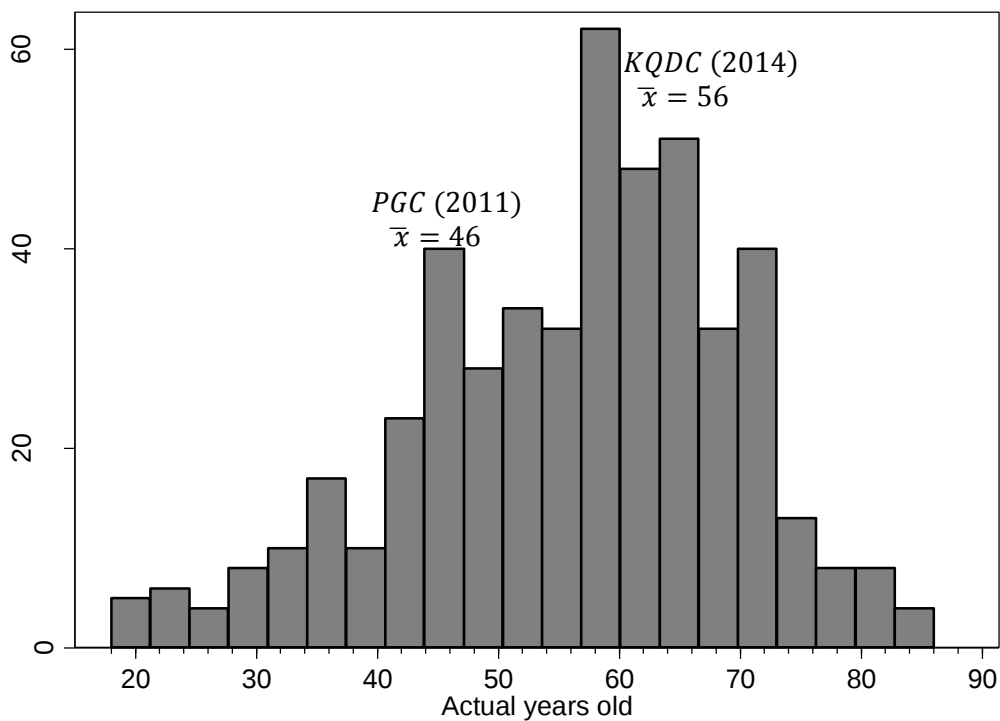


Figure 2.1. The age distribution of Kinzua Quality Deer Cooperative (KQDC) antlerless deer hunters which ranges from 18 to 86 years old in 2014. The average age of KQDC hunters is 56 years compared to 46 years old from the most recent Pennsylvania Game Commission (2011) survey.

Table 2.1. Descriptive statistics of Kinzua Quality Deer Cooperative antlerless deer hunters with variables included in analysis as determined through responses (N=489) a mail-back questionnaire, 2014. Range for 5-Likert scale is -2 to 2.

Explanatory Variables			
Descriptive	Gender	Male	97%; n=473
		Female	3%; n=13
	Age		56; n=483
	Education	Some high school	3%; n=13
		High school diploma or GED	38%; n=184
		Some college	18%; n=89
		2 or 4 year degree	30%; n=145
		Graduate degree	11%; n=53
	Income	Less than \$25,000	7%; n=32
		\$25-49,999	25%; n=109
		\$50-\$74,999	29%; n=130
		\$75-99,999	16%; n=70
		\$100-149,999	15%; n=66
		\$150-199,999	6%; n=25
		\$200,000 or more	3%; n=13
	Residence	Less than 2 hour drive	71%; n=341
		2-4 hour drive	12%; n=56
		4+ hour drive	6%; n=28
		Out of state	12%; n=58
Background	Years hunting		40; n=483
	Years hunting on KQDC		16; n=478
	Years previously hunted on KQDC		8; n=149
	Hunt KQDC 2013	Yes	65%; n=315
		No	35%; n=168
	Hunt elsewhere 2013	Yes	84%; n=394
		No	16%; n=73
	Preferred hunting land	Private	55%; n=234
		Public	29%; n=125
		Both	16%; n=66
	Harvest Antlered		9%; n=26
	Harvest Antlerless		21%; n=65
	Camping status	Own camp	16%; n=79
		Belong camp	9%; n=41
		Use camp	11%; n=54
		None of the above	65%; n=312
Motivations	Control the deer population size		.06; n=474
	Experience challenges of hunting		1.54; n=478
	Experience excitements of hunting		1.71; n=482
	Help control deer population		-.008; n=454

Table 2.1 (cont'd)

	See a lot of deer sign (tracks, scrapes, rubs)	-.43; n=461
	I see a lot of deer on the KQDC	-.92; n=465
	Get into deep woods away from other hunters	.5; n=462
	Test my outdoor skills	.92; n=469
	Pursue physical exercise	.99; n=472
	Enjoy nature and the outdoors	1.86; n=483
	Harvest enough deer to keep me interested	-.37; n=459
	Uncrowded conditions on the KQDC	.53; n=446
	Help protect the forested ecosystem	-.39; n=459
	Familiar with the landscape of the KQDC	.98; n=462
	Have always hunted for deer on the KQDC	.08; n=455
	My friends or family hunt on the KQDC	.57; n=462
Constraints	Too disabled or ill to hunt	-1.29; n=414
	Too old to hunt	-1.26; n=430
	Not interested in hunting deer	-1.51; n=440
	Not enough DMAP permits	-.9; n=423
	Not enough shots at deer	.35; n=436
	Don't know where to go to hunt	-.81; n=436
	Not enough information about hunting	-.69; n=439
	Don't kill enough deer to make it worthwhile	.03; n=434
	Not enough deer	.68; n=441
	Satisfaction	2.75; n=464
Dependent variable		
	Willingness to Participate	3.69; n=488

they had hunted on the KQDC, and 84% reported they had hunted somewhere other than the KQDC in 2013. Only 26% of antlerless deer hunters harvested at least one deer on the KQDC. Of hunters who killed a deer, however, 9% harvested an antlered deer, and 21% harvested at least one antlerless deer. Hunter's satisfaction with hunting on the KQDC averaged 2.8 on a 5-likert scale ranging from 'Not at all satisfied' to 'Extremely satisfied'. Hunter's willingness to participate in hunting on the KQDC in the future averaged 3.69 on a 5-likert scale ranging from 'Not at all likely' to 'Extremely likely'. Appendix C details the percentages of all hunter responses on the survey including percentages by when they purchased their permits.

Three motivation factors with eigenvalues >1 (Table 2.2) were identified as achievement, appreciative and cooperative. An extended table of loadings for motivations can be found in Appendix D. Variables were included if the loadings were .4 or greater. Of the variables, I intended to measure only 16 variables met the loading criteria. No hunters reported being solely motivated to hunt on the KQDC to manage deer as a primary motivation. Instead, 47% of hunters reported being achievement as a primary motivation. Only 3% of hunters were classified as having appreciative motivations. Nearly 35% of hunters had two primary motivations, which were achievement and appreciative (Appendix E). In the second exploratory factor analysis of constraints, four factors were identified (Table 2.3). These constraints were identified as personal, opportunity, no knowledge, and monetary. An extended table of loadings for these constraints can be found in Appendix D. Approximately 51% of antlerless deer hunters did not perceive any primary constraints to hunting on the KQDC in low deer densities. More than a quarter (28%) of hunters perceived opportunistic constraints to hunting on the KQDC in low deer densities. Hunters whose primary constraints were monetarily-based were 9% of the sample.

Table 2.2. Exploratory factor analysis of motivations of antlerless deer hunters of the Kinzua Quality Deer Cooperative with factor loadings and approximate percentage for primary motivations (n=381)

Factor	Loadings
Cooperative (0%)	
Control the deer population size	0.64
Help control deer population	0.8
See a lot of deer sign (tracks, scrapes, rubs)	0.78
Uncrowded conditions on the KQDC	0.51
Get into deep woods away from other hunters	0.49
Harvest enough deer to keep me interested	0.65
I see a lot of deer on the KQDC	0.81
Help protect the forested ecosystem	0.77
Eigenvalue=4.36; Variance explained=56.57%; Cronbach's alpha=.87	
Appreciative (6%)	
Familiar with the landscape of the KQDC	0.63
Have always hunted for deer on the KQDC	0.78
My friends or family hunt on the KQDC	0.69
Eigenvalue=1.49; Variance explained=21.33%; Cronbach's alpha=.76	
Achievement (42%)	
Experience challenges of hunting	0.78
Test my outdoor skills	0.55
Pursue physical exercise	0.45
Enjoy nature and the outdoors	0.49
Experience the excitements of hunting	0.64
Eigenvalue=1.49; Variance explained=31.44%; Cronbach's alpha=.69	

Table 2.3. Exploratory factor analysis of constraints of antlerless deer hunters of the Kinzua Quality Deer Cooperative with factor loadings and approximate percentage for primary constraints (n=369).

Factor	Loadings
No Opportunities (34%)	
I don't get enough shots at deer on the KQDC	.88
I don't kill enough deer on the KQDC to make it worthwhile	.85
There are not enough deer on the KQDC	.88
Eigenvalue=2.44; Variance explained=45.89%; Cronbach's alpha =.84	
Personal (.2%)	
I am disabled or too ill to hunt now	.87
I am getting to old to hunt anymore	.92
I am no longer interested in hunting deer	.71
Eigenvalue=1.55; Variance explained=40.57%; Cronbach's alpha=.79	
Lack Knowledge (2%)	
I do not know where to go to hunt on the KQDC	.88
I don't have enough information about hunting on the KQDC	.87
Not enough DMAP permits on the KQDC	.63
Eigenvalue=1.01; Variance explained=41.52%; Cronbach's alpha=.74	

Although a portion of the sample perceived more than two constraints simultaneously albeit 5% perceived monetary and opportunistic constraints (Appendix E).

Multinomial logistic regression

The condensed bivariate multinomial logistic regression (Table 2.4) indicates that ‘Continuous’ hunters differed from ‘Past’ and ‘Recent’ hunters in their responses. The probability of ‘Past’ hunters indicating they had hunted on the KQDC in 2013 was .29 times less likely than ‘Recent’ hunters. ‘Continuous’ hunters were 2.54 times more likely to indicate they hunted somewhere other than the KQDC. ‘Continuous’ hunters were also 2.63 times more likely to have a higher factor score for achievement oriented motivation than ‘Past’ hunters. ‘Continuous’ hunters were also less likely than either ‘Past,’ or ‘Recent’ hunters to perceive constraints to hunting on the KQDC. ‘Continuous’ hunters were also more likely than ‘Past’ or ‘Recent’ hunters to indicate that they did not have a camp on the KQDC. There were no difference detected in responses between when hunter’s purchased a DMAP and how satisfied they were with their hunting experience on the KQDC. There was a difference, however, in future participation. ‘Past’ hunters were least likely to indicate they would participate in the future compared to ‘Recent’ or ‘Continuous’ hunters. ‘Recent’ hunters were 1.35 times more likely to agree that they would hunt in the future, and ‘Continuous’ hunters were 2.05 times more likely to agree.

DISCUSSION

Interest in hunting on the KQDC, and area with relatively low deer densities, has decreased since the 2004. The antlerless deer hunters who participated in my study do not consider themselves

Table 2.4. Condensed bivariate multinomial logistic regression (relative risk ratio) of time periods regressed on motivations, constraints, hunting related characteristics, and demographics for hunters of the KQDC to ascertain probability of differences between when hunters purchased additional antlerless permits.

Variables	Past	Recent	Continuous
Years hunting		1.005(.011)	1.011(0.14)
	.994(.011)		1.006(.011)
Hunt KQDC 2013		.351(.119)***	.123(.058)***
	2.848(.968)***		.351(.148)**
Hunt elsewhere 2013		1.372(.734)	2.543(1.440)*
	.728(.389)		1.852(.747)
Cooperative		.975(.168)	.956(.192)
	1.025(.177)		.980(.159)
Achievement		1.225(.257)	2.631(.649)***
	.748(.144)		1.970(.403)
Appreciative		.854(.186)	.919(.233)
	1.170(.255)		1.076(.214)
No opportunity		.850(.162)	.685(.150)*
	1.175(.223)		.806(.141)
Lack knowledge		.851(.163)	.421(.108)***
	1.175(.225)		.495(.109)***
Personal		.912(.183)	.966(.224)
	1.095(.220)		1.058(.202)
No camp		1.100(.380)	.385(.152)**
	.908(.314)		.350(.112)***
Education		.726(.115)**	.851(.155)
	1.375(.218)		1.170(.173)
Income		1.020(.113)	.969(.126)
	.979(.109)		.949(.100)
Satisfaction		1.104(.154)	1.317(.217)
	.905(.126)		1.192(.160)
Future Participation		1.353(.173)**	2.054(.369)***
	.738(.094)**		1.517(.239)***

N=245; ***p<.01, **p<.05, *p<.1; Standard errors in parentheses

“managers.” Instead, many hunters have an achievement-oriented motivation. From this data, it’s important to understand that the antlerless deer hunters remaining active in the KQDC likely are the “traditional hunters” (Luloff et al. 2006). It seems that traditional hunters are pursuing antlerless deer hunting as additional hunting opportunities similar to a hunter who would only be interested in DMAP. KQDC antlerless deer hunters are on average 10 years older, with 10 years more experience, than the average Pennsylvania deer hunter (PGC, 2012). Many of these KQDC hunters are old enough to have witnessed changes in land management, forest composition, and deer densities over the past 40 years. Furthermore, more than half of KQDC antlerless deer hunters do not perceive any primary constraints to hunting on the KQDC although “continuous hunters” were least likely to perceive any constraints to hunting on the KQDC. It appears that many of the KQDC hunters have a strong tie to the place – many have permanent camps there – and are likely to remain although they report being only moderately satisfied with their hunting experience.

Hunters repeatedly report not identifying with serving as management tools or ecosystem stewards (Holsman, 2000; Ward et al., 2008; Bhandari et al. 2006; Brown et al., 2000; Enck & Brown, 2001). Similarly, KQDC hunters do not appear motivated by a sense of managerial obligation. Instead, they are compelled to fulfill basic desires of self and what makes them comfortable (Benson & Decker, 2001). The factors I identified differ slightly from the literature (Bhandari et al., 2006; Decker & Connelly, 1989; Grilliot & Armstrong, 2005). Approximately 42% of the KQDC hunters indicated an achievement-oriented motivation as a primary motivation. Although, hunters typically do not align with achievement as a primary motivation (Grilliot & Armstrong, 2005; Stedman et al., 2008; Harper et al., 2012; Decker & Connelly, 1989; Ward et al., 2008). Continuous hunters were most likely to score higher achievement-

oriented factor scores. There is the possibility that they are seeking a certain type of experience provided by the reduced deer densities on the KQDC. Under low deer densities common to northwest Pennsylvania, it may be that simply harvesting any deer is viewed as an achievement. Continued lack of success, or not seeing deer, can affect hunters' sense of fulfillment, and their satisfaction with their hunting experience.

The average age of KQDC antlerless hunters is 10 years older, with 10 years more hunting experience, than the average Pennsylvania hunter (PGC, 2012). The average age and hunting experience of KQDC antlerless deer hunters suggests they have an awareness of changes in trends within the deer population in their hunting areas (Woods, et al., 1996; Miller & Graefe 2001). Although aging hunters or those with more experience are more likely to hunt for reasons other than only obtaining a deer (Decker & Connelly, 1989), aging hunters are more susceptible to decreased participation in hunting (Winkler & Warnke, 2003). For example, hilly terrain characteristic of the Pennsylvania northwestern region (Stedman et al., 2004) make it difficult for older hunters to venture far into the woods.

Aging hunters may not be able to spend as much time hunting due to lifestyle changes that come with age, or interest in other activities that are not as physically demanding (Barro & Manfredo, 1996; Miller & Vaske, 2003; Stedman et al., 2004). Wickham, Mueller, Karnash, Zinn, & Vorhees (2007) found mature Pennsylvania hunters were more likely to attempt hunting alone compared to younger hunters which could lead to issues with retrieving deer that have been shot. Aging hunters are less likely to hunt in the future (Winkler & Warnke, 2003) because due their inability to venture far enough into the woods to harvest antlerless deer, and their mobility. Deer hunters, overall, do not seem to venture as far from roads as they think (Stedman et al., 2004). KQDC managers' ability to maintain ecological objectives are decreased when

hunters cannot access “safe haven” areas (Brown et al., 2000) of the KQDC either due lack of road access into areas with difficult terrain, or unfamiliarity with where to go.

Hunters are most often recruited into hunting by a family member (Stedman et al., 2008; Bhandari et al., 2006; Ryan & Shaw, 2011). In portions of Pennsylvania hunting is so embedded into the culture that the first day of firearm season schools are closed.. Hunting values that youth develop influence their motivations to hunt (Stedman et al., 2008). Zinn, Manfredo & Barro (2002) studied Pennsylvania and Colorado hunters’ wildlife value orientations and concluded that development of utilitarian orientations is preceded by participation in hunting. Hunting is a medium by which knowledge and values are imparted between its participants (Stedman et al., 2008; Ryan & Shaw, 2011; Zinn et al., 2002). In the past 40 years, the average hunting experience of a KQDC antlerless deer hunter, white-tailed deer management has been evolving from being hunter-centered to include non-hunting stakeholders in community-based opportunities (Fleegle, Rosenberry, & Wallingford, 2013; Stout et al., 2013). The aging population of the KQDC antlerless deer hunter, however, raises questions as to the sustainability of using the currently participating hunter population as a “management tool” (Winkler & Warnke, 2012) without recruitment and the imparting of knowledge.

KQDC land managers hypothesized decreases in vehicles seen on the KQDC during opening day of rifle season may be indicative of hunter’s perceiving constraints to access (Nelson, 2014). More than half of hunters surveyed, however, did not perceive any primary constraints to hunting on the KQDC. Compared to other Pennsylvania surveys where hunters perceived fewer deer, complicated regulations, time, crowding, work, and access issues as constraints (Luloff et al., 2006; Responsive Management, 2004; PGC, 2012), my survey identified lack of opportunities, personal issues, and lack of knowledge as constraints.

Continuous hunters were the least likely to perceive constraints to hunting on the KQDC. With 84% of KQDC hunters reporting they also hunted somewhere other than the KQDC, the lack of a primary constraint could be that hunters are choosing other areas as their primary hunting grounds, or they harvested the amount of deer they wanted during other seasons prior to attempting to hunt on the KQDC. As a result, they don't perceive a constraint to hunting on the KQDC although they may not have hunted during there recently. Most deer hunters are satisfied with taking two deer per season (Curtis et al. 2000). If the percentage of hunters who perceive no opportunities to hunt on the KQDC continues to increase, however, this, combined with the aging deer hunter population and increased hunting effort, may affect the ability of the landowners to continue achieving deer harvest needed to maintain ecosystem objectives. A change in access to hunting areas from public to private, or not being able to see deer could begin to negatively affect participation (Gigliotti, 2000; Heberlein, 2002; Frey et al., 2003; Miller & Graefe, 2001; Woods et al., 1996).

'Past' hunters were not as likely to agree that they would hunt on the KQDC in the future in low deer densities. Past hunters' decreased participation affirms Luloff et al.'s (2006) prediction that hunters would begin depart if densities continued to decrease. 'Recent' hunters along with 'Continuous' hunters make up the current core group of the KQDC, and although they are susceptible to not hunting on the KQDC as well. Currently, among KQDC hunters, almost 60% indicated that they are likely to hunt on the KQDC in the future, which is approximately 10% less than reported by Luloff et al.'s (2006) hunter sample, who indicated they'd hunt the KQDC in the next five years. Furthermore, continued lack of success at harvesting a deer, or not seeing deer, can affect these antlerless deer hunters' sense of fulfillment and satisfaction.

KQDC hunters I surveyed are only moderately satisfied with their hunting experiences on the KQDC which may negatively affect future participation. Antlerless deer harvests maintained deer densities between 3 deer/km² and 7 deer/km² for the past five years on the KQDC (Nelson, 2014). Sustained low deer densities on the KQDC have not altogether deterred hunters to seek opportunities elsewhere. Yet, hunter participation is instrumental to the continued achievement of objectives for ecosystem goods and services desired by KQDC landowners.

CHAPTER 3

FUTURE PARTICIPATION AMONG ANTLERLESS DEER HUNTERS ON THE KINZUA QUALITY DEER COOPERATIVE

INTRODUCTION

Hunting is considered a tradition across much of the United States, and currently is the primary control mechanism for managing hunted wildlife populations, particularly white-tailed deer (*Odocoileus virginianus*) (Brown, Decker, Riley, Enck, Lauber, Curtis, & Mattfeld, 2000; Wickham, Mueller, Karnash, Zinn, & Vorhees, 2007; Witmer & deCalesta, 1992; Zinn, 2003). Continued harvest of antlerless white-tailed deer is necessary to mitigate the effects browsing by this species has on forest regeneration and ecological diversity (Alverson, Waller, & Solheim, 1988; Anacker & Kirchsbaum, 2006; Horsley, Stout, & deCalesta, 2003; Marquis, 1981; McGuinness & deCalesta, 1996; Nuttle, Yerger, Stoleson, & Ristau, 2011; Reitz, Hille & Stout, 2004; Royo, Stout, deCalesta, & Pierson, 2003; Tilghman, 1989). However, the numbers of hunters' hunting are estimated to be decreasing annually in Pennsylvania (Curtis, Drake, Enck, Julian, & Taylor, 2005; Responsive Management, 2004; USFWS, 2012) compared to an estimated 5% increase nationwide from 2001-2011 (USFWS, 2012). As a result, the capacity to harvest is frequently less than needed for population control (Riley, Decker, Enck, Curtis, Lauber & Brown, 2003) because there is a disconnect between what hunter's, landowner's, and state natural resource manager's value relative to white-tailed deer management (Christoffel & Craven, 2000; Messmer, Dixon, Shields, Barras, & Schroeder, 1998; Woolf & Roseberry, 1998).

Multi-landowner governance scenarios face complex habitat management situations when their land management objectives are affected by white-tailed deer densities and require

hunter participation to mitigate deer browsing effects. However, Pennsylvania Game Commission sets the regulatory framework for white-tailed deer management and hunter licensing in Pennsylvania. With decreases in hunter participation, landowners and agencies abilities to achieve objectives (i.e. natural resource management, recreation) for desired ecosystem goods and services (i.e. ecological diversity, timber production) are affected. Between 2001 and 2011, licensed Pennsylvania hunter numbers are estimated to have decreased by 23% (USFWS, 2012). With the decreasing hunter base, attempts to reduce deer densities or maintain low deer densities may affect hunter willingness to hunt in the future.

The Kinzua Quality Deer Cooperative (KQDC), which started in 2001, in northwestern Pennsylvania, uses hunting as one of the primary mechanisms to influence deer populations. Hunting is one means of maintaining ecosystem objectives among multiple landowners engaged in public-private collaborations (Nelson, 2014; Reitz et al., 2004; Stout, Royo, McAleese, & Finley, 2013). Through the Deer Management Assistance Program (DMAP) offered by the PGC, which allows hunters to take additional antlerless deer beyond the standard state allotment, densities on the KQDC have decreased from an estimated average of 28 deer/mi² in 2003 to 13 deer/mi² in 2014 (Nelson, 2014). In a 2004 study of KQDC hunters, Luloff, Finley, Stedman, Matarrita, & Pierson (2006) found that 65% of those hunters would be less likely to participate in hunting on the KQDC in the future if deer densities decreased. In particular, Luloff et al. (2006) indicated that hunters interested in the KQDC solely because of its DMAP opportunities would be less likely to hunt on the KQDC in the future because of decreased harvesting opportunities and a lack of connection to the area. Since the 2004 survey, hunter participation on the KQDC has been sufficient to maintain deer densities between an averaged 12 and 15 deer/mi² (Nelson, 2014). However, there has been a visible decrease in the number of vehicles seen on opening day

of firearm season throughout the KQDC which raises questions about actual participation (Nelson, 2014; Reitz et al., 2004).

For KQDC landowners to maintain their objectives, continued antlerless deer hunter participation through the use of DMAP is believed to be imperative (Kochel, 2009). Insights into how and why antlerless deer hunter participation on the KQDC might change in the future are needed if lower deer densities are to be maintained. Conducting a study of the motivations of the antlerless deer hunters mentioned by Luloff et al. (2006) to hunt in low deer densities and the constraints hunters may perceive, may provide insight into the factors affecting KQDC antlerless deer hunters willingness to participate in the future.

The intent to hunt is influenced by a number of factors such as satisfaction derived from previous hunting experiences (Hendee, 1974; Woods, Guynn, Hammitt, & Patterson, 1996), motivations for hunting (Bhandari, Stedman, Luloff, Finley, & Diefenbach, 2006; Decker & Connelly, 1989; Messmer & Enck, 2012), and perceived constraints (Backman & Wright, 1993; Barro & Manfredo, 1996). Hunters, however, derive multiple satisfactions from their hunting experience (Hendee, 1974; Potter, Hendee, & Clark, 1973). For example, deer harvest is repeatedly correlated with higher ratings of satisfaction (Decker & Connelly, 1989; Heberlein, 2002; Shrestha, Burns, Pierskalla, & Selin, 2012). Additionally, satisfaction is derived from hunters' experiences (Heberlein, 2002; Decker & Connelly, 1989). Harvest success frequently is related to future or continued participation (Barro & Manfredo, 1996; Applegate, 1989). Non-harvest related aspects of hunting are important to hunter satisfaction as well (Hammitt, McDonald, & Patterson, 1990).

Woods et al. (1996) and Hayslette, Armstrong, & Mirarchi (2001) found that hunters who did not harvest game still rated their experience as satisfactory. Hunters' perception of abundant

populations of deer affects overall satisfaction (Gigliotti, 2000; Heberlein, 2002; Hendee, 1974; Miller & Graefe, 2001) because hunters tend to estimate the size of the deer herd based on how many they see (Woods et al., 1996; Miller & Graefe, 2001). Satisfactions derived from hunting may differ between people and vary with style of hunting (Miller & Graefe, 2001; Woods et al., 1996). Variations in satisfaction are attributed to hunters' sense of fulfillment from their experiences (Gigliotti, 2000; Woods et al., 2010).

Additionally, hunters have different motivations for participating in hunting (Decker & Connelly, 1989; Messmer & Enck 2012) which may vary with individual circumstances and situational specifics (Benson & Decker, 2001). Among antlerless deer hunters in New York, Decker & Connelly (1989) identified motivations for hunting of which most hunters tend to align with a "primary motivation". These motivations were categorized as affiliative (social), achievement (goal-oriented), and appreciative (appreciative) motivations. Older hunters are more likely to express an appreciative motivation (Stedman, Bhandari, Luloff, Diefenbach, & Finley, 2008), and hunters are generally least likely to align with achievement orientations (Stedman et al., 2008; Grilliot & Armstrong, 2005; Harper, Shaw, Fly, & Beaver, 2012; Decker & Connelly, 1989; Ward, Stedman, Luloff, Shortle, & Finley, 2008). Bhandari, et al., (2006) report meat-based motivations as being related to increased harvest of an antlerless deer.

Similar to satisfactions, hunters perceive constraints as situational (within agency control) or personal (Backman & Wright, 1993; Miller & Vaske 2003; Wright, Rodgers, & Backman, 2001). The more constraints a hunter perceives the less likely they are to participate in hunting (Barro & Manfredo, 1996). Constraints are influenced by life cycle stages, psychological state, and attributes related to the activity (Miller & Vaske, 2003). Wright et al. (2001) acknowledge, however, an absence of constraints is not always indicative of probability of participation, but

rather that constraints may mediate participation. Instead future behavioral intentions are most strongly indicative of actual participation (Ajzen & Fishbein, 1980; Fulton, Manfredo, & Lipscomb, 1996; Shrestha, et al., 2012). Backman & Wright (1993) identified seven constraint factors. These constraints were categorized as monetary costs, interest/preference, access/opportunity, physical effort, time costs, and public lands (crowded or dangerous).

Maintaining the deer population on the KQDC between 12-15 deer/mi² is dependent on hunter willingness to hunt in and harvest antlerless deer under conditions of low deer densities. My objective was to determine which factors influence antlerless deer hunters' participation in hunting under conditions of low deer densities.

METHODS

To develop surveys (IRB # x12-1056e; i042187), interviews were conducted in November 2013 of hunters who purchased a DMAP for the KQDC in 2012 (Appendix B). The pool of potential respondents for the questionnaire was made up of three groups of hunters: past hunters who purchased DMAP in 2007 or 2008; recent hunters who purchased in 2011 or 2012; and continuous hunters, an exclusive group, of hunters who purchased DMAP in 2007 or 2008, and 2011 or 2012. A random sample generated on Excel was created to choose one hunter from each household. Surveys were sent out during spring 2014 guided by the Dillman (2000) survey method (Appendix B). Surveys were entered and analyzed using Stata 13.1 SE.

Hunters were asked questions about how many years they've hunted, where they had hunted on the KQDC, if they had hunted on the KQDC or elsewhere in 2013, if they had harvested deer, and whether they had a camp on the KQDC. Demographical questions were asked to discern age, education, household income, and where they lived. Motivation-oriented

questions for the questionnaire were developed from interviews and the hunting motivation literature (Bhandari et al., 2006; Decker & Connelly, 1989; Luloff et al., 2006; Responsive Management, 2004). Constraint-oriented based questions for the questionnaire were developed from interviews and hunting constraints literature (Backman & Wright, 1993; Barro & Manfredo, 1996; Luloff et al., 2006; Responsive Management, 2004). Questions pertaining to motivations and constraints were created on a 5 point-likert scale ranging from ‘Completely Disagree (-2)’ to ‘Completely Agree (+2)’, and an option for ‘No Opinion’. The scale for satisfaction with hunting experience ranged from ‘Not at all satisfied (1)’ to ‘Extremely satisfied (5)’, and an option for ‘Have not hunted the KQDC.’ The scale for likelihood of future participation ranged from ‘Not likely at all (1)’ to ‘Extremely likely (5)’.

Prior to the factor analysis, I removed some parameters that in hindsight could be perceived as politically biased, double-barreled, or were subjective in nature. These variables were related to trophy hunting, timber harvesting, oil and gas development, clear cuts, predators, violating game laws, and difficult terrain. Averages and percentages were calculated for every variable. To depict respondent’s primary motivations and constraints, I used principle-axis factoring with oblique rotation for its ability to allow correlations between variables (Costello & Osborne, 2005; Johnson & Wichern, 1982). Principle-axis factoring reduces the amount of variables used to measure these concepts but explains the most variance. Only variables with a loading of .4 or greater, and eigenvalues greater than 1 (Costello & Osborne, 2005) were retained in the analysis. Cronbach’s alpha reliability was used to calculate scale reliability of 0.7 or greater for factors. Then primary motivations and primary constraints were determined if hunters scored a summative score +1 or higher for a factor.

Due to small cell issues, primary motivations and constraints were not used in the ordinary least squares (OLS) regression. However, the factors developed from the factor analysis were used as variables to calculate likelihood of future participation in hunting on the KQDC utilizing OLS regression. OLS regression has a few assumptions: linearity between dependent variable and independent variables, normal distribution of errors, errors have zero mean, constant variance (homoscedasticity), and errors are uncorrelated (for time series data). To ensure that these assumptions are met, I performed several additional statistical tests.

RESULTS

Sample characteristics

Of 1,008 potential respondents identified to receive a survey 36 were identified as bad addresses by the National Change of Address (NCOA), and 58 were non-deliverable due to incorrectly written addresses, deceased, or delivery was not possible. Two surveys were dropped from the sample due to the respondents being self-reported less than 18 years old. A total of 489 of 912 possible respondents returned their surveys for a response rate of 54%. Nearly 97% of respondents were male (see Chapter 2). The average age of KQDC hunters was 56 standard years with an average of 40 standard years of hunting experience. The majority of respondents had either a high school diploma or GED (38%) or a 2/4 year degree (30%). Additionally, 29% of antlerless deer hunters' household income was \$50,000-\$74,999. Of KQDC respondents 55% report primarily hunting on private lands compared to 29% on public lands. Approximately 71% of hunters live within a 2 hour drive of the KQDC, and 65% did not own, belong to, or use a camp. During the 2013 hunting season, 84% of hunters said they'd hunted somewhere other than the KQDC, and 65% of hunters indicated that they had hunted on the KQDC. Only 26% of

hunters hunting on the KQDC harvested at least one deer. Of the hunters who killed a deer, 9% harvested an antlered deer, and 21% harvested at least one antlerless deer. Most of these deer were reported taken during the firearm season.

Satisfactions, Motivations & Constraints

Hunter's satisfaction with hunting on the KQDC averaged 2.8 on a 5-likert scale ranging from 'Not at all satisfied' to 'Extremely satisfied'. Hunter's willingness to participate in hunting on the KQDC in the future averaged 3.69 on a 5-likert scale ranging from 'Not at all likely' to 'Extremely likely'. Appendix C details the percentages or averages of all antlerless deer hunter responses to the survey including percentages or averages by when they purchased their permits.

Three motivation factors with eigenvalues greater than 1 (see Chapter 2) were identified as achievement, appreciative and cooperative. An extended table of loadings for motivations can be found in Appendix D. Variables were included if the loadings were .4 or greater. Of the 23 variables I intended to measure only 12 variables met the loading criteria. No hunters reported being solely motivated to hunt on the KQDC to manage deer as a primary motivation. Instead, 47% of hunters reported being achievement-oriented as a primary motivation. Only 3% of hunters were had an appreciative-oriented motivation. Nearly 35% of hunters had two primary motivations, which were achievement and appreciative (Appendix E). In the second exploratory factor analysis of constraints, four factors were identified (see Chapter 2). These constraints were identified as personal, lack of opportunity, lack of knowledge, and monetary. An extended table of loadings for these constraints can be found in Appendix D. Approximately 51% of antlerless deer hunters did not perceive any primary constraints to hunting on the KQDC in low deer

densities. More than a quarter (28%) of hunters perceived opportunistic constraints to hunting on the KQDC in low deer densities. Hunters who reported primary monetary constraints were 9% of the sample. A portion of the sample perceived more than two constraints simultaneously such as 5% of hunters perceived monetary and opportunistic constraints (Appendix E).

Ordinary least squares regression

The resulting robust standard error regression model after adjusting for assumptions is significant $F(17, 234) = 16.96$; p -value 0.0000 (Table 3.1). The amount of variance (R-squared) explained by the model is .5521. Of the motivations, as the factor score for antlerless deer hunters with an achievement-oriented motivation increased by a unit, their rating for likelihood of future participation increased by .37 units while controlling for other variables. Personal constraints were significant in affecting future participation. KQDC antlerless deer hunters who scored higher personal constraint factor decreased in future participation by .18 units. For each unit increase in satisfaction with hunting experience on the KQDC, a hunter willingness to hunt in the future increased by .31 units when controlling for other variables. Choosing to hunt on private or public land, years of experience hunting, where a hunter lived (as a dummy variable comparing to hunters living out of state), if a hunter hunted somewhere else in 2013, education and income were not significant within this model. However, if a hunter indicated they had hunted on the KQDC during the 2013 season, their willingness to participate in the future increased by .92 units when controlling for other variables. Additionally, not having a camp on the KQDC resulted in decreased likelihood of future participation by .24 points while controlling for other factors.

Table 3.1. Ordinary least squares with robust standard error of future participation of antlerless deer hunters on the Kinzua Quality Deer Cooperative regressed on motivations, constraints, and hunting characteristics.

Variable	Robust Coefficient	Std. Error	t	P>t
Cooperative	0.125	0.089	1.40	0.162
Appreciative	0.044	0.087	0.51	0.613
Achievement	0.391	0.078	5.00	0.000
Lack of Opportunity	-0.176	0.110	-1.61	0.110
Lack Knowledge	0.094	0.094	0.99	0.321
Personal	-0.183	0.088	-2.08	0.038
Satisfaction	0.304	0.082	3.72	0.000
Hunt Public	0.146	0.135	1.09	0.279
Hunt Both	0.050	0.142	0.35	0.723
Years hunting	-0.004	0.004	-0.87	0.384
Hunt KQDC 2013 season	0.914	0.137	6.68	0.000
Hunt elsewhere 2013 season	-0.128	0.203	-0.63	0.528
Live 4+ hours away	-0.139	0.250	-0.56	0.579
Live 2-4 hours away	0.041	0.246	0.17	0.868
Live < 2 hours away	-0.126	0.207	-0.61	0.542
No camp	-0.257	0.128	-2.02	0.045
Education	0.077	0.060	1.28	0.202
Income	-0.022	0.045	-0.50	0.614
Constant	3.530	0.570	6.20	0.000

R-squared: .5501; F (18, 236)=17.84; Prob>F= 0.0000

DISCUSSION

The purpose of this study was to determine what influences hunters' future behavioral intentions to hunt antlerless deer in the future in areas with relatively low deer densities such as on the KQDC in northwestern Pennsylvania. From the data, I can discern several things. Many KQDC antlerless deer hunters do not perceive constraints to future participation although estimates for willingness of future participation have decreased since 2004 on the KQDC. Antlerless deer hunter's satisfaction with hunting experience is moderate, and affects future participation. Hunter's motivations to hunt on the KQDC are primarily due to their pursuit of a rewarding experience. However, recent hunting experience in 2013 strongly affected future participation which means there is an unaccounted for variable affecting hunter willingness to participate.

Among these antlerless deer hunters, overall willingness to hunt on the KQDC is only 60% compared to 70% of hunters from Luloff et al., (2006) sample who indicated they would hunt the KQDC in the next five years. Luloff et al., (2006) concluded that DMAP hunters would leave if deer densities decreased, and due to lack of connection to the area. Most antlerless deer hunters from 2007-2008 have not hunted on the KQDC again. These antlerless deer hunters have been replaced by local hunters who purchased DMAP in 2011 or 2012. The current sample is comprised primarily of local hunters who perceive some personal constraints to hunting the KQDC.

Luloff et al., (2006) predicted KQDC antlerless deer hunters would perceive lack of opportunities and lack of knowledge as primary constraints to hunting on the KQDC. I found personal constraints were a significant factor leading to decreased participation among KQDC antlerless deer hunters. KQDC hunters are aging, and as hunters age, it may lead to decreased interest in hunting, inability to hunt due to health, or issues with mobility (Barro & Manfredo,

1996; Miller & Vaske, 2003; Winkler & Warnke, 2003). Additional questions are necessary to clarify which variables related to personal constraints are affecting future participation among KQDC antlerless deer hunters.

Hunter's derive multiple satisfaction from their hunting experiences (Hendee, 1974; Decker & Connelly, 1989; Heberlein, 2002). KQDC hunters derive multiple satisfactions from their hunting experiences even if they don't harvest (Hendee, 1974; Hammit et al., 1990; Hayslette et al., 2001; Woods et al., 1996). KQDC hunters may be seeking a variety of different experiences from what I measured such as being able to use the KQDC, viewing deer, or interacting with other KQDC hunters (Gigliotti, 2000; Heberlein, 2002; Hendee, 1974; Miller & Graefe, 2001; Mitterling, Kramer, Frank, 2013).

The estimated decrease in hunter numbers in Pennsylvania suggests fewer hunters are taking to the field during hunting season (USFWS, 2012). Consequently, hunter willingness to hunt antlerless deer may not be sufficient to manage the deer population if hunter numbers continue to decrease (Riley et al., 2003; Winkler & Warnke, 2003). A functional response of hunters to decreased deer densities is a reduction in hunting effort due to the increase in effort needed to find deer when densities are below 6 deer/km² (Van deelen & Etter, 2003). Currently, hunter effort on the KQDC has been sufficient enough to maintain densities between 5-7 deer/km² (Nelson, 2014). The situation on the KQDC is reduced deer densities, and visibility from roads (Nelson, 2014; Reitz et al., 2004) could provide a challenging experience for some hunters. Achievement-oriented hunters may be more receptive to the type of hunting experience available on the KQDC. However, continued lack of success may affect their willingness to continue participating. If satisfaction with hunting experience decreases, and perceived

constraints become more evident, hunters may be less likely to continue hunting on the KQDC in the future.

My inability to account for the variance in hunters' stated future participation suggest something missing about why hunters are no longer hunting that may not be captured in the current data or the literature. Although, antlerless deer hunters perceived personal constraints I did not measure other personal constraints such as work, children, or participation in other activities. Hunters, who hunted during the 2013 season, were more likely to respond that they would hunt on the KQDC in the future. However, is there a point relative to the KQDC at which these hunters will not participate? Is it the total hunter's experience; other constraints I have not measured; dissatisfaction with the experience or management; or participation in other activities that are contributing to decreased willingness? Hunters that stop hunting are unlikely to hunt again in the future (Wright, et al., 2001), which means former hunters also perceive constraints to returning to the activity (Backman & Wright, 1993; Barro & Manfredo, 1996). The answers to these sorts of questions are not easily captured in surveys because of the limited ability to input the amount of questions needed to ensure meaningful response rate. Focus groups or in-depth interviews may provide an alternative (Backman & Wright, 1993; Tynon, 1997) although associated time, costs, and recall bias make this alternative less desirable (Zinn, 2003).

Limitations

Limitations of my results stem from the removal of multiple variables measuring motivations, and constraints during the exploratory factor analysis. The removal could have affected being able to measure factors affecting antlerless deer hunter participation on the KQDC. I did not measure all the possible motivations or constraints which are numerous, individual, and context

specific (Benson & Decker, 2003). Additionally, my model did not meet the homoscedasticity assumption, and was presented with robust standard errors in order to ameliorate heteroskedasticity. However, the conclusions I have deduced from the model may still be erroneous. Also, hunters, who hunted during 2009 and 2010, were not considered for the survey due to potential overlap of hunters. However, it is possible that these years could be composed of hunters with a different set of motivations and constraints.

Implications

KQDC hunters have various primary motivations for hunting on the KQDC, and they perceive multiple primary constraints. Satisfaction with past experience appears to strongly mediate hunter intentions to hunt on the KQDC in the future based on their motivation for hunting. Hunter numbers throughout much of the US are decreasing due to urbanization, aging, or interest in other activities (Wickham et al., 2007; Poudyal, Cho, & Hodges, 2008; Robison & Ridenour, 2012; Winkler & Warnke 2012). Low relative deer densities, however, can be expected to decrease the probability of sustaining harvest that will meet the objectives of ecosystem management (Van deelen & Etter, 2003). With hunters as one of the primary control mechanisms for white-tailed deer, their continued participation is necessary for managers to maintain their land management objectives. Harvest success is with a factor in hunters' satisfaction with their past hunting experience (Decker & Connelly, 1989; Heberlein et al., 2002; Shrestha et al., 2012). Future behavioral intention is a measurement of actual behavioral intention (Ajzen & Fishbein, 1980). The governing body of the KQDC may benefit from rebuilding its outreach committee to engage hunters in the cooperative to create awareness among hunters of the need for sustained deer harvests (Mitterling, Kramer, Riley & Rudolph,

2013). Management practices such as pellet group counts, or roadside counts in addition to other opportunities such as the hunter banquet may serve as a medium for connecting with deer hunters outside hunting season. Reestablishing this committee will require a collective effort on behalf of the KQDC leadership team.

CHAPTER 4

IMPLICATIONS

1. Participation in a cooperative governance arrangement requires clear goals and common understanding of a resource need that potentially necessitates management, where the benefits of management and participation are perceived to outweigh the costs. Given my assessment, the probability of sustained effectiveness of the KQDC may be improved with continual definition and communication of goals and objectives (e.g., a revised management plan), and identification of priority geographical areas for management. Based on my findings and the tenure of current leadership engagement of new leadership team members is important for sustainability of the cooperative. The outcome of defining and broadly communicating the goals and objectives for the KQDC ensures a common understanding among stakeholders, including hunters, and that even in the event of changes in leadership team members the cooperative continues to sustain deer densities required to achieve desired forest conditions.
2. Effectiveness of collective action in a governance structure is dependent on developing social capital and having roles reflective of a participant's expertise, which encourages active participation based on perceived contribution to governance effectiveness. KQDC leadership may encourage active participation of its members through identification of potential roles (or previously filled roles, such as outreach) for its leadership team members, and the contribution of those individuals to the success and sustainability of the cooperative. To increase the probability of sustained effectiveness of the cooperative,

newer leadership team members can engage in projects which can reinforce social capital, the amalgamation of norms, trustworthiness, and social networks, outside of formal meetings. Clarity and alignment of roles (duties and expectations) among leadership team members may supplement efficiency of the cooperative in accordance with stakeholder's expectations for achieving objectives.

3. Trustworthy third-party funding alleviates costs of cooperative arrangements, and encourages development of outreach, management or data collection that contribute to the sustainable nature of the arrangement. Pursuit of sustained third party funding may alleviate uncertainty associated with costs of the cooperative and designation of someone who likely will facilitate increased outreach ventures
4. The KQDC leadership team might consider expanding the KQDC by reaching out to surrounding landowners, and reconnecting with RAM Forest Products. Reaching out to additional landowners garners support for and understanding of the objectives of the KQDC. Hunters, through harvest of antlerless deer, are the primary reason for achievement of the KQDC's leadership team objectives; continual engagement of these key stakeholders will be needed to build legitimacy for the cooperative among these stakeholders. Establishing new connections with other surrounding landowners may draw in new interests, and provide information for what these landowners could do to obtain their land management objectives. Reestablishing the connection with RAM Forest Products will ensure that they are continuing to achieve their land management objectives, and are active stakeholders in the KQDC.
5. Maintaining sufficient hunter participation in antlerless deer hunting in areas with low deer densities will be a continual challenge for KQDC leadership. Increasing outreach to

hunters by encouraging hunter participation in activities such as check stations, reinstating hunter banquets, or development of additional information programs. These programs would encourage involvement in the cooperative and build an awareness among hunters of the relationship between white-tailed deer, their habitat, and may help sustain hunter participation and understanding of KQDC objectives. Engaging hunters with current information about the KQDC, and why hunters' continued participation in antlerless deer hunting is critical to ecosystem management will increase the likelihood of sustainability for the cooperative. Active engagement of hunters by KQDC leadership reinforces social capital, improves legitimacy, and demonstrates interest in hunters as stakeholders rather than tools in the KQDC. Little information exists from the KQDC area, Pennsylvania, or elsewhere that hunters view their role as a "tool of wildlife management" to achieve objectives for hunting other than their own.

6. Hunter satisfaction with their hunting experience determines their continued participation especially in areas with low deer densities. Viewing deer is an important component that affects hunter satisfaction. The KQDC leadership has in the past identified areas with excessive deer densities using pellet group and roadside data as a means to direct hunters. The KQDC may consider once again identifying these areas of the KQDC where hunters may see deer or deer signs prior to the hunting season. Additionally, they may consider a localized marketing strategy aimed at advertising the adaptive management method utilized by the KQDC, and the importance of this management method to small game management, recreational, and forest management using a website, Allegheny National Forest ranger stations, and local businesses to disseminate information.

APPENDICES

APPENDIX A: Leadership Team Questionnaire

Table A. 1. List of survey questions and responses of Kinzua Quality Deer Cooperative leadership team.

S1. Based on your experience with the Kinzua Quality Deer Cooperative over time, we are interested in knowing your opinions about the physical size and physical boundaries of the KQDC. The scale ranges from Completely agree: i to completely disagree: v.							
	i	ii	iii	iv	v	N/A	Total
The physical size of the KQDC is too large for hunters to hunt effectively.	-	1	-	-	6	-	7
The physical boundaries of the KQDC are clearly identifiable by hunters.	-	6	-	1	-	-	7
The KQDC is too large for effective management of vegetative resources.	-	-	-	-	7	-	7
It is easy for hunters to know where they are when they are on the KQDC.	-	3	1	3	-	-	7
S2. Based on your knowledge of forest regeneration and deer ecology (their interaction with land resources), we are interested in knowing your opinion of White-tailed deer impact on forest regeneration and White-tailed deer mobility on the KQDC.							
	i	ii	iii	iv	v	N/A	Total
Deer are able to use all land equally on the KQDC.	3	1	-	-	3	-	7
The current management of the KQDC will result in adequate forest regeneration.	1	3	1	2	-	-	7
The effects of browsing are easily seen on the KQDC.	5	1	-	-	1	-	7
Currently, there is an observable link between the number of deer present on the KQDC and forest regeneration.	3	4	-	-	-	-	7
S3. Based on your experience as a member of the leadership team, we are interested in knowing your perception of the number of people, roles, and communication on the leadership team.							
	i	ii	iii	iv	v	N/A	Total
The number of people on the leadership team is too large.	-	-	1	2	4	-	7
The roles of leadership team members are will (sic) understood by all team members	-	6	-	1	-	-	7
The number of members on the leadership team is sufficient to allow for efficient communication and assignment of duties.	3	4	-	-	-	-	7
There is a conflict of leadership team roles between members at times.	-	1	-	5	1	-	7

Table A.1 (cont'd)

S4. Based on your past presence on the leadership team, we are interested in understanding your previous relationships with others on the leadership team, your comprehension of the goals of the KQDC and adequacy of the expertise representation on the team.

	i	ii	iii	iv	v	N/A	Total
Members of the KQDC leadership team agree with the views I share about the management of the KQDC.	2	5	-	-	-	-	7
My past experiences with other leadership team members shaped my involvement in the KQDC today.	3	3	-	1	-	-	7
There is a disagreement among the leadership team about the future goals for the KQDC.	-	1	-	3	2	1	7
There is a common understanding that the primary purpose of the KQDC has been forest regeneration.	2	2	-	2	1	-	7
All members of the leadership team are appropriately involved according to their expertise.	2	3	-	2	-	-	7
The leadership team lacks representation in some areas that could benefit from being on the leadership team.	3	2	1	1	-	-	7
Deer management is the sole purpose for the creation of the KQDC.	2	1	2	-	2	-	7

S5. Based on your past experience and knowledge, we are interested in understanding your perception of land management practices on the KQDC, economics and legitimacy as perceived by the public.

	i	ii	iii	iv	v	N/A	Total
I am dependent on the involvement of other leadership team members for the management of my land.	1	-	-	-	1	5	7
The KQDC is an economically feasible arrangement.	3	2	1	1	-	-	7
Conflicting land management practices makes land management difficult.	-	1	-	4	1	1	7
Conflicting wildlife management practices makes land management difficult for me.	1	1	-	2	2	1	7
The KQDC has acquired a positive legitimacy over the past ten years among hunters.	1	5	2	-	-	-	7
The KQDC has acquired a positive legitimacy over the past ten years among the non-hunting public.	-	3	1	1	-	1	7
I benefit from the output and outcome of the KQDC for the cooperative	6	1	-	-	-	-	7

APPENDIX B: Hunter Questionnaire Resources

B. 1. Preliminary Interview Consent form IRB # x12-1056e; i042187

Introduction:

Good evening. My name is Zurijanne Kelley. I am conducting interviews about hunter participation and perceptions

May I speak to Mr/Mrs/Ms _____ who is at least 18 years old?

(repeat the above if the person has to come to the phone)

I'm conducting this as part of research Master's project at Michigan State University's Fisheries and Wildlife Program in East Lansing, MI. I'm working under the direction Dr. Shawn Riley of Michigan State.

I received your name through a list of persons who had applied for and received DMAP permits in 2012.

What will happen during the study?

I'm inviting you to do a telephone interview that will take about 20-30 minutes. I will ask you several questions about hunting on the Kinzua Quality Deer Cooperative in northwestern Pennsylvania, which is comprised of DMAP units 1996, 1981, and 185 and located in unit 2F, and I will take handwritten notes to record your answers as well as use an audio recorder to make sure I don't miss what you say".

Withdrawal

Participation in this research project is completely voluntary. You may choose not to answer specific questions or to stop participating at any time. You have the right to say no to any question and you may change your mind at any time and withdraw from the interview.

If you have concerns or questions about this study please contact Dr. Shawn Riley or Zurijanne Kelley at the Department of Fisheries and Wildlife, 13 Natural Resources Building, MSU, East Lansing, 48824; 517-432-4943 or email at rileysh2@msu.edu or kelleyzu@msu.edu.

4. DOCUMENTATION OF INFORMED CONSENT.

You indicate your voluntary agreement to participate by beginning this phone interview.

B. 2. Preliminary Interview questions.

I'd like to start by asking you some questions about your deer hunting experiences in general and in NW PA specifically.

1. How many years have you been hunting deer? Or, in what year did you start deer hunting?
2. Specifically, how long have you been hunting in DMAP units 1996, 1981, or 185?
3. Before this interview had you heard of those DMAP areas being referred to as the Kinzua Quality Deer Cooperative, or KQDC?
4. What would you say are the main reasons you choose to hunt deer in the KQDC. Were there any key reasons you started deer hunting there?
5. Thinking about your experience hunting deer in these DMAP units, is there anything that would keep you from deer hunting in these units, in the future?
6. Thinking of the past 3 years hunting DMAP units 1996, 1981, or 185, describe how satisfied you are you're your overall hunting experience on the KQDC
7. How has your past experience affected your plans to participate in hunting on the KQDC in the future?
8. Are you aware there is an organized leadership team for the KQDC,
 - i. How interested would you be in being involved on the leadership team?
9. Does the cooperative arrangement, in any way, affect your willingness to hunt DMAP unit 1996, 1981, or 185?
10. Is there anything else you would like to tell me about your deer hunting experiences on the KQDC?
 - a. Or anything in generally you'd like to say about the KQDC?

B. 3. Initial postcard. Postcard 4x6 including logos of all KQDC landowners except the U.S. Forest Service Allegheny National Forest.

Greeting line,

In the next few days, we will be inviting you to take part in a survey to help land and wildlife managers better understand your experiences as a deer hunter on the Kinzua Quality Deer Cooperative (KQDC) area of northwestern Pennsylvania. Your responses are important to us. They will enable us to monitor and enhance the quality of our management practices, which we hope will result in more rewarding experiences for all hunters. We asked Michigan State University, as an independent third party, to conduct the survey; they will be in touch soon.

Sincerely,

Brad Nelson
KQDC Coordinator

B. 4. The cover letter accompanying first round of surveys was printed on MSU letterhead.

rileysh2@msu.edu
517-353-9456 office
April 30, 2014

Greeting line,

You have been selected to participate in a survey based on your purchase of a deer management assistant program (DMAP) permit 2007, 2008, 2011 or 2012.

Your input is vitally important to decisions about deer hunting in northwestern Pennsylvania!

The purpose of this questionnaire is to better understand your experiences as a deer hunter on the Kinzua Quality Deer Cooperative (KQDC) area of northwestern Pennsylvania. Insights gained from this survey will enable land and wildlife managers of the KQDC to monitor and enhance the quality of their management practices with the aim of providing rewarding experiences for all hunters. Survey results will help the KQDC wildlife and land managers better understand what motivates hunters to hunt on the KQDC, and what may prevent hunters from being able to hunt on the KQDC. Michigan State University, as an independent third party, is administering the survey, which is funded by the Sand County Foundation.

Enclosed with this letter is a survey booklet and postage-paid pre-addressed return envelope. There is no cost to you, and your participation in this survey is completely voluntary. There is no compensation for completing the survey (and no penalty for not completing it), but if you choose to complete the survey you have the option to be entered into a drawing for one of 5 \$100.00 VISA gift cards. The drawing is expected take place on June 15th, 2014.

To participate, please complete the survey and return in the postage-paid return envelope.

If you wish to be entered into the drawing for a \$100 visa gift card, please fill out the contact information form on the back cover of the survey booklet. All personal information will be separated from responses and kept completely confidential. We will only use it to contact you if you are drawn as a winner. Survey results will be compiled only in summary form to protect confidentiality to the greatest extent under the law.

Your participation is greatly appreciated! If you have questions about the study please contact me, preferably by email (rileysh@msu.edu), or by phone at 517-353-9456.

Sincerely,
Shawn J. Riley, Professor
Wildlife Ecology & Management

B. 5. Consent form located inside questionnaire sent to Kinzua Quality Deer Cooperative hunters.

Understanding hunter experiences on the Kinzua Quality Deer Cooperative (KQDC)

A survey of your opinions

The purpose of this questionnaire is to better understand your experiences as a deer hunter on the Kinzua Quality Deer Cooperative (KQDC) area of northwestern Pennsylvania. The KQDC is a partnership of forest landowners, forest managers, biologists, hunters, and local businesses started in 2000. The original purpose of the KQDC was to demonstrate how hunting can be used to meet the goals of multiple publics in Pennsylvania deer management assistance programs (DMAP) units 1981, 1996, and 135. **Your opinions matter.** The insights gained from this questionnaire will help land and wildlife managers better meet the needs of Pennsylvania hunters and ecosystems.

You have been selected to participate in this survey based on your purchase of a DMAP permit in either 2007, 2008, 2011 or 2012. Contact information from participants will not be used at any time for any purpose other than correspondence about this survey. **The survey should only take about 15 minutes to complete.**

It is important that you know your rights as a participant in this survey. You must be at least 18 years old to participate in this survey. Participation is completely voluntary. You may choose not to answer specific question(s) or to stop participating at any time. You may change your mind or stop answering questions at any time. There are no costs for participating.

Participants who return completed survey forms will be entered into a drawing for one of 5 \$100.00 VISA gift cards. If you have concerns or questions about this study, such as scientific issues or how to do any part of the questionnaire, please contact Dr. Shawn Riley, preferably via email (rileysh2@msu.edu) or by phone at 517-353-9456. Mailing Address: Shawn Riley, Fisheries and Wildlife, 480 Wilson Road, Michigan State University, East Lansing, MI, 48824.

If you have any questions or concerns about your role and rights as a survey participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University Human Research Protection Program at 517-355-2180, FAX 517-432-4503, or e-mail irb@msu.edu, or regular mail at: 408 W. Circle Drive., Room 207 Olds Hall, MSU, East Lansing, MI 48824. This research is being conducted by the Department of Fisheries and Wildlife at Michigan State University and was funded by the Sand County Foundation.

By completing and returning this questionnaire you indicate your voluntary agreement to participate in this survey.

Thank You for Your Time and Effort

B. 6. Reminder 4x6 postcard delivered to Kinzua Quality Deer Cooperative hunters.

Greeting line,

Recently, you were mailed a questionnaire related to your hunting experiences on the Kinzua Quality Deer Cooperative in northwestern Pennsylvania.

If you completed and returned the questionnaire, please accept my sincere thanks!

If you have not completed the questionnaire, could you please do so today?

Your participation in this survey is important to help the land and wildlife managers of the Kinzua Quality Deer Cooperative enhance the quality of their management practices, which we hope result in more rewarding experiences for you and all hunters.

Thank you in advance for your time and consideration.

Sincerely,

Shawn J Riley
Professor, Michigan State University

B. 7. Reminder cover letter sent to Kinzua Quality Deer Cooperative hunters.

rileysh2@msu.edu
517-353-9456 office
May 20, 2014

Greeting line,

About three weeks ago, we sent you a questionnaire seeking to better understand your experiences as a deer hunter on the Kinzua Quality Deer Cooperative (KQDC) area of northwestern Pennsylvania. As of today, we have not received your completed questionnaire. If you have completed the questionnaire in the last few days and mailed it back to us, please accept our sincere thanks.

We are writing to you again because every questionnaire is important. **Insights gained from this survey will enable land and wildlife managers of the KQDC to monitor and enhance the quality of their deer habitat management practices with an aim of providing rewarding experiences for all hunters.** For results to represent the opinions of KQDC deer hunters, it is important that every questionnaire be completed and mailed back to us. Without your help, conclusions that we draw from questionnaires that we have already received from other hunters *may be wrong*.

Even if you do not hunt the KQDC anymore, your opinions are still important to us and must be considered. Survey results will help the KQDC wildlife and land managers better understand what motivates hunters to hunt on the KQDC, and what may prevent hunters from being able to hunt on the KQDC. If you choose to complete the survey you have the option to be entered into a drawing for one of five \$100.00 VISA gift cards. The drawing is expected take place in June 2014.

We have enclosed another copy of the questionnaire in case you did not receive the first copy or it was misplaced. Please place your completed questionnaire in the enclosed addressed and postage-paid envelope, and mail it back to us as promptly as possible. All personal information will be separated from responses and kept completely confidential. We will only use it to contact you if you are drawn as a winner. Survey results will be compiled only in summary form to protect confidentiality to the greatest extent under the law.

Your participation is greatly appreciated! If you have questions about the study please contact me, preferably by email (rileysh@msu.edu), or by phone at 517-353-9456.

Thank you for completing and returning the enclosed questionnaire. Your input is very important.

Sincerely,
Shawn J. Riley, Professor
Wildlife Ecology & Management

APPENDIX C: Survey and Summary Statistics

Figure C. 1. Images of blank version of questionnaire sent to Kinzua Quality Deer Cooperative hunters.

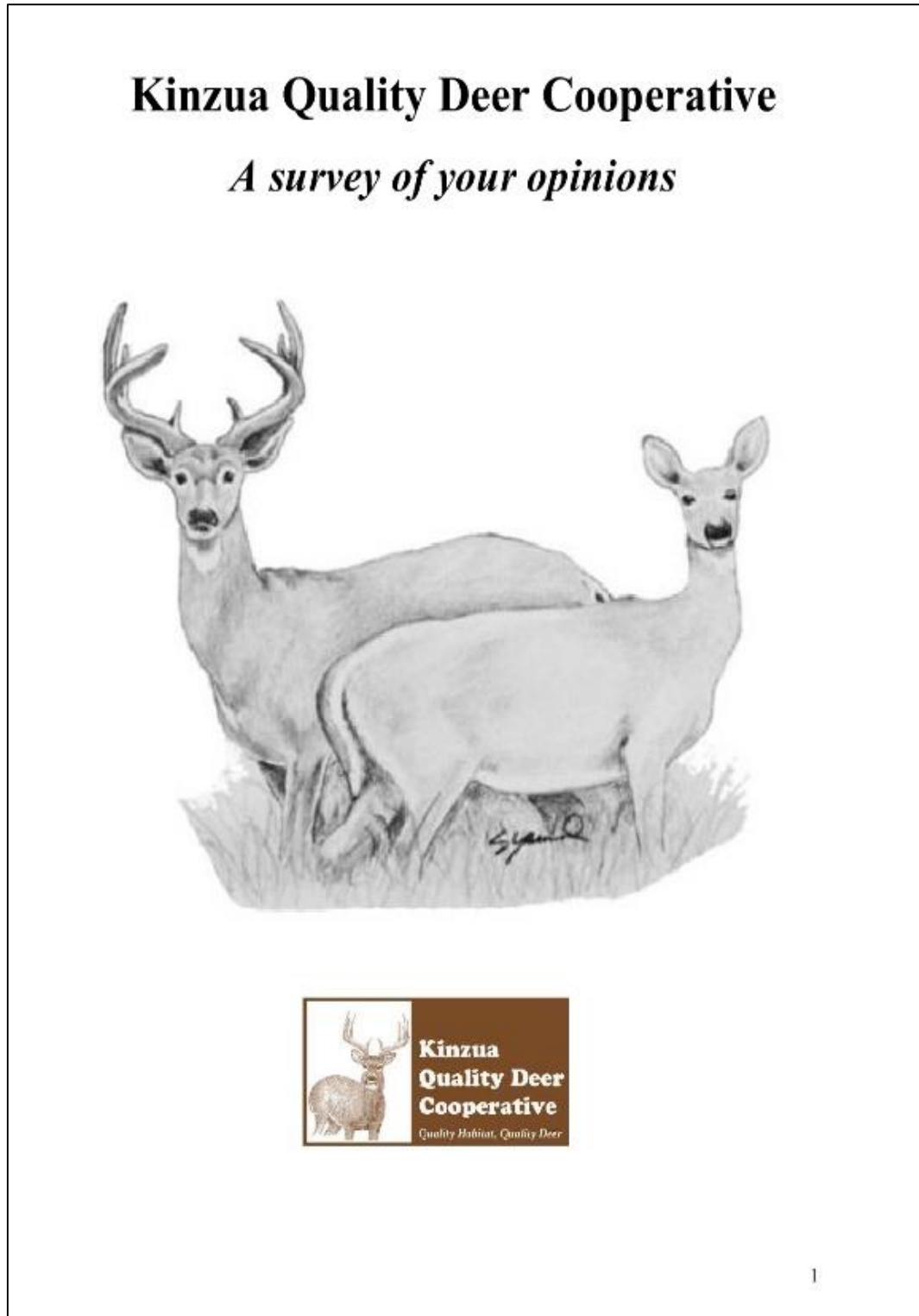


Figure C.1. (cont'd)

**Understanding hunter experiences on
the Kinzua Quality Deer Cooperative (KQDC)**
A survey of your opinions

The purpose of this questionnaire is to better understand your experiences as a deer hunter on the Kinzua Quality Deer Cooperative (KQDC) area of northwestern Pennsylvania. The KQDC is a partnership of forest landowners, forest managers, biologists, hunters, and local businesses started in 2000. The original purpose of the KQDC was to demonstrate how hunting can be used to meet the goals of multiple publics in Pennsylvania deer management assistance programs (DMAP) units 1981, 1996, and 135. **Your opinions matter.** The insights gained from this questionnaire will help land and wildlife managers better meet the needs of Pennsylvania hunters and ecosystems.

You have been selected to participate in this survey based on your purchase of a DMAP permit in either 2007, 2008, 2011 or 2012. Contact information from participants will not be used at any time for any purpose other than correspondence about this survey. **The survey should only take about 15 minutes to complete.**

It is important that you know your rights as a participant in this survey. You must be at least 18 years old to participate in this survey. Participation is completely voluntary. You may choose not to answer specific question(s) or to stop participating at any time. You may change your mind or stop answering questions at any time. There are no costs for participating.

Participants who return completed survey forms will be entered into a drawing for one of 5 \$100.00 VISA gift cards. If you have concerns or questions about this study, such as scientific issues or how to do any part of the questionnaire, please contact Dr. Shawn Riley, preferably via email (rileysh2@msu.edu) or by phone at 517-353-9456. Mailing Address: Shawn Riley, Fisheries and Wildlife, 480 Wilson Road, Michigan State University, East Lansing, MI, 48824.

If you have any questions or concerns about your role and rights as a survey participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University Human Research Protection Program at 517-355-2180, FAX 517-432-4503, or e-mail irb@msu.edu, or regular mail at: 408 W. Circle Drive., Room 207 Olds Hall, MSU, East Lansing, MI 48824. This research is being conducted by the Department of Fisheries and Wildlife at Michigan State University and was funded by the Sand County Foundation.

By completing and returning this questionnaire you indicate your voluntary agreement to participate in this survey.

Thank You for Your Time and Effort



Figure C.1. (cont'd)

DEER HUNTING EXPERIENCE

These first questions are designed to tell us a little about your hunting experience in general. Please fill in the appropriate blank space or circle the best answer for each question.

1. a. How many years have you been hunting deer in your lifetime (anywhere, not just KQDC)?
_____ years
- b. How many years have you been hunting deer on the KQDC Management area?
 _____ years
- b1. If you no longer hunt on the KQDC, how long were you hunting there before you stopped? _____ years
2. During the **2013 hunting season**, did you.....
- a. Hunt deer on the KQDC? Circle One: YES NO
- b. Hunt deer somewhere other than the KQDC during the 2013 hunting season? Circle One: YES NO
3. Where in the KQDC management area do/did you hunt deer? Please describe below or use the map and mark with an "X" on the map of the Kinzua Quality Deer Cooperative below the general area where you spend/spent the most time hunting.

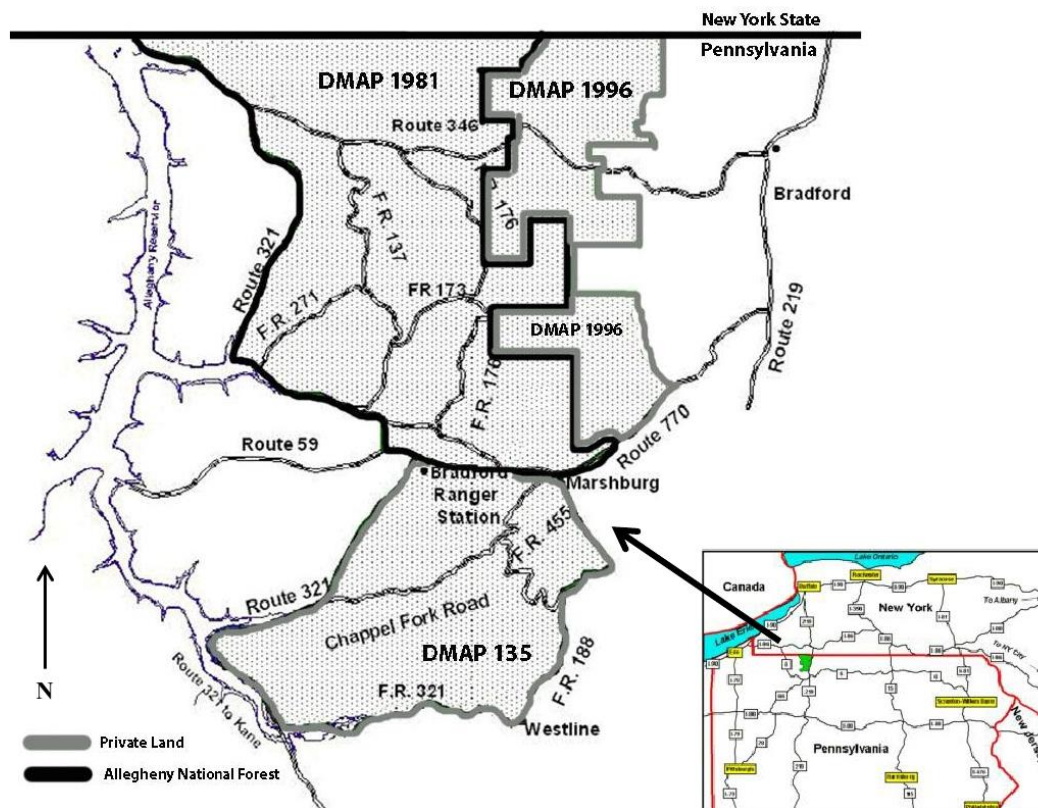


Figure C.1. (cont'd)

REASONS, MOTIVATIONS, AND PURPOSES FOR HUNTING: PART I

Hunting is considered a way of life for many Americans. Please tell us what you are most seeking from your hunting experience.

To what extent do you agree or disagree with the following statements about reasons why you choose to hunt deer generally? Please circle your response or mark the box with an 'X'

4. My primary reason for hunting deer generally – not just in the KQDC– is to:

	Completely disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Completely agree	No opinion
a. Test my outdoor skills	-2	-1	0	+1	+2	☐
b. Pursue physical exercise	-2	-1	0	+1	+2	☐
c. Enjoy nature and the outdoors	-2	-1	0	+1	+2	☐
d. Bring meat home for food	-2	-1	0	+1	+2	☐
e. Help control the deer population size	-2	-1	0	+1	+2	☐
f. Hunt for trophy animals	-2	-1	0	+1	+2	☐
g. Experience the challenges of hunting	-2	-1	0	+1	+2	☐
h. Experience the excitements of hunting	-2	-1	0	+1	+2	☐
i. Get away from the everyday routine of life	-2	-1	0	+1	+2	☐
j. Be with my friends or family	-2	-1	0	+1	+2	☐

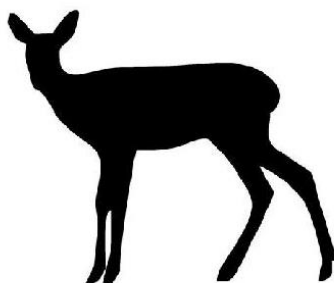


Figure C.1. (cont'd)

REASONS, MOTIVATIONS, AND PURPOSES FOR HUNTING PART II: The Kinzua Quality Deer Cooperative

For this set of questions, please share with us a few of the **key reasons you hunt/hunted on the KQDC specifically**.

To what extent would you agree with the following statements? Please circle your response or mark the box with an 'X'

5. My primary reason for hunting deer– specifically – on the KQDC is:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
a. The availability of DMAP permits on the KQDC	-2	-1	0	+1	+2	☐
b. Help control the deer population on the KQDC	-2	-1	0	+1	+2	☐
c. Uncrowded conditions on the KQDC	-2	-1	0	+1	+2	☐
d. I see a lot of deer sign (tracks, scrapes, rubs) on the KQDC	-2	-1	0	+1	+2	☐
e. The KQDC is a place I can get into deep woods away from other hunters	-2	-1	0	+1	+2	☐
f. I see a lot of deer on the KQDC	-2	-1	0	+1	+2	☐
g. I harvest enough deer on the KQDC to keep me interested	-2	-1	0	+1	+2	☐
h. Antlered deer are bigger on the KQDC than other places	-2	-1	0	+1	+2	☐
i. The KQDC is close to where I live	-2	-1	0	+1	+2	☐
j. Help protect the forested ecosystem from too many deer on the KQDC	-2	-1	0	+1	+2	☐
k. I am familiar with the landscape of the KQDC	-2	-1	0	+1	+2	☐
l. I just like the environment (habitat, terrain, conditions) of the KQDC	-2	-1	0	+1	+2	☐
m. I have always hunted the KQDC for deer	-2	-1	0	+1	+2	☐
n. My friends or family hunt on the KQDC	-2	-1	0	+1	+2	☐

Figure C.1. (cont'd)

**SHORTCOMINGS, CONSTRAINTS AND LIMITATIONS TO HUNTING:
PART I**

Often things come up that prevent us from participating in a planned activity like hunting. For this next series of questions we are interested in what has kept you from participating in **hunting generally**.

To what extent do you agree or disagree with the following statements of what affects your ability to hunt in general? Please circle your response or mark the box with an 'X'

6. The primary reason(s) I do not participate in deer hunting generally – not just in the KQDC- is that:

	Completely disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Completely agree	No opinion
a. I do not have enough time to hunt	-2	-1	0	+1	+2	☐
b. I no longer can find a satisfactory place to hunt	-2	-1	0	+1	+2	☐
c. I don't kill enough deer to make it worthwhile	-2	-1	0	+1	+2	☐
d. None of my family and/or friends hunt anymore	-2	-1	0	+1	+2	☐
e. Travel costs (gas, meals, lodging) make hunting too expensive	-2	-1	0	+1	+2	☐
f. The costs of hunting licenses and permits are too expensive	-2	-1	0	+1	+2	☐
g. The laws and regulations pertaining to hunting deer are too confusing these days	-2	-1	0	+1	+2	☐
h. I fear being injured by another hunter	-2	-1	0	+1	+2	☐
i. I am disabled or too ill to hunt now	-2	-1	0	+1	+2	☐
j. I am getting too old to hunt anymore	-2	-1	0	+1	+2	☐
k. I am no longer interested in hunting deer	-2	-1	0	+1	+2	☐

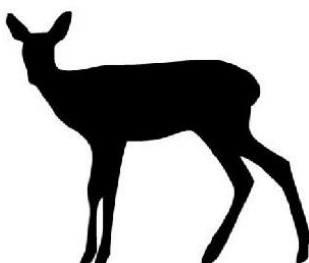


Figure C.1. (cont'd)

SHORTCOMINGS, CONSTRAINTS, AND LIMITATIONS TO HUNTING

PART II: The Kinzua Quality Deer Cooperative

For this next series of questions we are interested in what has kept you from participating in hunting on the KQDC.

To what extent do you agree or disagree with the following statements of what affects your ability to hunt on the KQDC? Please circle your response or mark the box with an 'X'

7. The primary reason(s) I do not participate in deer hunting in the KQDC is that:

	Completely disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Completely agree	No opinion
a. Not enough DMAP permits on the KQDC	-2	-1	0	+1	+2	☐
b. I don't get enough shots at deer on the KQDC	-2	-1	0	+1	+2	☐
c. I do not know where to go to hunt on the KQDC	-2	-1	0	+1	+2	☐
d. I don't have enough information about hunting on the KQDC	-2	-1	0	+1	+2	☐
e. I don't kill enough deer on the KQDC to make it worthwhile	-2	-1	0	+1	+2	☐
f. I don't kill enough bucks on the KQDC to make it worthwhile	-2	-1	0	+1	+2	☐
g. Lack of road access on the KQDC	-2	-1	0	+1	+2	☐
h. The environment (habitat, terrain, conditions) is too difficult to hunt.	-2	-1	0	+1	+2	☐
i. Oil and gas development in the KQDC prevents me from hunting deer	-2	-1	0	+1	+2	☐
j. Timber harvesting activities limit access to deep woods on the KQDC	-2	-1	0	+1	+2	☐
k. Lack of clear cuts or open areas keeps me from hunting deer on the KQDC	-2	-1	0	+1	+2	☐
l. There are too many predators on the KQDC	-2	-1	0	+1	+2	☐
m. There are not enough bucks on the KQDC	-2	-1	0	+1	+2	☐
n. There are not enough deer on the KQDC	-2	-1	0	+1	+2	☐
o. My family or friends don't hunt on the KQDC	-2	-1	0	+1	+2	☐
p. Too many people are violating game laws on the KQDC	-2	-1	0	+1	+2	☐
q. There are too many other hunters interfering with my hunt on the KQDC	-2	-1	0	+1	+2	☐

Figure C.1. (cont'd)

For the following question, please reflect on the past several years or the last time you hunted the KQDC.

8. Using a scale ranging from 1 (not at all satisfied) to 5 (extremely satisfied) how satisfied are you, overall, with the quality of deer hunting on the KQDC deer management area? (Circle the number that most closely aligns with your level of satisfaction)

Not At All Satisfied		Neither satisfied nor dissatisfied		Extremely Satisfied	Have not Hunted the KQDC
1	2	3	4	5	NA

We are interested in knowing how likely you are in the future to hunt deer on the KQDC.

9. Using a scale ranging from 1 (not at all likely) to 5 (extremely likely), how likely are you in the future, to hunt deer on the KQDC deer management area? (Circle one)

Not likely at all		Maybe		Extremely likely
1	2	3	4	5

For this last question, please take a moment to tell us a little about your hunting experiences during the last season, 2013. If you did not hunt the KQDC in 2013, please skip to Question 11.

10. a. Did you kill an antlered deer on the KQDC in 2013? (Circle One) YES NO

b. If YES, in what season did you kill this antlered deer? (Mark with an 'X')

☐ Early (Archery) ☐ Late (Archery, Flintlock)

☐ Firearm (Rifle/Pistol/Shotgun)

11. a. Did you kill an antlerless deer on the KQDC in 2013? (Circle One) YES NO

b. If YES, in what season did you kill this antlerless deer? (Mark with an 'X' all that apply)

☐ Early (Archery, Muzzleloader) ☐ Firearm (Rifle/Pistol/Shotgun)

☐ Early Junior/Senior (Archery, October Firearm, Flintlock/Muzzleloader) ☐ Late (Archery, Flintlock)

ABOUT YOU

To conclude this survey, please tell us a little about yourself.

12. In what Pennsylvania County do you live? name of county: _____

I used to live in Pennsylvania but I do not anymore _____ I do not live in Pennsylvania _____

13. Do you own, belong to, or use a camp in the KQDC deer management area? (Mark with 'X')

☐ Own camp ☐ Use camp
☐ Belong to camp ☐ None of the above

14. Are you? (Mark with an 'X') Male ☐ Female ☐

15. In what year were you born? 19 _____

16. What is the highest level of education you have completed? (Mark with 'X')

☐ Some high school ☐ 2 or 4 year degree
☐ High school diploma or GED ☐ Graduate degree
☐ Some college

17. What is your approximate household gross annual income (before taxes)? (Mark with 'X')

☐ Less than \$25,000 ☐ \$75,000 to \$99,999 ☐ \$200,000 or more
☐ \$25,000 to \$49,999 ☐ \$100,000 to \$149,999
☐ \$50,000 to \$74,999 ☐ \$150,000 to \$199,999

Figure C.1. (cont'd)

COMMENTS:

Please provide comments that will help the KQDC leadership better serve your deer hunting interests and needs, keep you informed about the KQDC, and activities you would like to see (i.e. banquet, check stations etc):

-----This portion below will be separated-----

Gift Card Drawing: The gift card drawing takes place on June 15th!

If you are returning a completed survey, please complete this section so we know how you prefer to be contacted if you are a winner:

Your name:

Postal Mail

Mailing Address:

Return Instructions: NO POSTAGE NECESSARY

For completed surveys:

Please place completed survey form in the business reply 6x9 envelope and return through U.S. Postal Mail. Postage is already paid, so you do not need to place a stamp on the return envelope.

If you choose not to participate in the drawing but you have completed the survey: Please return your complete survey form, but do not fill out the gift card option.

Thank you again for your time!

C. 1. Summary statistics of Kinzua Quality Deer Cooperative hunters.

1. a. How many years have you been hunting deer in your lifetime (anywhere, not just KQDC)? **40 years**
N=483
- b. How many years have you been hunting deer on the KQDC Management area?
16 years N=478
- b1. If you no longer hunt on the KQDC, how long were you hunting there before you stopped? **8**
years N=149
2. During the **2013 hunting season**, did you.....
- a. Hunt deer on the KQDC? Circle One: YES **65%** NO **35%** N=483
- b. Hunt deer somewhere other than the KQDC during the 2013 hunting season? YES **84%** NO **16%** N=467
3. Where in the KQDC management area do/did you hunt deer? Private **55%** Public **29%** Both **16%**
N= 425

Table C. 1. Summary statistics of Kinzua Quality Deer hunters.

Q4. My primary reason for hunting deer generally – not just in the KQDC– is to	Completely disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Completely agree	No opinion	N=
a. Test my outdoor skills	4.8%	3.5%	17%	41.2%	31%	2.5%	481
b. Pursue physical exercise	3.1%	1.9%	17.8%	45%	30.1%	2%	482
c. Enjoy nature and the outdoors	.2%		1%	10.8%	88%		483
d. Bring meat home for food	2.5%	1.9%	14.2%	30.7%	49.7%	1%	485
e. Help control the deer population size	18.5%	9.8%	30.3%	26%	13.7%	1.7%	482
f. Hunt for trophy animals	17.6%	4.3%	23.6%	28.7%	24.1%	1.7%	482
g. Experience the challenges of hunting	1%	.6%	6.2%	26.3%	64.8%	1%	483
h. Experience the excitements of hunting		.2%	3.9%	20.3%	75.2%	.4%	484
i. Get away from the everyday routine of life	.8%	1.7%	7.2%	23.3%	65.5%	1.5%	484
j. Be with my friends or family	1%	1.2%	8.8%	19.9%	68.2%	.8%	487

Table C. 1. (cont'd)

5. My primary reason for hunting deer—specifically – on the KQDC is:	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion	N=
a. The availability of DMAP permits on the KQDC	7%	3.9%	19.3%	36.9%	28.2%	4.6%	482
b. Help control the deer population on the KQDC	19.9%	8.3%	30.6%	23.7%	11.9%	5.6%	481
c. Uncrowded conditions on the KQDC	8.7%	6.8%	27.5%	29%	23%	4.9%	469
d. I see a lot of deer sign (tracks, scrapes, rubs) on the KQDC	28.2%	20%	19%	20.7%	7.5%	4.6%	483
e. The KQDC is a place I can get into deep woods away from other hunters	9.8%	9.1%	22.6%	31.7%	22.6%	4.1%	482
f. I see a lot of deer on the KQDC	41.6%	23.5%	17.5%	11.2%	2.9%	3.3%	481
g. I harvest enough deer on the KQDC to keep me interested	27.2%	15.6%	24.7%	20.9%	6.8%	4.7%	482
h. Antlered deer are bigger on the KQDC than other places	26.1%	15.4%	40%	10.2%	1.9%	6.4%	482
i. The KQDC is close to where I live	28%	12.2%	10.9%	23.1%	21.2%	4.5%	485
j. Help protect the forested ecosystem from too many deer on the KQDC	27.4%	14.7%	29.5%	15.3%	8.3%	4.7%	482
k. I am familiar with the landscape of the KQDC	4.3%	5%	16%	33.7%	37%	4%	481
l. I just like the environment (habitat, terrain, conditions) of the KQDC	2.7%	3.7%	21%	39.6%	29.3%	3.7%	482
m. I have always hunted the KQDC for deer	16.8%	14.9%	25.5%	18.4%	18.6%	5.8%	483
n. My friends or family hunt on the KQDC	12.2%	7.4%	17.9%	29.5%	28.3%	4.7%	485

Table C. 1. (cont'd)

6. The primary reason(s) I do not participate in deer hunting generally – not just in the KQDC- is that:	Completely disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Completely agree	No opinion	N=
a. I do not have enough time to hunt	28.9%	14.7%	17.1%	21.8%	11.2%	6.2%	463
b. I no longer can find a satisfactory place to hunt	26%	14.7%	23.4%	22.8%	8.5%	4.5%	461
c. I don't kill enough deer to make it worthwhile	28.9%	17.5%	27.2%	11.8%	8.3%	6.1%	456
d. None of my family and/or friends hunt anymore	45.7%	16.7%	19.5%	10%	3.3%	4.7%	460
e. Travel costs (gas, meals, lodging) make hunting too expensive	32.3%	14.9%	22.9%	16.9%	8.2%	4.7%	462
f. The costs of hunting licenses and permits are too expensive	33.3%	14%	24.4%	15.3%	9.3%	3.6%	463
g. The laws and regulations pertaining to hunting deer are too confusing these days	30.5%	15.6%	17.5%	18.4%	13.6%	4.3%	462
h. I fear being injured by another hunter	55.1%	14.7%	19.9%	4.3%	.9%	4.9%	461
i. I am disabled or too ill to hunt now	59.6%	5.8%	18%	4.3%	2.2%	10%	460
j. I am getting too old to hunt anymore	58.1%	11.2%	14.7%	7.5%	1.3%	7.1%	463
k. I am no longer interested in hunting deer	70.8%	8.2%	10.6%	4.5%	.9%	4.9%	463

Table C. 1. (cont'd)

7. The primary reason(s) I do not participate in deer hunting in the KQDC is that:	Completely disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Completely agree	No opinion	N=
a. Not enough DMAP permits on the KQDC	41.3%	14.5%	25.4%	6.5%	3.9%	8.2%	461
b. I don't get enough shots at deer on the KQDC	14.1%	12.1%	20.3%	22.1%	25.8%	5.6%	462
c. I do not know where to go to hunt on the KQDC	38.6%	19.7%	21.3%	10.4%	4.6%	5.4%	461
d. I don't have enough information about hunting on the KQDC	36.6%	16.7%	21.9%	13.7%	5.4%	5.5%	465
e. I don't kill enough deer on the KQDC to make it worthwhile	19.8%	11.8%	25.4%	17.8%	18.5%	6.5%	464
f. I don't kill enough bucks on the KQDC to make it worthwhile	17.8%	11.4%	24.7%	18.1%	20.9%	7.1%	465
g. Lack of road access on the KQDC	44%	14.9%	21.5%	8.6%	5.6%	5.2%	461
h. The environment (habitat, terrain, conditions) is too difficult to hunt.	41.5%	16.6%	22.7%	11.8%	2.4%	4.9%	463
i. Oil and gas development in the KQDC prevents me from hunting deer	31.8%	12.9%	19.3%	17.7%	12.6%	5.6%	462
j. Timber harvesting activities limit access to deep woods on the KQDC	33.4%	15.7%	20.9%	15.5%	8.8%	5.6%	464
k. Lack of clear cuts or open areas keeps me from hunting deer on the KQDC	38.5%	21.3%	23.3%	9.3%	1.7%	5.8%	464
l. There are too many predators on the KQDC	19.7%	11.2%	27.9%	15.3%	19.3%	6.4%	465
m. There are not enough bucks on the KQDC	11.3%	12.2%	25.1%	25.1%	19.4%	6.7%	458
n. There are not enough deer on the KQDC	9.9%	10.6%	16%	21.7%	37.3%	4.3%	461

Table C. 1. (cont'd)

o. My family or friends don't hunt on the KQDC	26.7%	15.6%	30.2%	12.2%	7.6%	7.8%	461
p. Too many people are violating game laws on the KQDC	26.8%	10.4%	38.7%	6.9%	4.9%	12.1%	462
q. There are too many other hunters interfering with my hunt on the KQDC	34.8%	17.5%	29.8%	7.1%	3.8%	6.9%	463

8. Using a scale ranging from 1 (not at all satisfied) to 5 (extremely satisfied) how satisfied are you, overall, with the quality of deer hunting on the KQDC deer management area? (Circle the number that most closely aligns with your level of satisfaction) **N=476**

Not At All Satisfied		Neither satisfied nor dissatisfied		Extremely Satisfied	Have not Hunted the KQDC
1	2	3	4	5	NA
19.9%	17.7%	33.4%	19.5%	6.9%	2.5%

We are interested in knowing how likely you are in the future to hunt deer on the KQDC.

11. Using a scale ranging from 1 (not at all likely) to 5 (extremely likely), how likely are you in the future, to hunt deer on the KQDC deer management area? (Circle one) **N=488**

Not likely at all		Maybe		Extremely likely
1	2	3	4	5
7.9%	7.8%	26%	23.6%	34.6%

9. a. Did you kill an antlered deer on the KQDC in 2013? (Circle One) **N=303; 8.6% YES; 91.4% NO**

b. If YES, in what season did you kill this antlered deer? (Mark with an 'X')

Early (Archery) **2.3%, N=302**

Early Junior/Senior (Archery) **0%,**

Firearm (Rifle/Pistol/Shotgun) **6 %, N=302**

Late (Archery, Flintlock/Muzzleloader) **.3%, N=302**

10. a. Did you kill an antlerless deer on the KQDC in 2013? (Circle One) **N=306, 21.2% YES, 78.8% NO**

b. If YES, in what season did you kill this antlerless deer? (Mark with an 'X' all that apply)

Early (Archery, Flintlock/Muzzleloader) **16%, N=306**

Early Junior/Senior (Archery, October Firearm, Flintlock/Muzzleloader) **.9%, N=305**

Firearm (Rifle/Pistol/Shotgun) **15.4%, N=305**

Late (Archery, Flintlock/Muzzleloader) **2.3%, N=306**

ABOUT YOU

11. In what Pennsylvania County do you live? name of county:

Recorded by region:

Erie Region **N=82, 16.9 %**
 Pennsylvania Wilds **N=259, 53.6 %**
 Pittsburgh Region **N=45, 9.3 %**
 Allegheny Valley **N=5, 1 %**
 Susquehanna Valley **N=5, 1 %**
 Pennsylvania Dutch Country **N=22, 4.6 %**
 Philadelphia **N=6, 1.2 %**
 Poconos & Endless Mountains **N=1, .2 %**
 I used to live in Pennsylvania but I do not anymore **N=17, 3.5 %**
 I do not live in Pennsylvania **N= 41, 8.5%**

12. Do you own, belong to, or use a camp in the KQDC deer management area? (Mark with 'X')

Own camp **N=79, 16.4 %**
 Belong to camp **N=41, 8.5 %**
 Use camp **N= 54, 11.2%**
 None of the above **N=312, 64.6 %**

13. Are you? (Mark with an 'X') **N=486 Male 97% Female 3%**

14. In what year were you born? **N=483, 56 years old**

15. What is the highest level of education you have completed? (Mark with 'X')

Some high school **N=13, 2.69 %**
 High school diploma or GED **N=184, 38 %**
 Some college **N=89, 18.4 %**
 2 or 4 year degree **N=145, 29.9 %**
 Graduate degree **N=53, 10.9 %**

16. What is your approximate household gross annual income (before taxes? (Mark with 'X')

Less than \$25,000 **N=32, 7.2 %**
 \$25,000 to \$49,999 **N=109, 24.5 %**
 \$50,000 to \$74,999 **N=130, 29.2 %**
 \$75,000 to \$99,999 **N=70, 15.7 %**
 \$100,000 to \$149,999 **N=66, 14.8%**
 \$150,000 to \$199,999 **N=25, 5.6 %**
 \$200,000 or more **N=13, 2.9 %**

Please provide comments that will help the KQDC leadership better serve your deer hunting interests and needs, keep you informed about the KQDC, and activities you would like to see (i.e. banquet, check stations etc):

Table C. 2. Summary statistics of Kinzua Quality Deer Cooperative hunters by time period.

	Past	Recent	Continuous
Explanatory Variables			
Socio-demographic characteristics			
Gender			
Male	96%; N=99	97%; N=257	98%; 117
Female	4%; N=4	3%; N=7	2%; N=2
Age	55; N=103	55; N=262	58; N=118
Education			
Some high school	4%; N=4	3%; N=7	2%; N=2
High school diploma or GED	32%; N=33	39%; N=102	41%; N=49
Some college	16%; N=16	20%; N=51	19%; N=23
2 or 4 year degree	35%; N=36	30%; N=78	26%; N=31
Graduate degree	14%; N=14	9%; N=24	13%; N=15
Income			
Less than \$25,000	8%; N=7	7%; N=17	8%; N=8
\$25-49,999	22%; N=21	24%; N=60	27%; N=28
\$50-\$74,999	31%; N=29	29%; N=72	28%; N=29
\$75-99,999	16%; N=15	17%; N=42	12%; N=13
\$100-149,999	14%; N=13	13%; N=33	19%; N=20
\$150-199,999	5%; N=5	7%; N=16	4%; N=4
\$200,000 or more	4%; N=4	3%; N=7	2%; N=2
Residence			
Less than 2 hour drive	65%; N=66	71%; N=186	75%; N=89
2-4 hour drive	15%; N=15	11%; N=28	11%; N=13
4+ hour drive	2%; N=2	8%; N=22	3%; N=4
Out of state	18%; N=18	10%; N=27	11%; N=13
Hunting Background			
Years hunting	40; N=102	39; N=263	43; N=118
Years hunting on KQDC	13; N=102	14; N=261	21; N=115
Years previously hunted on KQDC	8; N=58	6; N=70	13; N=21
Hunt KQDC 2013			
Yes	39%; N=40	69%; N=180	81%; N=95
No	61%; N=63	31%; N=82	19%; N=23
Hunt elsewhere 2013			
Yes	84%; N=84	86%; N=218	81%; 92
No	16%; N=16	14%; N=36	19%; 21
Preferred hunting land			
Private	53%; N=44	56%; N=130	54%; N=60
Public	36%; N=30	29%; N=67	25%; N=28
Both	11%; N=9	15%; N=34	21%; N=23

Table C.2. (cont'd)	Past	Recent	Continuous
Harvest Antlered	11%; N=4	6%; N=11	12%; N=11
Early archery	5%; N=2	2%; N=4	1%; N=1
Firearm	3%; N=1	5%; N=8	10%; N=9
Late (archery/flintlock/muzzleloader)	3%; N=1		
Harvest Antlerless	16%; N=6	21%; N=36	25%; N=23
Early (archery, flintlock/muzzleloader)	11%; N=4	3%; N=5	8%; N=7
Early junior/senior	3%; N=1	1%; N=1	1%; N=1
Firearm	5%; N=2	15%; N=27	20%; N=18
Late (archery/flintlock/muzzleloader)	3%; N=1	3%; N=6	
Camping status			
Own camp	12%; N=12	12%; N=30	31%; N=36
Belong camp	7%; N=7	8%; N=22	10%; N=12
Use camp	11%; N=11	10%; N=26	14%; N=17
None of the above	71%; N=73	71%; N=186	45%; N=53
General Motivations			
Test outdoor skills	1.02; N=100	.88; N=257	.94; N=112
Pursue physical exercise	1.01; N=100	.99; N=257	.98; N=115
Enjoy nature and the outdoors	1.89; N=102	1.84; N=263	1.88; N=118
Bring meat home for food	1.2; N=101	1.21; N=260	1.34; N=119
Control the deer population size	-.06; N=99	.15; N=260	0; N=115
Hunt for trophy animals	.27; N=101	.44; N=259	.34; N=116
Experience challenges of hunting	1.61; N=102	1.53; N=259	1.52; N=117
Experience excitements of hunting	1.73; N=103	1.71; N=261	1.68; N=118
Get away from routine of life	1.54; N=101	1.53; N=259	1.51; N=117
Be with my friends or family	1.47; N=101	1.58; N=262	1.52; N=120
KQDC Motivations			
Availability of DMAP permits	.65; N=92	.85; N=252	.76; N=116
Help control deer population	-.02; N=88	.08; N=250	-.21; N=116
Uncrowded conditions	.51; N=92	.52; N=243	.59; N=111
See a lot of deer sign (tracks, scrapes, rubs)	-.49; N=90	-.32; N=252	-.61; N=119
Get into deep woods away from other hunters	.42; N=92	.62; N=252	.33; N=118
I see a lot of deer	-.95; N=94	-.85; N=251	-1.05; N=120
Harvest enough deer to keep me interested	-.72; N=90	-.29; N=250	-.27; N=119
Antlered deer are bigger	-.69; N=88	-.48; N=246	-.68; N=117
Close to where I live	-.15; N=92	-.03; N=253	.06; N=118
Help protect the forested ecosystem	-.36; N=93	-.34; N=249	-.52; N=117
Familiar with the landscape	.59; N=92	.99; N=252	1.25; N=118
I just like the environment (habitat, terrain, conditions)	.76; N=93	.92; N=253	1.05; N=118
Have always hunted for deer	-.42; N=91	.01; N=245	.58; N=111

Table C.2. (cont'd)	Past	Recent	Continuous
My friends or family hunt	.24; N=94	.56; N=248	.84; N=120
General Constraints			
Not enough time to hunt	-.13; N=100	-.33; N=233	-.39; N=101
Cannot find a satisfactory place to hunt	-.22; N=97	-.34; N=238	-.2; N=105
Not worthwhile	-.71; N=95	-.42; N=233	-.49; N=100
No family and/or friends hunt anymore	-1.06; N=98	-.9; N=238	-.99; N=102
Travel costs (gas, meals, lodging) too expensive	-.67; N=99	-.41; N=237	-.46; N=104
Hunting licenses and permits too expensive	-.42; N=101	-.46; N=241	-.61; N=104
Laws and regulations are too confusing	-.24; M=100	-.34; N=239	-.35; N=103
Fear injury	-1.26; N=99	-1.24; N=234	-1.25; N=105
Too disabled or ill to hunt	-1.16; N=93	-1.33; N=221	-1.33; N=100
Too old to hunt	-1.21; N=98	-1.32; N=230	-1.16; N=102
Not interested in hunting deer	-1.44; N=99	-1.53; N=235	-1.51; N=106
KQDC Constraints			
Not enough DMAP permits	-.69; N=90	-.85; N=231	-1.21; N=102
Not enough shots at deer	.54; N=94	.29; N=237	.33; N=105
Don't know where to go to hunt	-.55; N=95	-.79; N=237	-1.11; N=104
Not enough information about hunting	-.52; N=98	-.61; N=236	-1.02; N=105
Don't kill enough deer to make it worthwhile	.23; N=95	-.01; N=233	-.03; N=106
Don't kill enough bucks to make it worthwhile	.14; N=92	.15; N=233	.1; N=105
Lack of road access	-.86; N=94	-.83; N=236	-1; N=107
Difficult terrain	-.82; N=96	-.88; N=237	-.91; N=107
Oil and gas development prevents from hunting deer	-.5; N=96	-.49; N=235	.08; N=105
Timber harvesting activities limit access to deep woods	-.72; N=96	-.56; N=236	-.26; N=106
Lack of clear cuts or open areas keeps me from hunting	-1; N=95	-.85; N=237	-.97; N=105
Too many predators	-.1; N=94	.02; N=234	.19; N=107
Not enough bucks	.25; N=89	.32; N=232	.34; N=106
Not enough deer	.76; N=96	.63; N=237	.74; N=108
My family or friends don't hunt there	-.21; N=92	-.42; N=230	-.73; N=103
Too many people violating game laws	-.5; N=86	-.51; N=219	-.63; N=101
Too many hunters interfering hunt	-.84; N=91	-.76; N=234	-.75; N=106
Satisfaction	2.6; N=94	2.8; N=255	2.77; N=115
Not at all satisfied	25%; N= 23	18%; N=46	23%; N=26
Somewhat not satisfied	22%; N=21	18%; N=47	14%; N=16

Table C.2. (cont'd)	Past	Recent	Continuous
Neither satisfied nor dissatisfied	32%; N=30	35%; N=90	34%; N=39
Somewhat satisfied	13%; N=12	22%; N=55	23%; N=26
Extremely satisfied	9%; N=8	7%; N=10	7%; N=8
Have not hunted KQDC	8%; N=8	2%; N=4	
Dependent Variable			
Willingness to Participate	3.08; N=104	3.73; N=265	4.12; N=119
Not at all likely	17%; N=18	6%; N=17	3%; N=4
Somewhat not likely	13%; N=13	8%; N=21	3%; N=4
Maybe	32%; N=33	26%; N=69	21%; N=25
Somewhat likely	21%; N=22	25%; N=67	22%; N=26
Extremely likely	17%; N=18	34%; N=91	50%; N=60

APPENDIX D: Extended Motivations & Constraints Factor Loadings

Table D. 1. Detailed factor loadings of motivations of Kinzua Quality Deer Cooperative hunters.

Variable	Cooperative	Appreciative	Achievement
Control the deer population size	<u>0.64</u>	0.02	0.11
Help control deer population	<u>0.80</u>	-0.02	0.002
See a lot of deer sign (tracks, scrapes, rubs)	<u>0.78</u>	0.10	-0.08
Uncrowded conditions on the KQDC	<u>0.51</u>	0.04	0.14
Get into deep woods away from other hunters	<u>0.49</u>	0.03	0.20
Harvest enough deer to keep me interested	<u>0.65</u>	0.21	-0.05
I see a lot of deer on the KQDC	<u>0.81</u>	-0.11	-0.04
Help protect the forested ecosystem	<u>0.77</u>	-0.01	0.04
Familiar with the landscape of the KQDC	0.07	<u>0.63</u>	0.01
Have always hunted for deer on the KQDC	-0.02	<u>0.78</u>	-0.04
My friends or family hunt on the KQDC	-0.006	<u>0.69</u>	0.02
Experience challenges of hunting	-0.03	-0.01	<u>0.78</u>
Test my outdoor skills	0.15	-0.05	<u>0.55</u>
Pursue physical exercise	0.09	-0.01	<u>0.45</u>
Enjoy nature and the outdoors	-0.03	0.01	<u>0.49</u>
Experience excitements of hunting	-0.02	0.04	<u>0.64</u>

Table D. 2. Detailed factor loadings of constraints of Kinzua Quality Deer Cooperative hunters.

Variable	Lack of Opportunities	Personal	No Knowledge
Not enough shots at deer	<u>0.80</u>	-0.02	0.02
Don't kill enough deer to make it worthwhile	<u>0.76</u>	0.02	0.05
Not enough deer	<u>0.76</u>	0.0003	-0.08
Too disabled or ill to hunt	0.01	<u>0.79</u>	.0006
Too old to hunt	-0.01	<u>0.84</u>	-0.006
Not interested in hunting deer	0.008	<u>0.56</u>	0.04
Not enough DMAP permits	-0.03	0.05	<u>0.41</u>
Don't know where to go to hunt	0.02	0.02	<u>0.82</u>
Not enough information about hunting	-0.001	-0.03	<u>0.80</u>

APPENDIX E: Primary Motivations & Constraints

Table E. 1. Primary motivations of Kinzua Quality Deer Cooperative antlerless deer hunters.

Motivations	N	Percent
No primary motivation	30	7.87
Achievement	161	42.26
Appreciative	24	6.30
Appreciative + Cooperative	1	0.26
Achievement + Cooperative	24	6.30
Achievement + Appreciative	113	29.66
Cooperative + Achievement + Appreciative	28	7.35

Table E. 2. Primary constraints of Kinzua Quality Deer Cooperative antlerless deer hunters.

Constraints	N	Percent
No primary constraint	226	61.25
Personal	1	0.27
Opportunity	126	34.15
Lack Knowledge	8	2.17
Personal + Opportunity	2	0.54
Opportunity + Lack knowledge	6	1.63

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