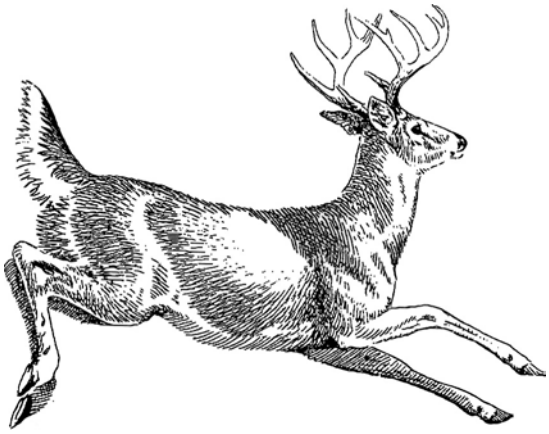
LANDOWNER AND HUNTER RESPONSE TO IMPLEMENTATION OF A QUALITY DEER MANAGEMENT (QDM) COOPERATIVE NEAR KING FERRY, NEW YORK



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Landowner and hunter response to implementation of a Quality Deer Management (QDM) cooperative near King Ferry, New York

EXECUTIVE SUMMARY

In 2001, staff with the New York State Department of Environmental Conservation, Bureau of Wildlife (BOW) started working with 36 private landowners and many hunters who typically hunted on those properties to establish a 12,000ac QDM cooperative near King Ferry, NY. BOW staff sought assistance from Cornell University's Human Dimensions Research Unit (HDRU) to evaluate the cooperative. The purpose of this study was to collect baseline behavioral and attitudinal data as a first step in a long-term evaluation of QDM as a harvest strategy to balance positive and negative deer-related impacts from the perspectives of landowners and deer hunters.

METHODS

Our preliminary evaluation efforts involved small group discussions followed by a mail survey. We used a meeting with a large group of hunters and landowners (n = 42) to identify major management outcomes desired from their participation in the QDM cooperative. Then we used a series of small group meetings with hunters (n = 2 to 8) and landowners (n = 5) to better understand the fundamental ends, or deer-related impacts, that participants associated with these management outcomes. Finally, implemented a mail survey to (a) verify specific deer-related impacts (both positive and negative) on which to focus management efforts, (b) calibrate relationships in the system of factors affecting levels of those impacts, and (c) determine current levels and desired/acceptable levels of impacts (i.e., fundamental objectives of QDM).

RESULTS

Group discussions revealed that hunters and landowners shared a “mental model” of deer management based on the general premise that deer population characteristics (e.g., total numbers of deer, and age and sex composition) affect the kinds of deer-related interactions that hunters and landowners experience. Hunters focused on maximizing certain kinds of interactions like observing and harvesting mature bucks, but they also desired fairness and safety in their interactions with each other. Landowners tended to focus on minimizing other kinds of interactions with deer including crop damage, over browsing in woodlots, and deer-vehicle accidents.

The mail survey verified that hunters and landowners wanted to participate in QDM to change the characteristics of the deer population which, in turn, would lead to more positive deer-related interactions, and fewer negative interactions. In essence, deer management objectives of importance to hunters and landowners had not been realized under conventional deer management. They believed that alternative management actions (i.e., QDM) were needed to change the outcomes of the system of interactions possible with existing deer population characteristics that are produced through conventional deer management (CDM). Thus starting in 1991, they adopted voluntary buck harvest standards (i.e., passing-up shots at younger bucks) and emphasized harvest of antlerless deer.

Further, small group discussions revealed that hunters and landowners wanted changes in deer population characteristics because they believed those changes were potential *means* to more *fundamental ends.* The set of fundamental ends valued highly by participants can be thought of as *deer-related impacts* to be managed through QDM. The survey verified that many hunters greatly valued these positive impacts: (1) friendships with landowners, (2) healthy individual deer, (3) fairness among hunters, and (4) naturalness in the deer population. A majority of hunters also was very concerned about the fear of being shot by other hunters indiscriminately shooting at deer. For landowners, the survey found that many landowners were very concerned about these negative impacts: (1) frustration about the persistent risk of crop damage, (2) risk of injury from a deer-vehicle accident, and (3) risk of excessive cost from a deer-vehicle accident.

Small group discussions revealed that they assumed desired or acceptable levels of impacts "automatically" would be achieved if the desired changes occurred in the deer population characteristics under QDM. These assumptions generally were verified through the mail surveys of hunters and landowners. However, we found some differences in assumptions between those who greatly valued particular impacts (high importance groups) compared to those who placed less importance on those impacts (low importance groups). In particular, those in the low importance groups tended to over-estimate the benefit of switching to QDM from CDM. We also found higher levels of uncertainty and/or disagreement among respondents in the high importance groups about whether various impacts would be more likely under QDM vs. CDM.

Further, we found areas of disagreement between high importance and low importance groups with respect to current levels of impacts and desired/acceptable (i.e., objective) levels. Respondents in the high importance groups indicated that current levels of positive impacts fell short of objective levels they desired, and current levels of negative impacts exceeded acceptable levels. Although respondents in the low importance groups though current levels of positive impacts were below desired levels, they generally underestimated the objective levels desired by those in the high importance groups. In addition, those in low importance groups generally thought that current levels of negative impacts were below maximum acceptable levels.

CONCLUSIONS

Hunters' satisfaction with QDM and willingness to continue with the cooperative were high after one hunting season. However, their assumptions about the likely benefits of QDM generally do not reflect well the fundamental ends that they seek from deer management (i.e., the deer-related impacts to be managed) or the system of factors that influence levels of those ends. Thus, not surprisingly, current levels of positive impacts generally are below desired levels and current levels of negative impacts generally exceed tolerable levels. Therefore, opportunities for several kinds of social learning need to be made available to participants prior to collaborative decision making about any alternative management actions to be implemented under QDM.

First, a better understanding is needed about which impacts to focus on as fundamental objectives of QDM. Second, greater understanding is needed about the systems of factors affecting the various impacts. In particular, learning is needed about which factors may affect multiple impacts, and about the magnitude or nature of the effect of a given factor on an impact.

Third, better understanding is needed about why respondents in the low-importance groups consistently underestimated current levels of impacts compared to respondents in the high-importance groups. Fourth, appropriate objective levels for impacts to be managed need to be determined, given possible trade-offs about what levels can realistically be achieved at the same time. Finally, a revised conception of the deer management system likely will provide a necessary foundation for the identification of alternative management actions to implement as part of QDM.

INTRODUCTION

The concept of Quality Deer Management (QDM) is becoming popular among hunters across the U.S. (Alsheimer 2003). Basic premises of QDM are to reduce harvest of young bucks to increase the number of older, more mature bucks with larger antlers, to increase harvest of adult female deer to create a more balanced deer sex ratio, and to decrease the total deer population if it is not in balance with available habitat (Woods et al. 1996). In 2001, staff with the New York State Department of Environmental Conservation, Bureau of Wildlife (BOW) approached a group of private landowners and associated hunters near King Ferry, NY about the possibility of establishing a QDM cooperative on private lands in the area. By the fall hunting season, 36 private landowners about 80 hunters who typically hunted on those properties agreed to establish a QDM cooperative on about 12,000ac. The number of participating landowners and associated hunters is much larger than single-owner or public land QDM sites in other areas.

BOW staff sought assistance from Cornell University's Human Dimensions Research Unit (HDRU) to evaluate the cooperative. The purpose of this study was to collect baseline behavioral and attitudinal data as a first step in a long-term evaluation of QDM as a harvest strategy to balance positive and negative deer-related impacts from the perspectives of landowners and deer hunters.

Research Objectives

(1) Determine factors influencing landowners' and deer hunters' decisions to participate in a QDM cooperative.

(2) Ascertain participating landowners' current access-related behaviors and attitudes towards deer-related impacts on their lands and towards management of those impacts.

(3) Ascertain participating hunters' current hunting-related behaviors and attitudes, focusing on factors affecting hunter satisfaction and sex-specific characteristics of

the deer population and harvest.

(4) Determine landowners' and hunters' satisfaction with QDM as implemented, and their willingness to continue participating in the cooperative.

(5) Determine changes in participating landowners' and hunters' behaviors or attitudes resulting from QDM.

(6) Determine the degree to which participating landowners and hunters attribute measurable changes in deer-related impacts to implementation of QDM.

This initial phase of the evaluation focuses on objectives 1-4 above to ascertain baseline information that can be used to assess at a later date objectives 5 and 6.

Organization Of Report

In the next section, we provide a brief overview of the methods used in this phase of the evaluation. We present study findings in subsequent sections for hunters and landowners. Findings are organized as a series of questions and answers, rather than descriptions of data pertaining to each of the study objectives. In most cases, a particular question relates to more than one study objective. We believe this format will be more useful for communicating insights and building understanding among the participants involved in the QDM cooperative.

METHODS

Meetings With Hunters And Landowners

BOW and HDRU staff invited all participating landowners and hunters to meet separately to better understand what they wanted from QDM and reasons why specific changes

in deer population characteristics were so important to them. The hunter meeting was held on 19 September 2001, and was attended by 42 hunters. We built upon the insights gained at the meeting with hunters by meeting with a small group of volunteers five more times between February and May 2002. At those subsequent meetings, we developed a better understanding of how hunters think about deer management and the kinds of outcomes that might be managed through QDM. The landowner meeting was held on 15 June 2002. Because this meeting attracted only 5 people, we did not have any follow-up meetings with landowners.

Based on information gleaned from the meetings, HDRU developed and mailed separate questionnaires to all landowners and hunters in October 2002. We used these surveys to validate some of the insights gained in the group discussions, collect base-line data on participants' perceptions of deer population characteristics, satisfaction with QDM and willingness to continue with the QDM cooperative, and determine some of the levels of deer-related impacts that hunters and landowners thought they needed to experience before they would say that QDM was a success.

RESULTS

What are the characteristics of landowners participating in the QDM cooperative?

About one-half of landowners participating in the cooperative (52.7%) responded to the survey. They averaged 52 years of age, and owned (or managed) their properties for an average of 22 years. They categorized their properties as either farms (58%) or rural, non-farm land (42%). Properties averaged about 264 acres (range = 8 to 1,100). Dominant land uses included cash crops ($\bar{x}$ = 106 acres), woodlots ($\bar{x}$ = 81 acres), and hay ($\bar{x}$ = 52 acres). Other uses included pasture ($\bar{x}$ = 13 acres), specialty crops ($\bar{x}$ = 5 acres), and barnyards and buildings ($\bar{x}$ = 4 acres).

Two-thirds (68%) of responding landowners had at least some college education and 21% had a post-graduate degree. A plurality (40%) reported household income of $25,000 to $49,999. Fewer reported household incomes ranging from $50,000 to $74,999 (13%), $75,000 to $100,000 (27%), and >$100,000 (20%).

Most landowners (83%) specifically inform hunters that their property is enrolled in QDM, or have participating hunters inform new hunters who seek access (6%), but 11% of landowners indicated they did not know how hunters found out their properties were enrolled in QDM. Landowners reported no difference in the number of hunters they allowed to hunt on their properties prior to QDM ($\bar{x}$ = 12) or since the cooperative was initiated ($\bar{x}$ = 11). Only one landowner changed his access policy since QDM was implemented (Table 1). That owner no longer provided access for family members, and no longer allowed open access without permission.

Table 1. Persons allowed to hunt on private properties before and after the properties were enrolled in a quality deer management (QDM) cooperative near King Ferry, New York in 2001, based on a 2002 mail survey of participating landowners.

Had permission to hunt property before QDM	n	%	Has had permission to hunt property since QDM	n	%
No one	19	0	No one	19	0
Family	19	26	Family	19	21
Friends and neighbors	19	89	Friends and neighbors	19	89
Strangers who asked	19	5	Strangers who asked	19	5
Anyone without asking	19	16	Anyone without asking	19	10

Although about one-half of responding landowners did not know how many deer typically were harvested on their properties, those who kept records indicated different harvests before QDM compared to after QDM was implemented. Since QDM was implemented, more antlerless deer QDM ($\bar{x}$ = 2.9) and fewer small bucks ($\bar{x}$ = 0.5) were harvested, compared to under conventional deer management ($\bar{x}$ = 1.8 for antlerless deer and x = 4.7 for small bucks). On average, very few mature bucks were harvested either before QDM (0.8) or since ($\bar{x}$ = 1.2).

What are the characteristics of hunters participating in the QDM cooperative?

All responding hunters were male. Most resided in a rural, non-farm area (72%) or in a small city (19%). While respondents generally had achieved a high level of formal education (64% had at least some college education), they reported a wide range of household incomes. Similar percentages reported household incomes between $25,000 and $49,999 (28%), between $50,000 and $74,999 (23%), and between $75,000 and $100,000 (28%).

Respondents averaged 49 years of age (range 20-80), had hunted deer for an average of 30 years, and had hunted deer in the King Ferry area for about 17 years. Overall, they had taken an average of about 16 antlered bucks and 15 antlerless deer in their lives. A slight majority (56%) indicated that the King Ferry QDM area was their primary hunting location.

Most respondents hunted deer during the regular firearm season, less than one-half during the early archery season, and only a few during the late archery or muzzleloader seasons (Table 2). Within each season, similar percentages hunted on the QDM area as hunted elsewhere. That is, if they bowhunted, they tended to hunt both on the QDM area and elsewhere. If they hunted during the regular season, they did so both on the area and elsewhere. Further, they hunted similar numbers of days regardless of where they hunted.

Table 2. Deer-hunting participation by season and location for persons who hunted deer in 2001 in a quality deer management (QDM) cooperative near King Ferry, New York, based on a 2002 mail survey.

Location hunted	Hunting season	Percent participating	Days hunted
King Ferry QDM	Early archery	40.9	10.0
	Regular firearm	75.9	8.0
	Late seasons	18.2	3.5
Elsewhere	Early archery	47.7	12.4
	Regular firearm	72.7	8.1
	Late seasons	15.9	3.0

Consistent with our expectations given the buck harvest standards implemented on the QDM area for the first time in 2001, more respondents harvested bucks elsewhere than on the QDM area during the 2001 hunting season (Table 3). Conversely, more respondents harvested $\geq$1 antlerless deer on the QDM area. This latter finding supports the notion that hunters tried to fill antlerless permits on the area rather than elsewhere. Overall, respondents had high rates of success in taking both anlterless deer (63% harvested at least 1 antlerless deer with one-half of those taking 2) and antlered bucks (45% harvested 1 buck, and 7% harvested 2).

Table 3. Deer harvest by location for persons who hunted deer in 2001 in a quality deer management (QDM) cooperative near King Ferry, New York, based on a 2002 mail survey.

Location hunted	Number antlerless deer harvested	Percent of hunters taking this number	Number antlered bucks harvested	Percent of hunters taking this number
King Ferry	0	59.1	0	86.0
	1	31.8	1	11.6
	2	9.1	2	2.3
Elsewhere	0	65.1	0	61.4
	1	23.3	1	34.1
	2	11.6	2	4.5

What do landowners want from QDM?

Five landowners met with HDRU and DEC staff in June 2002 to discuss their perceptions of the deer management system; all five were hunters. Their discussion focused on hunting-related outcomes although deer damage to crops and forest tree diversity, and concerns about deer-vehicle accidents also were mentioned. Respondents to the landowner mail survey reported that their interest for participating in the QDM cooperative was based on a desire for fewer negative effects from landowner-deer interactions and deer-habitat interactions. Most landowners wanted to see fewer deer on their property (61%) or experience less crop damage (56%). Many wanted fewer hunters shooting indiscriminately at bucks (50%), fewer deer-vehicle accidents (44%), or better tree regeneration in woodlots (33%).

Desires for more positive deer-related interactions were indicated by a minority of landowners. A few (22%) wanted to participate in QDM solely because their hunter friends wanted to try it, and one landowner indicated a willingness to participate because neighboring

landowners wanted to participate. Two landowners wanted healthier deer and one wanted a better chance to harvest a mature buck.

In the group discussion, we identified some potential positive and negative impacts that landowners associated with changes in deer-related interactions (either with deer directly or with deer hunters; see Appendix A). Although these might be considered fundamental objectives of deer management for at least some survey respondents, none of the potential impacts we listed were verified as impacts to be managed by a majority of respondents to the landowner survey (Table 4).

What do hunters want from QDM?

Our understanding of hunters' interests and desires is much richer than for landowners because we met with more hunters, more often. At the initial group meeting with hunters, the 42 participants listed 27 management outcomes desired from QDM (Table 5). These generally pertained to interactions hunters have with deer (especially bucks), each other (in terms of fairness), and landowners (in terms of access issues and setting rules for implementing QDM). Highest priority outcomes focused on changing hunters' interactions with deer (e.g., seeing and harvesting a larger number of mature antlered bucks, seeing a larger proportion of antlered bucks). These priorities are consistent with those purported by pro-QDM literature to be possible (e.g. Alsheimer 2003), and those reported as desired by hunters in other places where hunter-interest in QDM has been studied (e.g., Woods et al. 1996).

Table 4. Level of importance or concern associated with potential positive and negative deer-related impacts by landowners participating in a Quality Deer Management (CDM) cooperative near King Ferry, NY, based on a 2002 mail survey of participating landowners.

		Percent indicating each potential impact was…		
Potential positive impacts	n	Very important	Not at all to moderately important	Unsure about level of importance
Getting 'top dollar' for hunting lease	18	0.0	94.4	5.6
Less frustration about crop damage	18	38.9	50.0	11.1
Stay friends with other landowners	18	22.2	72.2	5.6
Having enough venison to eat, share	18	5.6	83.3	11.1
Property as good deer habitat	18	27.8	72.2	0.0
Stay friends with hunters using land	18	11.1	78.9	0.0
Less income lost from crop damage	18	38.9	55.6	5.6
Being an "expert deer hunter"	18	0.0	94.4	5.6
		Percent indicating they were…		
Potential negative impacts	n	Very concerned	Not at all to moderately concerned	Unsure about level of concern
Lost income from crop damage	18	27.8	72.2	0.0
Fear of being shot by hunters	18	27.8	72.2	0.0
Frustration about crop damage	18	38.9	61.1	0.0
Losing friendships with landowners	18	5.6	94.4	0.0
Having les tree diversity in woods	18	16.7	83.3	0.0
Fear of getting Lyme disease	18	16.7	83.3	0.0
Losing friendships with hunters	18	11.1	88.9	0.0
Being hurt in deer-vehicle accident	18	33.3	67.7	0.0
Fear eating deer sick with CWD	18	22.2	72.2	5.6
Paying for car repairs if hit a deer	18	33.3	67.7	0.0

Table 5. Desired management outcomes listed at an initial meeting on 19 September 2001 by 42 deer hunters interested in participating in a Quality Deer Management cooperative near King Ferry, New York.

Desired management outcomes	Number of votes received indicating each as… 1st priority	2nd priority	3rd priority
Seeing and harvesting bucks			
Increase sightings and harvest of mature antlered bucks	16	6	2
More balanced age structure among bucks (more older bucks)	5	4	2
Increase harvest of "big does" to avoid taking button bucks	1	2	3
Maintain opportunities to harvest a buck	1	--	--
Increase opportunities to harvest a buck	2	--	--
Increase sightings of younger bucks	--	2	--
Increase opportunities to hunt bucks during the prime rut	--	--	--
Changing the deer sex ratio			
More equal buck/doe ratio	5	7	4
Managing total numbers of deer			
Decrease total numbers of deer	2	--	1
Maintain total numbers of deer	--	5	1
Increase total numbers of deer	--	--	--
Managing the quality and health of individual deer			
Increase quality and health of all deer	2	--	2
Decrease predation on deer	1	--	3

Table 5 (continued)

Decrease sightings of archery-wounded deer in prior to firearms season	--	--	1
Decrease sighting of wounded deer during the firearms season	--	--	--
Increase opportunities to track wounded deer across property boundaries	--	--	--
Rules about implementing QDM			
All hunters should play by the same fair rules	2	6	5
Have consistent rules and opportunities for all hunting seasons (bow, muzzle, gun)	2	1	3
Have opportunities for exceptions to rules	1	--	1
Increase power of hunters and landowners to make decisions re QDM implementation	1	--	--
Increase power of landowners to control how many deer are taken from their properties	--	2	1
Decrease spotlighting during the season	--	--	1
Access issues			
Decrease hunters crossing over property lines	2	1	1
Increase access for all hunters to properties previously not open to hunting	1	--	--
Increase information about who is hunting and when on a given property	--	2	--
Increase honesty between hunters and landowners	--	1	1
Increase opportunities for hunters to contact landowners who want more deer harvested from their properties	--	--	--

Noticeably lacking from Table 5 is mention of changes in interactions between deer and their habitat. Only two of the 27 desired outcomes listed (decreasing total deer numbers, and linking hunters with landowners who want more deer harvested) are related to deer-landowner interactions. QDM literature tends to emphasize enhancement of habitat quality (e.g., Woods et al. 1996, Alsheimer 2003), but habitat quality generally is high in the agricultural landscape encompassing the King Ferry QDM cooperative.

What do hunters assume about the deer management system that leads them to believe that certain outcomes will happen if QDM is implemented?

Discussions with hunters attending the September 2001 meeting revealed that they have a "mental model" of how deer management works (Figure 1). Their basic premise is that deer population characteristics (e.g., total numbers of deer, and age and sex composition) affect the kinds of deer that hunters see and harvest (i.e., hunter-deer interactions). Management outcomes that hunters generally desired (i.e., objectives of management) are changes in specific deer population characteristics (i.e., sex ratio and age structure). Hunters believed that changing these characteristics will increase desirable hunter-deer interactions, especially relating to mature, antlered bucks.

Hunters who agreed to participate in QDM believe that some desired outcomes (i.e., management objectives) have not been achieved through the conventional hunting regulations (i.e., management actions) used in New York's Southern Zone for deer management. There interest in participating in QDM is based on the belief that achievement of desired objectives related to deer population characteristics will require implementing some *alternative management actions.* Thus, in 2001 participating hunters and landowners adopted a voluntary

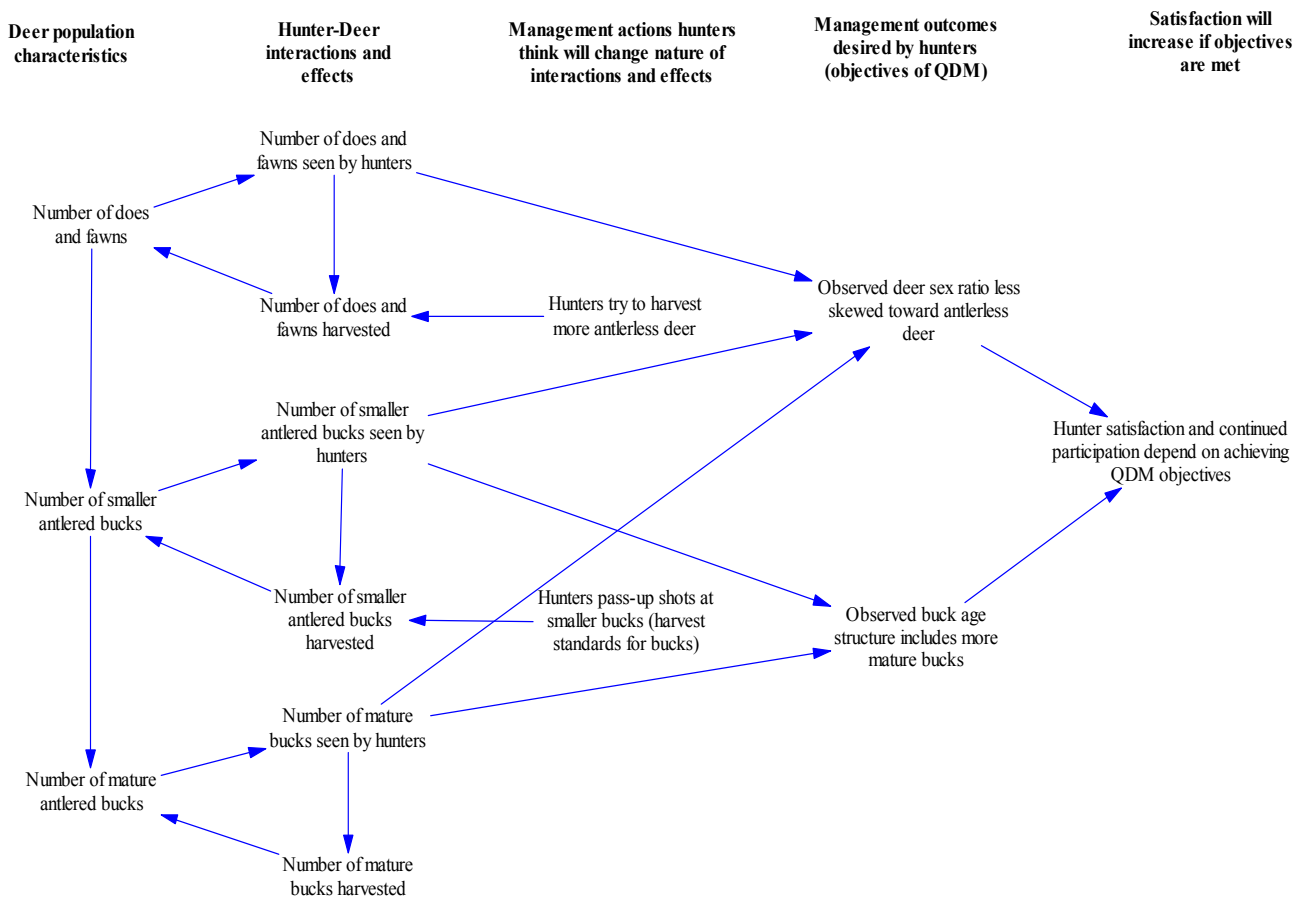


Figure 1. Deer hunters' initial conception of the deer management system reflecting their assumptions about how specific management actions will change hunter-deer interactions, and how those changes will achieve management objectives and increase hunter satisfaction, based on discussions with 42 hunters participating in a QDM cooperative near King Ferry, NY in 2002.

buck harvest standard (i.e., passing-up shots at younger bucks) and many pledged to personally increase their harvest of antlerless deer.

The arrows in Figure 1 show how hunters generally think about connections between deer population characteristics (particularly numbers of deer by age and sex), hunter-deer interactions, and management actions directed toward changing the nature of those interactions. Thus, Figure 1 represents hunters' conceptual model of the deer management system. Hunters expected that adoption of QDM harvest standards will change the outcomes of that system, compared to outcomes that would occur under conventional deer management (CDM). Based on this initial conception of the deer management system, we better understood why hunters believed attainment of desired management outcomes, or "fundamental objectives" were possible only by meeting certain "enabling objectives" focused on deer and related to harvest (Table 6).

Table 6. Initial means-ends matrix pertaining to management outcomes (i.e., ends) sought by hunters participating in a quality deer management (QDM) cooperative near King Ferry, New York, based on group discussions with participating hunters.

Initial fundamental objectives	Initial enabling objectives
More balanced deer sex ratio	Increase harvest rate for antlerless deer from 30% to 45%
	Decrease harvest rate for yearling bucks from 70% to 10%
Buck age structure less skewed towards younger, smaller bucks	

What *fundamental ends* do hunters associate with desired management outcomes?

At initial small group meetings in February 2002, hunters discussed why they desired certain outcomes listed at the September meeting. The discussion revealed that desired changes in deer population characteristics and related changes in hunter-deer interactions were not really *ends* in and of themselves, but were *means* to more *fundamental ends* that hunters sought. These included: (1) healthy deer, (2) natural deer population, (3) hunters being fair to each other, (4) sufficient venison for eating and sharing, and (5) demonstrating that they are better-than-average hunters. Riley et al. (2002) referred to these fundamental ends valued by hunters as *deer-related impacts* to be managed. If they wanted, participants could agree to establish a fundamental objective for each impact, perhaps based on minimum desired levels hunters would need to perceive or experience before they would say QDM management actions have been successful.

Our discussions revealed that hunters assumed these impacts "automatically" would be achieved if desired changes occurred in deer population characteristics (Figure 2). That is, if QDM harvest standards led to changes in the kinds of hunter-deer and hunter-hunter interactions produced by the deer management system, then desired levels of impacts also should be achieved. Arrows in Figure 2 show impacts that hunters associated with specific kinds of interactions. This reflects hunters' first description of fundamental objectives for QDM and the means necessary to achieve them. (See Appendix A for a depiction of how landowners think about the deer management system and the attainment of fundamental objectives for QDM.)

Discussions further revealed that hunters were concerned about some negative, deer-related impacts. They described how they wanted management to reduce (or maintain at low levels) "…some of the bad things related to deer or other hunters." These included: (1) fear of being shot by other hunters shooting indiscriminately at deer, (2) fear of being injured in a deer-

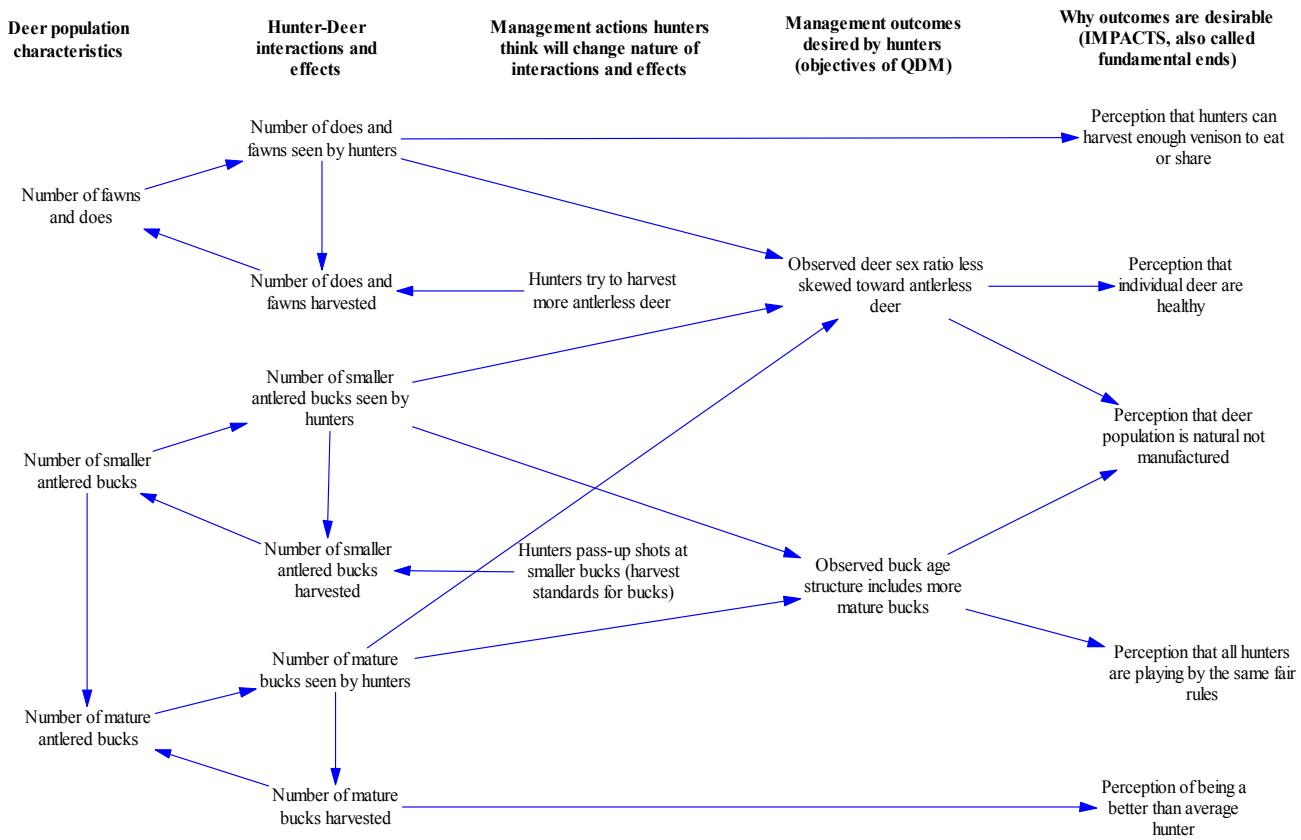


Figure 2. First revision of hunters' conception of the deer management system, identifying 5 deer-related impacts (far right) that they associated with particular hunter-deer interactions and changes in specific deer population characteristics, based on discussions with 42 hunters participating in a QDM cooperative near King Ferry, NY in 2002.

vehicle accident, (3) excessive cost of repairs after having a deer-vehicle accident, (4) lack of sufficient tree regeneration in woodlots from deer browsing, (5) losing friendships with landowners (and access to private land for hunting) because of issues with deer, and (6) getting sick or contracting a disease from deer. Although hunters in the small groups identified these potential negative impacts to be managed, they were more interested in discussing positive impacts to be achieved. Hence, they do not appear in Figure 2.

How well did the small groups reflect the thoughts of all hunters about the deer management system and impacts they want managed as fundamental ends of that system?

The mail survey supported the conception of the deer management system that emerged from the small group discussions. Respondents wanted to participate in QDM based on several desired changes in hunter-deer interactions. Most respondents wanted to see a greater number of mature bucks (78%) and still be able to "shoot enough deer to have all the venison I want" (53%). Many wanted to hunt where the deer sex ratio is nearly balanced (44%), where others do not shoot small bucks (44%), and where they feel they can pass up shots at small bucks (40%).

Survey respondents also verified some of the positive and negative impacts identified in the small group discussions. Health of individual deer, fairness among hunters, and a natural deer population each were "very important" to a majority of respondents (Table 7). Being a venison provider or a better-than-average hunter also were verified as impacts, but for a minority of respondents. Maintaining a friendship with the landowner was deemed "very important" by the largest percentage of survey respondents. This may have reflected recognition that continuation of the QDM cooperative depends on willingness of landowners to continue providing access for hunting.

Table 7. Level of importance associated with potential, positive deer-related impacts by hunters participating in a Quality Deer Management (QDM) cooperative near King Ferry, New York, based on a 2002 mail survey.

		Percent indicating each potential impact was…		
Potential positive impacts	n	Very important	Not at all to moderately important	Unsure about how important
Friendship with landowner	45	86.7	13.3	0.0
Healthiness of individual deer	46	76.1	23.9	0.0
Hunters being fair to each other	45	65.2	32.6	2.2
Natural buck age	46	58.7	41.3	0.0
Natural sex ratio	45	45.7	52.2	2.2
Being an "expert hunter" (i.e., better than average hunter)	45	37.0	60.9	2.2
Showing friends and family a big buck I harvested	46	32.6	67.4	0.0
Having enough venison to eat or share	46	28.3	71.7	0.0
Being a venison provider	46	19.6	76.1	4.3

Some of the negative impacts that were a concern to those in the small groups also were verified through the survey (Table 8). Two of these are negative versions of positive impacts (e.g., lack of fairness among hunters, losing friendships with landowners). Other negative impacts for substantial percentages of respondents pertained to risks to human safety and economic costs associated with deer.

Table 8. Level of concern associated with potential, negative deer-related impacts by hunters participating in a Quality Deer Management (QDM) cooperative near King Ferry, New York, based on a 2002 mail survey.

		Percent indicating each potential impact made them feel…		
Potential negative impacts	n	Very concerned	Not at all to moderately concerned	Unsure about how concerned they were
Lose friendship with landowner because of deer	42	64.3	35.7	0.0
Fear being shot by hunters shooting indiscriminately at deer	43	55.8	44.2	0.0
Fear eating deer that might be sick with Chronic Wasting Disease	42	42.9	54.8	2.4
Having to pay for car repairs after a deer-vehicle accident	42	42.9	57.1	0.0
Some hunters being unfair to others	42	37.2	60.5	2.3
Deer browsing decreasing diversity of tree species in woodlots	38	23.8	66.7	9.5
Fear getting Lyme disease	42	19.0	81.0	0.0
Being urgent to shoot the first antlered buck I see	41	9.8	90.2	0.0

We also found that respondents consistently valued certain impacts highly regardless of the reasons they wanted to participate in QDM (Table 9). For example, 88-100% of respondents who indicated they participated in QDM for any of the reasons listed in the questionnaire said that maintaining friendships with private landowners was “very important.” Similarly, healthy deer was “very important” to 71-85% of respondents, regardless of their reason for participating.

Table 9. Relationship between reasons for participating in Quality Deer Management (QDM) and potential impacts rated as "very important" or about which they were "very concerned", for hunters in a QDM cooperative near King Ferry, New York in 2002.

	Reasons that hunters said they were willing to participate in a QDM cooperative													
Potential positive impacts	I want to see more mature bucks 35/45 = 78%		I do not want to harvest small bucks 18/45 = 40%		I still want to get enough venison 24/45 = 53%		I want no one to take small bucks 20/45 = 44%		To hunt where sex ratio is equal 20/45 = 44%		The Landowner wants QDM 9 /45 = 20%		My hunting companions want QDM 4/45 = 9%	
	(n and % indicating a potential positive impact was "very important" to them personally)													
Have friendship with landowner	30	88%	16	94%	22	92%	17	89%	19	95%	8	89%	4	100%
Be venison provider	4	12%	3	19%	7	30%	3	17%	6	30%	4	44%	2	50%
Have healthy deer	29	83%	14	78%	17	71%	17	85%	15	75%	7	78%	3	75%
Be better than average hunter	13	38%	7	41%	8	33%	8	42%	5	25%	4	44%	1	25%
Have natural deer sex ratio	16	47%	9	50%	11	48%	10	50%	10	53%	5	63%	2	67%
Share venison	9	26%	6	33%	8	33%	6	30%	6	30%	3	33%	1	25%
Have fair hunters	23	68%	13	77%	16	70%	15	79%	13	68%	7	78%	4	100%
Tell family about big buck	12	34%	6	33%	7	29%	7	35%	6	30%	4	44%	2	50%
Have natural buck age structure	25	71%	16	89%	19	79%	17	85%	14	70%	3	33%	2	50%
Potential negative impacts														
	(n and % indicating they were "very concerned " about each potential negative impact)													
Fear being shot	17	49%	9	50%	11	46%	10	50%	10	53%	6	67%	2	50%
Some unfair hunters	14	41%	9	53%	11	48%	11	58%	8	44%	4	44%	3	75%
Have poor tree diversity	9	28%	4	23%	5	22%	4	22%	4	21%	2	25%	1	25%
Feel urgency to shoot first buck seen	3	9%	1	6%	3	13%	2	11%	2	10%	2	22%	1	25%
Get lyme disease	6	18%	4	23%	7	30%	5	26%	5	26%	4	44%	3	75%
Lose landowner friendship	20	59%	11	65%	16	67%	12	63%	14	74%	8	89%	4	100%
Pay for car repairs	13	38%	5	29%	10	42%	5	26%	8	42%	4	44%	2	50%
Eat deer with CWD	13	39%	7	44%	10	42%	7	39%	7	37%	6	68%	3	75%

Substantial percentages of respondents also indicated they were "very concerned" about some of the negative impacts, particularly those related to risks to human health and safety. These findings support our contention that hunters participating in the QDM cooperative share the basic assumption that important impacts will be attained if certain *enabling objectives* are met, particularly those related to changes in deer population characteristics

Which impacts do landowners and hunters think are most likely to be achieved under QDM vs. conventional deer management (CDM)?

To assess landowners' and hunters' assumptions about whether particular impacts were more likely to be achieved under QDM vs. CDM, we separated respondents into two groups for each of nine possible impacts. A high-importance group of respondents reported the impact was "very important" or that they were "very concerned" about it. A low-importance group associated less importance or concern with that possible impact. Using this analysis, any respondent could be in high-importance groups for some possible impacts, but in the low-importance groups for others.

Because the number of landowners was much smaller than the number of hunters, we present the results differently. We describe in the paragraphs below the aggregate findings from all of the relatively few responding landowners, highlighting agreement, disagreement, and uncertainty in their assumptions. For the larger pool of responding hunters, we present a series of graphs that provide a visual comparison of opinions by those in the high importance and low importance groups.

Very little agreement existed among responding landowners about whether QDM would be more beneficial than CDM in either reducing negative impacts or increasing positive impacts. A plurality of landowners assumed that (1) risk of losing income from crop damage, (2) fear

about being shot by hunters, (3) risk of deer decreasing plant diversity in woodlots, and (4) poor health of individual deer would be more likely under CDM compared to QDM. That is, a plurality believed that QDM would be beneficial in terms of decreasing these negative deer-related impacts. However, much uncertainty existed among landowners about the benefits of QDM as relatively high percentages (e.g., 25%-40%) of responding landowners either were unsure about whether these negative impacts would be improved under either QDM or thought they were equally likely to occur under either QDM or CDM.

A plurality of landowners assumed that (1) not being frustrated about crop damage, (2) not worrying about the risk of being injured in a deer-vehicle accident, and (3) maintaining friendships with deer hunters on their properties all were equally likely under either QDM or CDM. That is, a plurality assumed no clear benefit under either approach although about a quarter of respondents disagreed and believed that QDM would be more beneficial for decreasing the risk of being injured in an accident and for maintaining friendships with hunters. Great uncertainty existed about whether losing friendships with neighboring landowners because of issues with deer was more likely under either QDM or CDM.

We found more agreement among responding hunters, at least for some of the deer-related impacts we examined. Most hunters in both high importance and low importance groups assumed that a natural buck age structure was more likely under QDM (Figure 3a). This was not surprising considering that the buck harvest standard adopted by participants as the only difference from CDM is intended to allow small bucks to become mature bucks. Hunters in the two groups disagreed, however, about whether a natural deer sex ratio was more likely under QDM or CDM (Figure 3b). Those in the high-importance group were split about which management approach would be most beneficial, and about one-quarter indicated they were

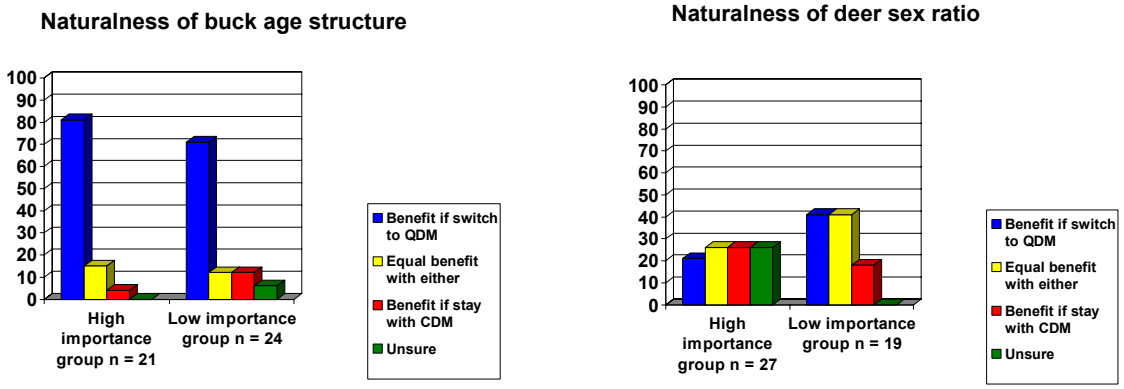


Figure 3 a, b. Percent of respondents assuming (a) a natural buck age structure and (b) a natural deer sex ratio are more likely under quality deer management (QDM) vs. conventional deer management (CDM), comparing hunters for whom level of naturalness is "very important" (high-importance group) with hunters who place less importance on naturalness as a management outcome (low-importance group).

unsure. Respondents in the low-importance group assumed a natural sex ratio was either more likely under QDM or equally likely under either approach, suggesting they assumed that a switch to QDM from CDM would not diminish naturalness of the sex ratio.

Many respondents in both groups assumed that hunters would be more likely to be *unfair* to each other under QDM compared to CDM (Figure 4a). That is, they assumed fairness would be higher under CDM. Small group discussions revealed that the notion of fairness has two parts (a) "equal gain," and (b) "equal pain." Under CDM, all hunters can shoot any antlered buck they see; thus, opportunity exists for equal gain, and there are no rules under CDM which "…cause equal pain." Under QDM, buck antler restrictions require hunters to share equal pain (i.e., everyone must pass-up shots at small bucks). A hunter would be unfair to others if he "cheated" and harvested a small buck, thus not sharing in the "equal pain."

Related to concern about "cheating" is hunters' sense of urgency to shoot the first buck they see, as urgency increases as perceived cheating by others increases. Respondents in both

groups generally assumed that urgency would be minimized under QDM (Figure 4b), although one-half of hunters in the high-importance group assumed urgency would be equally likely under either management approach (i.e., at least urgency would be no higher under QDM than under CDM). Figures 4a and b suggest that hunters assume the QDM strategy of having hunters pass-up younger bucks will diminish their own urgency to take the first buck they see, but they also assume other hunters will "cheat" and thus be unfair to the larger group.

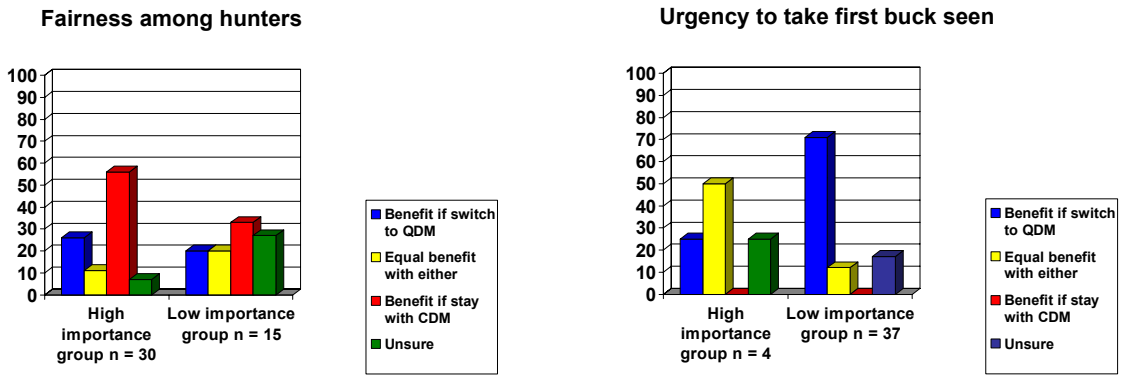


Figure 4 a, b. Percent of respondents assuming (a) hunters being fair to each other and (b) personal urgency to take the first buck they see will be more likely under quality deer management (QDM) vs. conventional deer management (CDM), comparing hunters for whom levels of fairness and urgency are important enough to be managed (high-importance group) with hunters who place less importance on these management outcomes (low-importance group).

A third outcome of the deer management system related to passing-up shots is hunters' fear about being shot by other hunters shooting indiscriminately at deer. A majority of respondents in the high-importance group assumed that this fear would be more likely under CDM, and thus their level of fear would be reduced under QDM (Figure 5). About one-half of respondents in the low-importance group assumed that fear about being shot was equally likely under either management approach (i.e., at least fear about being shot would not be any worse under QDM), and most of the remainder assumed that this fear would be higher under CDM.

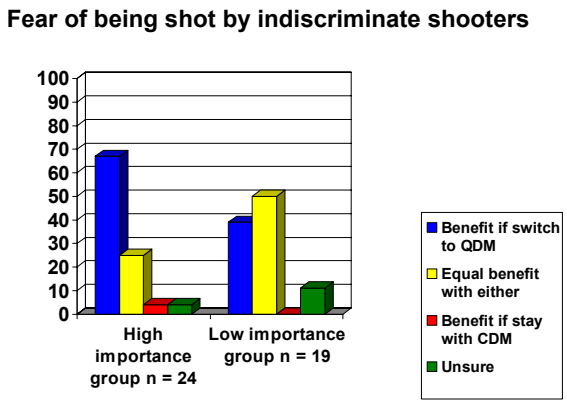
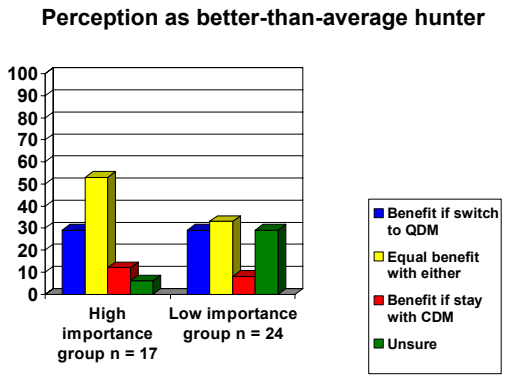


Figure 5. Percent of respondents assuming that level of fear about being shot by other hunters shooting indiscriminately at deer will be more likely under quality deer management (QDM) vs. conventional deer management (CDM), comparing hunters for whom this fear is an outcome about which they are "very concerned" (high-importance group) with hunters who are less concerned about this management outcome (low-importance group).

Most respondents who indicated that being a better-than-average hunter was "very important" assumed that this self-perception was more likely under QDM or was equally likely under either approach to management (Figure 6a). Respondents in the low-importance group for this self-perception were mixed with respect to their assumptions, perhaps reflecting their lack of understanding about the relationship between QDM outcomes and self-perception as a better-than-average hunter. Conversely, hunters who indicated that being a venison provider was "very important" had mixed assumptions about whether this self-perception was more likely under QDM or CDM (Figure 6b), in part because of uncertainty about future antlerless deer numbers given the lack of any adopted rules about harvest of antlerless deer. Respondents in the low-importance group for being a venison provider assumed this self-perception was more likely under CDM or was equally likely under either approach.



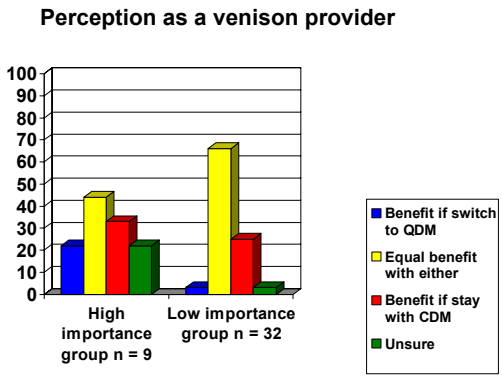


Figure 6 a, b. Percent of respondents assuming that self-perceptions as (a) a better-than-average hunter and (b) a venison provider will be more likely under quality deer management (QDM) vs. conventional deer management (CDM), comparing hunters for whom these self-perceptions are "very important" (high-importance group) with hunters who place less importance on these management outcomes (low-importance group).

Respondents in the high-importance groups for having healthy individual deer and sufficient diversity of tree species in woodlots had mixed assumptions about whether either of these ends was more likely under QDM compared to CDM (Figure 7a, b). However, many respondents in the low-importance group assumed deer would be healthier under QDM, but that tree diversity would be greater under CDM. This finding suggests that a substantial number of participating hunters did not link deer health to habitat quality (indexed by tree diversity). Also a substantial percentages of respondents indicated that they were unsure about whether either of these potential impacts was more likely under QDM or CDM.

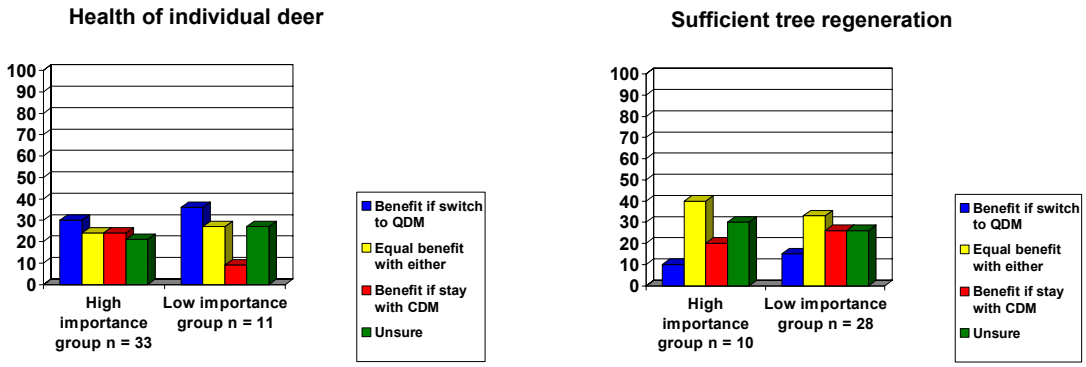


Figure 7 a, b. Percent of respondents assuming (a) healthier individual deer and (b) greater tree diversity will be more likely under quality deer management (QDM) vs. conventional deer management (CDM), comparing hunters who indicated these outcomes were "very important" (high-importance group) with hunters who place less importance on these outcomes (low-importance group).

What are desired/acceptable levels of impacts for landowners and hunters, and how do existing levels differ from these levels?

For landowners, we compared current and desired levels of four positive impacts, and current and acceptable levels of four negative impacts (Table 10). Landowners indicated that current levels were above desired (i.e., objective) levels for (1) friendships with neighboring landowners, and (2) self-perception as a venison provider, but that current levels were below desired levels for (1) potential of getting "top dollar" for leasing hunting access, and (2) self-perception as a better-than-average hunter. Current levels exceeded acceptable (i.e., objective) levels for each of the four negative impacts we examined. These findings are aggregated for all landowners because of the small number of respondents. Thus, we could not identify areas of disagreement or uncertainty about current vs. objective levels for landowners who placed high importance on these impacts compared to those who placed less importance on them.

Table 10. Comparison of mean current levels and mean objective levels for eight possible deer-related impacts, perceived by landowners participating in a quality deer management (QDM) cooperative near King Ferry, New York, based on a mail survey in 2002. Levels based on a scale from 0 to 10.

Possible positive deer-related impacts	Current level	Desirable (objective) level
Interactions with neighboring landowners over deer-related issues allow me to have this level of friendship with them	4.7	2.7
Deer characteristics on my land could allow me to get this level of payment for leasing hunting access	3.3	3.5
Interactions I have with deer on my land allow me to demonstrate this level of "expertness" as a deer hunter	1.9	3.7
Interactions I have with deer on my land allow me to demonstrate this level of being a "venison provider"	2.6	2.3
Possible negative deer-related impacts	**Current level**	**Acceptable (objective) level**
Interactions with hunters make me have this level of fear about being shot by hunters shooting indiscriminately at deer	3.9	2.9
Interactions with deer make me feel this level of risk about losing income from deer damage to crops	4.4	3.5
Interactions with deer make me feel this level of frustration about deer damage to crops	4.6	3.5
Interactions with deer make me feel this level of risk that deer browsing with diminish tree species diversity in my woodlots	4.1	3.5

We also compared current and desired levels of four positive impacts and four negative impacts in the hunter survey. Because we had found differing assumptions between hunters in high-importance and low-importance groups for various possible impacts, we divided hunters into these groups when we examined current and objective levels of impacts (Table 11). Not surprisingly, given the near universal interest in trying-out QDM as an alternative to CDM, respondents in the high-importance groups generally indicated that current levels fell short of levels they desired. Also, respondents in the two groups generally disagreed about both current levels and objective levels.

Respondents who greatly valued fairness among hunters (i.e., high-importance group) indicated that they would need to experience higher levels of fairness than they currently did before they would say QDM was a success. Consistent with this finding, they also indicated that their current level of disappointment about lack of fairness among hunters exceeded the level of disappointment that they were willing to tolerate and still say that QDM was a success. Although respondents in the low-importance group for fairness thought the current level of fairness was below objective level, they underestimated the level of fairness desired by those who greatly valued it as an impact to be managed. Also, respondents in the low-importance group believed not only that the current level of disappointment about lack of fairness was much lower than current disappointment indicated by those in the high-importance group for fairness, but non-impact respondents also thought that the current level of disappointment was below a maximum tolerable level.

Two other potential negative impacts associated with the idea of fairness among hunters are an urgency to shoot the first buck that a hunter see and fear about being shot by others shooting indiscriminately at deer. Although respondents in the high-importance group for

Table 11. Comparison of mean current levels and objective levels for eight possible deer-related impacts, perceived by deer hunters who greatly valued each particular impact (high-importance group) and deer hunters who placed less importance on each (low-importance group), determined through a mail survey of hunters participating in a quality deer management (QDM) cooperative near King Ferry, New York in 2002. Levels based on a scale from 0 to 10.

Possible deer-related impacts	All respondents	High-importance group	Low-importance group
Current level of fairness	n = 46	n = 30	n = 15
among hunters	4.8	5.1	4.1
Objective level of fairness	7.3	7.9	6.1
Current level of disappointment			
that some hunters are	n = 46	n = 30	n = 15
unfair to other hunters	5.1	5.9	3.6
Objective level of disappointment	5.0	5.4	4.1
Current level of urgency	n = 41	n = 4	n = 37
to shoot first buck seen	2.8	5.0	2.6
Objective level of urgency	4.2	6.0	3.8
Current level of fear of being shot	n = 43	n = 24	n = 19
by indiscriminant hunters	3.9	5.6	2.1
Objective level of fear	3.7	4.3	2.8
Current level of risk of having to	n = 42	n = 18	n = 24
pay for repairs from a			
deer-vehicle accident	4.8	7.1	2.9
Objective level of risk	4.3	4.6	3.9
Current level of self-perception	n = 46	n = 17	n = 28
as a better than average hunter	5.6	7.1	4.7
Objective level of “expertness”	6.2	7.1	5.6
Current level of self-perception	n = 45	n = 9	n = 35
as a venison provider	6.5	7.4	6.3
Objective level of “provider”	5.8	6.9	5.5
Current level of naturalness	n = 46	n = 27	n = 19
of the deer population	5.5	5.7	5.2
Objective level of naturalness	6.8	7.2	6.2

urgency perceived a higher level of urgency compared to respondents in the low-importance group, current levels of urgency were below tolerable (i.e., objective) levels for both groups. Conversely, the current level of fear of being shot was much higher for those in the high-importance group compared to the low-importance group, and the current level exceeded a tolerable (i.e., objective) level of fear for those in the high-importance group but not those in the low-importance group.

We also found differences among those in high-importance and low-importance groups for risk of having to pay for repairs from deer-vehicle accidents. Those in the high-importance group perceived a higher current level of risk compared to those in the low-importance group. They also indicated that the current level of risk exceeded their tolerable level, whereas respondents in the low-importance group indicated that current levels of risk were tolerable.

Respondents in the high-importance groups for the two self-perceptions (i.e., being a better-than-average hunter and being a venison provider) perceived relatively high current levels of these outcomes, and perceived higher current levels than for respondents in the low-importance groups. The current level of self-perception as a venison provider is above the objective level for those who greatly value it, whereas the current level of self-perception for being a better-than-average hunter is equal to the desired objective level.

Respondents in both the impact and low-importance groups for the possible impact of a natural deer population perceived similar current levels of naturalness. For both groups, the current level is below desired objective level. Further, those in the low-importance group underestimated the level of naturalness desired by those who greatly valued it.

What kind of *social learning* among participants would be beneficial prior to making decisions about new "alternative management actions" to implement as part of QDM?

Several opportunities exist for *social learning* to occur among participants that will enhance collaborative decision making. The idea behind social learning is that facilitated group discussion can enhance common knowledge, awareness of issues of importance to each other, and understanding about why these issues are important. Greatest learning can occur through a process whereby stakeholders are"…thinking, discussing, and acting together" (Borrini-Feyerabend et al. 2000:12). This supports the notion that for collaborative decision making to be successful, participants in the collaboration need to go through a process of mutual, interactive learning because no one individual has all the answers (Wondolleck and Yaffee 2000). Indeed, it is possible that no two individuals share the same understanding of the management question they are trying to answer. In these situations, scientific knowledge (e.g., about deer population size, harvest rates, crop losses) may be necessary but insufficient without also having knowledge of areas of agreement or disagreement about what people in the group value about these things.

For example, many areas of disagreement and/or uncertainty exist about whether particular impacts would be more likely under QDM or CDM. This is particularly evident from examining simultaneously assumptions of hunters in the high-importance groups for nine possible impacts (Figure 8). Each circle in the figure represents hunters' assumptions about a particular impact. Agreement or disagreement is indicated by the location of each circle, which is determined by the percentage of hunters who assumed the impact was more likely under CDM (x coordinate) vs. the percentage who assumed it was more likely under QDM (y coordinate). Uncertainty is indicated by the size of the circle, which reflects the percentage of hunters who were "not sure" whether that impact was more likely under one approach or the other.

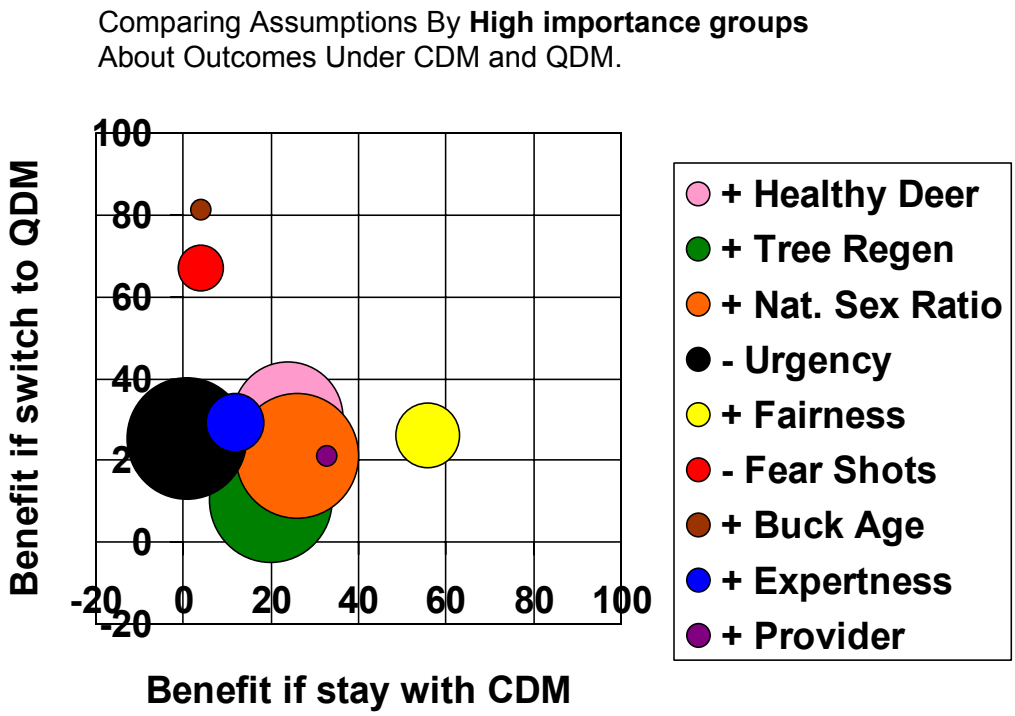


Figure 8. Simultaneous comparison of deer hunters' assumptions about whether staying with conventional deer management (CDM) or switching to quality deer management (QDM) will be more beneficial in terms of achieving nine potential outcomes of deer management, for hunters who highly valued each outcome. In the legend, a "+" indicates assumed increase in the outcome and a "-" indicates an assumed decrease.

Circles for six of the nine possible impacts are grouped in the bottom left corner of the graph. This indicates that even hunters who highly valued these impacts see little clear benefit (i.e., improvement) by either staying with CDM or switching to QDM as it currently is being implemented. More agreement seems to exist that (a) more natural buck age structure, and (b) less fear of being shot will occur with a switch to QDM, and that (c) fairness among hunters will be higher by staying with CDM.

Respondents' uncertainty is further reflected in large size of many circles. Smaller circles associated with being (a) a better-than-average hunter and (b) a venison provider indicate higher levels of certainty. However, many respondents for whom these were important fundamental ends thought they were equally likely under either management approach.

Additional areas of disagreement and uncertainty can be identified by examining simultaneously the assumptions of hunters in the low-importance groups (Figure 9). Perhaps of greatest importance in terms of collaborative decision making about alternative management actions is that respondents in the low-importance group had different assumptions, compared to those in the high-importance group for nearly all the possible impacts examined. For example, those in low-importance groups assumed that urgency to shoot the first buck seen would diminish and naturalness of the sex ratio would improve under QDM, whereas those who greatly valued these two impacts were less certain about whether either would be more likely under QDM or CDM. Thus, some hunters may support the idea of switching to QDM based on false assumptions about the benefits others may receive. Note also uncertainty about clear benefit under either QDM or CDM for the seven other possible impacts, indicated by their location in the bottom left corner of the graph.

The uncertainty indicated in Figures 8 and 9, and the perception that at least one positive impact (i.e., fairness among hunters) is more likely under CDM, suggest additional alternative management actions are needed to ensure success of the QDM cooperative. Collaborative decision making about alternative management actions to implement requires several kinds of social learning, especially among those hunters who greatly value specific outcomes. First, these hunters could learn from each other about the factors that affect perceived/experienced levels of impacts. Second, based on an improved understanding of the *system of factors* that influence the

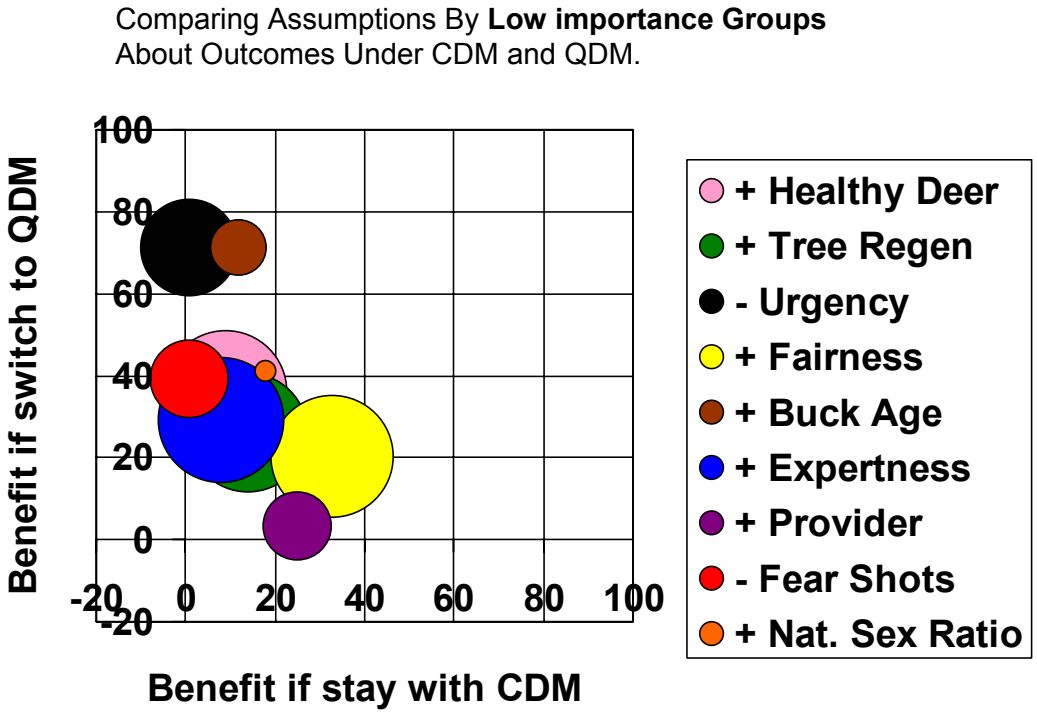


Figure 9. Simultaneous comparison of deer hunters' assumptions about whether staying with conventional deer management (DCM) or switching to quality deer management (QDM) will be more beneficial in terms of achieving nine potential outcomes of management, for hunters who placed relatively low importance on each outcome. In the legend, a "+" indicates assumed increase in that outcome, and a "-" indicates assumed decrease.

levels of those impacts (i.e., improved understanding of the *deer management system)*, participants could benefit by discussing the kinds of alternative management actions they believe will lead to desired changes in the desired levels of impacts to be managed. Finally, participants can benefit by learning about areas of agreement and disagreement regarding current levels of each impact as well as desired/acceptable levels that could be established as management

objectives to achieve under QDM.

Learning about the system of factors that affect the various impacts would be beneficial for those in the low-importance groups for several reasons. First, it would improve their understanding of how impacts they do not value very highly may be related to impacts which are "very important" to them. Second, development of a revised, more accurate notion of the system of factors that affect levels of impacts could provide a sound basis on which they evaluate their support/opposition to any alternative management actions.

Additional benefit can be gained if social learning among all participants is directed at better understanding current and objective levels of impacts. Respondents in the high-importance groups for the four positive impacts we examined consistently perceived higher current levels and desired higher objective levels, compared to respondents in low-importance groups. However, consistent underestimating on the part of hunters in the low-importance groups may not have much practical significance given that their perceptions about whether objective levels are being met generally matched perceptions of those in the high-importance groups. Respondents in both groups perceived naturalness of the deer population and fairness among hunters to be lower than desired, and both groups perceived the level of self-perception as a venison provider to be adequate. Still, better understanding of the relatively high levels desired by those in the high-importance groups could improve decisions about what alternative management actions may need to be implemented under QDM.

Even greater benefit could be gained through social learning focused on current and objective levels of negative impacts to be managed. For three of the negative impacts we examined, respondents in the high-importance group indicated not only higher current levels compared to those in the low-importance groups, but they also indicated that tolerable levels had

been exceeded. Hunters in the low-importance groups clearly lacked understanding about the need for management actions focused on achieving lower levels of these negative impacts.

Identifying alternative management actions depends on understanding factors that affect a particular impact to be managed and the relationships between those factors and the level of the impact. In other words, it depends on understanding the system of interrelationships involved. Taken together across all impacts to be managed, the broad set of interrelationships can be thought of as the *deer management system.* Although deer managers may have a particular conception of the deer management system (D. Reihlman, DEC, personal communication), participants in the QDM cooperative have other conceptions. Better collaborative decision making likely would occur if hunters, landowner, and DEC deer managers had a shared mental model of what this system looked like. Figure 2 presented earlier depicts our rendition of hunters' initial conception of the deer management system, and Appendix A depicts our rendition of landowners' initial conception.

Through the social learning that occurred in the small group discussions with hunters, participating hunters revised their conception of particular parts of the deer management system. A key step in revising their conception was to identify a single, particular impact and to discuss the various factors that either increased or decreased its level, as well as the relationships among these factors. We then used the mail survey to quantitatively calibrate some of the important relationships.

What is the hypothesized model of the deer management system for the impact referred to as "fairness among hunters"?

Hunters in the small groups hypothesized that level of fairness is influenced most by the

proportion of other hunters who comply with the QDM harvest standard by which hunters are supposed to pass-up shots at small bucks (Figure 10). If most hunters comply and pass-up small bucks, perceived level of fairness will be high, most hunters will be satisfied that QDM is working, and they will be willing to continue participating in the cooperative. However, if the proportion of "cheaters" starts increasing, level of fairness will decrease and hunters will become increasingly disappointed at the lack of fairness being demonstrated by other hunters. As disappointment increases, hunters' sense of urgency to shoot the next antlered buck they see (regardless of whether it meets the harvest standards) increases. Essentially, their willingness to continue pass-up shots at small bucks erodes when they think others are shooting small bucks. As level of urgency increases, harvest of small bucks increases, and perceived level of fairness further decreases.

The relationship between compliance, fairness, urgency, harvest of smaller bucks, and back to compliance is critically important because it can operate as a reinforcing, negative feedback loop. Level of fairness can be likened to water behind a dam, and urgency to take the next antlered buck seen can be likened to the pressure of water squeezing through a hole in the dam. When a little bit of water (fairness) starts to leak out of the dam, pressure (urgency) on the hole builds, and fairly quickly the little leak can become a torrent. If that happens, not only will the fundamental objective of fairness drop below the level desired, but it is unlikely that other objectives related to changes in the buck age structure can be achieved (e.g., seeing and harvesting mature bucks, naturalness of the deer population, self-perception as a better-than-average hunter) because small bucks will not live long enough to become mature bucks.

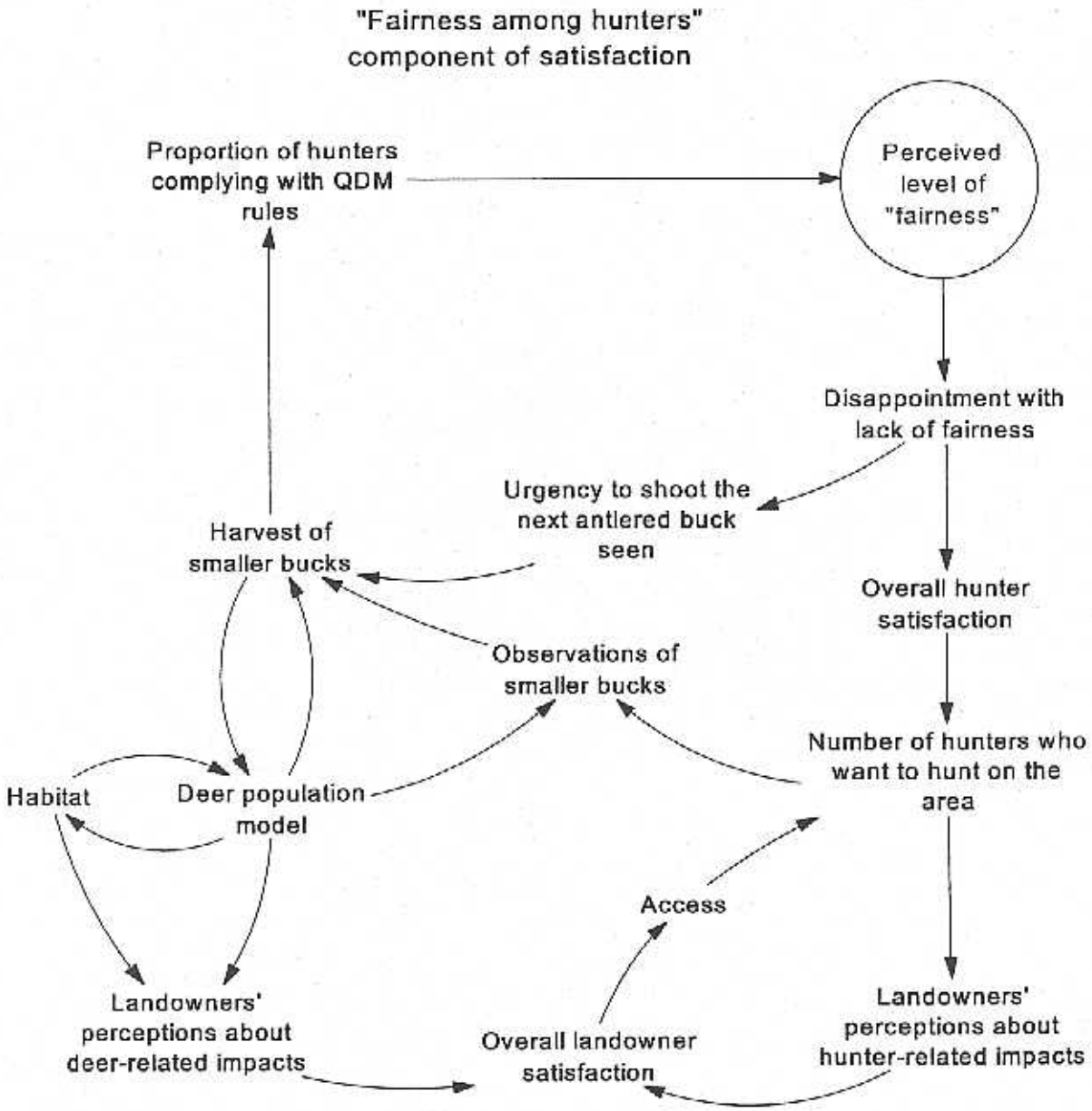


Figure 10. Model of factors affecting level of fairness among hunters (i.e., that all hunters are "playing by the same fair rules"), as described by a small group of hunters participating in a Quality Deer Management (QDM) cooperative near King Ferry, New York in 2002.

The hypothesized model of factors affecting level of fairness that we generated from the small group discussions was supported by results from the survey. Current level of fairness is below the desired (objective) level and disappointment about lack of fairness among hunters exceeds the level tolerated by hunters (refer to Table 9). These levels reflected the high proportion of hunters who were thought to have cheated during the first hunting season under QDM. Survey respondents estimated that about 30% of all participating hunters shot small bucks that did not meet the agreed-upon harvest standards. Although only 14% of respondents reported taking an antlered buck of <u>any</u> size on the QDM area (and no other harvest data were collected by any other means), the magnitude of suspected "cheating" substantially diminished the perceived level of fairness. Apparently, respondents are willing to tolerate only low levels of non-compliance with the QDM harvest standards for bucks.

From the survey, we calibrated the relationship between proportion of hunters not complying with the QDM harvest standard and disappointment about lack of fairness (Figure 11). Disappointment increases substantially when >6% of hunters are thought to be "cheating" by taking small bucks. Figure 16 and the estimated 30% rate of non-compliance both support the finding that current level of disappointment is high and is above a tolerable (i.e., objective) level.

We also calibrated the relationship between perceived rate of non-compliance with the buck harvest standard and hunters' sense of urgency to take the next antlered buck they see, regardless of whether it meets the standard (Figure 12). Urgency is relatively low when non-compliance is thought to be low, but increases quickly as non-compliance increases. Comparison of current level of urgency (refer to Table 9) and the level of urgency that hunters associated with the 30% rate of perceived non-compliance seems inconsistent; we would expect

current level of urgency to be higher based on Figure 12.

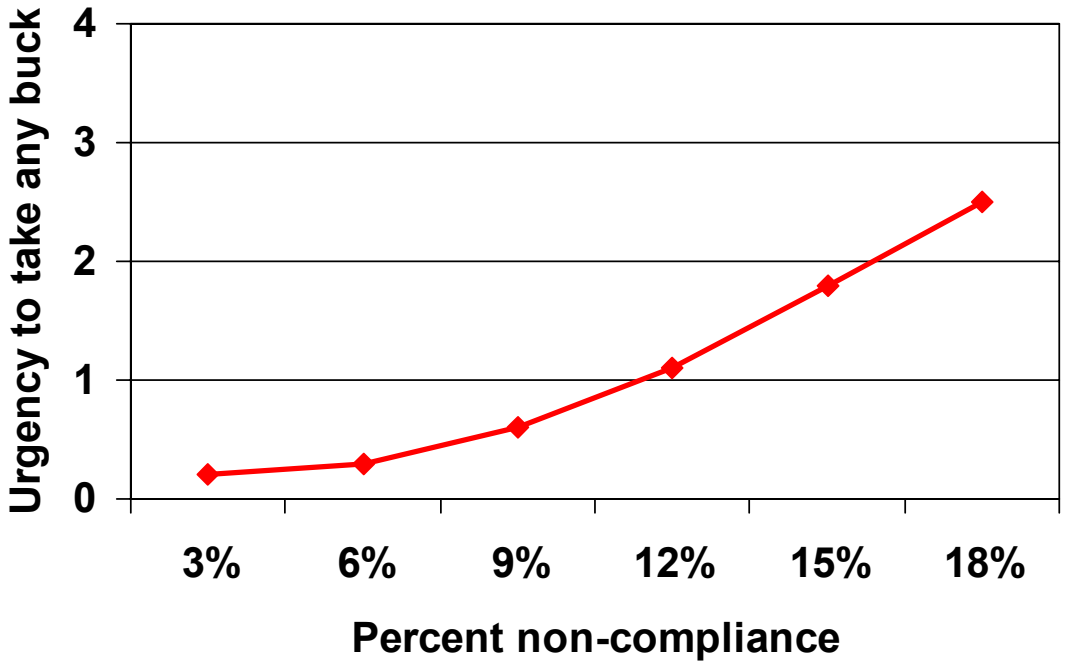


Figure 11. Relationship between the perceived percentage of hunters not complying with a quality deer management (QDM) regulation to pass-up shots at smaller antlered bucks and hunters' level of disappointment about lack of fairness shown by other hunters, from a mail survey of hunters participating in a QDM cooperative near King Ferry, New York in 2002. Disappointment is scaled from no disappointment at all (0) to complete disappointment (4).

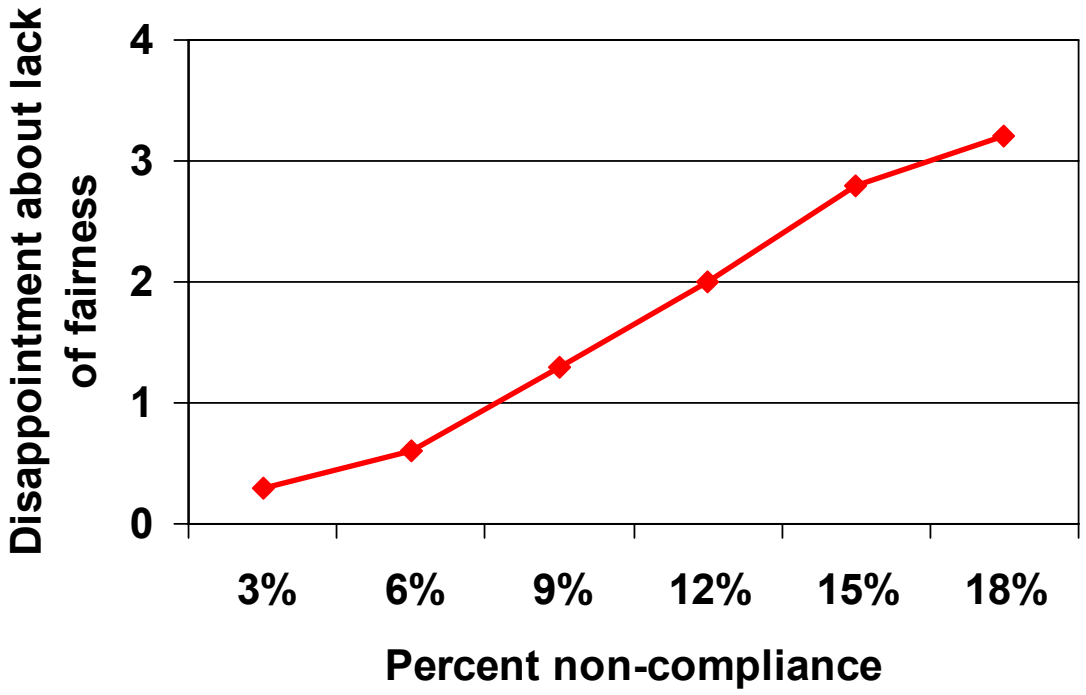


Figure 12. Relationship between the perceived percentage of hunters not complying with a quality deer management (QDM) regulation to pass-up shots at smaller antlered bucks and hunters' sense of urgency to shoot the next buck they see, from a mail survey of hunters participating in a QDM cooperative near King Ferry, New York in 2002. Urgency is scaled from no urgency at all (0) to complete urgency (4).

A plausible explanation for this discrepancy is that level of urgency to harvest the next antlered buck seen also is affected by other factors besides perceptions of fairness. For example, most respondents (78%) indicated that they would feel at least moderately disappointed in themselves if they did not hold out for a mature buck, and 27% said they would feel "completely disappointed" in themselves if they "cheated." Perhaps the amount of increase in urgency related to disappointment with lack of fairness among hunters is dissipated to some extent by their desire to uphold personal values about complying with the QDM harvest standard.

Another possible explanation emerged from hunters in small group discussions who suggested that their urgency to shoot the next buck they see is held in check by desire to increase their self-perception as a better-than-average hunter. According to those in the small groups, this self-perception is diminished if they harvest a small buck (Figure 13). Under this scenario, the relationship between self-perception as a better-than-average hunter, urgency to harvest the next buck seen, and harvest of small bucks would act as a counteracting loop. When the level of self-perception deviates too far from the objective level, urgency should adjust correspondingly.

However, recall that the current level of this self-perception was about equal to the level desired (refer to Table 9). We are uncertain about how the level of urgency would change if the level of self-perception as a better-than-average hunter decreased below the minimum acceptable level. We could not examine these relationships due to space constraints in the survey. Nonetheless, the apparent discrepancy between current level of urgency to take the next antlered buck seen and the level that *should* correspond to the 30% estimated rate of non-compliance with QDM rules highlights the need for better understanding about the relationships between the impacts to be managed and the sets of influencing factors that encompass participants' conception of the deer management system.

"Being a better than average hunter" component of satisfaction

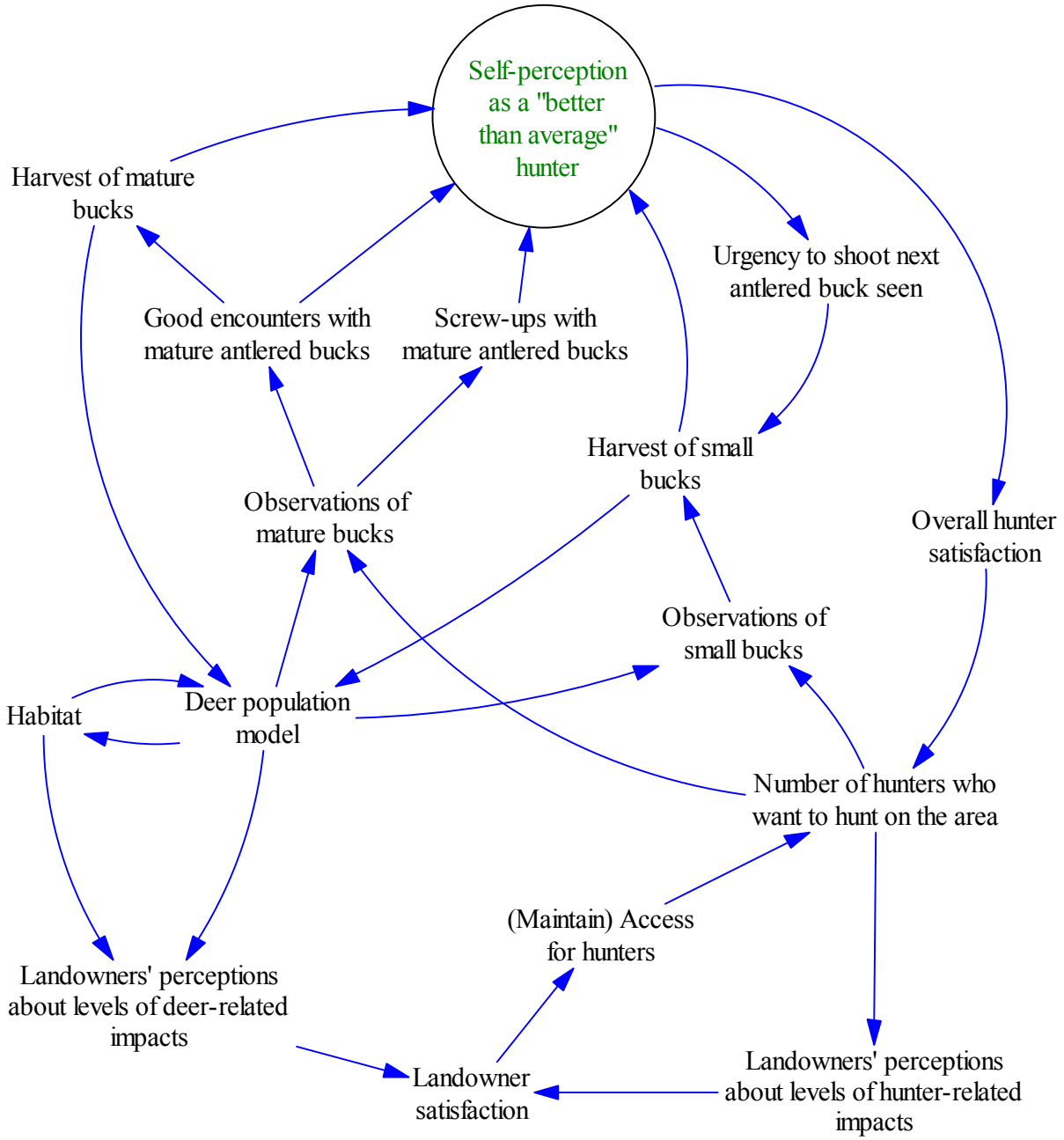


Figure 13. Model of factors affecting deer hunters' self-perceptions as better-than-average hunters, as described by a small group of hunters participating in a Quality Deer Management (QDM) cooperative near King Ferry, New York in 2002.

What is the hypothesized model of the deer management system for the impact referred to as "naturalness of the deer population"?

Another possible moderating influence on hunters' urgency to harvest the next antlered buck seen is their perception of the naturalness of the deer population. Although we have no survey data to explore relationship between naturalness and urgency, we used survey results to calibrate the influence of hunters' observations of the deer sex ratio and buck age structure on their perceptions of naturalness of the deer population. Hunters in the small groups had identified these factors as important influences on naturalness (Figure 14). To them, a natural deer population has a relatively balanced ratio of female and male deer, and a noticeable age structure among antlered bucks. Further, a deer population that is skewed towards antlerless deer or lacks older age classes of bucks "…feels unnatural, like it is manufactured by hunting."

Hunters in the small groups hypothesized that level of naturalness should increase if (1) sex ratio becomes less skewed towards antlerless deer, and (2) proportion of older, antlered bucks increases. In turn, if naturalness increases, hunter satisfaction should increase, and willingness to continue participating in the QDM cooperative should remain high. If naturalness is too low (i.e., below objective), hunters' (1) willingness to harvest antlerless deer should increase to bring the sex ratio more into balance, and (2) urgency to harvest the next buck they see regardless of its age should decrease to allow more bucks to live to maturity.

Survey data supported the hypothesized model inasmuch as the current level of naturalness is below objective level (refer to Table 9), and both sex ratio and buck age structure were perceived to be skewed. The average sex ratio reported was about 75 antlerless deer and 25 antlered bucks out of every 100 total deer observed (3:1 ratio). The average age structure was about 8 small bucks and 2 mature bucks out of every 10 total bucks (4:1 ratio).

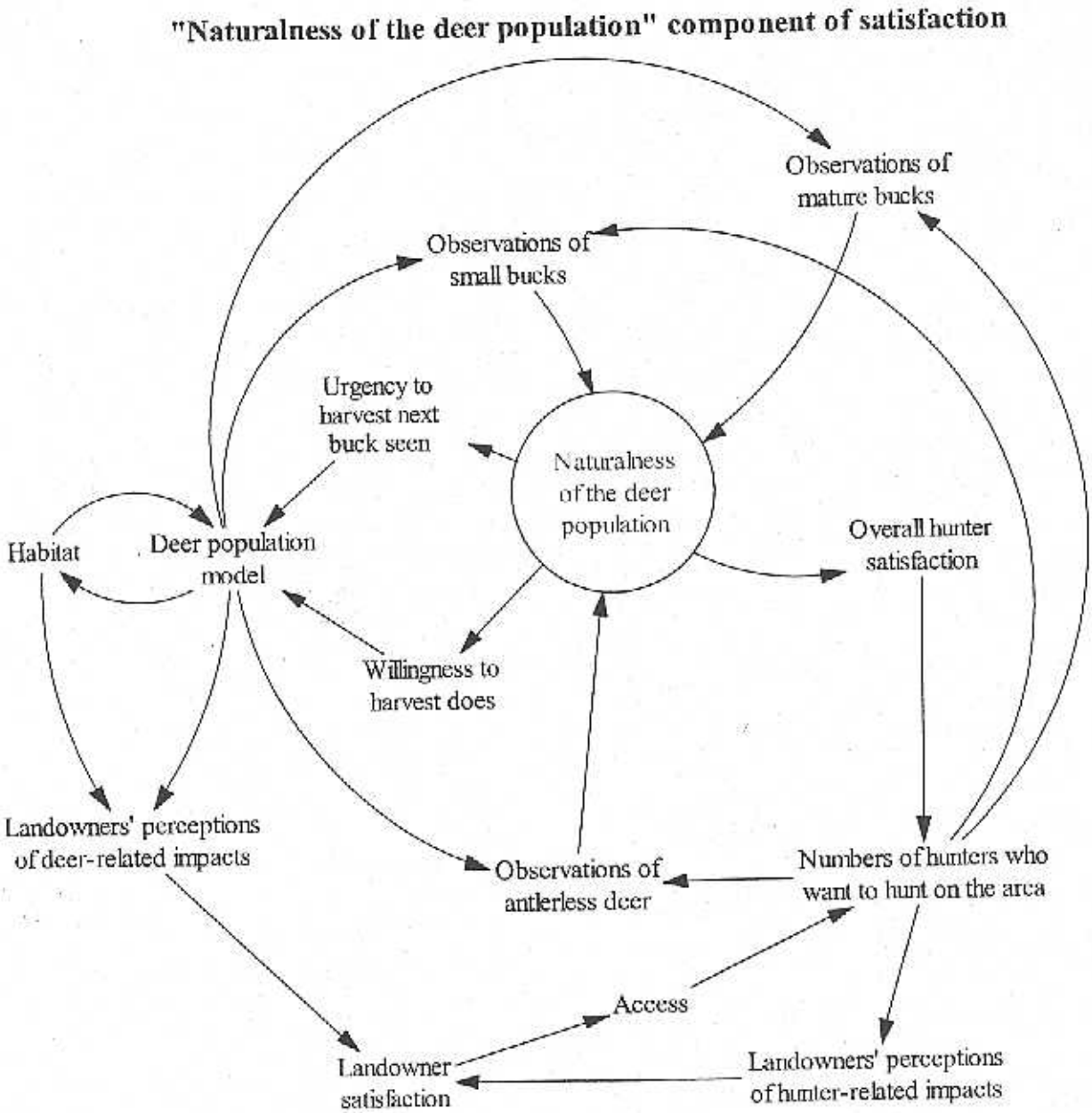
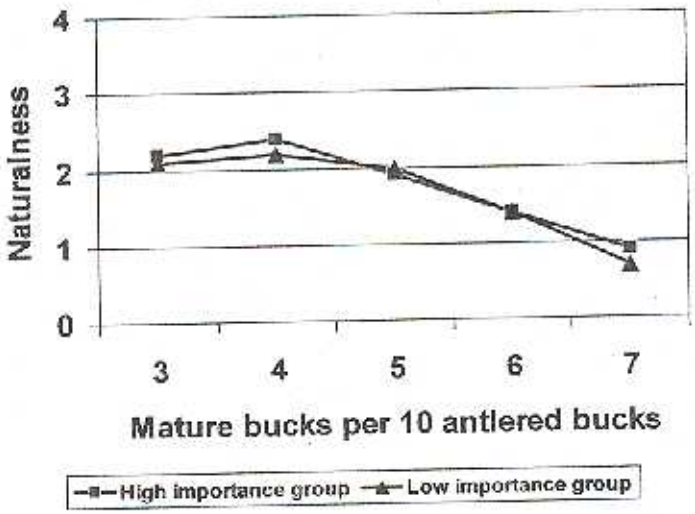


Figure 14. Model of factors affecting hunters' perceptions of the naturalness of the deer population, as described by a small group of hunters participating in a Quality Deer Management (QDM) cooperative near King Ferry, New York in 2002.

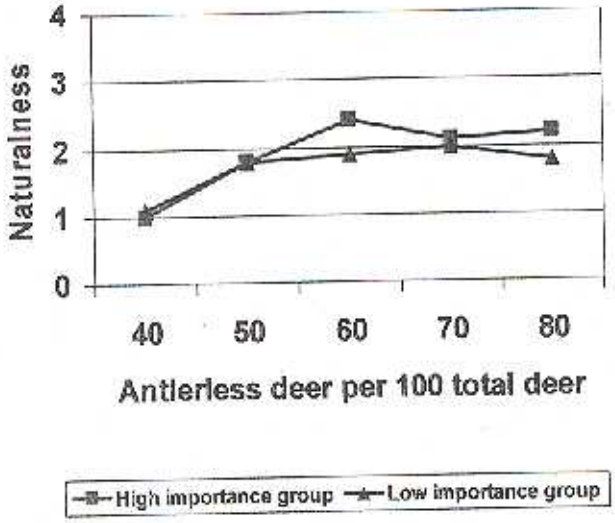
Respondents in the high-importance groups for natural sex ratio and natural buck age structure thought these deer population characteristics were even more skewed than respondents in the low-importance groups (Table 12). However, respondents in high-importance and low-importance groups associated similar levels of naturalness with various deer sex ratios (Figure 15a), and with various buck age structures (Figure 15b). Thus, differences between high-importance and low-importance groups with respect to current level of naturalness (refer to Table 9) can be explained by different perceptions of the deer sex ratio and buck age structure, rather than differences in level of naturalness associated with various ratios and structures.

Table 12. Comparison of deer sex ratio and buck age structure estimated by hunters who greatly value naturalness of the sex ratio and buck age structure as outcomes to be achieved through management (high-importance groups) and hunters who place less importance on naturalness (low-importance groups), from a mail survey of hunters participating in a quality deer management (QDM) cooperative near King Ferry, New York in 2002.

Deer population characteristic group	High-importance group	Low-importance group
Deer sex ratio prior to QDM		
(out of 100 total deer)	(n = 21)	(n = 25)
mean no. antlered bucks	22	28
mean no. antlerless deer	78	72
Buck age structure prior to QDM		
(out of 10 total antlered bucks)	(n = 27)	(n = 18)
mean no. mature bucks	1.5	2.7
mean no. small bucks	8.5	7.3



a.



b.

Figure 15. Naturalness of the deer population associated with (top) various deer sex ratios, and (bottom) various buck age structures by deer hunters for whom naturalness is "very important" (high-importance group) and hunters who place less importance on naturalness (low-importance group), from a mail survey of hunters participating in a quality deer management cooperative near King Ferry, New York in 2002. Naturalness is scaled from not at all natural (0) to completely natural (4).

Naturalness increases from "not very natural" when the sex ratio is about 40 antlerless deer per 100 total deer to a peak between "moderately" and "very natural" when the sex ratio is about 60 antlerless deer per 100 total deer. However, higher sex ratios of 70 and 80 antlerless deer per 100 total deer still were considered "moderately natural." For buck age structure, a "moderately natural" level occurs when there are 4 mature bucks out of every 10 antlered bucks. Naturalness diminishes substantially as the proportion of mature bucks increases from 4 to 7.

Based on the preceding discussion about portions of the deer management system pertaining to deer-related impacts referred to as fairness among hunters, being a better-than-average hunter, and naturalness of the deer population, we developed an example of a revised means-ends matrix (Figure 16). This matrix shows how achievement of management ends desired by hunters (i.e., fundamental objectives) likely would require means (i.e., enabling objectives) directed at both deer and people. We developed this example as a starting point for discussion, but the greatest benefit in terms of social learning value likely would occur if participants developed a matrix based on insights from this report and further facilitated discussions.

What alternative management actions are landowners willing to implement, and would they be successful based on the revised conception of the deer management system?

We asked landowners in the mail survey to indicate the various ways in which they would be willing to participate in the cooperative in future years. One-half or more of the responding landowners indicated they were willing to take actions that could increase the success of the cooperative (see italics enabling objectives in Figure 16). In particular, 56% said they were willing to require hunters to harvest an antlerless deer on their property before being

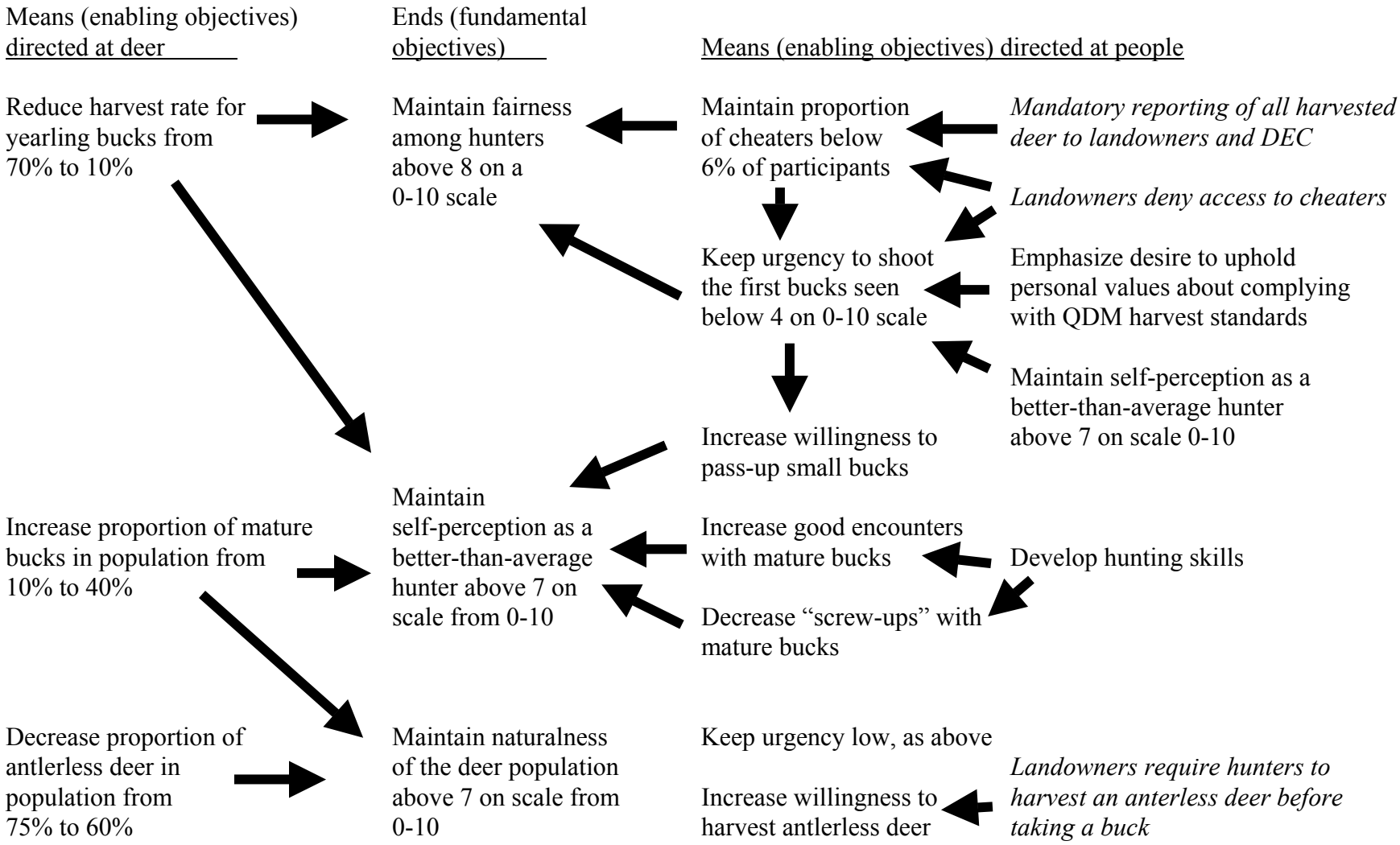


Figure 16. An example of a revised management means-ends matrix for three deer-related impacts of importance to hunters participating in a quality deer management (QDM) cooperative near King Ferry, New York.

allowed to take a buck. Fifty percent of landowners said they were willing to have hunters report all harvested deer to them and then pass that information along to DEC. Forty-four percent said they were willing to deny access to hunters who "cheated" and did not abide by the QDM harvest standards. However, relatively few said they were willing to attend meetings to revise rules (33%), allow additional hunters to have access to their property (22%), or talk with other landowners about alternative management actions (6%).

What were baseline levels of satisfaction and willingness to continue with QDM?

After one season of QDM experience, a majority of hunters (58%) and landowners (61%) were satisfied. One out of six hunters (19%) was dissatisfied; with14% greatly dissatisfied. Only one landowner was dissatisfied (greatly).

About one-half of hunters (51%) indicated that they were even more willing to participate now after one season of experience with QDM, but 12% said they were less willing to participate. Willingness to participate had not changed for the remainder of the hunters. Similarly, willingness to participate had not changed for most landowners (72%), with the rest split between being more willing and less willing. Given our findings that many important deer-related impacts were below desirable levels or above tolerable levels, however, participants' satisfaction and willingness to continue may erode quickly if they do not perceive improvement in desired/tolerable levels of impacts.

CONCLUSIONS

Landowners' and hunters' willingness to try QDM seems to be based on their assumptions about how the deer management system works and how outcomes of that system can be changed by adopting QDM harvest standards as an alternative management action to CDM. However, those assumptions generally do not reflect well the fundamental ends that participants seek (i.e., the deer-related impacts to be managed) or the system of factors that influence levels of those ends. Thus, not surprisingly, current levels of positive impacts generally are below desired levels and current levels of negative impacts generally exceed tolerable levels. Further, disagreement and uncertainty exist within the landowner and hunter groups with respect to whether fundamental objectives associated with impacts are more likely to be achieved under QDM or CDM. Therefore, before hunters and landowners can make decisions about alternative management actions to implement under QDM, several kinds of social learning are needed.

First, a better understanding is needed about which impacts to focus on as fundamental objectives of QDM. For example, of the various possible impacts we examined, majorities of hunters indicated that 4 positive impacts were "very important" and that they were "very concerned" about 2 negative impacts. Do hunters agree that these are the most appropriate impacts to manage? Do new impacts emerge from the discussions, particularly negative psychological impacts associated with economic and health risks from deer? For example, a minority of respondents was very concerned about the cost of deer-vehicle accidents, but we do not know whether the percentage would increase if we had asked specifically about frustration with having to pay for repairs, risk of having to pay for repairs, or excessiveness of the cost of repairs.

Second, greater understanding is needed about the systems of factors affecting the various impacts. The success of collaborative decision making in identifying and implementing alternative management actions depends greatly on everyone sharing the same conception of the deer management system. Our results suggest that various hunters, landowners, and DEC staff have different conceptions. Social learning about the deer management system occurred among participants in the small group discussions, but that learning needs to be extended to the broader group of hunters and landowners participating in the cooperative.

Hunters taking part in the small groups developed a shared notion that basic relationships among certain factors (and their associated feedback loops) increase or decrease levels of impacts. However, some relationships hypothesized by hunters who took part in the small group discussions were not supported by findings from the mail survey. Survey respondents indicated that naturalness of the deer population was lower than desired. Hunters in the small groups had hypothesized that low levels of naturalness were associated with skewed sex ratios and buck age structures, and survey respondents indeed reported that these were skewed. However, the current level of naturalness perceived by survey respondents did not correspond to the level that they associated with the observed, average sex ratio and buck age structure.

Some discrepancies may have occurred because the same factor affects multiple impacts. Other discrepancies may have resulted from poor understanding about the magnitude or nature of the effect of a given factor on an impact. For example, very few hunters were concerned about their urgency to shoot the next buck they see regardless of its age, and hunters reported that their current level of urgency is fairly low. However, insights about the system of factors affecting fairness among hunters indicate that urgency is like a leak in a dam. It may start out small, but increase quickly, and thus drain the level of fairness perceived among hunters.

Third, collaborative decision making might be improved by understanding why respondents in the low-importance groups consistently rated lower current levels of impacts compared to respondents in the high-importance groups. Were different perceptions of current levels related to misunderstanding about the management system affecting given impacts? If so, support for or opposition to various alternative management actions could be affected.

Fourth, social learning is needed about the appropriate objective levels for impacts to be managed. We determined desired/tolerable levels for a few possible impacts, but do not know whether these levels are realistic or achievable because of trade-offs among the impacts. For example, the current level of self-perception associated with being a venison provider exceeds the objective level, and small group discussions revealed that this probably is because hunters have plenty of opportunity to harvest antlerless deer. On the other hand, naturalness of the deer population currently is too low and may be related to some extent by a sex ratio skewed toward antlerless deer. What are realistic levels of naturalness and being a venison provider that can be achieved simultaneously? What trade-offs may need to occur for other impacts?

Finally, with a revised conception of the deer management system developed through these opportunities for social learning, participants can better identify alternative management actions to implement as part of QDM. The antler restriction currently implemented as an alternative to CDM may not be sufficient by itself to achieve any of the fundamental objectives important to participants. Hunters and landowners initially identified this management action based on the assumption that it would result in different kinds of interactions with deer compared to those they experience under CDM. Indeed, regulating buck harvest through an antler restriction may be a necessary but insufficient action. In particular, actions focused on minimizing hunters' urgency to shoot the next antlered buck they see also may be necessary.

Requiring hunters to register harvested deer at a check station, and/or encouraging landowners to deny access to hunters who do not comply with the antler restriction are just two examples of actions that landowners indicated they were willing to implement, and which may be necessary for success of the cooperative.

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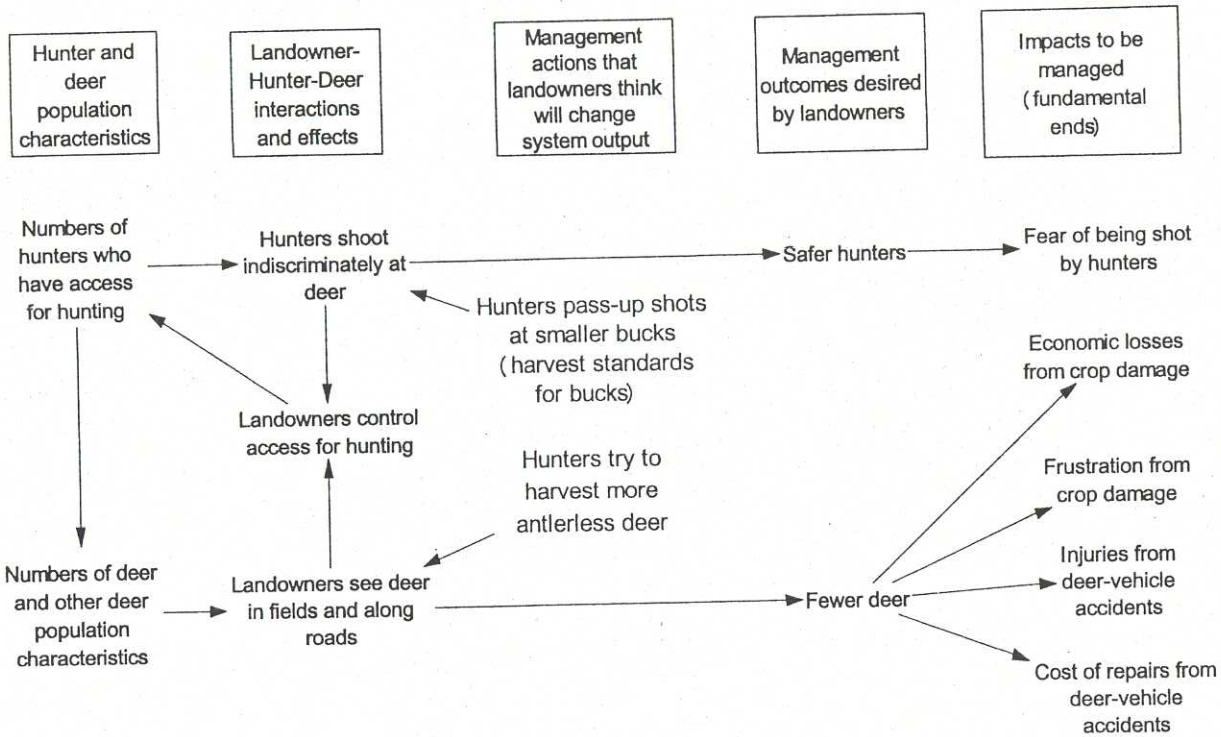

Appendix A. A model of landowners' conception of the deer management system showing their assumptions about relationships between the interactions they have with deer and hunters and resulting deer-related impacts (fundamental ends) that they want managed, based on a group interview with landowners participating in a quality deer management (QDM) cooperative near King Ferry, New York in 2002.