



Original Article

The Sustainability of Controlled Archery Programs: The Motivation and Satisfaction of Suburban Hunters

MARK WECKEL,¹ *Mianus River Gorge Preserve, 167 Mianus River Road, Bedford, NY 10506, USA; Division of Vertebrate Zoology, American Museum of Natural History, Central Park W at 79th St, New York, NY 10024, USA; The Graduate Center, The City University of New York, 365 Fifth Avenue, New York, NY 10016, USA*

ROBERT F. ROCKWELL, *Division of Vertebrate Zoology, American Museum of Natural History, Central Park W at 79th St, New York, NY 10024, USA*

ANASTASIA WINCORN, *Mianus River Gorge Preserve, 167 Mianus River Road, Bedford, NY 10506, USA*

ABSTRACT Over the last decade, wildlife professionals in the New York City (NY, USA) metropolitan area have increasingly turned to controlled archery hunts to reduce overabundant suburban deer populations. The success of these deer management programs (DMPs) depends on a willing pool of hunters motivated to meet harvest goals. This requires maintaining hunter satisfaction both now, and in the future when successful herd reduction will result in fewer opportunities for deer harvest. With the goal of providing local deer managers with feedback from hunters partaking in DMPs, we used surveys designed to evaluate why members hunted, why they joined DMPs, members' views on deer management, and ultimately, their satisfaction with controlled hunts. Members were primarily motivated to hunt by the chance to see wildlife, opportunities for recreation, and a passion for archery. Most (71%) reported that their enjoyment had increased since first joining a DMP and satisfaction was not linked to harvest opportunity or success. Nevertheless, we documented several trends that threaten the long-term sustainability of DMPs. First, 78.2% of survey respondents were over the age of 40, possibly suggesting fewer younger recruits into DMPs. Second, the opportunity to hunt previously unharvested land, a transitory incentive, was the most common reason for participating in DMPs. Third, respondents whose DMP doe harvest was limited by choosing to spend time on private, non-DMP land were also more likely to have seen fewer deer on DMP lands (G -test = 13.2, $df = 4$, $P = 0.01$). This suggests that effort will decline as deer herds decline. © 2011 The Wildlife Society.

KEY WORDS archery, bow hunting, hunter motivation, *Odocoileus virginianus*, overabundance, suburban, white-tailed deer.

Over the past 2 decades, overpopulation of white-tailed deer (*Odocoileus virginianus*) has been a persistent ecological and public safety concern in the suburban Northeast, where densities in excess of 20 deer/km² have been reported (Kilpatrick and Walter 1999, DeNicola and Williams 2008, Daniels et al. 2009). At high densities, deer cause increased car accidents (Conover et al. 1995, Etter et al. 2002), declines in biodiversity (Rooney and Waller 2003, Côté et al. 2004), increased threat of Lyme disease transmission (Wilson et al. 1985), and destruction of landscaping (Sayre et al. 1992). In response, suburban land managers have implemented deer management programs (DMPs) in an effort to reduce overabundant populations. Unlike purely recreational hunts, suburban DMPs come with their own set of rules and regulations (McDonald et al. 1998) such as the requirement that hunters take a certain number of ant-

lerless deer before they can harvest an antlered buck. In the New York metropolitan area (NY, USA), these DMPs provide new opportunities for recreational hunters.

Successful deer management requires a reliable pool of hunters who enjoy participating in these highly regulated hunts, and who are motivated to reach the goals set by managers (Brown et al. 2000). However, the goal of drastic population reduction may not be an attractive prospect for deer hunters (deCalesta and Stout 1997). In a statewide study of Pennsylvania, USA hunters, most did not see current herd densities as detrimental to forests and were reluctant to harvest adequate numbers of antlerless deer despite documented browse damage to forest vegetation (Diefenbach et al. 1997). There is evidence that hunters are more accepting of herd reduction in suburban settings (Responsive Management 2004) where deer overpopulation and its impact on human health and safety may be more apparent. Regardless, hunters often do not view themselves as instruments of deer management, and it is unknown to what degree hunters are willing to alter their hunting effort

Received: 29 December 2010; Accepted: 18 June 2011

¹E-mail: mweckel@mianus.org

and strategy to meet the goals set by managers (Brown et al. 2000). Furthermore, if herd reduction is successful, hunters may lose interest in participating in DMPs as deer numbers decline and harvesting deer becomes more difficult, which would threaten DMP sustainability. To remedy this problem, managers need to design DMPs that cater to all aspects of the hunting experience (Hendee 1974).

Studies have shown that hunters have a diverse set of motivations and goals that determine their satisfaction with the hunting experience (Hendee 1974). However, there has been little research on the motivations and satisfaction of suburban hunters participating in DMPs (Brown et al. 2000). In this paper, we examine the attitudes, motivations, and satisfaction of bow hunters participating in archery-only DMPs in Westchester County, New York and Fairfield County, Connecticut, USA. Specifically, we surveyed DMP hunters (hereafter, members) to determine 1) their demographics, 2) their primary motivations for hunting, 3) their views on deer management and how they view their role in DMPs, 4) where they get their information about deer, 5) their opinions on possible management strategies (e.g., fawn harvest, antler restrictions), 6) whether and to what extent they enjoy participating in DMPs, and 7) limitations on their ability to successfully harvest does in DMPs. The DMPs included in this study are less than a decade old, so we initiated this survey to provide managers with information that could be useful in adapting programs to maintain hunter participation over time.

STUDY AREA

Westchester County (1,121 km²) and Fairfield County (1,621 km²) are part of the greater metropolitan New York area and are located directly north of New York City (Fig. 1). Westchester County was slightly more densely populated (\bar{x} = 846.7 people/km²) than Fairfield (\bar{x} = 565.6/km²; U.S. Census Bureau 2010). Both counties were characterized by a strong south-to-north urban-rural gradient with dense urban centers such as Yonkers, New York (4,203.7 people/km²) and Stamford, Connecticut (1,279.8 people/km²). Deer management programs were concentrated in more forested areas to the north where population densities were well below county averages.

METHODS

In 2009, we distributed a voluntary, anonymous survey prior to the hunting season and asked that surveys be completed by 31 January 2010. We created a website (www.urbanwhite-tail.com) and recruited respondents by distributing advertisements at DMP meetings. Surveys could be filled out by hand or online. We made an effort to enlist respondents from all DMPs active in 2009 in Westchester County and Fairfield County. These DMPs involved bow hunting only, relied on recreational hunters, operated during the regular New York and Connecticut hunting seasons, and had forest regeneration as a primary management objective. Deer management programs differed with regard to organizational structure, regulations, and harvest quotas.

Questions addressed basic demographics and employment, information on hunting history, motivations for hunting, reasons for participating in controlled archery programs, overall satisfaction with specific DMPs, and factors that limited the number of antlerless deer each hunter harvested. Respondents were allowed to skip questions and submit partially completed surveys. When % of respondents is indicated, sample size n represents the number of survey takers who provided an answer and did not leave a question blank. On questions asking for opinions, we asked respondents to choose from a 5-point scale (from 1 = strongly disagree to 5 = strongly agree). For motivational questions, we asked respondents to rate the overall importance of each variable on a 4-point scale (very important = 4 to not important = 1). In an attempt to identify a few motivational types, we used factor analysis to extract latent composite factors explaining variation in respondents' motivation following the methods outlined in Decker and Connelly (1989). We used a Cattell's scree, a graphical test plotting eigenvalues (describing variance extracted by each factor) against the number of factor components to determine the appropriate number of latent factors to extract (McGarigal et al. 2000).

To evaluate the degree of nonreporting bias, we examined the age distribution of survey respondents compared to that of registered members from 3 DMPs where such data were made available. Agreement between respondents (sampled population) and registered DMP members (parent population) would suggest the sample is representative, at least with regard to age (Filion 1975). Age is an important statistic because previous studies have shown strong correlations between hunter age, motivation, satisfaction, and response rate (Filion 1975, Decker and Connelly 1989). All analyses were performed in R (R Development Core Team, Vienna, Austria). Surveys were carried out under Institutional Review Board protocol 09-0031C approved by the City College of the City University of New York.

RESULTS

Surveys were completed by 89 hunters of 7 Westchester DMPs (Bedford Audubon, BA; Butler Sanctuary, BS; Mianus River Gorge Preserve, MRGP; Rockefeller State Park, RF; Town of Pound Ridge, TRP; Westchester County Parks, WCP; and Westmoreland Sanctuary, WMS; and 2 Fairfield DMPs (Town of Redding, TR; and Greenwich Audubon, GA). Return rates expressed as a percentage of eligible 2009 DMP participants ranged from a low of 11.8% (Town of Pound Ridge) to a high of 100.0% (Bedford Audubon), with a mean of 50.87% (SE = 9.92).

The mean age of survey respondents (n = 86) was 48.0 (SE = 1.08; Fig. 2), while the mean age of 120 registered DMP members from WCP, TPR, and MRGP (representing DMPs with high and low response rates) was 44.1 (SE = 0.95). The distribution of hunters across age classes was not different between the 2 groups (G -test = 8.93; df = 11, P = 0.63) minimizing the potential problem of nonreporting bias based on age.

Of 87 respondents, 71.0% answered that they hunted as children, and the mean age at first hunt was 17.4 (n = 77,

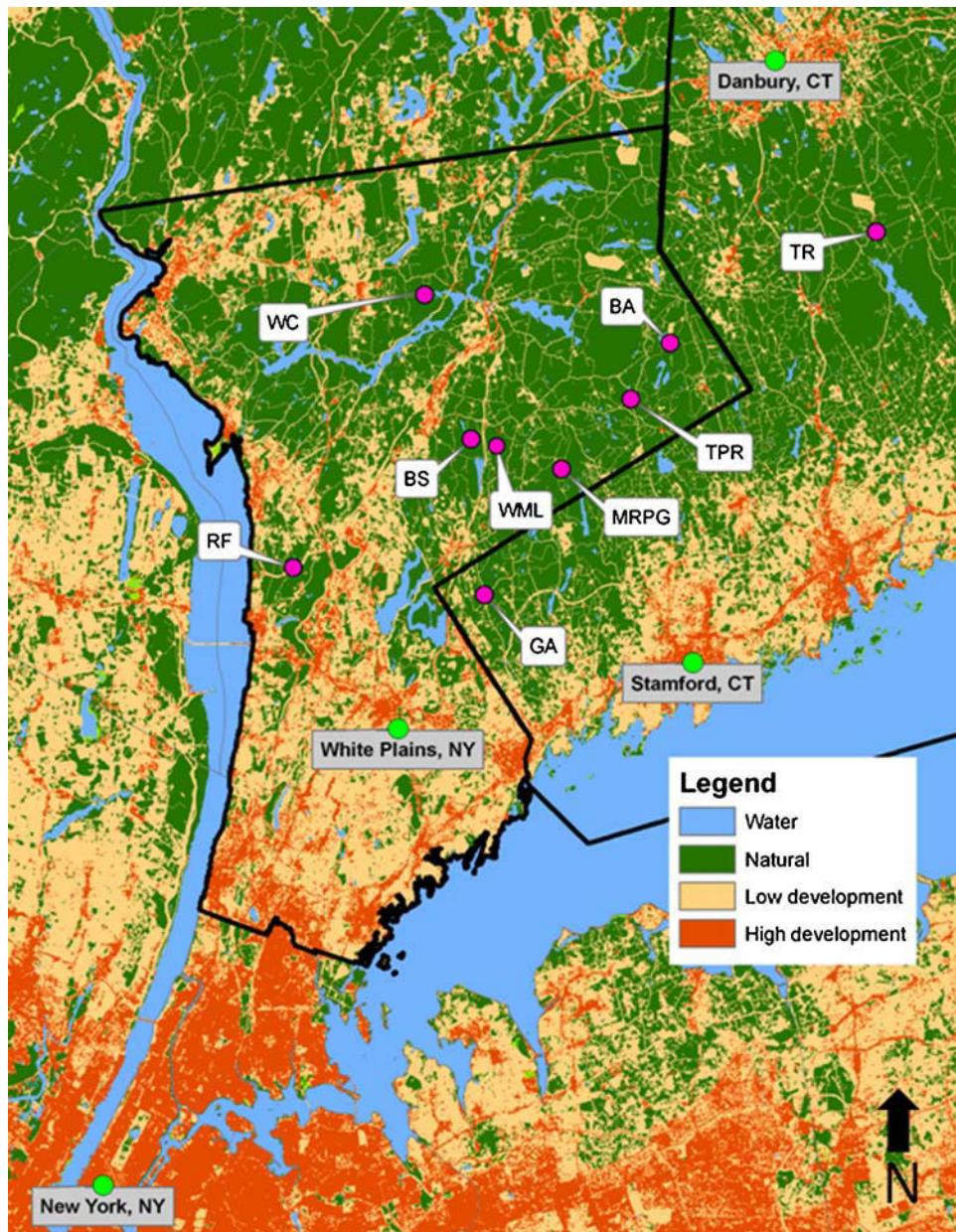


Figure 1. Map of Westchester County, New York and Fairfield County, Connecticut (USA) showing land use and location of deer management programs (DMPs) included in this study. DMPs and year of first hunt: Greenwich Audubon (GA, 2003); Mianus River Gorge Preserve (MRGP, 2004); Rockefeller State Park (RF, 2005); Town of Pound Ridge (TPR, 2006); Town of Redding (TR, 2006); Bedford Audubon (BA, 2008); Butler Sanctuary (BS, 2009); Westchester County (WC, 2009); Westmoreland Sanctuary (WML, 2009).

SE = 0.87). Nearly all respondents (99.0%) who provided the age of their first hunt ($n = 77$) had their first hunting experience before the mean age of DMP hunters, and 88% began hunting at an age younger than the youngest DMP participant (Fig. 2). Of those who hunted as children and completed questions regarding the locale of such hunting ($n = 47$), 72% indicated they hunted in suburban and/or urban areas in their youth. Fifty-four percent of respondents ($n = 78$) held white-collar jobs, followed by 36% blue collar, 9% retired, and 4% students. Using U.S. Census classifications, the top 4 jobs were management (18.2%), construction (16.7%), sales (12.12%), and financial services (9.09%).

The majority of respondents assigned a high degree of importance to most motivation variables, making our factor analysis of hunting motivation largely inconclusive. Examining Catell's scree plot, we found that each extracted component explained an equal portion of the variance and, therefore, did not suggest the existence of a few explanatory latent factors. However, factor loadings grouping the motivation variables "Hunt for recreation" and "Hunt to see wildlife" were consistently high (>0.5) for all component numbers. These variables, along with "Archery is a passion," ranked as the most important motivating variables among all participants (Table 1).

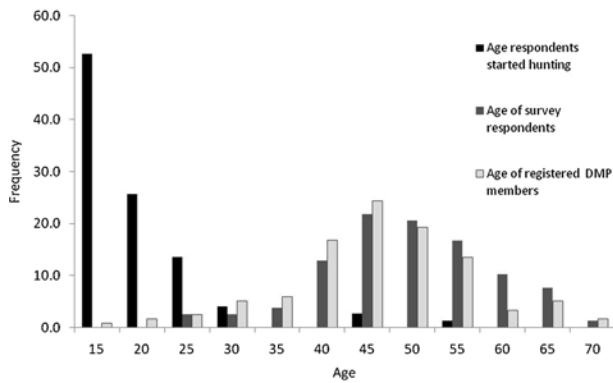


Figure 2. Histogram describing the age of survey respondents ($n = 81$), and members ($n = 120$) of 3 deer management programs (Mianus River Gorge Preserve, Town of Pound Ridge, and Westchester County Parks), and the age at which respondents began hunting ($n = 74$), Westchester, New York, and Fairfield, Connecticut (USA), in 2009.

The majority (64.5%) of respondents ($n = 76$) in DMPs believed that deer had a negative impact on human safety and forest health (81.6%). Nevertheless, 71.0% of those respondents who thought deer negatively impacted people and the forest ($n = 62$) believed that there were “a good number” of does in the DMPs in which they participated, and only 4.8% believed there were too many. Nearly all (98.6%) of respondents ($n = 73$) agreed that archery could lower deer populations and reduce negative impacts on forest regeneration, destruction to ornamental plantings (95.9%), deer–automobile collisions (73.2%), and Lyme disease (71.2%). Respondents obtained information on deer biology and management from a variety of media and institutional sources. Overall, DMP staff were the most common source of deer information, with >86% of respondents ($n = 77$) indicating this was an important source in contrast to blogs (33%). Magazines and state agencies were equally relevant, with 76% of hunters claiming them as important, followed by 65% who also relied on Quality Deer Management Associations (QDMA) and 54% who relied on scientific literature.

Nearly all (93.4%) respondents ($n = 76$) indicated that the opportunity to hunt previously un hunted land was an important factor in participating in DMPs. The second most commonly cited reason was the opportunity to harvest a trophy buck (89.5%), and the third was population control

(87.2%). Only 23.7% of respondents relied on DMPs for their only hunting spot, even though 55% of all respondents ($n = 77$) indicated that they were unable to hunt their own property.

Overall, 86.7% of respondents ($n = 75$) were satisfied with the rules and regulations of their individual DMPs. Eighty-two percent of respondents ($n = 73$) agreed that managers took participants’ input into consideration in the design and implementation of controlled hunts. Only 4.1% disagreed. For those respondents who participated in ≥ 1 season prior to taking the survey ($n = 53$), the mean years in their DMP was 2.53 (SE = 0.24). The majority of these returning respondents reported that their enjoyment in their DMP had increased since they started (71%). Responses on whether harvesting a buck was more difficult since they joined their DMPs were split (38.9% agreed, 37.0% disagreed, 24.1% had no opinion). Discounting respondents who had no opinion, respondents’ level of enjoyment of participating in DMPs was not dependent on the perceived level of difficulty in harvesting a buck (G -test = 0.03; $df = 1$, $P = 0.86$). Regarding does, nearly 48.1% of respondents believed harvesting a doe had become more difficult (37.0% disagreed, 12.3% had no opinion). As with bucks, hunter enjoyment was not dependent on perceived difficulty of harvesting does (G -test = 1.17; $df = 1$, $P = 0.28$).

Most (79%) of the respondents ($n = 74$) supported antler restrictions that would protect bucks under a certain antler size from harvest. Nearly 64% of all respondents ($n = 74$) believed that the antler size of remaining bucks would increase by allowing controlled hunts. Twenty-three percent believed antler size would decline. The majority of respondents supported earn-a-buck initiatives (60%, $n = 74$) that allow hunters to harvest a bucks only after they harvest a certain number of antlerless deer. However, a sizeable minority opposed them (24%). Nearly all (98.0%) of the respondents ($n = 80$) agreed that it is ethical to harvest adult does and adult bucks; however, there was considerably less support among respondents ($n = 78$) for the harvest of fawns (34% ethical, 52% unethical). Of those respondents who believed it is unethical ($n = 41$), 54% would harvest a fawn if required and 41% would harvest a fawn if it counted as an antlerless harvest where earn-a-buck restrictions are in place.

Table 1. Reasons for hunting cited by participants in deer management programs of Westchester, New York and Fairfield, Connecticut (USA), 2009.

Category	<i>n</i>	Important ^a	Not important	No opinion
To see wildlife	83	100.0	0.0	0.0
Recreation	77	98.7	0.0	1.3
Passion for archery	79	97.5	1.3	1.3
To harvest a buck	82	90.3	6.1	3.7
To test one’s skill	75	89.3	5.3	5.3
To control deer populations	83	86.7	2.4	10.8
Solitude	81	84.0	12.4	3.7
Opportunity to socialize	81	79.0	9.9	11.1
For food	83	71.1	19.3	9.6
Tradition	82	64.6	15.9	19.5
Nostalgia	80	60.0	18.8	21.3+

^a Very important and important responses were combined.

Table 2. Hunter's reasons explaining the number of does harvested in deer management programs, Westchester, New York and Fairfield, Connecticut (USA), 2009.

Category	<i>n</i>	Important ^a	No opinion	Not important
Chose to hunt private lands	52	55.8	19.2	25.0
No further ethical shot opportunities	52	44.2	15.4	36.5
Participation in other deer management programs	51	37.3	23.5	31.4
Pass up shots of does while hunting bucks	51	33.3	13.7	58.8
Pass up shots of does during the rut	51	32.7	13.5	51.9
Did not see any more does	52	26.9	21.2	50.0
Enough food for personal use	52	21.2	13.5	65.4
No more doe tags	52	21.2	21.2	55.8

^a Very important and important responses were combined.

When asked what variables limit the hunters' doe harvest in DMPs (Table 2), the reason most frequently reported (55.8%) by respondents ($n = 52$) was choosing to spend time hunting non-DMP land. Choosing to spend time on non-DMP land was related to a lack of deer observations (G -test = 13.2, $df = 4$, $P = 0.01$) and few shot availabilities (G -test = 13.7 $df = 4$, P -value = 0.008). In addition, 37.3% of respondents ($n = 51$) indicated that hunting in multiple DMPs influenced their deer harvest in any one program. Selective avoidance of does when hunting bucks was important to 33.3% of all respondents ($n = 51$), while 21.2% of respondents ($n = 52$) indicated that a lack of state hunting tags or no additional need for venison played a role in their doe harvest.

A large majority (82.0%) of respondents ($n = 61$) believed the opportunity to hunt in DMPs would be available for the foreseeable decade; however, this number declined to 69.4% ($n = 62$) and 64.6% ($n = 65$) at 15 yr and 20 yr, respectively. Fifty-one respondents indicated why they thought DMPs would or would not be available in the future. For those who thought DMPs would survive ≥ 15 yr and provided a reason ($n = 31$), the majority (93.5%) believed their services would be needed to maintain herd levels or for further herd reductions. Among those who expressed skepticism and voiced an opinion ($n = 20$), 50.0% believed DMPs would decline due to anti-hunting sentiment, 35.0% believed the success and subsequent cessation of controlled hunts would make their services unnecessary, and 10.0% believed there were too few hunters to maintain DMPs.

DISCUSSION

The immediate challenge facing urban deer managers is meeting their mandate to reduce deer herds to levels that may be frustrating or unacceptable to those recreational hunters enlisted to get the job done. Suburban DMP members appear to support the goals of DMPs and share the perspective that the size of the current deer population in Westchester and Fairfield is detrimental to human and ecological health. Nevertheless, regarding the DMPs they hunt, the majority of members were satisfied with current deer densities and few believed that there were either too many or too few deer. Members know that wildlife professionals are employing them as management tools to reduce deer populations, and currently there does not appear to be a

conflict, with only 15% of those surveyed claiming that their enjoyment in DMPs has diminished over time.

Nevertheless, Westchester and Fairfield DMPs are young, and long-term adaptive management of suburban DMPs requires that managers identify and plan for potential impediments to long-term sustainability. The first, and perhaps most pressing, concern is that hunters in the Westchester–Fairfield are a mature population. The majority of DMP members first started hunting before the age of 25, yet there is a paucity of DMP members of this age group, thus representing a nearly 2–3-decade gap in hunter recruitment. Although this is not of immediate concern, this can threaten the sustainability of DMPs in the relatively near future, and there is no obvious reason to expect a reversal in this trend. First, hunting is not a widespread component of the NYC metropolitan suburban culture. Second, informal interviews of several DMP members found that few of their children choose to hunt. Without tradition and peer-group interest, youth are unlikely to pick up recreational hunting owing to competing recreational activities such as video games and organized sports (Schulz et al. 2003). Recruiting older age adults is a possibility, but studies have suggested that individuals that start hunting later in life are more likely to abandon the activity (Purdy and Decker 1986). It is possible that DMPs attract only older hunters from the general (and a younger) hunting population and our findings consequently exaggerate this recruitment gap. However, surveys of 2009 New York state hunters showed the state-wide mean hunter age, similar to this study, was 49.5 (J. Hurst, New York State Department of Environmental Conservation, personal communication) and has been increasing since the 1980s (Enck and Brown 2008).

If hunting is to be an important element in a long-term regional solution to suburban deer overpopulation, then dealing with this recruitment gap is paramount. The decline in hunter recruitment is a national issue (Brown et al. 2000), and the causes and solutions are well beyond the capabilities and purview of local DMP managers. Aside from the issue of scale, managers may be constrained in advocating for policies or programs that could increase the number of hunters and, therefore, DMP recruits. Many managers of suburban DMPs walk a fine line between maintaining support for controlled archery and inciting anti-hunting activism. There is a risk of having public hunts shut down

due to anti-hunting opposition, as was the case for the 2010 controlled hunts in the Town of Croton and Teatown Lake Reservation in Westchester (F. Koontz, Teatown Lake Reservation, personal communication). There is also a general concern among some hunters that supporters of DMPs tolerate hunting only as a necessity and would prefer nonlethal control methods if they were feasible (M. Weckel, personal observation). This atmosphere reinforces the idea of hunters as tools of management: local wildlife professionals support hunting out of necessity while avoiding support for hunting as a sport or pastime. Thus, some DMP members believe controlled hunts will be dismantled either because hunters are successful and no longer necessary or because political support will swing the other way.

In addition to a limited pool of hunters, DMP members have alternative options for hunting other than DMPs. Only 23.7% of respondents relied on DMPs for access to land, and the top driver for participating in a DMP (accessing un hunted land) is short-lived. This might give new DMPs an initial boost; but it suggests that DMP participants might be a highly mobile resource. For example, 37% of respondents indicated that the need to hunt across multiple DMPs limited their doe harvest in any one DMP. This competition for DMP members may serve to redistribute hunting effort across the region, but may not translate into overall increases in regional harvests (Brown et al. 2000). Furthermore, 55% of respondents also expressed that their desire to hunt private, non-DMP land limited their antlerless harvest on DMP land. These same respondents also were more likely to cite few deer sightings and few shot opportunities on DMP land as reasons explaining their antlerless take. Although DMP members may not report that they are dissatisfied by seeing fewer deer, they did respond to perceived fewer deer sightings by deciding to hunt on private parcels and/or different DMP land.

Overall harvests may also be limited by individual decisions made by hunters. Over a quarter of respondents indicate that they do not harvest does either during the rut or while hunting a buck. Bow hunting has been criticized for being relatively inefficient (Hansen and Beringer 1997), producing slow, moderate, or incomplete declines (Ellingwood and Spignesi 1986, Krueger et al. 2002); and passing up shots of does will only further limit the success of bow hunters. Faced with the prospect of a highly mobile pool of hunters, some of whom may curtail their maximum potential doe harvest, managers should consider rules that require a minimum amount of hunter effort for retention in the program. For example, respondents were mixed with regard to the ethics of harvesting fawns. Nevertheless, even those opposed to harvesting fawns were willing to do so if they counted toward a buck or if managers required them to take fawns. Rules that incentivize extra effort or larger harvests should not be so complicated or onerous as to frustrate hunters or discourage future participation (Enck and Decker 1990, Heffelfinger and Olding 1997); however, they should be stringent enough to ensure that hunters meet harvest quotas of individual programs.

Overall, hunters did not express that a perceived increase in the difficulty of harvesting a deer was linked to hunter satisfaction, supporting previous research where killing deer was not the most important reward for hunting (Hammit et al. 1990). In fact, respondents demonstrated a broad variety of motivating factors. This presents managers with the opportunity to tailor their programs in a broad variety of ways to keep hunters engaged (Hendee 1974, Decker et al. 1980, Hammit et al. 1990), even in the face of declining deer populations. Suburban hunters in this study were a fairly cohesive group that could not be subdivided into any preconceived category. They shared many characteristics with appreciative (Decker and Connelly 1989), or nature-loving (Kellert 1978) hunters, such as the importance they placed on viewing wildlife, their fairly advanced age and level of experience (Decker and Connelly 1989), and the relative unimportance to them of hunting as a source of food (Burt 1980). This supports previous research that suggested that urban-suburban hunters were dominated by "nature"-oriented hunters (Kellert 1976, Burt 1980). However, DMP participants also identified the chance to socialize (affiliative-oriented; Decker and Connelly 1989), performance-based measures (achievement-oriented; Decker and Connelly 1989), and the ability to have solitude while hunting as highly important motivating factors. In follow-up studies, forcing respondents to rank motivating variables may clarify the relative importance of these factors and help managers prioritize strategies to maximize hunter participation, satisfaction, and ultimately, efficiency.

With regard to the desire for solitude, suburban deer managers can arrange DMP members throughout the landscape in a way that minimizes interaction between other members while hunting. This is in contrast to state-run hunts in which (in many cases) there are no individually assigned hunting spots and hunters share the woods with other registered hunters. Both the MRGP DMP and the TPR DMP currently assign members permanent spots. That the use of assigned spots caters to an important hunter motivation is a fortuitous coincidence. Managers assigned hunting spots in response to a high level of controversy over hunting on DMP land. By assigning areas, managers were aware, often several days in advance, of which members were in which locations at what times. This procedure satisfied concerns over public safety and DMP accountability. Participants of both the MRGP and TPR DMP have expressed that having assigned spots is a favorite perk because it maximizes the feeling of remoteness and solitude while hunting (Chief D. Ryan, Town of Pound Ridge, personal communication).

Another step managers can take to optimize the DMP experience is to integrate members into the design and implementation of DMPs. This both assures a certain level of buy-in on the part of hunters and caters to their desire for opportunities to socialize. Integrating members into the management of the program can be done in 2 ways. The first is to allow hunters to participate in the leadership of the DMP. For example, the MRGP DMP participants elect a representative council every 2 yr. Council members are

responsible for assessing how many new members are needed for the program, member retention and recruitment, and the development of new rules for the program. A second way of involving members in the administration of DMPs is by capitalizing on existing hunting communities. Managers can seek out existing hunting organizations to help run DMPs. A number of regional DMPs have implemented this approach. The RS DMP has enlisted Westchester Bow Association for help, GA DMP uses the Greenwich Sportsmen Landowners Association, and BP DMP uses the Westchester–Putnam chapter of QDMA to help administer their programs. In theory, hunters will be more likely to follow rules they have developed themselves. They will also likely take a more active role in building and maintaining the DMP if they feel that they are part of a community that can influence the future of the program, rather than just serve as “management tools.”

If individual members are to share in the responsibilities of running DMPs, they need to know in what ways the program has succeeded and where it needs work. Hunters from programs throughout the region have shown themselves to be avid consumers of deer information stemming from a variety of sources, the most important being DMP managers. Managers should, therefore, openly share information on hunting statistics, such as the number, gender, and size of animals harvested or observed, to justify potential changes to DMP rules and regulations. In addition, sharing information with members encourages socialization between managers and hunters, which was an important motivating factor for the hunters in this study. To that end, managers of many DMPs maintain an open-door policy and try to be present for hunts. Managers of the WC DMP often greet hunters daily at sign-in kiosks to motivate hunters and to facilitate the sharing of deer sightings (D. Aitchison, Curator of Wildlife Westchester County Parks, personal communication). Numerous DMP members have expressed that they enjoy hunting Westchester and Fairfield DMPs for the connection between research, conservation, and deer management (M. Weckel, personal observation). Furthermore, this sharing of information and ideas on management will become important in addressing members’ reluctance to harvest does while buck-hunting, and members’ perceived declines in deer density. Ultimately, the goal is to create policies that meet the needs of managers without alienating hunters.

MANAGEMENT IMPLICATIONS

Schulz et al. (2003) suggested that the challenge facing urban wildlife professionals was finding a balance between the goals of increasing hunter opportunity while minimizing the artificiality of the hunt experience. Suburban DMP managers must attend to this dichotomy in addition to the political reality that support for deer hunting is not universally shared among all stakeholders.

As a result, it is important that wildlife professionals make it clear to hunters, land owners, preserve patrons, and politicians that the decision to open preserve land to bow hunting is only the first step toward herd reduction. What

comes next is an ongoing and evolving discussion that is necessary to designing sustainable DMPs that acknowledge the limitations of archery and the conflicting motivations of hunters and managers. Notwithstanding the inherent limitation of archery, bow hunters will need to demonstrate substantial declines in deer populations if they want public support for hunting to continue. In turn, managers should design programs that satisfy other nontangible motivations for hunting in preparation for the day when bow hunters appreciably reduce local deer herds.

ACKNOWLEDGMENTS

We extend our appreciation to the managers of Fairfield and Westchester DMPs who assisted in distributing hunter surveys. Dr. P. West of Barnard College, D. Erikson of Westchester Bow Association, R. Christie of the Mianus River Gorge Preserve, and K. Clarke, New York State Region 3S Furbear biologist, provided key insight into survey design. Funding was provided by the Conservation Fund of the Campfire Club of America and the MRGP.

LITERATURE CITED

- Brown, T. L., D. J. Decker, S. J. Riley, J. W. Enck, B. Lauber, P. D. Curtis, F. George, and F. Mattfield. 2000. The future of hunting as a mechanism to control white-tailed deer populations. *Wildlife Society Bulletin* 28:797–807.
- Burt, C. J. 1980. White-tailed deer hunter attitudes in east-central New York. *Wildlife Society Bulletin* 8:142–149.
- Conover, M. R., W. C. Pitt, K. K. Kessler, T. J. Dubow, and W. A. Sanborn. 1995. Review of human injuries, illnesses, and economic losses caused by wildlife in the United States. *Wildlife Society Bulletin* 23:399–403.
- Côté, S. D., T. P. Rooney, J. Tremblay, C. Dussault, and D. M. Waller. 2004. Ecological impacts of deer overabundance. *Annual Review of Ecology, Evolution, and Systematics* 35:113–147.
- Daniels, T. J., R. C. Falco, E. E. McHugh, J. Vellozi, T. Boccia, A. J. DeNicola, J. Pound, J. Miller, J. E. George, and D. Fish. 2009. Acaricidal treatment of white-tailed deer to control *Ixodes scapularis* (Acari: Ixodidae) in a New York Lyme disease-endemic community. *Vector-Borne and Zoonotic Diseases* 9:381–387.
- deCalesta, D. S., and S. L. Stout. 1997. Relative deer density and sustainability: a conceptual framework for integrating deer management with ecosystem management. *Wildlife Society Bulletin* 25:252–258.
- Decker, D. J., T. L. Brown, and R. J. Gutierrez. 1980. Further insights into the multiple-satisfaction approach for hunter management. *Wildlife Society Bulletin* 8:323–331.
- Decker, D. J., and N. A. Connelly. 1989. Motivations for deer hunting: implications for antlerless deer harvest as a management tool. *Wildlife Society Bulletin* 17:455–463.
- DeNicola, A. J., and S. C. Williams. 2008. Sharpshooting suburban white-tailed deer reduces deer-vehicle collisions. *Human–Wildlife Conflicts* 2:28–33.
- Diefenbach, D. R., W. L. Palmer, and W. K. Shope. 1997. Attitudes of Pennsylvania sportsmen towards managing white-tailed deer to protect the ecological integrity of forests. *Wildlife Society Bulletin* 25:244–251.
- Ellingwood, M. R., and J. V. Spignesi. 1986. Management of an urban deer herd and the concept of cultural carrying capacity. *Transactions of the Northeast Deer Technical Committee* 22:42–45.
- Enck, J. W., and T. L. Brown. 2008. 2007 Statewide deer hunter survey: participation during the '06 seasons, opinions about hot-button issues, and trends in the characteristics of hunters. Cornell University Human Dimensions Research Unit HDRU Series, no. 08-5, Ithaca, New York, USA.
- Enck, J. W., and D. J. Decker. 1990. Overcoming impediments to youth participation in hunting program design evaluation. Cornell University Human Dimensions Research Unit Series no. 90-4, Ithaca, New York, USA.

- Etter, D. R., K. M. Hollis, T. R. Van Deelen, D. R. Ludwig, J. E. Chelsvig, C. L. Anchor, and R. E. Warner. 2002. Survival and movement of white-tailed deer in suburban Chicago, Illinois. *Journal of Wildlife Management* 66:500–510.
- Filion, F. L. 1975. Estimating bias due to nonresponse in mail surveys. *The Public Opinion Quarterly* 39:482–492.
- Hammitt, W. E., C. D. McDonald, and M. E. Patterson. 1990. Determinants of multiple satisfactions for deer hunting. *Wildlife Society Bulletin* 18:331–337.
- Hansen, L., and J. Beringer. 1997. Managed hunts to control white-tailed deer populations on urban public areas in Missouri. *Wildlife Society Bulletin* 25:484–487.
- Heffelfinger, J. R., and R. J. Olding. 1997. The increasing complexity of deer management: is more better? Pages 51–61 in J. C. deVos, editor. *Proceedings of the 1997 Peer/Elk Workshop*. Arizona Game and Fish Department, Phoenix, USA.
- Hendee, J. C. 1974. A multiple-satisfaction approach to game management. *Wildlife Society Bulletin* 2:104–113.
- Kellert, S. R. 1976. Perceptions of animals in American society. *Transaction of the North American Wildlife and Natural Resources Conference* 41:533–546.
- Kellert, S. R. 1978. Attitudes and characteristics of hunters and antihunters. *Transaction of the North American Wildlife and Natural Resources Conference* 43:412–423.
- Kilpatrick, H. J., and W. D. Walter. 1999. A controlled archery deer hunt in a residential community: cost, effectiveness, and deer recovery rates. *Wildlife Society Bulletin* 27:115–123.
- Krueger, W. J., J. B. McAninich, and D. E. Samuel. 2002. Retrieval and loss rates of white-tailed deer by Minnesota bowhunters. Pages 76–84 in R. J. Warren, editor. *Proceedings of the First National Bowhunting Conference*. Archery Manufacturers and Merchants Organization, Comfrey, Minnesota, USA.
- McDonald, J. E., M. R. Ellingwood, and G. M. Vecellio. 1998. Case studies in controlled deer hunting. New Hampshire Fish and Game Department, Concord, USA.
- McGarigal, K., S. Cushman, and S. G. Stafford. 2000. *Multivariate statistics for wildlife and ecology research*. Springer-Verlag, New York, New York, USA.
- Purdy, K. G., and D. J. Decker. 1986. A longitudinal investigation of social-psychological influences on hunting participation in New York: study I (1983–1985). Cornell University Human Dimensions Research Unit Series no. 86-7, Ithaca, New York, USA.
- Responsive Management. 2004. Opinions and attitudes of Georgia residents, hunters, and landowners toward deer management in Georgia. Conducted for the Georgia Department of Natural Resources, Harrisonburg, Virginia, USA.
- Rooney, T. P., and D. M. Waller. 2003. Direct and indirect effects of white-tailed deer in forest ecosystems. *Forest Ecology and Management* 181:165–176.
- Sayre, R. W., D. J. Decker, and G. L. Good. 1992. Deer damage to landscape plants in New York State: perception of nursery producers, landscape firms, and homeowners. *Journal of Environmental Horticulture* 10:46–51.
- Schulz, J. H., J. J. Millspaugh, D. T. Zekor, and B. E. Washburn. 2003. Enhancing sport-hunting opportunities for urbanites. *Wildlife Society Bulletin* 31:565–573.
- U.S. Census Bureau. 2010. American fact finder. <<http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>>. Accessed 1 May 2011.
- Wilson, M. L., G. H. Adler, and A. Spielman. 1985. Correlation between abundance of deer and that of the deer tick, *Ixodes dammini* (Acari: Ixodidae). *Annals of the Entomological Society of America* 78:172–176.

Associate Editor: Porter.