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Keys to managing a successful archery deer hunt in an urban community: a case study

Chad M. Stewart, Indiana Department of Natural Resources, 5596 East State Road 46, Bloomington, IN 47401, USA *cstewart@dnr.in.gov*

Bruce Keller, Hidden Valley Lake Community, 19325 Schmarr Drive, Lawrenceburg, IN 47025, USA

Chad R. Williamson, Ball State University, Department of Biology, Muncie, IN 47306, USA

Abstract: White-tailed deer (*Odocoileus virginianus*) populations can expand greatly in suburban areas where hunting is limited or prohibited. Incorporating a hunting program for management purposes is often unfeasible due to property parcelization and varying opinions on deer management within each community. We present the case of Hidden Valley Lake, Indiana (707 ha), whose deer population was effectively reduced by archery hunting within a dense human population. Prior to implementing a managed archery program, deer density estimates exceeded 60 deer/km^2. After the first year of the managed archery hunt, where 230 deer (~36 deer/km^2) were removed, deer density estimates for Hidden Valley and the surrounding area were greatly reduced. After a second year of hunting, 300 deer had been removed, and harvest-to-effort ratios decreased dramatically from the first to the second year of the program. Our study suggests that a managed archery program within heavily populated suburban areas can lower deer densities quickly and effectively under the right circumstances. The ability to provide access for hunters, cooperation and flexibility of state regulations, resilient community leaders, and motivated local hunters are all necessary to reduce a localized deer population within a brief time period.

Key words: bow hunting, deer, human–wildlife conflicts, Indiana, *Odocoileus virginianus*, suburban

Increasing urban and suburban populations of white-tailed deer (*Odocoileus virginianus*) remain a challenge for wildlife managers throughout their range (Etter et al. 2002, Kilpatrick et al. 2007*a*). Expansion of urban development and residential suburbs provides white-tailed deer with suitable habitat that promotes rapid increases in their population beyond their biological and cultural carrying capacity (Messmer et al. 1997, Lauber and Knuth 2004). Increases in deer populations often lead to higher frequencies of deer–vehicle collisions, personal property damage, and elevated incidence of Lyme disease, all of which can increase support for population management (Kilpatrick et al. 2007*a*, Siemer et al. 2004). However, the method of deer reduction typically is a highly debated topic among local community stakeholders, hunters, and state agencies (Koval and Mertig 2004, Storm et al. 2007, Stewart 2011). The ability to successfully incorporate perspectives of stakeholders and wildlife managers into a management plan that is accepted by both parties is crucial to the goal of successful urban deer management (Messmer et al. 1997, Riley et al. 2002, Kilpatrick and LaBonte 2003).

Techniques discussed to manage urban deer populations vary from traditional hunting practices to nontraditional methods, including managed hunts, sharpshooting, capture and euthanasia, capture and release, and contraception (DeNicola et al. 1997, Kilpatrick et al. 1997). Among these methods, state agencies prefer regulated hunting as their primary method of controlling populations of white-tailed deer statewide (Stewart 2011, Urbanek et al. 2011). However, limited hunter access, high deer survival rates, and high fecundity often make it a challenge for hunters to control growing populations effectively in urban and suburban areas (Harden et al. 2005, Storm et al. 2007).

Hunting opportunities in suburban areas are typically limited to archery alone because of public safety concerns or local ordinances that prohibit the use of firearms (Kilpatrick et al. 1997, Kilpatrick et al. 2007*b*). In 2011, 85% of 34 state agencies reported that managed archery hunts were the most used and most effective method of managing urban and suburban white-tailed deer populations (Urbanek et al. 2011). Suburban archery hunts have been attempted successfully in the past,

Figure 1. Deer within Hidden Valley Lake community, Dearborn County, Indiana, USA.

but they typically are restricted to removing <100 deer from a community (Ver Steeg et al. 1995, Kilpatrick et al. 2002, Suchy et al. 2002), and, thus, are unlikely to provide rapid relief for communities needing high numbers of deer removed. In this paper, we examine the cooperation between the Indiana Department of Natural Resources (IDNR), a local community, and resident hunters in successfully reducing a suburban white-tailed deer population through a managed archery hunt.

Study area

Our study area was located in Hidden Valley Lake community (HVL) in Dearborn County, Indiana, a 707-ha, privately-owned community that has prohibited hunting since it was chartered in 1972. There are 227 ha of common greenspaces and recreational areas and a 60-ha lake centrally located within the community. There are >1,800 habitations in HVL, with the average lot size consisting of about 0.1 ha, and a population of approximately 5,000 residents. The community is adjacent to a golf course and surrounded by deciduous forest and pasture on all sides, with steep, wooded ravines that run throughout the community.

A forest stewardship plan created in 2008 analyzed >64 ha of woodlands and found that the overstory consisted primarily of sugar maple (*Acer saccharum*), black walnut (*Juglans nigra*), white ash (*Fraxinus americana*), and bitternut hickory (*Carya cordiformis*), while the understory had dense patches of Asian bush honeysuckle (*Lonicera maackii*) and dense cover of garlic mustard (*Alliaria pettiolata*), with few native forbs (D. Breedlove, District Forester, IDNR, unpublished data). In many areas, leaf litter cover was sparse or absent, with patches of bare soil present. Native woody regeneration was lacking or absent throughout much of the woodlands.

Additional concerns within the community include elevated levels of *Escherichia coli* in Hidden Valley Lake, measured each month between March 2008 and February 2009. The bacteria were attributed in part to abundant deer fecal matter and an absence of vegetation throughout the understory in woodlots of the community, causing sedimentation and nutrient loading within the lake (J. Hughes, Stormwater Coordinator, Dearborn County Soil and Water Conservation District, personal communication). Residents of HVL also complained of habituation by resident deer to people and pets (Figure 1). In one instance, an HVL resident's dog was trampled to death by an adult doe.

In the winter of 2009, a flyover survey was conducted using a Robinson R44 4-seat helicopter and counted 314 deer within the limits of HVL, resulting in an estimated density of 48 deer/km^2 (Stratus Helicopters, LLC, Cincinnati, Ohio). Applying the detection rate observed by Beringer et al (1998), the number of deer within HVL was likely closer to 400 animals, nearly 62 deer/km^2. A survey of HVL residents was conducted in 2009, asking whether a lethal deer management program should be implemented within the community. A total of 622 respondents (83% of respondents) voted in favor of a cull.

Results

A deer density of ~7 deer/km^2 was provided by the IDNR for optimum biological diversity based on previous studies (Tilghman 1989, DeCalesta 1994). This density was meant to serve as a direction in terms of magnitude of effort surrounding the hunt, with realistic expectations that the density may never be reached. In February of 2010, a no-feed rule was instituted by the HVL board of directors as the beginning of their deer management program. The first managed archery hunt began in the fall of 2010. Hidden Valley Lake followed IDNR guidelines regarding season

and bag limits, but instituted additional restrictions, requiring hunters to take 5 antlerless deer prior to attempting to remove an antlered deer. Because several residents were sensitive to the taking of deer, HVL hunters did not conduct removal efforts on weekends, holidays, and other selected dates. All archers were required to pass a community-organized proficiency test, attend an orientation meeting, and complete a hunter's liability waiver prior to hunting within HVL community. Archers could not exceed the maximum archery season bag limit set forth by IDNR regulations (10 antlerless deer and 1 antlered deer). Hidden Valley Lake opened up 227 ha of community greenspace for hunting, though only about half was hunted; additionally, 122 residents volunteered their properties (~12 ha) for hunting (Figure 2). All private property that was volunteered had to be adjacent to community greenspace to be eligible for inclusion. Hunters were assigned specific zones within HVL to avoid overcrowding within 1 zone.

Figure 2. Map of Hidden Valley Lake community, including hunt zones (black) throughout the community.

Thirty-eight hunters qualified to hunt in HVL the first year. Twenty-one hunters removed 95 deer during selected days within the archery season, an average of 4.5 deer per hunter (median = 4). An additional 8 deer were shot but not recovered. Of the deer removed, 93% were antlerless (Table 1). Upon conclusion of the regular archery season, IDNR issued HVL a special permit that extended hunting opportunities through March 20, 2011. These same hunters who were eligible to hunt during the regular archery season were allowed to hunt under the special permit. The special permit allowed hunters to hunt over bait, which is prohibited during Indiana's regular hunting seasons. Hunters removed an additional 122 deer (not including 5 deer that were shot but not recovered by hunters) by February 14, 2011, when removal operations stopped. Successful hunters under the special permit ranged from taking 1 deer/hunter to 35 deer/hunter. A survey using thermal imagery, conducted immediately afterward in March 2011, counted 174 deer in a 15.5 km^2 area (HVL boundaries and adjacent areas), resulting in a density of 11.2 deer/km^2 (Vision Air Research Inc., Boise, Idaho). Roadkills picked up by maintenance personnel within the community dropped from 15 to 8 after the initial removal year. During the first year, 230 deer were removed (regulated hunting and permit hunting combined), averaging approximately 35.5 deer/km^2 removed. Additional deer were removed via regulated hunting immediately outside of the HVL boundaries, but it is unknown exactly how many were taken in these areas. It is assumed that the number of deer taken outside of HVL is only a fraction of what was taken within HVL boundaries.

In 2011, HVL made significant modifications to their regular archery season hunt based on community feedback. Regulated hunting was limited to a 3-week period in December (rather than from October through December), and hunters were prohibited from taking an antlered deer within HVL. Only successful hunters from the previous year were invited to qualify and participate during the second year, thus, limiting the number of potential hunters within the community. Of the 20 hunters eligible to

Table 1. Managed archery hunt types and efficacy from Hidden Valley Lake community, Dearborn County, Indiana, in 2010–2011.

Year	Type hunt	# hunters authorized	# hunters successful	Duration (days)	# antlered deer removed	# Antlerless deer removed	Shot but not recovered	Total deer removed by hunters	Total deer removed/successful hunter
2010	Season hunt	38	21	44	6	89	8	103	4.9
2010	Permit hunt	38	18	36	7	115	5	127	7.1
2011	Season hunt	20	15	21	0	29	5	35	2.3
2011	Permit hunt	22	7	50	0	37	0	37	5.2
				Total	13	270	18	302	

hunt during the regular archery season, fifteen were successful in removing 29 deer, for an average of 1.9 deer per hunter (median = 2). An additional 5 deer were shot but not recovered by hunters. Of the deer removed, 100% were antlerless due to changed restrictions.

Upon closure of the regular archery season, HVL was once again issued a special permit that allowed archery hunting to continue from January 16 to March 20, 2012. An appeal by 2 HVL community members caused a delay in hunting activities until February 3, 2012. During the special permit hunt, 22 hunters (the 20 archery season hunters plus 2 other approved hunters) were eligible to participate, and 7 hunters successfully removed 37 deer via the special permit. Successful hunters during the permit season ranged from taking 1 deer/hunter to 12 deer/hunter. A total of 66 deer were removed during the second year (regulated archery hunting and permit hunting combined), which averages to approximately 10.2 deer/km^2 removed. A total of 302 deer were removed via archery from HVL in 2 years (Table 1), with 138 deer being removed during the regular archery season, and 164 deer removed via special permit. Many deer taken during the special permit were donated through various venison donation programs organized through the HVL deer management program.

Discussion

Managed archery hunting has been effective at reducing the deer population in HVL. The accuracy of aerial counts and thermal imaging in estimating deer populations has been greatly debated in literature (Wiggers and Beckerman 1993, Haroldson et al. 2003, Potvin and Breton 2005). The true effect of the reduction could vary greatly, given the wide range of detection rates documented in previous literature (31 to 89%; Haroldson et al. 2003). The realized number of deer after the initial harvest fell to between 196 and 561 deer within HVL and the surrounding area, or densities ranging from 12.6 to 36.2 deer/km^2. This is still noticeably lower than the estimated 60 deer/km^2 occurring within HVL prior to archery hunting.

Harvest-to-effort ratios often have been employed to trace deer population changes (Van Deelen and Etter 2003, Weckerly et al. 2005).In HVL, the harvest: successful hunter ratio decreased in the second year of the program and increased within each year as efforts shifted from regulated hunting to permit hunting. The HVL archery management program has shown that significant numbers of deer can be taken with only a few motivated hunters. Managed archery programs have proven successful in other communities (Ver Steeg et al. 1995, Kilpatrick et al. 2002, Suchy et al. 2002), though we are unaware of any in recent literature reporting the magnitude of reduction in a minimal area within as short of a period as seen in HVL. It is unknown whether a managed archery hunt will prove to be a long-term, sustainable program at lower deer densities, but it has proven successful in the short term at reducing deer numbers.

Community hunters did not differentiate in the type of antlerless deer they reportedly harvested (e.g., doe, buck, fawn, shed male). Although some of each cohort was taken during these hunts, we are unable to enumerate exact numbers for each. Sentiment from community hunters and management indicate that an overwhelming majority of the antlerless deer removed were female deer. Though removal of female deer is obviously critical in the management of future recruitment of deer within the community, there is still significant value in removing male deer from the community. Male deer have equal ability, if not more, to damage landscape plantings, raid garden plantings, and to be struck by vehicles within the community. Removal of buck fawns during 2010 counted toward the antlerless goal of each hunter before they could become eligible to remove an antlered deer, and we believe that the opportunity for hunters to progress to the chance to harvest a buck likely kept hunters motivated to remove deer, a notion that has been supported in previous research by Weckel et al. (2011). It is unknown whether lower deer densities or regulation changes during the second year (prohibiting antlered deer harvest, restricting harvest dates) changed hunter participation and interest, but it is a topic worthy of exploration and measurement in urban deer programs.

Kilpatrick et al. (2010) demonstrated that the use of bait can increase harvest opportunities and hunter success rates in urban areas. Hidden Valley Lake archers removed 127 deer in a 36-day period, an average of 3.5 deer/day, under the special permit that allowed the use of bait in 2010, after 103 were taken during 44 days (an average of 2.3 deer/day) during the regular hunting season when bait was prohibited. Bait did not seem to improve success rates during 2011, where more deer were taken per day during the hunting season rather than under the permit (Table 1). However, we feel that this is likely due to 2 reasons: (1) lower deer densities from the first year removal efforts and issuance of the permit after the regular archery season when deer have been immediately removed; and (2) a challenge from some community members that delayed the implementation of the permit by 2 weeks, thus, negating carryover momentum from the deer-hunting season. Our findings suggest that bait was an important factor that improved effectiveness of hunters by removing a higher volume of deer in the first year of our program. It may also have aided in minimizing wounding loss, as hunters could improve the quality of each shot taken by locating deer in optimal areas to improve their success.

This case study suggests that urban deer management should have 4 parts to achieve success. First, hunters must have access to areas large enough to retrieve deer after they have been shot. We believe the success of our program was largely due to the amount of contiguous linear greenspace throughout the community. These greenspaces are community-owned and publicly-accessible and served as hunting zones and flight destinations of many deer that were shot (Figure 2). These greenspaces were legally and easily accessible to hunters to pursue and retrieve their deer. As a result, these greenspaces were the primary areas where deer were retrieved by hunters, reducing and all but eliminating concerns regarding injured deer being seen within the community. A few deer did expire on neighboring private properties, an inevitability in an urban archery program. Though briefly unappealing and contentious to the individual residents, these few scenarios did not escalate opposition or compromise the program. In communities where contiguous community-owned greenspace is not accessible to hunters or community-owned properties are highly parcelized in between privately owned lots, we anticipate that removal efforts would not be so successful.

Second, wildlife management agencies must have the flexibility within their regulations and the willingness to use that flexibility to assist urban and suburban communities reach their goals. Decker et al. (2004) described the importance of the flexibility of a management agency to adapt to localized conditions that result in satisfactory outcomes pertaining to the local deer conflict. Though archery hunting proved effective after the first year, several nonhunting members within the community remained sensitive to urban deer hunting and attempted to shut hunting down permanently after it was voted to continue the second year. Thus, long archery seasons that are typically implemented at the state level to help manage

deer herds may not be socially acceptable within densely populated communities. Furthermore, compromises on baiting and post-hunting-season allowances to remove deer proved to be a favorable combination in our experience. States with baiting bans or archery seasons that end in early winter may benefit from exceptions and extensions into late winter, when deer are more willing to come to bait, improving the efficacy of archers. The use of baiting, however has to be tempered with disease transmission concerns, and agencies must consider the risk versus rewards when making baiting allowances.

Third, community managers must be resolute in their commitment to manage local deer populations and to reach a previously identified goal. Gaining community support and acceptance of preset goals at the onset of a management program is important. Though hunting is accepted as a preferred deer management option to urban residents in Indiana, each community will likely have residents who are vehemently opposed to such actions (Stewart 2011). Such opposition can lead to litigation that threaten the progress and long-term sustainability of a program if the necessary background information has not been previously documented.

Finally, each effort must utilize a well-conceived hunting program designed to address local needs and concerns. Incorporating trained, sensitive, skilled, and abiding hunters who are willing and capable of removing deer in urban communities is of great value. Partnering with a venison donation organization can allow hunters to continue hunting and removing deer after they have satisfied their own venison needs, as well as addressing local concerns of potential waste. The ability to include community resident hunters allows for participation by those who have prolonged exposure and intimate knowledge of the resident deer herd, a vested interest in managing the community-based problem, and perhaps most importantly, increased access to areas containing deer causing the most conflict within the community. We believe HVL resident hunters shared many characteristics that are paramount to the success of urban deer management programs supported in previous studies (Brown et al. 2000, Weckel et al. 2011).

Management implications

Managed archery hunts in densely populated communities can be successful in reducing deer populations immediately with proper techniques. One critical variable is the ability to access publicly-owned or community-managed land throughout the hunt area and incorporate an even dispersal of willing and motivated hunters. These public spaces often serve as flight destinations for many wounded deer, which are easily retrieved by hunters without violation of trespassing laws. We found that baiting improved recovery rate and improved efficiency of hunters in the first year of our program, and should be considered in urban deer-removal settings. Prior to implementing a management program, the community should document the damage to personal property and natural areas caused by deer. This information can be useful if litigious proceedings are brought forth to suspend or eliminate a deer removal program.

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Chad M. Stewart is a TWS certified wildlife biologist and deer research biologist for the Indiana Department of Natural Resources. He received his B.S. degree in wildlife and fisheries sciences from Penn State University and his M.S. degree in natural resources and environmental sciences from the University of Illinois. His research interests include ungulate management, conservation, and conflict resolution. He is the president of the Indiana chapter of The Wildlife Society.

Bruce Keller (photo unavailable) is a 26-year veteran of the U.S. Air Force and has been the community manager of Hidden Valley Lake, Indiana, for 6 ½ years.

Chad R. Williamson is an undergraduate student in the Department of Biology and program option of wildlife biology at Ball State University in Indiana. He is expected to graduate in May 2013 and will remain at Ball State as an M.S. degree student researching white-tailed deer fawn mortality and dispersal in Indiana. His primary research interests include human–wildlife conflicts, wildlife habitat and space use, and ungulate ecology and management. He is the current president of the Ball State Chapter of The Wildlife Society.