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Source: *Journal of Wildlife Management*, 74(4):714-718.

Published By: The Wildlife Society

DOI: <http://dx.doi.org/10.2193/2009-244>

URL: <http://www.bioone.org/doi/full/10.2193/2009-244>

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Management and Conservation Article

Use of Bait to Increase Archery Deer Harvest in an Urban–Suburban Landscape

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ABSTRACT Hunting is the primary tool for managing white-tailed deer (*Odocoileus virginianus*) populations. Effectiveness of hunting in suburban areas may be reduced due to limited hunter access to small properties, firearms-discharge laws, and public safety concerns. In Connecticut, USA, hunting over bait on private land was recently legalized to increase harvest opportunities. Our objective was to assess bow-hunter willingness to use bait and effects of bait type, hunter disturbance, time spent hunting, and property size on deer-harvest potential in a suburban landscape. We mailed a prebaiting survey in February 2002 and a postbaiting survey in February 2004 to the same group of hunters. Hunters using bait were more successful and harvested more deer than hunters using no bait. Hunters using bait on small properties observed similar numbers of deer within shooting range as hunters using bait on larger properties. Hunters using bait met their venison needs, whereas hunters using no bait did not meet their needs. Resource managers should implement strategies that increase hunter success when developing urban deer-management programs for communities.

KEY WORDS archery, bait, bow-hunters, Connecticut, hunting success, *Odocoileus virginianus*, white-tailed deer.

Hunting is the primary tool for managing white-tailed deer (*Odocoileus virginianus*) populations (Woolf and Roseberry 1998). Effectiveness of hunting in suburban areas may be reduced due to limited hunter access to small properties, firearms-discharge laws, and public safety concerns (Ellingwood and Kilpatrick 1995, Jones and Witham 1995, Kuser 1995, Mayer et al. 1995, Kilpatrick and Walter 1997).

Some states have legalized baiting to increase deer harvest rates in agricultural and suburban areas (D. Ferrigno, New Jersey Division of Fish and Wildlife; K. Reynolds, Delaware Division of Fish, Game, and Wildlife, personal communication), whereas other states have restricted baiting and feeding of deer to reduce risk of spreading diseases such as chronic wasting disease and tuberculosis (i.e., WI, MI, NY [USA]).

Effectiveness of bait to increase deer-hunter success rate is unclear. Langenau et al. (1985) and Petchenik (1993) reported that baiting had little effect on deer-hunter success rates. VanDeelen et al. (2006) reported that a ban on baiting in Wisconsin, USA, had no net effect on overall harvest. However, Synatzske (1981), Winterstein (1992), and Frawley (2002) reported that hunting over bait increased deer observations and harvest rates and reduced mean shot distance and hunter effort. In urban–suburban areas with high deer densities, potential advantages of baiting may outweigh the disadvantages. No studies have examined hunter interest and willingness to use bait, experience with baiting, and opportunities and expectations while hunting over bait in a suburban landscape. Our objectives were to assess bow-hunter willingness to use bait and effects of bait type, hunter disturbance, and property size on deer-harvest potential in a suburban landscape. Connecticut, USA, provided a unique opportunity to study effectiveness of bait as an urban deer-management tool because baiting was

allowed only in urban–suburban deer-management zones and hunters were surveyed before and after baiting was legalized.

STUDY AREA

The study area was the town of Greenwich, Connecticut, a 124-km² township located in Fairfield County in the southwest corner of Connecticut, 40 km from New York City. Greenwich was bounded on the south by Long Island Sound, on the east by the City of Stamford, and on the north and west by Westchester County, New York, USA. The human population was 58,000 (461 people/km²; Connecticut Economic Resource Center 2003). Only 17 parcels comprising 147 ha remained as farmland (Planning and Zoning Commission 1998). Greenwich was 36% forest land, 29% turf–nursery, 23% commercial–residential, 8% field–pasture, and 4% other.

Estimated deer population in the town of Greenwich in February 2001 was 2,566 (20.7 deer/km²; Kilpatrick et al. 2004). From 1998 to 2001, 95% of deer harvested in Greenwich were taken during the archery season (Kilpatrick et al. 2001, 2002). Estimated mean annual archery deer harvest was 421 (3.4 deer/km²; Kilpatrick et al. 2004). No minimum property size or minimum distance was required to discharge a bow. Using the 2002 deer-hunting season framework, each bow-hunter could harvest 2 bucks and unlimited antlerless deer (no cost for additional antlerless deer tags) in any order during a 91-day archery deer-hunting season (15 Sep–31 Dec). The 2002 archery season was extended through the end of January and 2 additional deer tags were added (one either-sex and one antlerless tag) in urban–suburban deer-management zones, which included the town of Greenwich. Hunting on Sundays, hunting over bait, or hunting with crossbows (except for physically disabled hunters) was prohibited. In 2003, in urban–suburban deer-management zones hunting over bait on

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private land was legalized to increase harvest opportunities. Deer hunters were required to obtain written permission from the landowner to hunt on private land. Only 11% of the town potentially could be open to firearms hunting because of a law that prohibited hunting within 152 m of a house. However, homeowners could sign a written waiver to allow firearms hunting within 152 m of a house.

METHODS

We surveyed every bow-hunter who reported harvesting a deer in Greenwich or purchased an archery deer permit and lived in the town of Greenwich. We first generated a list of all bow-hunters that reported harvesting ≥ 1 deer over a 3-year period (1999–2001) in Greenwich ($n = 99$). Then we generated a list of all Greenwich residents that purchased archery deer permits in 2001 ($n = 83$). We cross-referenced both lists of hunters to prevent duplicate mailings.

In February 2002, we mailed a survey (prebaiting survey) to assess how often bow-hunters hunted, number of deer harvested, and willingness to hunt over bait if legalized. We mailed a follow-up survey to nonrespondents every 4–5 weeks. We contacted nonrespondents by phone after 4 unsuccessful mailings, and requested that surveys be completed and returned to maximize response rate (Dillman 1978).

In February 2004, after hunting over bait was legalized (2003), we mailed a second survey (postbaiting survey) to the same group of hunters surveyed in 2002 using the same survey protocol to assess changes in hunter acceptance and use of bait, hunter success, and deer observation rates and harvest opportunities at bait sites. We partitioned size of property that hunters baited into 4 classes: ≤ 0.8 ha ($n = 17$), 1.2–2.4 ha ($n = 40$), 2.8–4.9 ha ($n = 21$), and ≥ 5.3 ha ($n = 15$). We considered deer within shooting range as deer that could be potentially harvested.

We compared differences in mean number of deer harvested, deer needed to meet venison needs, and deer within shooting range among groups using the Mann–Whitney U -test ($P < 0.05$; SPSS Inc., Chicago, IL). We compared differences in potential harvest among property size classes using the Kruskal–Wallis H -test ($P < 0.05$). We calculated standard error for all comparisons (Ebdon 1985).

The study protocol and surveys were reviewed and approved by the Connecticut Wildlife Division. We conducted surveys in accordance with federal guidelines by excluding minors, ensuring results were not identifiable to individuals, and ensuring that the surveys involved no risks to individuals.

RESULTS

Of 159 prebaiting surveys mailed, 110 were completed, 3 were undeliverable, and 1 was unusable, resulting in a response rate of 71%. Of the 159 postbaiting surveys mailed, 94 were completed, 21 were undeliverable, and 5 were unusable, resulting in a response rate of 71%. We did not assess nonresponse bias due to our high return rate and limited sample size of outstanding surveys.

On the prebaiting survey, 64% (SE = 4.7) of hunters indicated that they would use bait, 16% (SE = 3.6) would

use no bait, and 20% (SE = 3.9) were unsure about use of bait if it was legalized. Primary reasons hunters would use bait included improve hunter success (75%), safety (20%), and shot placement (5%).

On the postbaiting survey, most hunters (77%, SE = 4.3) were aware that hunting over bait was legalized and 58% (SE = 5.8) of those hunters used bait. Of hunters using no bait ($n = 44$), hunters had no time or access to property where bait was legal (32%), no knowledge that bait was legal (27%), believed there was no need to use bait (23%), or believed bait was unethical or unsporting (16%). Of hunters who responded to the postbaiting survey, 78% (SE = 4.4) expected to use bait during the upcoming hunting season (2004). Hunters using bait maintained a mean of 2.5 bait sites ($n = 41$, SE = 0.29). Half of hunters (50%) using bait in 2003 expected to maintain the same number of bait sites, 38% expected to maintain more, and 12% expected to maintain fewer in 2004. Of 102 bait sites established, 48% were baited with corn, 31% with sweet feed (horse feed with molasses), 9% with apples and corn, and 8% with other types of bait or combinations of bait. Only 3 hunters used automatic feeders for baiting. Eighty-five percent of hunters prebaited sites ≤ 1 week ($\bar{x} = 2.2$ days, SE = 0.3) before hunting over bait sites and 15% prebaited >1 week ($\bar{x} = 14.6$ days, SE = 2.6) before hunting over bait sites. Most hunters (98%) using bait believed baiting increased their chances of shooting deer.

Of 14 hunters who indicated on the prebaiting survey that they would not use bait, 3 (21%) indicated on the postbaiting survey that they used bait. Of 14 hunters who indicated on the prebaiting survey that they were unsure about use of bait, 6 (43%) indicated on the postbaiting survey that they used bait.

On the postbaiting survey, hunters indicated that while approaching bait sites for hunting, they disturbed deer often (36%), occasionally (43%), and rarely or not at all (20%). Of hunters who thought baiting was less successful than expected (20%), reasons included deer used bait before or after shooting hours (70%), deer bedded too close (21%), and deer were disturbed while approaching bait sites for hunting (9%). Most hunters (76%) using bait hunted mornings and afternoons, and 17% hunted afternoons only. Sixty-six percent of hunters believed that hunting over bait was more effective during the afternoon and 12% believed it was more effective during the morning. The remaining hunters had no opinion (21%). Thirteen of 94 hunters provided an unsolicited response to this question by indicating that hunting in the afternoon was more effective because deer arrived at bait sites after hunters were positioned in tree stands and deer were less likely to be disturbed.

On the postbaiting survey, hunters using bait observed a mean of 47 ($n = 40$, SE = 14.2) deer within shooting range during the 118-day archery season. Hunters observed a mean of 34.9 antlerless (SE = 11.1, 95% CI = ± 23.7) and 12.1 antlered deer (SE = 3.8, 95% CI = ± 7.7) within shooting range while hunting over bait. Median property size of baited sites was 1.6 ha. Mean number of deer per day observed within shooting range at bait sites was not affected

by property size (≤ 0.8 ha, 1.2–2.4, 2.8–4.9, ≥ 5.3 ha; $H_3 = 3.26$, $P = 0.353$). Hunters using sweet feed for bait observed a similar number of deer within shooting range per day ($n = 24$, $\bar{x} = 4.1$, $SE = 0.8$) as did hunters using corn ($n = 43$, $\bar{x} = 2.0$, $SE = 0.3$, $U_{402.03} = 2.2$, $P = 0.136$).

On the postbaiting survey, 83% of hunters that used bait and 58% of hunters that used no bait successfully harvested deer. Hunters using bait harvested more deer per hunter ($\bar{x} = 4.2$ deer/hunter, $SE = 0.67$) than hunters using no bait ($\bar{x} = 0.83$ deer/hunter, $SE = 0.18$, $U_{433.5} = 26.7$, $P < 0.001$). Of 169 deer harvested from September to December 2003, 78% were killed by hunters using bait. Of 51 deer harvested in January 2004, 88% were killed by hunters using bait. Hunters using bait harvested more antlerless deer ($\bar{x} = 2.3$ deer harvested/hunter, $SE = 0.47$) than antlered deer ($\bar{x} = 0.78$ deer harvested/hunter, $SE = 0.47$, $U_{744.5} = 5.4$, $P = 0.020$) per hunter.

No difference existed in mean number of days spent hunting in Greenwich between hunters using bait ($\bar{x} = 35.9$, $SD = 26.7$) and hunters using no bait ($\bar{x} = 25.8$, $SD = 22.6$; $U_2 = 580$, $P = 0.068$), nor was there a difference in number of hours hunted between hunters using bait ($\bar{x} = 4.3$, $SD = 4.3$) and hunters using no bait ($\bar{x} = 4.4$, $SD = 2.6$; $U_2 = 729$, $P = 0.718$). Of hunters who returned the pre- and postbaiting surveys, no difference existed in mean number of days spent hunting in towns other than Greenwich between hunters using bait ($\bar{x} = 15.1$, $SD = 15.4$) and hunters using no bait ($\bar{x} = 12.0$, $SD = 13.8$; $U_2 = 672$, $P = 0.349$).

Hunters who used bait in 2003 ($n = 35$) harvested a mean of 4.3 deer ($SE = 0.46$) and harvested enough venison to meet their needs ($\bar{x} = 4.9$ deer, $SE = 0.47$; $U_{471.0} = 2.81$, $P = 0.094$). Of hunters using bait, 32% met or exceeded their venison needs. Hunters who used no bait in 2003 ($n = 37$) harvested a mean of 0.97 deer ($SE = 0.24$) and did not harvest enough venison to meet their needs ($\bar{x} = 4.3$ deer, $SE = 0.57$; $U_{172.5} = 31.7$, $P < 0.001$). Of hunters using no bait, 8% met or exceeded their venison needs. Venison needs of hunters using bait and hunters using no bait were similar ($U_{774.5} = 2.1$, $P = 0.147$).

DISCUSSION

Use of Bait

We found that just over half of hunters aware that baiting was legalized in Connecticut used bait during the hunting season; however, number of hunters planning to use bait the following year was expected to increase as was the number of bait sites each hunter maintained. Additionally, 43% of hunters who initially indicated they would use no bait if it were legalized actually used bait once legal. Similarly, researchers in Michigan, USA, reported that 29% of hunters used bait in 1984 (54% of hunters were unaware bait was legal), which increased to 48% in 1999 (Langenau et al. 1985, Frawley 2000). Surveys designed to assess hunter willingness to use new management tools may underestimate actual use after they become available to hunters.

Some hunters using bait were less successful than they expected, and reasons for lack of success differed. However,

we found that most hunters only prebaited sites for ≤ 1 week before hunting over bait, and only 3 hunters used automatic feeders. Using automatic feeders, Henke (1997) allowed 2 weeks for deer to acclimate to bait sites and found that deer activity typically occurred during a 2-hour time period immediately before and after food was dispensed from feeders. Kilpatrick et al. (2005) found that deer developed predictable feeding patterns after discovering feeders and deer use peaked 3–4 weeks after bait site discovery. Using automatic feeders and allowing deer to acclimate to bait sites for ≥ 2 weeks likely would further increase harvest opportunities and success at bait sites.

Harvest Opportunities

We evaluated effects of property size relative to number of deer observed within shooting range at bait sites, rather than just number of deer harvested, because hunters may be passing on opportunities to harvest deer or may see deer but may not be able to harvest deer. Hunters using bait observed an average of 47 deer within shooting range during the 118-day archery season and observed 3 times more antlerless deer than antlered deer within shooting range. Kilpatrick et al. (2005) reported that antlerless deer developed more predictable feeding patterns and used bait sites more often than antlered deer.

In Connecticut, baiting was allowed only on private lands in suburban landscapes, where hunter access to land was limited and deer densities were high. Hunters using bait on small properties (≤ 0.8 ha) observed similar numbers of deer within shooting range as did hunters using bait on larger properties (≥ 5.3 ha). In the absence of bait, ability of hunters to effectively remove deer on small properties is less due to limited hunting space. Small properties have limited availability of food and cover to attract deer and limited availability of suitable trees to set up tree-stands. Use of bait (as an attractant) provided hunters a similar number of shooting opportunities on small properties as on large properties. Hunters using corn observed a similar number of deer at bait sites as did hunters using sweet feed. One benefit of using corn is that corn typically costs less and can easily be used in automatic feeders with less potential for clogging than sweet feed. Baiting, especially with corn and automatic feeders, which can limit the timing of deer activity and amount of feed dispensed, may be an important management tool to increase harvest rates in suburban landscapes, where hunter access is limited to small properties.

Synatzke (1981) reported that during times when range conditions were poor, hunters using bait in Texas, USA, observed 40% more deer per hunter than did hunters using no bait. Synatzke (1981) reported that deer using bait became more nocturnal as hunts progressed and observations of deer and hunter success declined at a greater rate than for hunters using no bait. Synatzke (1981) attributed this shift in deer activity to continuous hunting pressure. In our study, hunters who perceived baiting to be less successful than expected reported disturbing deer as they approached tree stands, deer bedding too close to bait sites, or deer using bait before or after shooting hours. Hunters believed

hunting over bait during the afternoon was more effective than hunting during the morning because deer arrived at bait sites after hunters were positioned in trees stands. To maintain high harvest potential, hunters should establish bait sites in locations to minimize disturbance when approaching stands reducing potential nocturnal activity shifts. Timing of the hunting season (late-Jan season when snow cover may be available) and hunter activity (morning or evening hunting, use of feeders) also influenced hunter success with bait.

Hunter Success

Prior to baiting (2000–2002) deer-harvest rates increased 3.2% annually in the urban deer-management zones where baiting was allowed. The year baiting was allowed (2003) deer-harvest rates increased 16.8% in zones where bait was allowed and increased by only 1.4% in zones where bait was not allowed (Tuori et al. 2005). Winterstein (1992) reported that bait played an important role in the harvest of antlerless deer during the early archery season in Michigan. Similarly, hunters using bait in Connecticut harvested 3 times more antlerless deer than antlered deer. Hunters using bait harvested 4 times more deer during the regular archery season (Sep–Dec) and nearly 8 times more deer during the January archery season than hunters using no bait. Increased harvest rates by hunters using bait in January likely was attributed to increased deer use of bait due to colder temperatures, increased snow cover, and limited availability of natural foods.

Venison needs and hunter effort between bait hunters and nonbait hunters were similar. However, hunters using bait harvested enough deer to meet their needs, whereas hunters using no bait did not harvest enough deer to meet their needs. As deer populations are reduced, use of bait may maintain high deer observation rates, allow hunters to meet their venison needs, and may reduce hunter concerns about reduced hunting opportunities in the future.

MANAGEMENT IMPLICATIONS

Development of successful hunt programs in urban-suburban landscapes will require strategies that maximize hunter harvest. Strategies that increase hunter success and opportunity to harvest antlerless deer should be important considerations in developing urban deer-management programs. Allowing hunting over bait could increase harvest opportunities and hunter success rates, especially for antlerless deer and during late-season hunts when natural foods are less abundant and climatic conditions are more severe. Use of bait should be considered especially on private land in suburban landscapes where hunter access is limited and relative property size is small. However, because of concerns relating to wildlife diseases, state wildlife agencies should consider advantages and disadvantages of using bait as a management tool and may wish to impose restrictions on amount of bait used by hunters or methods in which bait can be placed (feeders). As managers, we should educate hunters on how they can effectively use bait as a technique

to increase hunter success and avoid distributing large quantities of supplemental foods.

ACKNOWLEDGMENTS

We thank 3 anonymous reviewers for reviewing earlier drafts of this manuscript, G. Chasko, D. May, and K. McCaffery, R. Peyton, and M. Ortega for reviewing the bow-hunter survey, and R. Cabral and R. Lemieux for assisting with data collection. The Greenwich Conservation Commission, University of Connecticut, Federal Aid in Wildlife Restoration Project 49-27 and the Connecticut Department of Environmental Protection, Wildlife Division supported this project.

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Associate Editor: Hall.