Effects of Various Approaches to Quality Deer Management on White-tailed Deer Harvest

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Abstract: Quality deer management (QDM) is increasingly promoted and practiced throughout the range of white-tailed deer *Odocoileus virginianus*. However, published data evaluating the effects of this management strategy are few. We compared harvest characteristics of one private property (Ames Plantation) and three Wildlife Management Areas (WMAs) in Tennessee before and after implementation of selective harvest restrictions and recommendations to determine effects on buck harvest rates as well as harvest age structure and sex ratio. Annual buck harvest following selective restrictions decreased on the WMAs, but was not different at Ames Plantation. Mature buck (>3.5 years) harvest increased at Ames Plantation and Catoosa WMA, but did not change at Oak Ridge or Yuchi WMAs. Annual doe and buck fawn harvests did not change at any area, but the percentage of does in the harvest increased at Ames Plantation and Oak Ridge WMA. Percentage of buck fawns in the antlerless harvest was similar before and after implementation of selective harvest restrictions and recommendations and exceeded 10% for all areas. We recommend wildlife managers implementing QDM use an age restriction in conjunction with an antler restriction (based on characteristics by age class in a particular area) to ensure adequate protection of young (<2.5 years old) bucks. This will ensure hunters are not penalized when a buck reaches harvestable age, even if antler size does not exceed the minimum antler restriction. Educational efforts to help hunters estimate the age of live deer and identify buck fawns are needed wherever QDM is practiced.

Key words: harvest, *Odocoileus virginianus*, quality deer management, white-tailed deer

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Quality deer management (QDM) focuses on managing white-tailed (*Odocoileus virginianus*) deer herds in a biologically and socially sound manner in accordance with existing habitat constraints (Hamilton et al. 1995b). QDM emphasizes management of deer populations within the nutritional carrying capacity of the surrounding areas and thus has been used to ameliorate problems associated with overpopulation and a skewed sex ratio (Hamilton et al. 1995a). Often, an age or antler restriction that protects younger bucks is coupled with an appropriate doe harvest to balance the sex ratio and increase buck age structure.

Prior attempts to implement antler restrictions on public lands in Tennessee have produced mixed results. Because of increased interest in "trophy deer management" (Hastings and Pelton 1988), the Tennessee Wildlife Resources Agency (TWRA) initiated an antler restriction during the 1989–90 deer season at Natchez Trace Wildlife Management Area (WMA) in Carroll and Henderson counties. However, the number of 2.5-year-old bucks in the harvest did not increase within five years. This was likely a result of a high percentage of yearling bucks in the harvest during the first two years of the program and harvest of yearling bucks on adjacent properties (B. Layton, TWRA, personal communication). Despite limited changes in harvest characteristics, however, a survey of 1991–1994 Natchez Trace quota hunt applicants indicated more than 70% support for continuation of the program (TWRA survey, unpublished data).

Since 1998, several tracts of private land and several WMAs in Tennessee have implemented selective harvest restrictions. However, an evaluation of the effects of these programs on harvest characteristics has not been conducted. We evaluated a private property (Ames Plantation) and three WMAs that implemented some type of harvest restriction to protect younger bucks, as well as some level of antlerless harvest. Our objectives were to determine the effects of these harvest restrictions and recommendations on buck harvest rates, age structure of the buck harvest, and sex ratio of deer harvested.

Study Areas

Ames Plantation

The 7,549-ha Ames Plantation is located in the Coastal Plain physiographic province in Fayette and Hardeman counties. Deer

hunting at Ames followed statewide regulations with permits issued through the 2002–03 season. Harvest data were collected beginning with the 2002–03 season when 316 permits were issued. During the 2003–04 season, Ames Plantation Hunting Club was established with 52 hunters. Harvest data collected during 2002–03 and 2003–04 were used to establish an antler restriction that would protect bucks <2.5 years old. During the 2004–05 season, QDM guidelines were implemented that included a doe harvest quota (180) and a 110-inch gross score (Nesbitt and Wright 1997) requirement (or >5.5 years old) for bucks. Annual doe harvest goals were determined based on browse surveys and infrared-triggered camera data. Membership grew to 125 hunters in the 2006–07 season, when the buck harvest restriction increased to a 120-inch gross score minimum (or >4.5 years).

Catoosa Wildlife Management Area

Catoosa WMA (32,270 ha) is located within the Cumberland Plateau physiographic province in Cumberland and Morgan counties. Deer hunting (including quota and non-quota hunts) has occurred at Catoosa since 1955, and harvest data are collected at check-in stations on-site each year. A buck harvest restriction initiated in 1998 established a four-point (on one side) antler restriction to protect yearling bucks. Opportunities for killing does was limited to a nine-day archery season and a one-day gun season (each with a one-doe limit) prior to 1998, and a nine-day archery season and a two-day gun season for juveniles only (each with a one- or two-doe limit) from 1998 to 2006.

Oak Ridge Wildlife Management Area

Oak Ridge WMA (14,973 ha) is located within the Ridge and Valley physiographic province in Roane and Anderson counties. Deer hunting has occurred on Oak Ridge since 1985 except during 2001 when hunting was suspended for national security reasons. Hunters were selected through a random drawing to hunt during three two-day hunts held during November and December. Oak Ridge is divided into archery-only and gun hunting zones, and slightly less than half the hunters are assigned to the gun hunting zones. Harvest data have been collected at check-in stations on-site since 1985. A buck harvest restriction initiated in 2003 required bucks have at least four one-inch antler points on one side of the rack or an outside antler spread of >15 inches to protect yearling bucks. Hunters were able to kill does during each hunt from 1998–2000; however, from 2004–2006, opportunity for hunters to kill does more than doubled with additional hunt quotas and increased bag limits for antlerless deer.

Yuchi Wildlife Management Area

Yuchi Refuge (957 ha) at Smith Bend is located within the Ridge and Valley physiographic province in Rhea County. Prior to 2000, the area was privately-owned and deer hunting was permitted during statewide deer seasons with no public access. In 2000, Yuchi Refuge was purchased by TWRA and has been open to public hunting since. Hunters are selected through a random drawing for six two-day quota hunts held between September and November. Harvest data have been collected at a check-in station on-site since 2000. A buck harvest restriction was established in 2003, which followed the same restriction as Oak Ridge WMA. From 2001–2003, opportunities to kill does were limited to the juvenile and archery seasons; does could not be killed during the muzzleloading or gun seasons. From 2004–2006, opportunities to kill does during the muzzleloading and gun seasons were eventually included.

Methods

Sex and age were recorded for deer killed at all study areas. Age was estimated using the tooth replacement and wear method (Severinghaus 1949) by one technician and one manager at Ames and by TWRA personnel at WMAs.

To evaluate the QDM programs, we compared harvest data from a similar number of years before and after initiation of harvest restrictions. At Oak Ridge, national security concerns in 2001 resulted in no harvest which altered harvest patterns in years immediately prior to the start of the QDM program, so we compared harvests from 1998–2000 to 2004–2006. Only two years of pretreatment data were available at Yuchi, so we compared these data to data three years after the initial season of restrictions.

We compared harvest characteristics at each site using a repeated measures ANOVA (SAS Proc MIXED with the variance components covariance structure) by variable and by study area. We analyzed study areas separately because harvest criteria and targeted buck age varied among sites. Response variables included mean buck (all age classes) and doe harvest, percentage of buck fawns in the antlerless harvest, percentage of does in the total harvest, ≥2.5-year-old buck harvest, and ≥3.5-year-old buck harvest. Count variables (total buck, ≥2.5- and ≥3.5-year-old buck, and doe harvest) were standardized based on hunter pressure to assess changes in harvest characteristics. For Ames Plantation, we divided variables by the number of hunters each year. Because Catoosa had a mixture of quota and nonquota hunts, hunter estimates collected by TWRA personnel were used. For Oak Ridge and Yuchi, we used the total number of quota permits issued each year. We normalized variables expressed as a percent via arcsin transformation and count variables were log transformed for analysis. When

there was a violation of normality and/or variance (>3-fold difference of standard deviations between pre- and post-QDM comparisons), rank transformations were used.

We compared proportions of 1.5-, 2.5-, and ≥3.5-year-old bucks in the ≥1.5-year-old buck harvest using Pearson Chi-Square tests with adjusted residuals of ±2.0 used to indicate deviations. Significant changes in 2.5- and 3.5-year-old percentages are mostly explained mathematically (by removal of 1.5-year-old bucks from the harvest following antler-based restrictions) and may lead to incorrect conclusions (Demarais et al. 2005). Therefore, total harvest of ≥2.5- and ≥3.5-year-old bucks was also used to evaluate changes in the buck harvest.

Results

Ames Plantation

Annual buck harvest per hunter following the initial season selective harvest restrictions were implemented (2004) did not differ from the years prior to restrictions (Table 1). Age composition of the ≥1.5-year-old buck harvest differed (Pearson Chi-Square = 103.52, df = 2, $P < 0.01$) before and after restrictions because of a decrease in the percentage of 1.5-year-old bucks (63.1% to 8.3%) and an increase in the percentage of ≥3.5-year-old bucks (7.1% to 51.0%). Percentage of 2.5-year-old bucks in the ≥1.5-year-old buck harvest was 29.8% and 40.6% before and after restrictions, respectively. The ≥2.5-year-old buck harvest per hunter was similar, but the ≥3.5-year-old buck harvest per hunter, which was the target at Ames, increased following harvest restrictions. The percentage of buck fawns in the antlerless harvest prior to and after recommendation for an increased doe harvest was similar, while the percentage of does in the total harvest increased ($\bar{x}$ = 84 does pre; $\bar{x}$ = 209 does post). Doe harvest per hunter was similar.

Catoosa Wildlife Management Area

Annual buck harvest per hunter decreased following the initial season (1998) selective harvest restrictions were implemented (Table 2). Age composition of the ≥1.5-year-old buck harvest changed

Table 1. Mean harvest characteristics[a] (SE) and % of sex/age class on Ames Plantation before and after QDM.

Period	Years[b]	Total deer/hunter $\bar{x}$ (SE)	Total does/hunter $\bar{x}$ (SE)	Total bucks/hunter $\bar{x}$ (SE)	1.5 buck/hunter $\bar{x}$ (SE)	≥2.5 buck/hunter $\bar{x}$ (SE)	≥3.5 buck/hunter $\bar{x}$ (SE)	% bucks of total	% does of total	% buck fawns in antlerless harvest
Pre	2002–2003	1.85(1.02)	0.83(0.53)	1.00(0.48)	0.52(0.25)	0.30(0.14)	0.05(0.01)	57.8	42.2	18.1
Post	2005–2006	2.59(0.58)	1.90(0.38)	0.68(0.20)	0.04(0.02)	0.40(0.12)	0.22(0.03)	26.1	73.9	11.0
			$P = 0.31$	$P = 0.72$		$P = 0.59$	$P = 0.03$		$P = 0.04$	$P = 0.11$
			F1,2 = 1.86	F1,2 = 0.23		F1,2 = 0.41	F1,2 = 31.42		F1,2 = 21.95	F1,2 = 8.00

a. Count variables were standardized on a per hunter basis to account for differences in hunter numbers across years: 316 in 2002, 52 in 2003, 67 in 2004, 100 in 2005, 125 in 2006. Significance values of tests for before and after comparisons are indicated under columns of variables tested. All variables were not tested to lower Type I error and because of the relatedness of some variables.

b. Antler restrictions (≥110-inch gross score or ≥5.5 years old) implemented in 2004 and changed to ≥120-inch (or ≥4.5 years old) in 2006.

Table 2. Average harvest characteristics (SE) on wildlife management areas in Tennessee before and after QDM.

Site[a]	Period[b]	Years[c]	Total deer/ 100 hunters $\bar{x}$ (SE)	Total does/ 100 hunters $\bar{x}$ (SE)	Total bucks/ 100 hunters $\bar{x}$ (SE)	1.5 buck/ 100 hunters $\bar{x}$ (SE)	≥2.5 buck/ 100 hunters $\bar{x}$ (SE)	≥3.5 buck/ 100 hunters $\bar{x}$ (SE)	% bucks of total	% does of total	% buck fawns in antlerless harvest
CA	Pre	1990–1997	5.79(0.38)	1.85(0.17)	3.94(0.27)	2.24(0.17)	0.95(0.10)	0.19(0.03)	68.1	31.9	9.8
CA	Post	1999–2006	4.18(0.33)	1.40(0.16)	2.78(0.21)	0.35(0.03)	1.98(0.16)	0.44(0.04)	66.9	33.1	15.7
				$P = 0.08$	$P < 0.01$		$P < 0.01$	$P < 0.01$		$P = 0.67$	$P = 0.19$
				F1,14=3.67	F1,14 = 11.67		F1,14 = 29.60	F1,14 = 26.39		F1,14 = 0.18	F1,14 = 1.89
OR	Pre	1998–2000	11.95(0.48)	4.91(0.25)	7.03(0.62)	3.51(0.09)	2.35(0.48)	0.54(0.14)	58.7	41.3	19.0
OR	Post	2004–2006	11.01(1.35)	6.23(0.84)	4.79(0.52)	0.30(0.10)	3.51(0.41)	0.91(0.13)	43.6	56.4	13.5
				$P = 0.21$	$P = 0.05$		$P = 0.14$	$P = 0.12$		$P = 0.01$	$P = 0.12$
				F1,4 = 2.27	F1,4 = 7.75		F1,4 = 3.34	F1,4 = 3.83		F1,4 = 19.82	F1,4 = 3.89
YU	Pre	2001–2002	43.98(1.13)	23.06(2.49)	20.92(1.37)	10.63(1.08)	3.54(1.32)	0.68(0.46)	47.7	52.3	11.8
YU	Post	2004–2006	28.52(1.23)	17.70(0.66)	10.81(1.69)	0.52(0.20)	4.22(0.56)	0.67(0.46)	37.6	62.4	19.3
				$P = 0.07$	$P = 0.02$		$P = 0.53$	$P = 0.98$		$P = 0.22$	$P = 0.06$
				F1,3 = 7.59	F1,3 = 17.55		F1,3 = 0.49	F1,3 = 0.00		F1,3 = 2.44	F1,3 = 9.00

a. Catoosa (CA) WMA standardized based on hunter estimates, while Oak Ridge (OR) and Yuchi (YU) WMA standardized based on quota permits issued. Data expressed as deer harvested per 100 hunters (CA) or quota permits (OR and YU) issued.

b. Significance values of tests for before and after comparisons within a site are indicated under columns of variables tested. All variables were not tested to lower Type I error and because of the relatedness of some variables.

c. Antler restrictions and year of implementation were: CA-four one-inch antler points on one side of the rack minimum in 1998; OR and YU- four one-inch antler points on one side of the rack or an outside antler spread of 15 inches minimum in 2003.

(Pearson Chi-Square = 1061.90, df = 2, $P < 0.01$) as a result of a decreased percentage of 1.5-year-old bucks (70.2% to 15.1%) and increased percentages of 2.5- (23.7% to 66.3%) and ≥3.5-year-old bucks (6.1% to 18.6%). The ≥2.5-year-old buck harvest per hunter and ≥3.5-year-old buck harvest per hunter increased following selective harvest restrictions (Table 2). Percentage of buck fawns in the antlerless harvest, and the percentage of does in the total harvest ($\bar{x}$ = 177 does pre; $\bar{x}$ = 107 does post) were similar before and after initiation of selective harvest restrictions. The doe harvest per hunter was also similar.

Oak Ridge Wildlife Management Area

Annual buck harvest per quota permit at Oak Ridge WMA decreased following the initial season (2003) selective harvest restrictions were implemented (Table 2). Age composition of the ≥1.5-year-old buck harvest changed (Pearson Chi-Square = 234.95, df = 2, $P < 0.01$) as a result of a decreased percentage of 1.5-year-old bucks (60.3% to 7.8%) and increased percentages of 2.5- (30.7% to 68.4%) and ≥3.5-year-old bucks (8.9% to 23.9%). The ≥2.5-year-old buck harvest per permit and ≥3.5-year-old buck harvest per permit were similar before and after selective harvest restrictions were implemented (Table 2). Percentage of buck fawns in the antlerless harvest was similar, and the percentage of does in the total harvest increased ($\bar{x}$ = 145 does pre; $\bar{x}$ = 182 does post). The doe harvest per permit was similar.

Yuchi Wildlife Management Area

Average annual buck harvest per quota permit decreased following the initial season (2003) selective harvest restrictions were implemented (Table 2). Age composition of the ≥1.5-year-old buck harvest changed (Pearson Chi-Square = 68.25, df = 2, $P < 0.01$) as a result of a decreased percentage of 1.5-year-old bucks (75.7% to 10.9%) and an increased percentage of 2.5-year-old bucks (19.8% to 75.0%). The ≥2.5-year-old buck harvest per permit and ≥3.5-year-old buck harvest per permit were similar before and after selective harvest restrictions were implemented (Table 2). Percentage of buck fawns in the antlerless harvest and the percentage of does in the total harvest ($\bar{x}$ = 94 does pre; $\bar{x}$ = 80 does post) were similar before and after initiation of QDM guidelines. The doe harvest per permit was also similar.

Discussion

QDM success should not be based on killing bucks with high-scoring antlers. In fact, killing large bucks should not even be an objective. Rather, an objective should be to improve the age structure of bucks by protecting young bucks from harvest. As a result, older bucks (thus larger) will then be available for harvest by default.

An increased harvest of older bucks is often accompanied by a decrease in the total buck harvest following harvest restrictions (Hamilton et al. 1995b, Van Brackle and McDonald 1995, Demarais et al. 2005). Annual buck harvest per hunter at Ames Plantation following restrictions was 68% of harvest before restrictions. Annual buck harvest following restrictions at Catoosa, Oak Ridge, and Yuchi was 55%, 68%, and 59%, respectively, of pre-restriction levels. Demarais et al. (2005) reported total buck harvest on WMAs in Mississippi following a statewide antler regulation that protected bucks with <4 (total) antler points was 60% of harvest before the regulation. Nonetheless, despite a lower total buck harvest, hunters at Ames and the WMAs in our study indicated they were satisfied with the restrictions and the results (Shaw 2008).

The objective of increasing mature bucks into the harvest was met at Ames Plantation and Catoosa. In 2004 and 2005, the 110-inch gross score restriction at Ames Plantation protected all yearling bucks; however, several 2.5-year-old bucks that exceeded 110 inches were killed. This violated the age restriction (5.5 years), indicating hunters were relatively unfamiliar in aging live bucks. In 2006, fewer 2.5-year-old bucks were killed when the antler restriction was increased to 120 inches and the age restriction lowered to 4.5 years. Although there were still a few 2.5-year-old bucks killed, there was evidence the age restriction was sound and warranted as there were a couple of 4.5-year-old bucks killed that were just below the 120-inch antler restriction.

At Catoosa, an objective of the TWRA was to increase the number of >2.5-year-old bucks in the harvest. This objective was accomplished with a four-point (on one side) restriction. However, on most areas, a sizeable proportion of yearling bucks produce seven or eight points, and a point restriction may lead to cohort antler degradation, especially if the harvest rate of males is relatively high. For this reason, we believe point restrictions should be used with caution. Antler size of mature bucks (>3.5 years old) on several WMAs in Mississippi was reduced after larger-antlered individuals within a cohort were selectively harvested during five years of a <4-point (total) antler restriction (Strickland et al. 2001, Demarais et al. 2005).

Point restrictions may allow a relatively high percentage of yearling bucks in the harvest. Following antler restrictions, 15% of the antlered buck harvest at Catoosa was comprised of 1.5-year-old bucks, compared to 8% and 11% at Oak Ridge and Yuchi, respectively, which combined a point restriction with a spread restriction. Based on data collected in pre-treatment years, the four-point (on one side) restriction should have protected 89% and 91% of yearling bucks at Yuchi and Oak Ridge, respectively. This suggests the top 10% of the yearling cohort on these WMAs is susceptible to harvest with this restriction. The spread restric-

tion (outside antler spread of 15 or more inches to be legal) alone, however, should have protected all yearling bucks at Yuchi and Oak Ridge.

It is important for managers and hunters to have realistic expectations when implementing QDM programs, as meaningful results may require several years (Hamilton et al. 1995b) and results may vary among properties. This is especially important when motivations for participating in programs include harvesting larger-antlered (normally older) bucks. The objective of increasing the mature buck harvest at Yuchi and Oak Ridge were not realized. We believe this is probably related to time. Although the mature buck harvest increased within three years after implementing restrictions at Ames Plantation, the number of mature bucks harvested at Catoosa slowly increased since the restrictions were put in place in 1998. The QDM programs at Yuchi and Oak Ridge had only been in place three years since the initial season. While statistical differences were not realized at Yuchi or Oak Ridge, there was a definite trend toward more mature bucks in the harvest at Oak Ridge, as the number of mature bucks per area (ha) was nearly twice as many following the restrictions (Table 3). A similar trend, though not nearly as great, occurred at Yuchi. Another point of interest is the overall area of Yuchi is much smaller than Catoosa, Oak Ridge, and Ames Plantation.

The WMAs in our study had a relatively low percentage of does in the total harvest when compared to Ames Plantation. However, increases in doe harvest depend upon management objectives and herd productivity. At Catoosa, there was no desire by the TWRA to increase the doe harvest, as managers felt the population could increase as related to nutritional carrying capacity and improve hunter satisfaction. At Oak Ridge, a population increase was not desirable, and additional antlerless opportunities were provided in an attempt to improve the sex ratio. This was successful as Oak Ridge experienced an increase in the percentage of does in the total harvest after QDM was implemented. At Yuchi, infrared-triggered camera estimates suggested deer density approached 35 deer/ km^2. Browse lines were present. Although increased opportunity to kill does was provided after 2003, the doe harvest did not increase. This was most likely a reflection of the quota hunt system. Quota hunts were two days in length at Yuchi and, for most hunts, hunters were able to kill two deer, of which no more than one could be antlered. Thus, many hunters likely held out for a buck, and would not kill a doe before shooting a buck. Hunter response at Ames Plantation was different. Hunters at Ames were able to hunt throughout the season, and when an increased doe harvest was strongly encouraged by club managers, hunters met and exceeded doe harvest goals, which increased the percentage of does in total harvest. This most likely improved the sex ratio also, as observation data collected by Ames hunters suggested 1 buck:1.99 does in 2004 and 1 buck:1.76 does in 2006.

Table 3. Mean harvest characteristics (SE) per area for study sites in Tennessee before and after QDM.

Site[a]	Period	Years[b]	Hectares per buck $\bar{x}$ (SE)	Hectares per doe $\bar{x}$ (SE)	Hectares per ≥2.5 buck $\bar{x}$ (SE)	Hectares per ≥3.5 buck $\bar{x}$ (SE)
AP	Pre	2002–2003	71(26)	92(14)	239(88)	1597(912)
AP	Post	2005–2006	104(19)	36(3)	177(32)	307(6)
CA	Pre	1990–1997	93(10)	203(24)	397(42)	2287(489)
CA	Post	1999–2006	169(20)	368(70)	236(23)	1045(69)
OR	Pre	1998–2000	73(4)	105(9)	231(33)	1095(285)
OR	Post	2004–2006	107(6)	83(6)	146(6)	571(56)
YU	Pre	2001–2002	12(1)	11(2)	76(20)	598(359)
YU	Post	2004–2006	21(3)	12(1)	52(6)	NA[c]

a. AP=Ames Plantation, CA=Catoosa WMA, OR=Oak Ridge WMA, YU=Yuchi WMA

b. Antler restrictions and year of implementation were: AP - ≥110-inch gross score or ≥5.5 years old implemented in 2004 and changed to ≥120-inch (or ≥4.5 years old) in 2006; CA - four one-inch antler points on one side of the rack minimum in 1998; OR and YU - four one-inch antler points on one side of the rack or an outside antler spread of 15 inches minimum in 2003.

c. No bucks ≥3.5 years of age were killed at Yuchi WMA in 2005, preventing calculation of a post-QDM mean for this variable.

Buck fawn harvest is often a concern when an increased doe harvest is recommended. There was no change in the percent of buck fawns in the antlerless harvest at any of our study sites, but it remained above 10% at all sites. Educational efforts can increase the success of QDM programs by decreasing the percentage of buck fawns in the antlerless harvest. Hamilton et al. (1995a) noted the percentage of buck fawns in the antlerless harvest was reduced (16.7% to 9.7%) in the coastal plain of South Carolina after an extensive hunter education program. Educational efforts among private hunting clubs in Tennessee helped reduce the percentage of buck fawns in the antlerless harvest below 5% (Shaw 2008).

Management Recommendations

There can be no argument that an age restriction is most biologically sound to protect young bucks and improve buck age structure. However, estimating the age of a live buck is a relatively new concept for most hunters, and expecting hunters to use this technique without adequate instruction is unrealistic. Providing educational opportunities for private hunting club members is relatively easy as there is a finite and captive audience, but reaching public lands hunters is more difficult. Nonetheless, we feel this can be accomplished over time with brochures and posters provided at check-in stations, seminars, and information printed in hunting regulations digests. Educational efforts should also teach hunters to distinguish buck fawns from doe fawns to reduce the percentage of buck fawns in the antlerless harvest.

Potential problems associated with antler point restrictions

have been documented (Strickland et al. 2001, Demarais et al. 2005). For areas where an age restriction may be currently unrealistic, we recommend managers evaluate average antler characteristics by age class closely before determining an antler restriction. For example, at Oak Ridge and Yuchi WMAs, a 15-inch outside antler restriction (alone) would have protected virtually all yearling bucks, which would have met an objective of the TWRA. Where antler restrictions are used, we believe an age restriction should always be used in combination with the antler restriction. This allows hunters to harvest older bucks that do not meet the minimum antler requirement without penalty.

To address the relatively low doe harvest experienced with quota hunts on WMAs managed under QDM guidelines (such as at Yuchi), we recommend the agency allow unlimited doe harvest per hunter during the two- to-three-day quota hunt. Thus, hunters who wish to kill does can help make up for hunters reluctant to shoot a doe. Opportunities to kill a buck should be limited to the primitive weapons (bow and muzzleloader), juvenile, and handicap seasons, and allow does only to be killed during the general gun quota hunts.

Our data show selective harvest criteria and recommendations can affect harvest characteristics. It is important to know how harvest characteristics impact the deer population and to document progress of QDM programs. Monitoring deer populations can be a real challenge, especially for public lands managers, who are often responsible for large areas with limited personnel and funding. We recommend public lands managers implementing QDM use hunters to help monitor changes in the deer population by requiring hunters to fill out observation cards after every hunt. Preliminary data collected at Ames Plantation suggest hunter observation cards can be an effective and economic way to track deer density, age structure, and sex ratio.

Hunter pressure affects harvest rates, and managers have to identify appropriate quotas that result in quality hunting experiences while still achieving management goals. Infrared-triggered camera surveys can help managers gauge program success beyond that realized with harvest data. At Ames Plantation, mature bucks were photographed that hunters never saw. This helped increase awareness of program success and encouraged excitement among hunters.

Finally, we believe managers should consider hunter satisfaction when implementing a QDM program. Surveys of Oak Ridge hunters conducted two years after the program began indicated 87% felt harvest restrictions were working and 90% planned to apply to hunt the WMA the following season (Shaw 2008). Further, Oak Ridge hunters ranked the quality of hunting there better than in surrounding counties. Indeed, hunter attitudes and satisfaction are important considerations because hunters are the active managers in a QDM program.

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