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LANDOWNER ATTITUDES REGARDING PENNSYLVANIA'S EXTENDED ANTLERLESS DEER SEASON ON DEER-DAMAGED FARMS

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Abstract: The Pennsylvania Game Commission authorized an extension of the 1990-91 antlerless white-tailed deer (*Odocoileus virginianus*) season to reduce deer abundance on farms having excessive crop damage. A mail survey of the 574 participating landowners was conducted to assess the effectiveness of the program. After 2 mailings 93% ($n = 531$) responded, and 444 returns had complete information for numbers of hunters, hectares, and harvested deer. Based on landowner responses, an estimated 2,674 deer were harvested by 35,181 hunters on 58,525 ha. An average of 4.6 deer were harvested/km² of huntable land, which compared to a statewide estimate of 2.3 deer harvested/km² during the 1990 4-day regular antlerless-deer season. Twenty-four percent ($n = 107$) of respondents reported zero deer harvested. Twenty-five percent of respondents ($n = 110$) were satisfied with the program. Landowners who were dissatisfied ($n = 331$, 75%) could provide up to 5 reasons for dissatisfaction. Four hundred sixty-nine responses were provided. Three-hundred-forty-seven responses (74%) indicated too few deer were killed, while 23% ($n = 106$) indicated the program was inconvenient. Satisfaction related to number and density of deer harvested, hectares of huntable land, perception of hunter density, and suggested improvements. Many respondents ($n = 204$, 46%) indicated they would participate again, in spite of the high degree of dissatisfaction. Number and density of deer harvested, density of hunters, perception of hunter density, satisfaction, and reason for dissatisfaction, were related to willingness to participate again. Landowner suggestions for improvements (5 allowed per respondent, $n = 364$ received) centered on harvesting more deer by involving more land ($n = 201$, 55%) and moving the timing of the season ($n = 119$, 33%). Seventy-two percent ($n = 320$) of responses (5 allowed per respondent, $n = 625$ received) indicated neighboring posted land was the primary reason for too many deer on their property. This remains the greatest challenge in providing relief from high deer densities.

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Deer damage to agricultural crops is a serious problem in Pennsylvania and many other states. A 1987 national survey of state wildlife and agricultural professionals indicated that 4 of 5 groups ranked deer higher than any other species for degree of damage caused, and that the percentage of states reporting deer problems increased from 83% in 1957 to 100% in 1987 (Conover and Decker 1991). A survey of Pennsylvania farmers (Palmer et al. 1983) indicated that they perceived annual losses to deer of \$15-32 million.

Because of recognition of local areas with high deer numbers and associated depredations on crops, the Pennsylvania Game Commission has a liberal damage-control program (e.g., providing fencing materials and 50% of installation costs, allowing growers to shoot unlimited numbers of depredating deer at any time, year-round). However, high deer population levels in the late 1980s, in combination with severe economic pressures on agricultural producers, have created a demand for additional damage-control programs.

In Conover and Decker's (1991) survey, 90% of wildlife agencies manipulated hunting seasons and bag limits to alleviate wildlife-caused damage. Regular deer seasons in Pennsylvania are designed to manage populations on a county-wide basis. To address the deer damage problem on a localized basis, a 12-day addition to the regular 3-day December antlerless season was authorized for 14-26 January 1991, specifically on

farms experiencing crop damage. We surveyed the participating landowners to assess the effectiveness of this program and identify opportunities for improvement.

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METHODS

A mail-survey questionnaire was designed to determine numbers of deer harvested, hunters, and huntable hectares, reasons for too many deer, if neighboring farms participated, landowner satisfaction, willingness to participate again, and suggestions for improvements.

There were 574 landowners enrolled in the program in 52 of Pennsylvania's 67 counties. The first mailing was sent prior to, or early in, the extended season.

Questions regarding reasons for dissatisfaction, suggestions for improvements, and reasons for too many deer were open-ended. To facilitate data analysis, up to 5 responses were allowed per question. Hence, sample sizes used in summaries of these variables represent number of responses provided, and generally exceeds the number of respondents. Hunters/4 ha and deer/km² were calculated to provide standardized measures of hunting pressure and harvested deer density.

The Kruskal-Wallis test was used to determine if number of hunters, hectares, hunters/4 ha, harvested deer, and harvested deer/km² varied among satisfaction and participation groups. Pearson Chi-square was used to determine if frequency of respondents in satisfaction and participation groups varied among numerous categorical variables. All calculations and statistical tests were completed using SYSTAT (Wilkinson 1989). $P \leq 0.05$ was used to determine significance.

RESULTS

After 2 mailings, 93% of questionnaires were received. Results presented below are based on returns ($n = 444$) that had complete information for hunters, hectares, and harvested deer.

Harvest.—An estimated 2,674 deer were harvested by 35,181 hunters on 58,525 ha. The average landowner reported 5 deer harvested on 102.4 ha. An average of 4.6 antlerless deer were harvested/km² of huntable land, which compares to a statewide harvest estimate of 2.3 antlerless deer/km² during the 1990 4-day (3-day regular plus 1 extension day) antlerless-deer season. Twenty-four percent ($n = 106$) of respondents reported zero deer harvested.

Perception of Hunter Density.—Sixty-four percent of respondents ($n = 268$ of 416) indicated that the number of hunters was "about right," only 24% ($n = 98$) indicated "too many," and 12% ($n = 50$) indicated "not enough."

Neighbor Participation.—The majority of respondents (77%, $n = 336$ of 439) indicated that adjacent farms did not participate in the program.

Too Many Deer.—There were 16 reasons given for too many deer on farms, which we summarized into 5 broad categories - "neighboring posted land," "too few deer killed," "adjacent to state game land," "better feed on farm," and "miscellaneous." "Neighboring posted land" was the most common reason given (72%, $n = 447$ of 625) followed by "too few deer killed during the regular seasons" (13%, $n = 84$), "adjacent to state game land" (11%, $n = 68$), and "better feed on farm" (3%, $n = 21$).

Factors Related To Satisfaction.—Average deer harvest and amount of huntable land were related to landowner satisfaction (Kruskal-Wallis, $P \leq 0.006$, Table 1). Satisfied landowners experienced average harvests of 8 deer, or 8.1 deer/km². Landowners with huntable land >115 ha expressed higher levels of satisfaction.

Perception of hunter density and suggested improvement were related to satisfaction ($X^2, P \leq 0.010$). Thirty-two percent ($n = 85$) of the 266 respondents who indicated that the number of hunters was "about right" were satisfied versus only 9% ($n = 9$) satisfied for those ($n = 98$) who indicated "too many" (Table 2). A higher percentage of respondents were satisfied for those ($n = 44$) who suggested ways to minimize inconveniences (41% satisfied, $n = 18$), in contrast to those ($n = 199$)

who suggested including more land (18% satisfied, $n = 36$) or those ($n = 119$) who suggested moving the season (15% satisfied, $n = 18$) (Table 3).

Satisfaction.—Twenty-five percent of respondents ($n = 110$ of 441) were either "satisfied" or "very satisfied" with the program (Table 1). There were 26 reasons given for dissatisfaction, which we summarized into 3 broad categories - "too few deer harvested," "inconvenience," and "miscellaneous." For the 331 dissatisfied respondents, 74% ($n = 347$ of 469) of responses indicated "too few deer killed" as the reason for dissatisfaction, although 23% ($n = 106$) indicated "inconvenience."

Table 1. Mean numbers of hunters, hectares, and harvested deer; and mean hunter and harvested deer density by landowner satisfaction category, for deer-damaged farms in Pennsylvania during 1991.

Variable	Satisfaction ($n = 441$)				P^a
	Very Satisfied ($n = 29$)	Satisfied ($n = 81$)	Somewhat less than Satisfied ($n = 137$)	Not Satisfied ($n = 194$)	
Hunters	98	62	59	58	0.597
Hectares	153	134	96	86	0.006
Hunters/4 ha	4	2	4	4	0.448
Deer	11	8	4	3	0.000
Deer/km ²	8.5	8.1	5.4	3.5	0.000

^a P 's from Kruskal-Wallis test, to test the null hypothesis that numbers varied among satisfaction categories.

Table 2. Percentage of respondents in landowner satisfaction category, by response to the question "Was the number of hunters about right, too many, or not enough?" for deer-damaged farms in Pennsylvania during 1991.^a

Hunter Density	n (414)	% Satisfaction			
		Very Satisfied	Satisfied	Somewhat Less than Satisfied	Not Satisfied
About right	266	6	26	32	36
Too many	98	4	5	38	53
Not enough	50	12	10	24	54

^a Pearson Chi-square = 30.18, $df = 6$, $P < 0.001$.

Improvements.—There were 26 suggestions for improvements, which we summarized into 3 broad categories - "more land," "move season," and "minimize inconvenience." Suggested improvements emphasized ways of harvesting more deer, such as enrolling more land in the program (55%, $n = 201$ of 364) and moving the season (33%, $n = 119$) to coincide with the time when crop damage occurs, or when more deer are on the farm, such as during the antlered-deer season. Only 12%

($n = 44$) of responses were specifically to minimize inconveniences. For those suggesting more land be enrolled ($n = 201$), their primary recommendations were to expand the huntable area to the township or county level (34%, $n = 69$), or to involve more neighboring land or state land (26%, $n = 53$ each).

Table 3. Percentage of respondents in landowner satisfaction category, by suggested improvement for deer-damaged farms in Pennsylvania during 1991^a.

Suggested improvement	<i>n</i> (362)	% Satisfaction			
		Very Satisfied	Satisfied	less than Satisfied	Not Satisfied
More Land	199	5	13	29	54
Move season	119	6	9	29	56
Minimize Inconvenience	44	11	30	27	32

Pearson Chi-square = 16.69, $df = 6$, $P = 0.010$.

Participation.—Many respondents (46%, $n = 204$) indicated they would participate if the program were offered again (Table 4). Twenty-six percent ($n = 113$) indicated they would not, and 28% ($n = 122$) did not know if they would participate again.

Table 4. Mean numbers of hunters, hectares, and harvested deer, and mean hunter density and harvested deer, by participation category, for deer-damaged farms in Pennsylvania during 1991.

Variable	Future Participation ($n = 439$)			P^a
	Yes ($n = 204$)	No ($n = 113$)	Don't know ($n = 122$)	
Hunters	61	70	57	0.220
Hectares	115	92	93	0.124
Hunters/4 ha	3	6	3	0.020
Deer	6	4	4	0.000
Deer/km ²	6.2	5.0	4.2	0.003

^a P 's from Kruskal-Wallis test, to test the null hypothesis that numbers varied among "participate again?" categories.

Factors Related To Participation.—Average deer harvest and hunter density were related to willingness to participate in the future (Kruskal-Wallis, $P < 0.020$, Table 4). Respondents willing to participate again reported higher deer harvests ($\bar{x} = 6$ deer, 6.2 deer/km²) than respondents indicating "no" or "don't know" ($\bar{x} = 4$ deer for each, and 5.0 and 4.2 deer/km², respectively). Hunter densities were highest for respondents indicating "no" ($\bar{x} = 6$ hunters/4 ha versus 3 hunters/4 ha for those marking "yes" and "don't know").

Willingness to participate again varied among perception of hunter density, satisfaction, and reason for dissatisfaction categories (X^2 , $P < 0.001$). Higher levels of willingness to

participate were demonstrated by those ($n = 266$) who indicated hunter numbers were "about right" (56% yes) and those ($n = 48$) who indicated "not enough" (62% yes), versus 16% yes for those ($n = 98$) who indicated "too many" (Table 5). The highest percentage of respondents indicating that they would participate again were those ($n = 29$) who indicated they were very satisfied (97% yes), and the lowest percentage was for those ($n = 194$) who were not satisfied (28% yes, Table 6). For respondents who were dissatisfied, those ($n = 344$) expressing the reason of too few deer harvested were most apt to participate again (42% yes), whereas those ($n = 106$) concerned with inconveniences were less apt to participate again (8% yes, Table 7).

Table 5. Percentage of respondents in participation category, by response to the question "Was the number of hunters about right, too many, or not enough?" for deer-damaged farms in Pennsylvania during 1991.^a

Hunters Numbers	<i>n</i> (412)	% Future Participation		
		Yes	No	Don't Know
About right	266	56	18	26
Too many	98	16	50	34
Not enough	48	62	21	17

^a Pearson Chi-square = 59.17, $df = 4$, $P < 0.001$.

Table 6. Percentage of respondents in participation category, by satisfaction category, for deer-damaged farms in Pennsylvania during 1991.^a

Satisfaction	<i>n</i> (437)	% Future Participation		
		Yes	No	Don't Know
Very satisfied	29	97	3	0
Satisfied	80	75	2	22
Somewhat less than satisfied	136	44	19	37
Not satisfied	192	28	44	28

^a Pearson Chi-square = 105.38, $df = 6$, $P < 0.001$.

Table 7. Percentage of respondents in participation category, by reason for dissatisfaction, for deer-damaged farms in Pennsylvania during 1991.^a

Reason for dissatisfaction	<i>n</i> (465)	% Future Participation		
		Yes	No	Don't Know
Too few deer harvested	344	42	27	31
Inconvenience	106	8	58	34
Miscellaneous	15	13	53	33

^a Pearson Chi-square = 54.66, $df = 4$, $P < 0.001$.

DISCUSSION

There were numerous benefits from the 12-day extended antlerless-deer season of January 1991 on farms reporting excessive levels of deer crop damage. The additional harvest of 5 antlerless deer on the average farm would result in 8-10 fewer deer feeding on crops during the following summer and fall, even though the harvest was found to be below the expectation of most landowners. Also, by identifying participating farms with signs before the regular firearms seasons, there was probably more hunting pressure attracted to these farms for the regular seasons, increasing harvests to above-normal levels. A survey conducted by the Pennsylvania Farmers Association indicated that harvest during the extended season may have added an additional 40% to the total deer harvest on these farms. Reductions in local deer abundance from all sources should have a positive effect, but it is too early to assess the biological impact of the program.

Approximately 140 landowners received a satisfactory level of relief from deer damage. In addition, there were incidental benefits that cannot be discounted. We received numerous comments from landowners that their interactions with hunters and Wildlife Conservation Officers were positive. The increased awareness among sportsmen and the public regarding the crop damage problem should serve to benefit agricultural producers and hunters alike.

Improvement opportunities for the program merit attention. The most common landowner recommendations for improvements involved enrolling more land, either at the township, county, or neighboring farm levels, and shifting the season to a time when it might be more effective. A goal of increasing the number of harvested deer/farm should have a positive impact on landowner satisfaction. Perhaps doubling the season length would be of benefit because the current harvest level was about half of the harvest level to attain satisfaction. Also, shifting the season to a time when other hunting activities occur should help reduce a common belief that when hunters arrived, deer avoided the farm. Disturbance on surrounding lands may help keep deer moving, thereby increasing harvest rates. Probably the period of greatest effectiveness would be during the antlered-deer season.

Enrolling more neighbors in the program should enhance deer harvest, but it may not improve landowner satisfaction. During this trial season, having a neighbor enrolled in the program did not influence satisfaction or willingness to participate again. Landowners appeared to base their satisfaction primarily on the number of deer killed on their farm, not on the number harvested in the area.

High hunter densities were a negative factor for satisfaction and willingness to participate again. Concentrating the attention of even a small fraction of Pennsylvania's one-half million antlerless-deer hunters on 574 landowners created a great deal of inconvenience for the farmers. However, because landowners determined the number of hunters allowed on their farms, it was not surprising that the majority of farmers indicated that the number of hunters was "about right". Most landowners had an idea of how many hunters their farm could support, and regulated numbers accordingly. Although individual landowners have different opinions as to what the "right" number of hunters should be, we suggest a guideline that hunter densities be restricted to approximately 1 hunter/4 ha/day.

There are challenges that this program may not be able to address. Posted land was cited as the primary reason for too many deer. A program based on hunting will be ineffective if deer are inaccessible. Also, smaller farms tended to have lower satisfaction ratings. The average farm size for respondents indicating zero deer harvested was 63 ha, well below the average.

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