DEER MANAGEMENT IN NEW YORK'S HUDSON VALLEY REGION: AN ASSESSMENT OF THE INTERESTS AND OPINIONS OF THREE KEY CONSTITUENCIES

By

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STUDY HIGHLIGHTS

Introduction and Background

Management of white-tailed deer (*Odocoileus virginianus*) population levels in New York has been based on biological feasibility and social acceptability. However, preferences regarding the level at which deer should be managed often differ among the various constituencies that may be affected by the deer resource. If the preferences differ considerably, establishment of acceptable deer management programs may be difficult without agency intervention. This study was conducted to determine some of the human factors influencing deer management in the Hudson River Valley of southeastern New York.

In recent years in the Hudson Valley, concern has increased about damage caused by deer to agricultural crops, especially fruit crops. A growing deer population coupled with an increase in the planting of size-controlled root stock have intensified orchardists' concerns about deer damage. In addition, although a large demand exists for deer hunting opportunities in the Deer Management Units (DMUs) in the Hudson Valley, access for hunting on private lands has decreased because of demographic and land-use changes.

Wildlife managers have identified several constituents whose attitudes and behaviors regarding deer and deer damage are "key" to the development of effective deer management strategies in the area. These key constituencies are (1) commercial fruit growers, (2) private landowners with properties adjoining those of fruit growers (hereafter referred to as "adjacent landowners"), and (3) regional deer hunters. This study attempted to assess the attitudes about deer and deer damage held by these constituencies and to

ascertain factors that may act as impediments or incentives to effective deer management.

Methods

The study was restricted to the 41 townships comprising DMUs 46, 48, and 56 in the Hudson Valley. Each of the 3 key constituencies was surveyed separately. About 160 fruit growers with ≥10 acres in commercial fruit production were identified from County Cooperative Extension records. A self-administered mail-back questionnaire was sent to orchard growers in the spring of 1987. Multiple follow-up mailings were used to maximize response and post-survey telephone interviews with nonrespondents were conducted to assess nonresponse bias.

Fruit growers were asked whether a significant part of the crop damage they experienced was attributable to adjacent properties where deer congregated because hunting was not allowed. The property locations of fruit growers responding affirmatively to this question were identified and a list of all adjacent landowners with properties ≥5 acres was developed from county tax assessment records. A telephone survey focusing on attitudes towards deer, deer damage, hunting access, and perceptions of deer damage problems was conducted with 65 adjacent landowners in early 1988.

A systematically-selected sample of about 900 deer hunters (300 each in DMUs 46, 48, and 56) was sent mail-back questionnaires in the fall of 1987. Assessments for nonresponse bias were conducted via telephone following the mail survey.

Results

- Survey response for the 3 constituencies were: fruit growers = 61%, adjacent landowners = 63%, and deer hunters = 61%.

Fruit growers

- About 90% of the fruit growers experienced deer damage to their crops in 1986, and two-thirds of those experiencing damage indicated that the damage was moderate or severe.
- Apples experienced most of the damage.
- Size-controlled root stock experienced more damage than standard trees.
- About 20% of the production of all types of fruit was lost or substantially delayed as a result of deer damage.
- Most growers (83%) used some method of damage control in the 12 months preceding the survey, and more than 1 method of control was often used.
- Bar soap repellents and hunting were the 2 predominant means of control.
- Deer fencing and permits for shooting nuisance deer were considered "most effective" by 82% and 78% of their users, respectively, but these control methods were among the least used.
- About 4 of 5 growers considered deer a nuisance or enjoyed deer but had strong reservations about the risk of crop loss associated with deer in their area.
- More than half of the growers believed the deer population was "too high," and among those growers, 60% believed that the population was being managed at a level that was simply too large for the fruit growers' interests, and 46% believed that the amount of posted property prevented hunters from harvesting the needed number of deer.
- About 40% of the fruit growers surveyed posted their lands. Posting occurred as a means to restrict hunting privileges to certain groups, not to prevent hunting altogether. Growers who posted were less likely to allow strangers to hunt on their properties than were growers who did not post but showed no difference when compared to nonposters in their allowances for access to family members or friends.
- Three-quarters of the growers who indicated that at least 1 adjacent landowner prohibited deer hunting and who believed that deer congregated on that land during the hunting season also believed that a large portion of the deer damage to their fruit trees was attributable to deer from the nonhunted properties.

Adjacent landowners

- Adjacent landowners had greater interests in sighting deer on their properties and in maintaining larger deer population levels than did fruit growers.
- About half were satisfied with the level of the deer population in their area in 1987, although many (35%) indicated that even more deer would be desirable.
- Adjacent landowners did experience some deer damage on their properties, mostly to fruit trees (62%) and gardens or ornamental plantings (20%). A majority of the damage was described as "light."
- Only about half of the adjacent landowners (47%) recognized that the commercial orchard neighboring their property was experiencing deer damage.
- Eighty-two percent believed that fruit growers should reasonably assume "moderate" risks of deer damage, but not "severe" risks. However, the adjacent landowners' perceptions of "moderate" or "severe" may not have been the same as the perceptions of the fruit growers.
- Few (<25%) adjacent landowners hunt deer on their own properties, and many do not allow even their own family members to hunt.
- Reasons for not allowing hunting included safety concerns (45%) and a philosophical opposition to hunting (40%).
- Almost all (94%) of those who did not allow hunting reported they would not allow hunting even if hunters paid for the privilege.
- Very few adjacent landowners recognized that their denial of hunting access may result in the creation of refugia for deer during the deer hunting season.

Deer hunters

- Although 84% of deer hunters indicated they hunted on private land, only 7% indicated they usually hunted on lands containing a managed orchard.
- Overall, 16% of the hunters indicated that they would prefer to hunt on orchard lands. This reflects the finding that the property types on which respondents indicated they hunted most were seldom the same as those selected as most preferred.
- Of all hunters surveyed, 44% indicated they were willing to pay to gain access to private land ($\bar{x}$ = $80/season).

- Ninety percent recognized that area orchards experienced damage from deer.
- Hunters believed that the most important contribution to the damage problem was the predominance of lands posted against hunting.
- Overall, the majority of hunters (62%) believed that deer were being managed at a level that was "about right."
- Over half (55%) reported that they had applied for a Deer Management Permit.
- Among those who did not apply, about one-third reportedly forgot to apply. Only about one-tenth of those who did not apply indicated they were philosophically opposed to hunting female deer.

Implications and Conclusions

Deer in the Hudson River Valley were viewed with "mixed appreciation" by the 3 constituencies surveyed. Maintenance of deer populations at or near current levels is likely to continue to be a concern to commercial fruit growers. However, reduction of the deer population to a level that is satisfactory to most fruit growers would likely be unacceptable to the other constituencies. Findings from this study have several implications that will assist managers to better meet this management challenge.

Adjacent landowners and deer hunters shared the recognition that the level of deer managed in the area should not result in "severe" risks of crop damage to commercial fruit growers. However, the degree to which these constituencies can be expected to participate or indirectly assist with the traditional deer management practice of regulated hunting is likely to differ. Hunters' preferences for deer hunting on private lands, and the willingness of many hunters to pay for the opportunity to do so, may be used by some fruit growers seeking to offset economic losses from deer damage.

Attitudinal differences between commercial fruit growers and their adjacent landowners regarding interests in deer and feelings about deer

hunting are unlikely to be easily resolved. Nonetheless, the value of efforts to increase adjacent landowners' awareness of the deer damage problems experienced by fruit growers, and their potential role in helping to mitigate deer damage, should not be overlooked.

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INTRODUCTION

In New York State, considerable effort has been devoted to managing white-tailed deer (*Odocoileus virginianus*) population levels based on biological feasibility and social acceptability. A primary social factor affecting the level at which deer are managed in many agricultural areas is the concern about deer damage expressed by farmers (Brown and Decker 1979, Brown et al. 1980, Decker et al. 1985, Purdy 1987). Of additional importance are the interests of other constituents who seek benefits from or who have concerns about the deer resource. Each key constituency group may exhibit differing preferences regarding the level at which deer should be managed. If the views of these groups are considerably divergent, then establishment of deer management programs commensurate with such views may be difficult in the absence of agency intervention efforts. Therefore, understanding the nature and influences of constituency preferences for deer management is essential to the development and maintenance of effective and acceptable deer management programs. The study described herein was conducted to assist determinations of the human factors influencing deer management in an important agricultural region in southeastern New York.

BACKGROUND

The Hudson River Valley region of southeastern New York is an important contributor to the state's agricultural economy. One of 3 primary fruit-producing regions within the state, area farmers produce about $28 million worth of fruit annually (U.S. Dept. of Commerce 1982). Four counties contribute most to this production: Orange, Ulster, Dutchess, and Columbia. Over half of the land devoted to fruit production in these counties is planted with apple trees (New York Crop Reporting Service 1986).

In recent years, large deer populations coupled with increased plantings of apple trees having size-controlled rootstock have intensified orchardists' concerns about deer damage. An earlier study in the Hudson River Valley by Decker and Brown (1982) found that, as compared to other area farmers, orchardists reported greater incidences of deer damage, perceived greater economic impacts to their farming operations from deer damage, and were more apprehensive about deer and deer damage generally. More recent studies in the region have estimated that revenue losses from deer damage and associated control costs averaged about $1,500 per apple orchardist in 1986 (Phillips et al. 1988). Generally, where deer damage is considered excessive by individual crop producers, permits may be issued by the New York State Department of Environmental Conservation (DEC) for shooting nuisance deer. Although deer are but 1 of the wildlife species for which orchardists have crop damage concerns, they are nevertheless an important consideration in orchardists' crop management schemes.

Traditionally, hunting has been used as a means for controlling deer populations in areas where agricultural crop damage is a concern. Similar to other areas in New York, a large demand exists for deer hunting within the Deer Management Units (DMUs) of the Hudson River Valley. However, hunter access to private lands has been found to be a larger problem in this region than in other areas of the state (Decker and Brown 1979). As a result, hunter distribution within DMUs is seldom homogenous and in some localities, deer populations may not be reduced to the levels desired by managers. Furthermore, in some DMUs, harvests of antlerless deer have declined in recent years, despite stable or increasing numbers of hunters. Wildlife biologists are concerned that negative hunter attitudes about shooting antlerless deer

combined with limited access to private lands for hunting may increase the difficulty of managing deer populations in the region.

Demographic and land-use changes occurring in the Hudson River Valley constitute additional factors that may affect orchardists' experiences with deer damage and, perhaps more importantly, the traditional approach to managing area deer populations. Bounded by the metropolitan areas of Albany to the north and New York City to the south the region has, in recent years, observed an influx of persons seeking permanent as well as part-time residences in this traditionally rural area. Many once-large landholdings have been transformed into smaller parcels. Where these parcels are partly wooded and exist as contiguous units of land, they continue to provide food and cover for deer, although access for hunting is often diminished. Regional wildlife managers are concerned that 2 primary factors associated with these changes may influence the deer damage and management situation: (1) new landowners may be reluctant to allow deer hunting on their properties due to safety concerns associated with reduced property size and (2) new landowners coming from urban areas may not share attitudes that are as supportive of hunting as those typically found among rural residents (G. Cole and Q. VanNortwick, DEC, pers. commun.). If so, these parcels of land may effectively serve as refugia, rendering deer population control by hunting ineffectual and serving as cover for unhindered movements of deer to and from nearby orchard lands.

Clearly, the issue of deer management in the Hudson Valley is multi-faceted. Wildlife managers view the attitudes and behaviors of certain constituencies as "key" to the development of effective deer management and damage control efforts. These key constituencies include (1) commercial fruit

growers, (2) private landowners with properties adjoining those of fruit growers (hereafter referred to as "adjacent landowners"), and (3) regional deer hunters. Each key constituency group has an interest in the deer resource--for some persons, that interest may be expressed as concerns related to crop or ornamental plant damage--for others, appreciative and recreational uses may be foremost among their interests in the resource. The degree to which the views of these groups reflect differing preferences for deer management is uncertain. In this study we have attempted to assess those views and ascertain factors that may act as impediments or incentives to effective deer management.

METHODS

The efforts of this study were focused geographically within 3 specific parts of the Hudson River Valley. Wildlife managers with the New York State Department of Environmental Conservation considered these areas "sensitive" for deer management programs from the perspectives of the aforementioned key constituency groups. Specifically, the study area consisted of 41 townships within Ulster, Orange, and Columbia Counties that comprise DMUs 46, 48, and 56. Study methods used with each of the constituency groups involved in this research are described below.

Commercial Fruit Growers

Listings of commercial fruit growers were obtained from the records of County Cooperative Extension Agents. From these lists, all growers with $\geq$10 acres in commercial fruit production were identified. Complete names and mailing addresses were obtained for 162 growers. Self-administered, mail-back questionnaires were developed to assess growers' experiences with and

attitudes toward deer and deer damage as well as their perceived needs and preferences for deer damage control assistance. The survey was implemented in early spring of 1987. Multiple follow-up mailings were used to maximize response and post-survey telephone interviews with nonrespondents were conducted to assess nonresponse bias.

Adjacent Landowners

Private landowners with properties adjacent to commercial fruit growers who were perceived by fruit growers as potential contributors to their deer damage problems because of deer hunting access policies were a constituency of importance in this study. To identify these property owners, we asked fruit growers to indicate whether they thought that " . . . a significant part of the crop damage they were receiving was attributable to adjacent properties where deer congregated because hunting was not allowed?" The property locations of fruit growers providing affirmative answers to this question were recorded. Using these selected fruit growers' properties, a list of all adjacent landowners with properties $\geq$5 acres was developed from county tax assessment records. Because our primary focus concerned the influences of private landowners on deer management efforts, those that could be categorized as corporate or governmental landowners (as well as commercial fruit growers who were previously surveyed) were excluded from the list. Complete information on names, mailing addresses, and telephone numbers were obtained for 112 private adjacent landowners. A telephone survey, focusing on attitudes toward deer, deer damage, hunting access, and perceptions of deer damage problems on the adjacent fruit grower's property was conducted with 65 adjacent landowners in early 1988.

Deer Hunters

Names and addresses of potential deer hunters within the study area were obtained from copies of DEC Big Game Hunting licenses[1]. Using licenses purchased in the study area for the 1986-87 big game hunting season, a sample of approximately 900 license buyers was systematically selected; about 300 each from DMUs 46, 48, and 56. A self-administered, mail-back questionnaire was developed to assess deer hunting experiences, land use and access-related preferences and problems, and attitudes about deer management and antlerless deer harvest. A survey enlisting multiple follow-up mailings was implemented in the fall of 1987. Assessments for nonresponse bias were conducted via telephone following the mail survey.

Data Analysis

Analysis of data obtained from this study was conducted using the SPSSX statistical package. Because respondents may not have answered all questions in the questionnaire, the data reported herein are adjusted for nonresponse to particular questions. Statistical tests were conducted using Chi-square (X^2) tests for comparisons of categorical data and Student's t-tests for comparisons of normally-distributed data.

RESULTS

Survey Response

Survey response for the 3 audiences addressed in this study were as follows: fruit growers = 61%, adjacent landowners = 63%, and deer hunters =

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[1]In New York, big game hunting includes deer and black bear (*Ursus americanus*). Few big game license buyers hunt exclusively for bear. Thus, we assumed that big game license buyers in the study area represented the population of potential deer hunters.

61%. Comprehensive follow-up interviews with nonrespondents indicated that survey results were unbiased by nonresponse.

Commercial Fruit Growers

Deer damage experiences. Results of the survey of fruit growers showed that fully 90% of all respondents indicated they had experienced deer damage to their crops during 1986, over twice the incidence reported 5 years earlier by Decker et al. (1981) for orchardists in the Hudson River Valley. Nearly two-thirds of those reporting damage described it as moderate (45%) or severe (18%). Fifty-four percent of the damage reported for specific crops involved apples. Growers possessed about the same acreages of size-controlled apple trees ($\bar{x}$=78 acres) as they did standard trees ($\bar{x}$=74 acres). Size-controlled trees were reported no more frequently as the object of deer damage than were standard trees. Growers' production loss estimates suggested, however, that the impact of damage on size-controlled trees was relatively greater than that for standard trees. Considering all fruit crops damaged, the amount of production estimated to be lost or substantially delayed as a result of deer damage averaged about 20%. Orchardists' earlier (i.e., 1981) estimates of generally $\leq$10% crop impact reported by Decker et al. further suggest that deer damage was perceived as a problem of considerable magnitude within the study area in 1986.

Damage control efforts. Fruit growers' efforts to control deer damage to their crops were largely consistent with their perceptions of widespread damage; 83% reported using damage controls in the 12 months preceding the survey. Few growers were relying only on 1 method of control; the median number used was 2 and nearly 30% used $\geq$4 methods. Among the controls used, those classed as repellents appeared most popular, with homemade bar soap

repellents the predominate method (Table 1). Allowing hunters to harvest deer

Table 1. Percentage of fruit growers using deer damage controls.

	Percent[a]
Repellents:	
Bar soap	70.1
Commercial chemicals	43.3
Hair bags	40.3
Allowed hunting	61.2
Deer fencing	16.4
Nuisance deer harvest permits	13.4
Scare devices	11.9
Other	6.0

[a]Multiple answers were possible from each respondent. Therefore, percentages do not total 100.0.

on orchard properties was also a practice adopted by many. Nevertheless, 2 of the least used methods overall, were given the highest ratings for effectiveness by those who used them; deer fencing and permits for shooting nuisance deer were considered "most effective" by 82% and 78% of their users, respectively. About 12% of control users indicated that, regardless of method, their damage control efforts had been relatively ineffective. Their estimates of crop production loss ($\bar{x}$=37%) were consistent with this perception and were markedly larger than those reporting effective use of damage controls ($\bar{x}$=21%) ($P \leq 0.05$, $t = -2.07$, 42 df).

Attitudes about deer and deer management. Relative to deer population levels in the study area in 1986, few growers appeared to be satisfied with

the number of deer in their localities. Overall, nearly 80% of growers considered deer a nuisance or believed the risk of crop loss overshadowed the benefits associated with deer in their area (Table 2). Nearly 60% believed

Table 2. Fruit growers' attitudes about deer.

Appreciation for deer:	All growers (n=88)	Damage control Users (n=66)	Damage control Non-users (n=13)
Enjoy deer and their presence is worth risk of crop loss (or) presence of deer does not matter	21.6	15.1	38.5
Enjoy deer but their presence is not worth risk of crop loss (or) regard deer as a nuisance	78.4	84.9	61.5
	100.0	100.0	100.0
Perception of deer population level:			
Too low	5.4	0.0	0.0
Just right	35.5	28.0	61.5
Too high	59.1	72.0	38.5
	100.0	100.0	100.0

the level at which the deer population was being maintained was "too high." As might be expected, those persons using deer damage controls were more likely than those not using controls to consider the deer population to be "too high.". Among those who felt that deer were too plentiful, 2 beliefs were expressed by a majority or near-majority as the reasons for that perception: (1) 60% believed that deer were being managed at a level that was simply too large for fruit growers' interests and (2) 46% believed that the amount of posted property in their areas effectively kept hunters from harvesting the needed number of deer.

Hunting access. Among the fruit growers surveyed, 41% had their own properties posted against hunter access during the 1986 deer hunting season. Nevertheless, fruit growers' posted property should not be equated to lands closed to deer hunting. In fact, posting landowners were no more likely to deny deer hunting access than were persons who did not post (X^2=0.05, df=1, P>0.05); about 90% of both groups usually allowed others to hunt deer on their properties. Growers who posted tended to do so as a means to restrict hunting privileges to certain groups. Specifically, growers who posted were less likely than those who did not post to allow strangers (even those who asked permission) to hunt their properties (X^2=4.02, df= 1, P≤0.05) but showed no significant difference when compared to nonposters in their allowances for access to family members (X^2=1.97, df=1, P>0.05) or friends (X^2=0.31, df=1, P>0.05) (Figure 1).

Deer sanctuary concerns. Nearly half of the commercial fruit growers reported that 1 or more adjacent landowners prohibited deer hunting. Three-fourths of these individuals believed that deer congregated on the adjacent properties where hunting was not allowed more so than on properties where hunting was permitted. Furthermore, most (76%) growers who believed that neighboring properties possessed both of the above characteristics also felt that a large portion of the deer damage to their fruit trees was attributable to deer from those properties. Thus, nearly 3 of 5 fruit growers reporting adjacent properties where deer were not hunted, or about one-fourth of all growers surveyed, felt that the "no deer hunting policies" of neighbors acted to exacerbate their own deer damage problem. In the following sections we

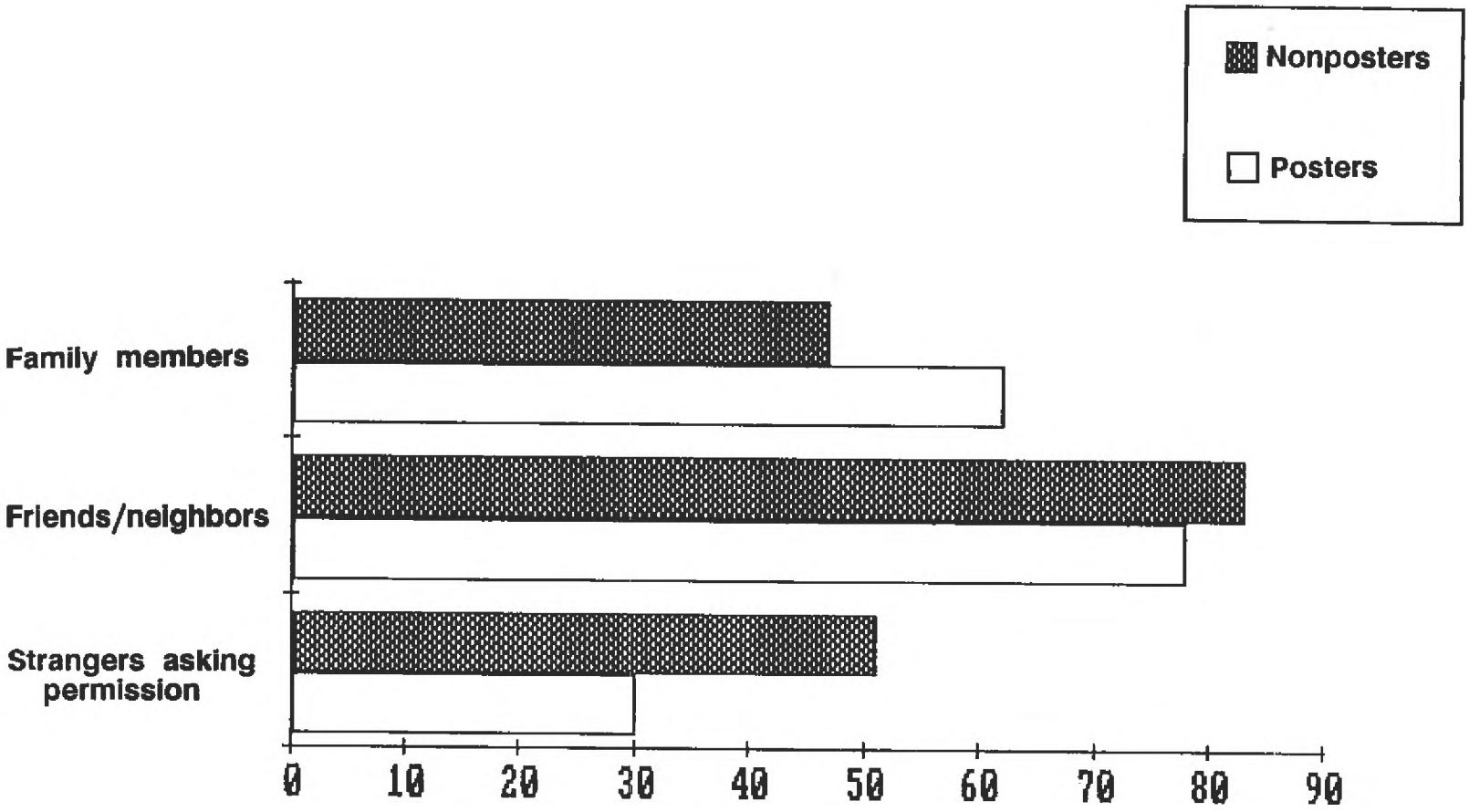

Figure 1. Comparison of types of persons allowed to hunt deer on properties of fruit growers who posted against access vs. those who did not post.

explore that issue by focusing on the deer-related experiences, interests, and attitudes of those adjacent landowners.[2]

Adjacent Landowners

Although immigration into the Hudson River Valley by persons from nearby urban/suburban areas is occurring, those individuals with private landholdings adjacent to fruit growers' properties surveyed in this study are not accurately characterized as "newcomers" to the region. Only about 16% had owned the property adjacent to the commercial fruit growers for ≤5 years and the average ownership ($\bar{x}$=19 years) depicts a relatively slow turnover of properties. Most (76%) maintained a residence on their land and the primary land uses were varied--39% = home site, 37% = farm land, 13% = property maintained as idle land, and 11% = other uses.

Deer interests and experiences. Relative to their neighboring fruit growers, adjacent landowners had greater interests in sighting deer on their properties and generally maintaining higher deer population levels. Nearly 70% indicated that it was important to be able to see deer on their land and most had actually done so. Indeed, about 4 of 5 persons reported having seen deer on their property in the previous 12 months. On average, the largest number of deer observed at any 1 time during that period consisted of about 5 animals and only 10% had observed groups of >10 deer.

Although about half of the adjacent landowners were satisfied with the level of deer that occupied their areas in 1987, many respondents believed

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[2]No attempt was made in this study to have fruit growers implicate specific adjacent landowners as contributors to their deer damage problems or to disclose the names of those individuals. To protect the anonymity of these adjacent landowners, a census was conducted of all landowners adjacent to fruit growers who had indicated that adjoining landowners were potential contributors to the deer damage problem.

that more deer in the region would be desirable. As compared to fruit growers, adjacent landowners were about 7 times more likely (5% vs. 35%, respectively) to desire an increase in the deer population. Only 13% believed there were too many deer in the area.

Relatively few (33%) of the adjacent landowners reported damage attributed to the presence of deer on their properties. Like commercial fruit growers, most (62%) of the damage experienced by these adjacent landowners was associated with fruit trees. Gardens and/or ornamental plantings were less frequently (20%) the objects of deer damage. Unlike their neighbors with commercial interests in fruit, however, the majority (55%) of the damage that occurred was described as being "light." Nevertheless, damage was not altogether tolerated as over half of the adjacent landowners who reported damage had also taken action to control it; actions that, although somewhat more varied than those of neighboring fruit growers, were largely similar in technique.

Perceptions of deer damage on neighboring commercial orchards. The problem of deer damage, perceived by fruit growers, was not one of which most adjacent landowners were aware. Slightly less than half (47%) of the responding adjacent landowners believed that the commercial orchard neighboring their property had a problem with deer damage. Two-fifths were reluctant to express an opinion, presumably due to a lack of information. Nevertheless, as a group, adjacent landowners may be considered relatively sympathetic to fruit growers' concerns about deer damage. Eighty-two percent of the adjacent landowners believed it reasonable that fruit growers should assume "moderate" risks of deer damage, but "severe" risks should be mitigated by deer management efforts (Figure 2). This finding must be tempered by

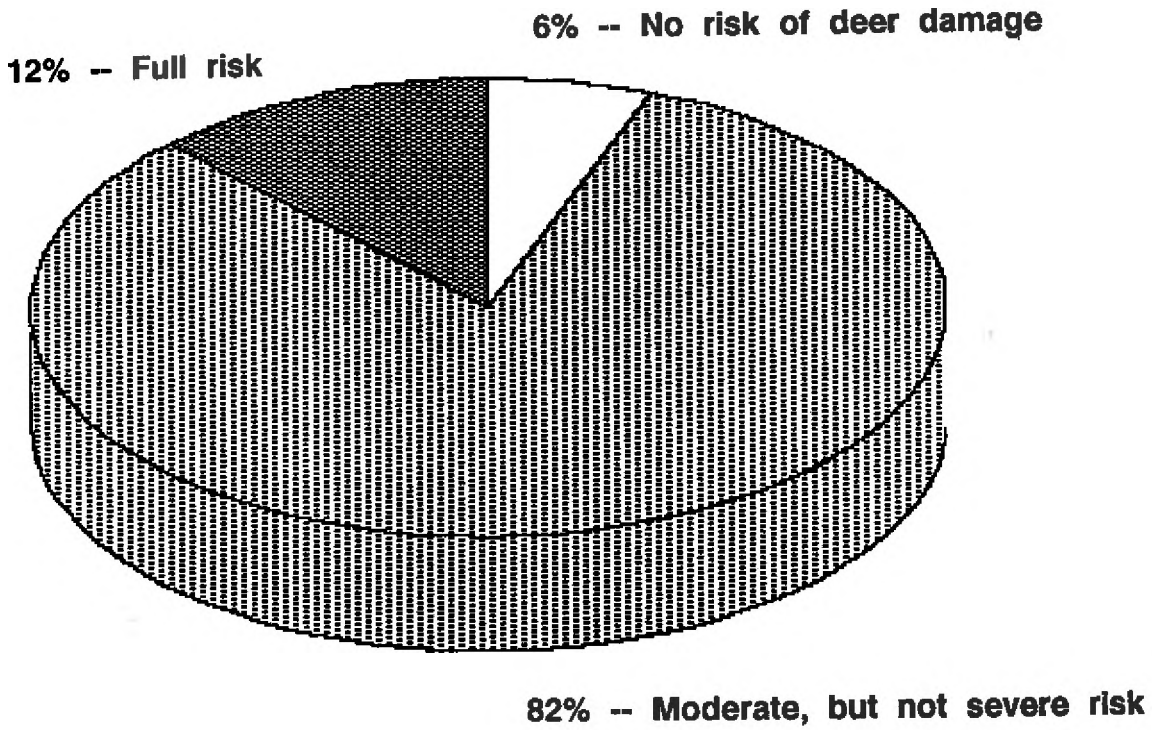

Figure 2. Adjacent landowners' beliefs about the reasonable levels of risk of deer damage that should be assumed by commercial fruit growers.

recognizing that adjacent landowners' perceptions of "moderate" or "severe" levels of damage may not be the same as those held by fruit growers. Nevertheless, the finding does represent a recognition on the part of adjacent landowners that deer populations may present excessive risks of economic impacts to commercial fruit growers and that deer reductions via management efforts may be necessary.

Attitudes about deer hunting and hunting access. The degree to which many adjacent landowners can be expected to participate in and/or comply with deer reductions by regulated hunting, however, is questionable. Over three-fourths of the adjacent landowners do not hunt deer on their own property and the majority of those individuals (about 45% of all adjacent landowners) indicated they do not usually allow others (even family or friends) to hunt deer on their land (Table 3). About 40% of the landowners who did not allow

Table 3. Percent of adjacent landowners participating in and allowing other persons to hunt deer on their own properties.

				Allow others to hunt on property		
		n	%	No	Yes	
Personally hunt deer on property	No	58	77	57%	43%	100%
	Yes	17	23	18%	82%	100%
		75	100			
				Overall 48%	52%	100%

deer hunting on their property indicated that the primary reasons were because they were opposed philosophically to hunting or did not want to disturb the deer. A slightly higher percentage (45%) of respondents suggested that safety

factors were paramount as reasons for denying hunting; properties being too small, housing too abundant, and concerns about livestock safety were indicated to be additional disincentives for hunting. Economic incentives were virtually totally rejected (in concept) as a means of increasing hunting access to properties--94% of those persons who did not allow hunting on their properties reported they would not do so even if hunters were willing to pay for the privilege.

About half (53%) of all adjacent landowners had posted their property with no trespassing signs. Like fruit growers, however, most (61%) of adjacent landowners who posted their properties allowed deer hunting anyway--selectively.

Addressing the concerns voiced by fruit growers and echoed by wildlife managers about potential nonhunting refugia surrounding commercial orchards, we asked adjacent landowners who did not allow hunting whether they believed their property attracted deer during the deer hunting season more so than other neighboring properties where deer were hunted. Responses suggested that few adjacent landowners perceived their actions as resulting in sanctuaries where deer congregate; slightly over three-fourths replied negatively to the question.

Deer Hunters

Hunting access preferences and values. Although access to private lands may be more limited for deer hunters in the Hudson River Valley than in many other parts of New York (Brown et al. 1984), relatively little hunting activity occurred on properties other than those privately owned. Eighty-three percent of all hunters surveyed indicated the property types they hunted most for deer were private lands. Nearly 20% indicated they sometimes hunted

lands containing a managed orchard, but only about 7% did most of their deer hunting on such properties. Public lands were cited by only 17% of the deer hunters as the areas hunted most. When asked to indicate the single type of property they would most like to hunt, assuming all properties were equally available, 16% overall preferred orchard lands.

With the exception of self-owned property, the property types on which respondents indicated they hunted most were seldom the same as those selected as most preferred (Table 4). A possible explanation for these differences is

Table 4. Percentage of deer hunters indicating that the property on which they hunted most was the same as that they would most prefer to hunt.

Property hunted most	Overall n	Overall %	Percentage reporting same property as most preferred for hunting
Private orchard land	37	07	54
Sportsmens' club land	53	10	53
Leased private land	11	02	54
Self-owned land	89	17	70
Other private land	239	46	49
State forest land	45	09	52
State wildlife mgt. area	14	03	21
Other public land	25	05	08
TOTALS:	513	100	

that hunters perceive areas other than those they hunt most frequently as having greater potentials for hunting success. Yet, data from this study

suggest that such perceptions are not accurate. As illustrated in Figure 3, the percentage differences in deer-hunters' harvest success during the 1986 season were fairly small regardless of the property hunted most often; none were statistically different (X^2=2.52, df=7, P>0.05).

The demand for obtaining access to private lands for deer hunting was also reflected in our finding that about two-fifths (44%) of all hunters surveyed were willing to provide economic incentives to gain deer hunting access to private property. When asked their willingness to pay (WTP) for a season-long deer hunting lease on private property, considering the amount of time typically spent deer hunting, the amounts reported by hunters who indicated they would pay averaged about $80. Generally, WTP for hunting access decreased as the DMU in which hunters resided became more remote from the metropolitan New York City area--($\bar{x}_{WTP}$ for DMU 46 = $118), ($\bar{x}_{WTP}$ for DMU 48 = $70), and ($\bar{x}_{WTP}$ for DMU 56 = $50).

Attitudes about the deer damage problem. As a constituency, deer hunters in the study area seem well aware that deer populations large enough to satisfy their own interests may cause problems for other individuals. Ninety percent recognized that deer populations in their area impact fruit growers by damaging their crops. From the hunters' perspectives, numerous reasons for the problem of deer damage in orchard areas were offered. However, the single-most important contributor to the problem was believed by about 66% of all hunters to be the predominance of lands posted against hunting access (Figure 4).

As did adjacent landowners, most deer hunters perceived a need for moderation of the risks of deer damage that must be assumed by fruit growers. Over two-thirds believed that growers must be willing to take some risks of

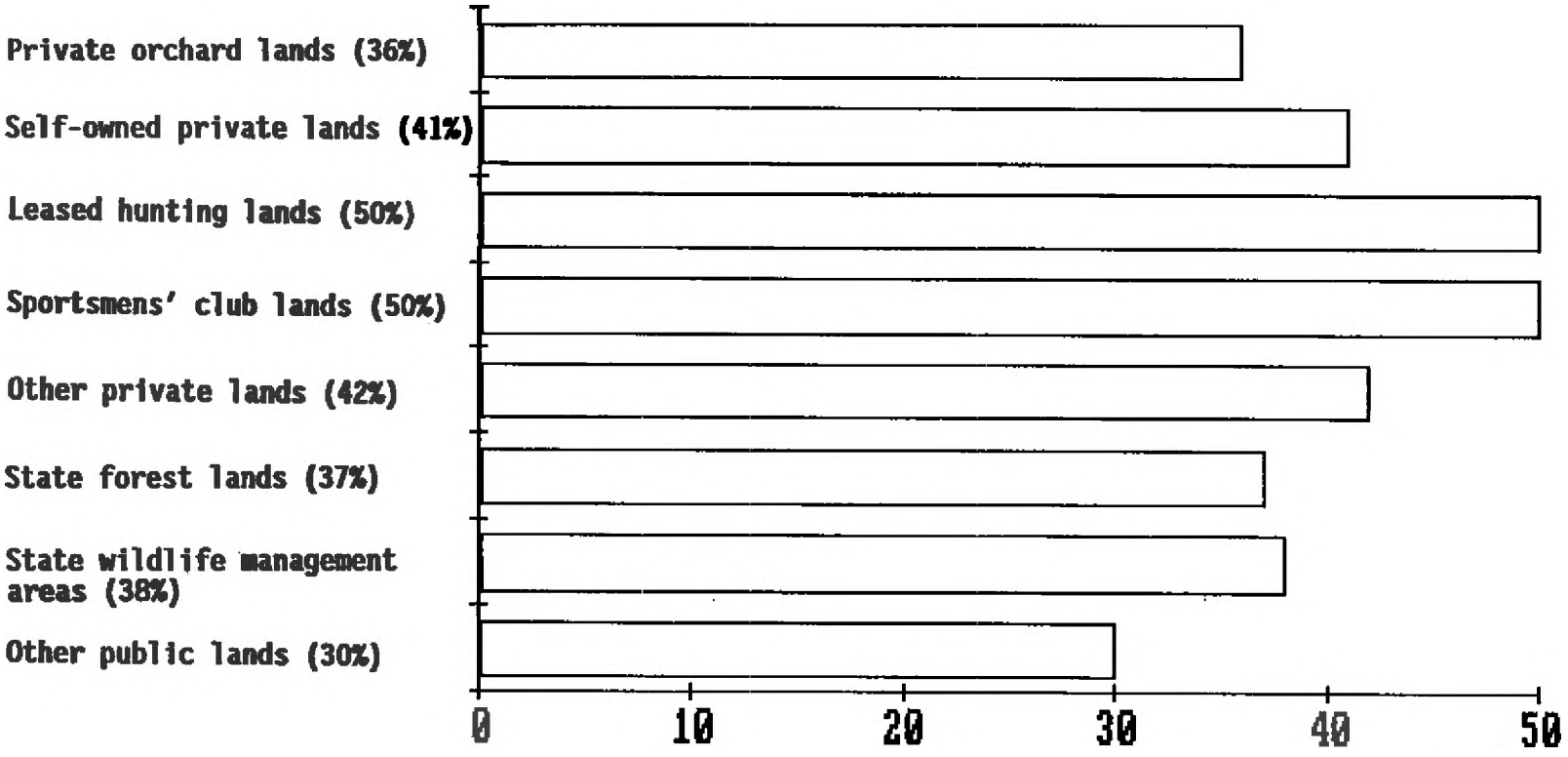

Figure 3. Comparison of the percentage of successful deer hunters for the 1986 deer-hunting season to the property types on which they hunted most frequently.

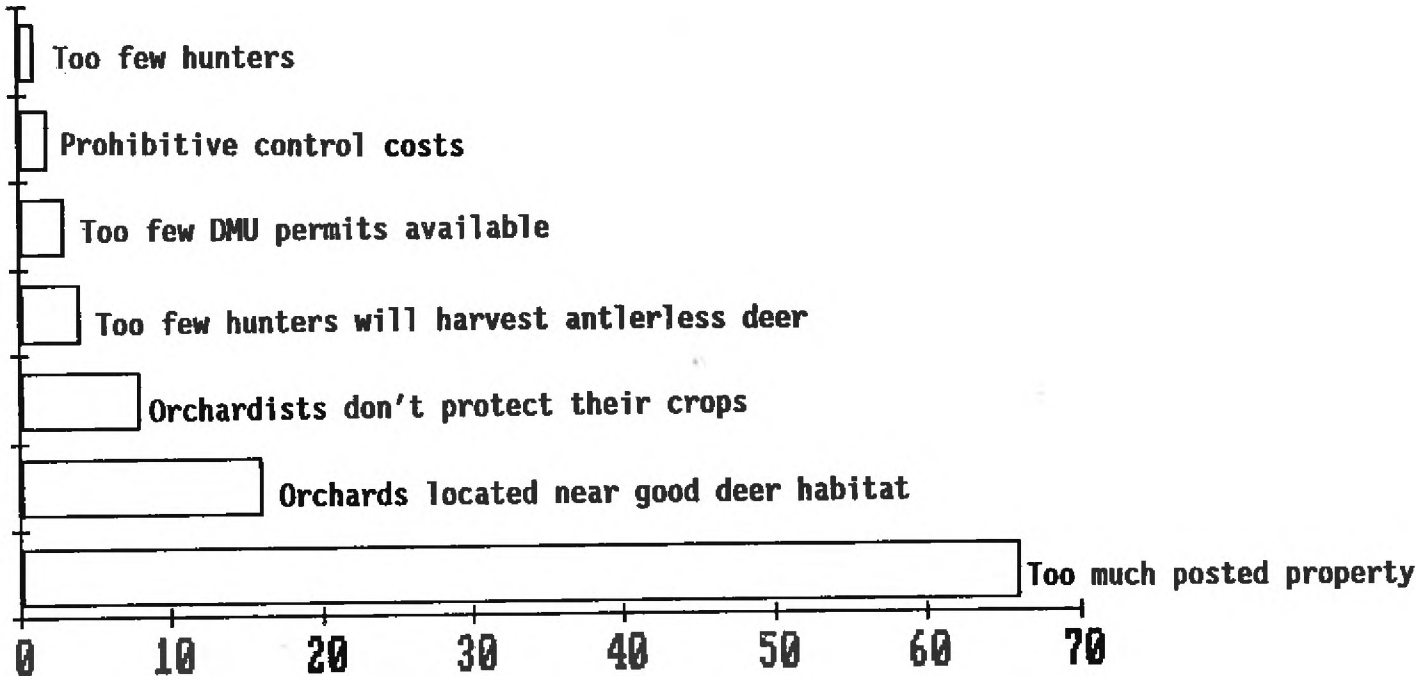

Figure 4. Deer hunters' beliefs about the most important reason that deer damage is a problem in orchard areas.

crop damage but the risks should not be considered "severe". Comparatively, however, hunters were nearly twice as likely as adjacent landowners (20% vs. 12%, respectively) to believe that growers must be willing to assume the risk for any level of crop damage associated with deer regardless of the severity of that risk. One explanation for this finding may be that some adjacent landowners grew fruit trees, although usually not for commercial production, whereas the deer hunters generally did not have experience with fruit production.

Deer management opinions. The level of deer maintained in 1986 was satisfactory to the majority of hunters surveyed; 62% believed that deer were being managed at a level that was "about right." Overall, only 1 of 5 hunters believed there were too few deer to meet their interests. Differences within DMUs were noted, however, as more hunters in DMU 56 than in other DMUs believed there were too few deer available (X^2=19.24, df=2, $P \leq 0.05$) while more hunters from DMU 46 than other DMUs felt there were too many deer in their area (X^2=15.79, df=2, $P \leq 0.05$).

In most of New York, successful management of deer populations is partially dependent upon the effective harvest of female deer. Deer Management Permits (DMPs), distributed via lottery to big game hunter applicants, serve as the primary vehicle through which antlerless deer are managed. In this study of Hudson River Valley deer hunters, responses indicated that in 1986, about 55% of the hunters participated in the DMP system by applying for permits. Hunters residing in DMUs 48 and 56 were most likely to have applied for permits within the DMU in which they resided; hunters from DMU 46 were about equally split in their applications for permits within and outside of their DMU of residence.

Human error appeared to be an important influence of nonparticipation in the DMP system. Among those who did not apply for a permit, about one-third indicated that the reason they did not do so was because they simply forgot (Figure 5). Problems attributed to the application process and to a perceived low probability of being selected for a DMP were cited by about 1 of 5 non-applicants. Only about one-tenth of the hunters indicated that nonapplication was due to being philosophically opposed to hunting female deer.

When all hunters were asked about their feelings toward the harvest of antlerless deer via the DMP system, a strong majority appeared to have confidence in the benefits of the management practice. Two-thirds believed that harvesting antlerless deer helps maintain a healthy deer population. A total of 22% felt that *either* antlerless deer harvests were detrimental to a healthy deer herd (9%) *or* that they simply did not like to shoot antlerless deer, regardless of its affect on the deer population (13%). Interestingly, many of these individuals appeared to overcome their ethical/managerial concerns about hunting antlerless deer in 1986--40% indicated that they had applied for DMPs in 1986. A possible alternate explanation, however, is that these individuals had applied for permits in an attempt to deny others the opportunity to shoot antlerless deer.

IMPLICATIONS AND CONCLUSIONS

A major responsibility for wildlife managers is ensuring that management actions are consistent with public attitudes and interests in the wildlife resource. Meeting this responsibility in the Hudson River Valley will continue to challenge deer managers. Successful and effective management programs will depend, in part, on the quality of the biological and sociological inputs into the management planning process. We have attempted

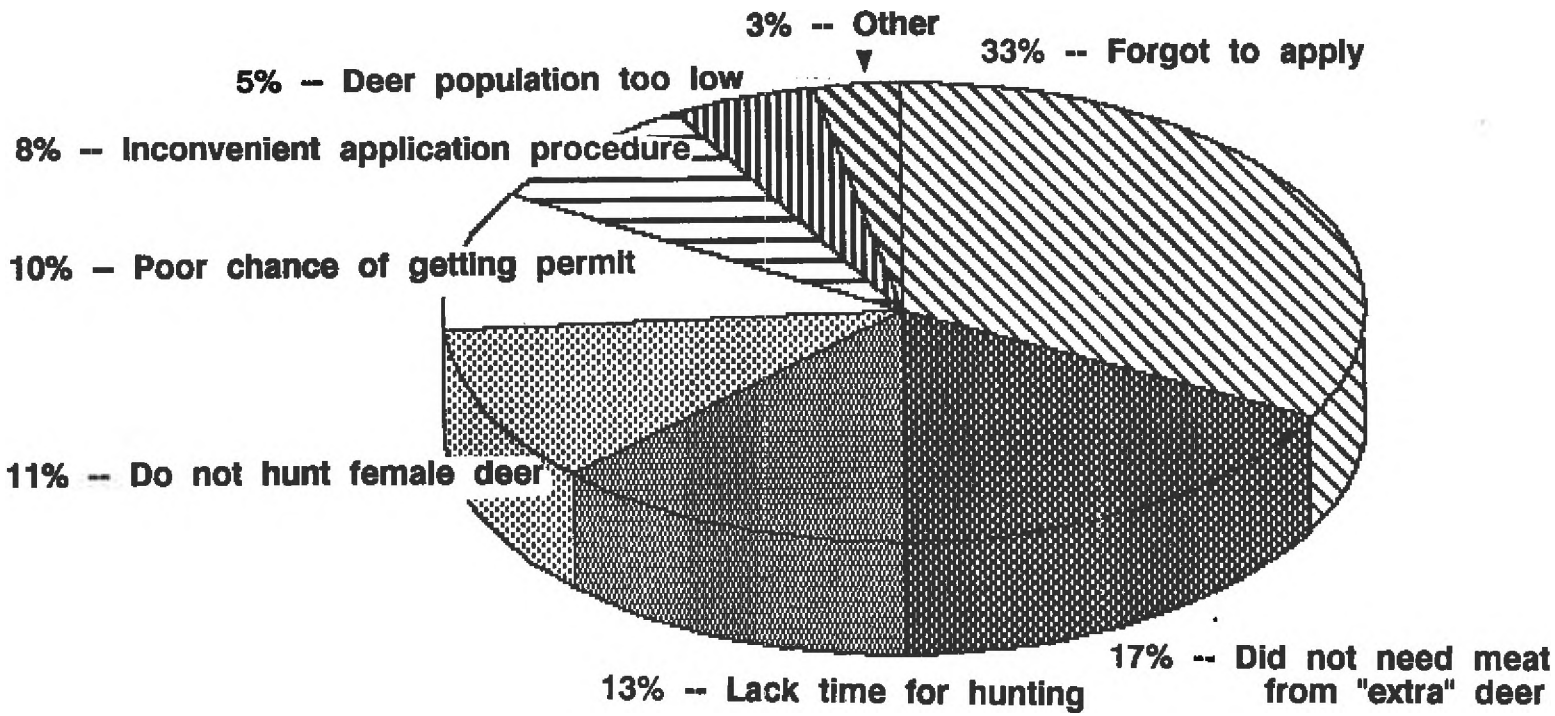

Figure 5. Deer hunters' reasons for not applying for a Deer Management Permit.

through this study to help facilitate that process by demonstrating and defining the similarities as well as the differences among key constituents of the region's deer management programs.

Generally, deer in the Hudson River Valley were viewed with what might be described as "mixed appreciation" by the constituents involved in this study. Few individuals expressed complete disinterest in having deer present in their areas. For commercial fruit growers, however, their appreciation for deer is overshadowed by the risks that are associated with deer damage to their fruit trees and crops. Landowners with properties adjacent to those of fruit growers and regional deer hunters, other constituents who both directly and indirectly affect the deer damage situation experienced by fruit growers, share less guarded interests in deer and generally demonstrate greater "acceptance capacities" (Decker and Purdy 1988) for deer (Figure 6).

Maintenance of deer populations at or near current levels is likely to continue to be a concern to commercial fruit growers. However, reduction of deer to a level that is satisfactory to most fruit growers would likely be unacceptable to other constituencies. Managing deer at a level that represents a compromise of these perspectives is the primary challenge for regional wildlife managers. Findings from this study have several implications that may help managers better meet that challenge.

Foremost among the attitudinal similarities between deer hunters and adjacent landowners is the shared recognition that the level of deer managed in the region should not result in "severe" risks of crop damage to commercial fruit growers. Differences may exist between the groups' perceptions of what constitutes "severe." Nevertheless, this commonly-held perception is important from the perspective that both groups recognize the need to consider

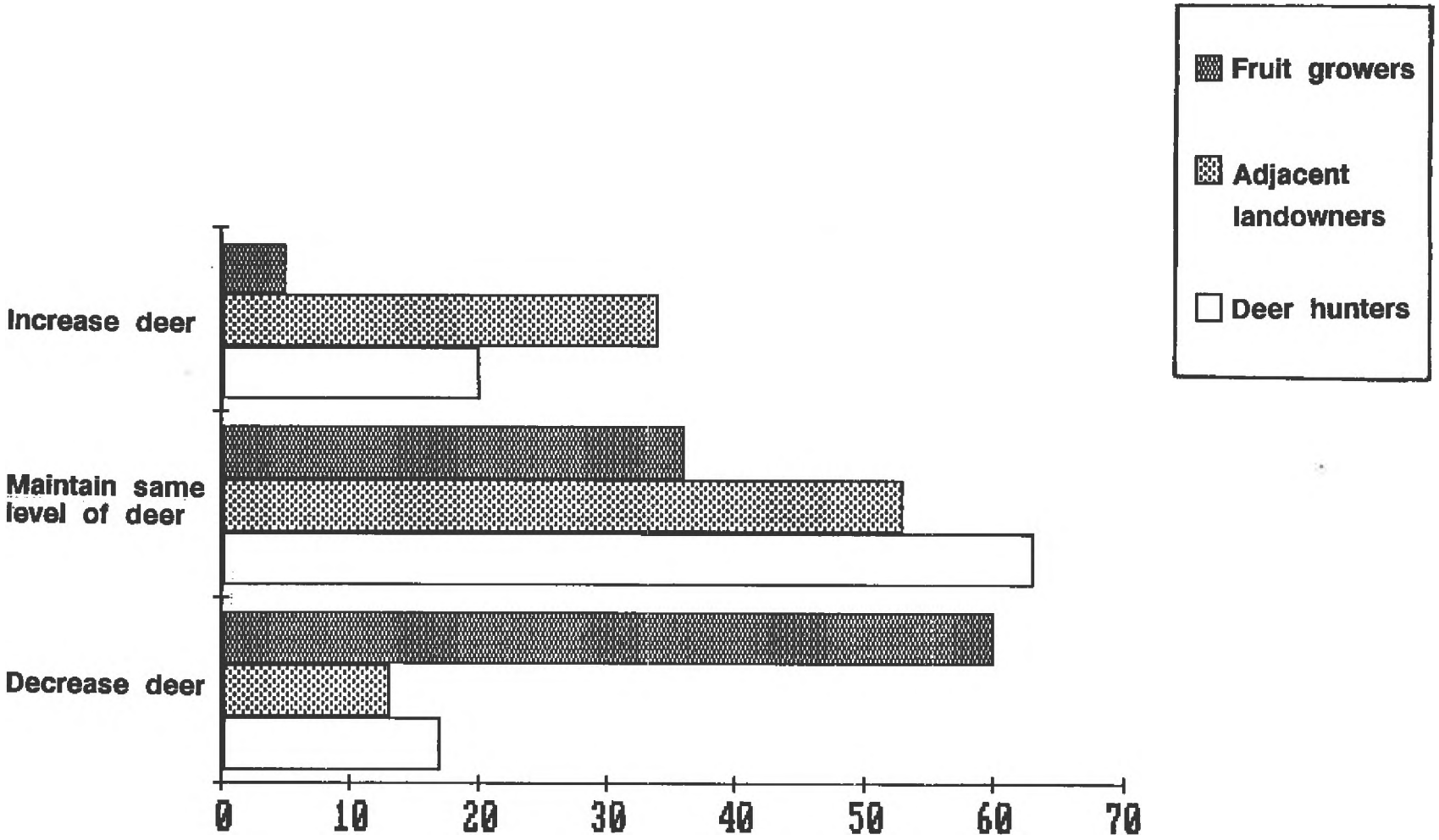

Figure 6. Comparisons of commercial fruit growers', adjacent landowners', and deer hunters' preferences for deer populations in the Hudson River Valley.

fruit growers' interests when establishing deer management objectives. The degree to which both groups can be expected to participate in or indirectly assist with the traditional deer management practice of regulated hunting, however, is likely to differ.

Hunters' preferences for deer hunting on private lands, and the willingness of many hunters to pay for the opportunity to do so, may be used to advantage by some fruit growers seeking to offset economic losses from deer damage. The demand for hunting on properties containing managed orchards may not be as large as that for hunting other types of private lands, but orchardists who possess or have properties adjacent to areas of quality deer habitat should find sufficient hunter demand to make hunting-lease ventures worthy of consideration. Recent efforts in the Hudson River Valley to test hunters' demand for and satisfaction with managed deer hunts on commercial orchard properties (although payments were not solicited) were reported to be highly successful (J. McAninch, Carey Arboretum, pers. commun.).

Attitudinal differences, between commercial fruit growers and their adjacent landowners, regarding interests in deer and feelings about deer hunting are unlikely to be resolved easily. Information obtained from nearly half of those adjacent landowners surveyed suggests that due to their interests in the welfare of deer, lack of personal participation in hunting and philosophical opposition to the activity, they are unlikely to contribute to the management of deer via regulated hunting or by providing access to hunters. Furthermore, economic incentives are not likely to be effective for increasing hunting access to these properties. However, from the perspective of constituency support/opposition to deer management programs, the value of efforts to increase adjacent landowners' awareness of the deer damage problems

experienced by fruit growers, and their potential role in helping to mitigate deer damage, should not be overlooked.

Among fruit growers, efforts to control deer damage are not unidimensional. Indeed, hunting is but 1 of the methods used to mitigate deer damage in commercial orchards. Some of the methods used are costly and labor intensive. For these and other reasons (e.g., the issue of responsibility for wildlife resources), much discussion has occurred regarding the issue of agency assistance for farmers' deer damage control efforts. As another product of this study, we have addressed this issue by providing findings related to the preferences of commercial fruit growers for types of damage controls and control assistance (Purdy et al. 1987). Generally, those findings indicated that current forms of "assistance," (e.g., permits for shooting nuisance deer and technical information about deer damage control), while not fulfilling all orchardists' needs for deer damage control, appear adequate to meet the needs of most growers. Development of other possibilities for assistance, such as monetary reimbursements, on-site assistance, and provision of damage control materials are not clearly warranted based on growers' preferences and interests.

Continuing a progressive evolution of deer damage and management programs in the Hudson River Valley will require careful monitoring of the human factors affecting management decisions. Understanding the interests, preferences, and basis for behaviors of key audiences or constituencies will enable managers to serve their constituents more effectively by providing management programs that are consistent with constituents' interests and needs.

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