EVALUATING REPORTS OF DEER DAMAGE TO CROPS: IMPLICATIONS FOR WILDLIFE RESEARCH AND MANAGEMENT PROGRAMS

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ABSTRACT

We examined damage permit records to determine the incidence of reported white-tailed deer (Odocoileus virginianus) damage to crops in Virginia from 1982 to 1984. Permits were issued to 144, 252, and 195 landholders in 1982, 1983, and 1984, respectively. The total number of permits issued in 1983 (355), a drought year, was greater than that of 1982 (199) or 1984 (258). Most permits were issued for peanuts and soybeans in the southeastern section of the state and for orchards in the western portion of the state. Permits were also issued for gardens, corn, and tobacco. We found some patterns between issuance of crop permits and crop phenology. We found no apparent relationships between the number of permits and the amount of deer habitat or estimated deer population size per county. We propose that analysis of damage permit records be used as an aid in (1) directing the emphasis and timing of wildlife control programs, (2) adjusting game harvest quotas, and (3) determining research priorities. Results of such analyses can be incorporated into an integrated pest management approach to the study and management of crop-wildlife interactions.

INTRODUCTION

The white-tailed deer is usually considered an esthetic, economic, and recreational asset. However, conflicts with agricultural activities can compromise these values. In the United States, non-migratory wildlife are managed by states, and are considered public property. Sometimes conflicts arise between the public benefits of wildlife and costs incurred by private individuals. This is exemplified by deer, which is often cited as a "pest" species in agricultural areas (Flyger and Thoerig 1962, Nielsen et al. 1982, Matschke et al. 1984).

Non-lethal methods for private landowners to control deer damage to their crops include chemical repellants, physical barriers such as fences, and dogs. These methods generally can be employed without involving the state natural resource agency. By contrast, lethal damage control methods are directed and monitored by the natural resource agency. In Virginia, a major means of dealing with a local problem is through issuance of permits outside of the regular hunting season to kill deer that are damaging crops. These damage permits are issued at the discretion of the game warden for designated persons to kill deer that are causing damage to fruit trees, crops, or personal property (Code of Virginia S29-146).

Many states have similar programs for handling deer damage problems (Herig 1981). Detailed information on these closed season damage permits may be summarized in uncirculated state reports, but these reports are not readily available. Using the issuance of damage permits in Virginia as an index to the frequency of deer damage, we examined the following: (1) crops damaged, (2) areas with the greatest frequency of deer damage, (3) relationships between permit issuance and crop phenology, and (4) number of deer reported killed with damage permits. Our objectives were to develop an approach for examining these data and propose applications for wildlife research and management programs.

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METHODS

We developed a computer file based on all damage permit records submitted by game wardens to VCGIF during 1982-1984. The items contained on complete records are landowner and address, person(s) authorized to kill deer, date of permit issuance, duration of permit (15 day maximum), location of the field(s) incurring damage, crop(s) damaged by deer, and the number of deer killed by the issuee(s) under current or previous permits during the year. We examined these records to summarize patterns of permit issuance among years, crops, and seasons.

We calculated county deer population density from unpublished VCGIF estimates. The amount of forested area per county is considered an index of the deer habitat (VCGIF 1984). Crop phenology descriptions are taken from Virginia Crop Reporting Service (1984) summaries.

We used the Statistical Analysis System (SAS Institute 1982) for data analysis. We used X^2 contingency table analysis (Sokal and Rohlf 1969) for comparisons among years. As some records contained incomplete information, sample sizes are reported where appropriate.

RESULTS

Permits were issued to 144, 252 and 195 landholders in 1982, 1983, and 1984, respectively (Table 1). The total number of permits issued in 1983 (355), a drought year, was greater than 1982 (199) or 1984 (258). Numerous landholders received >1 permit during a single year, and many received permits in consecutive years. Some permits specified >1 crop, with peanuts and soybeans the most frequently occurring combination.

The crops for which permits were most frequently issued were peanuts, soybeans, and orchards, primarily peach and apple (Fig. 1). The number of permits per crop is related to year ($X^2 = 27.194$, $p = 0.007$). However, contigency table analyses of individual crops by year indicated significant ($p < 0.1$) relationships only for orchards ($X^2 = 6.332$, $p = 0.04$) and peanuts ($X^2 = 21.764$, $p = 0.001$).

The largest numbers of permits were issued in counties with large tracts of public lands with limited or no hunting (Fig. 2). Many permits were issued for peanuts and soybeans in the southeastern counties that include the Great Dismal Swamp National Wildlife Refuge. Similarly, many permits for deer damage in orchards were issued for farms near Shenandoah National Park. There were no apparent statistical relationships between the number of permits issued and the amount of deer habitat in individual counties. We also found no statistical relationships between estimated deer density and the number of permits issued per county.

Crops were identified on only 79% of the reports. The relatively small yearly sample sizes per crop make it difficult to discern patterns of permit issuance with respect to crop phenologies. However, some relationships can be described for the principal crops (Table 2). Permits were issued throughout the year for orchards, with most records issued for autumn months. Permits for peanuts were issued from planting through harvest. The pattern for peanuts is somewhat bimodal, with a small peak early in the growing season and a larger peak during late summer and early fall as the crops reached maturity. Permits for soybeans were also issued throughout the growing season, with 73% issued May through July.

The number of deer killed was reported on only 6% of all damage permit records. Of the 181 deer reported on these records, 57% were female and 43% were male. We obtained VCGIF summaries reported by the 6

Enforcement Districts of the number of deer killed with damage permits (Table 3). The total was lowest in 1982 (N = 513) and highest in 1983 (N = 1767). The ratio of approximately 3 does to 1 buck was consistent among years.

DISCUSSION

We interpret our data with acknowledgement of the limitations of having only 3 years of data, especially considering the severe statewide drought in 1983 and its resultant effects to crop growth and yield. Relatively small sample sizes and geographic variability within crop phenologies preclude extensive statistical analysis.

Most permits were issued for field crops in the southeastern part of the state and for orchards in the west. However, only 1-5 permits per year were issued in many counties. Comments noted on some permit records indicate that the fields were adjacent to public parks and other areas serving as refuges for deer. This phenomenon of localized problems adjacent to tracts with little or no hunting was noted by numerous farmers, extension agents, and game wardens in surveys concerning deer damage to soybeans (Lyon in prep. a). Other studies (Brown et al. 1977, Dolbeer 1980) also have found patchiness in the occurrance of significant wildlife damage to crops.

The lack of statistical relationships between the number of permits and amount of deer habitat or deer density suggests that simple mathematical models are not appropriate predictors of the need for permits on the county level. This is likely due to numerous factors, including variability in quality of habitat and hunting pressure both among and within counties. In addition, the value of the crop and nature of damage could also influence the number of permits issued in a county. For example, a farmer may tolerate a low level of browsing on soybean plants because the effect on yield is often negligible (Lyon in prep b.). In contrast, deer browsing of fruit tree stock could destroy the crop and likely would be deemed intolerable by the farmer.

The timing of permit issuance appears to be related to both the annual cycle of deer and crop phenology. Damage to orchards is reported year round, suggesting that the nature of this damage includes browsing of twigs and buds, pre-rut rubbing (Nielsen et al. 1982), and eating fruit. Most damage to soybeans was reported early in the growing season. This is supported by field data collected for a related study (Lyon in prep. b) where most browsing of soybeans by deer occurred early in the growing season and decreased as plants matured. The bimodal pattern for peanuts suggests that deer are a problem just after planting and again before harvest.

Controlling deer damage through a permit system has several shortcomings as a management method. The system is sometimes unpopular, with complaints from hunters that trophy deer are culled and that the population is reduced prior to the legal hunting season. There are also claims that rapport with the local game warden may bias a landowner's ability to secure permits. A further criticism involves the lack of standards by which to determine the relationship between the nature and extent of damage and an economic threshold. The sighting of deer in a field or orchard is often equated with damage, but this relationship is not necessarily valid (Lyon and Scanlon 1985). In addition, a permit system is sometimes used where reform in the regular hunting season regulations is needed.

Natural resource agencies can apply damage permit information to wildlife management programs, including population manipulation. Options include changing harvest quotas, season lengths, or the timing of doe season. However, this may not be appropriate for dealing with a localized problems where small-scale changes to hunting regulations may be difficult for hunters to interpret and for game wardens to enforce. A permit system could be modified further by issuing

permits for does only in areas where decreasing the doe population would meet the local deer management plan. Another option for control of deer damage is by population reduction though post-season deer hunting in "problem" areas (Crouch 1980).

Analysis of damage permits also can be used in developing research programs and priorities. For example, research efforts could be directed toward developing economic thresholds for crops for which a large number of permits are issued. Using this criterion, peanut, soybean, and orchard crops warrant attention in Virginia. Damage permit analysis would highlight not only deer damage, but also problems with other wildlife species such as raccoon and bear. States with similar crop-wildlife conflicts could work cooperatively, thereby enabling individual states to more effectively allocate their resources.

SUMMARY

Our evaluation of the data suggests several applications of the information as follows. (1) Natural resource agencies can direct control efforts on specific crops and locations where high numbers of damage permits have been issued. (2) Data pertaining to total number of deer killed and the doe to buck ratio can be used to adjust local hunting seasons and quotas and to issue permits for does only. (3) Analysis of damage permits can aid in establishing research priorities for crops, localities, or wildlife species.

We emphasize that damage permit analysis should be only one of many component parts leading to management and funding decisions. The permit records are only an index of where problems have been reported, not an entire picture of the ecological role and public perceptions of a wildlife species in an agroecosystem. Other criteria involving overall management objectives must be evaluated prior to resource allocation.

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Table 1. Summary of deer permits issued for crop protection in Virginia, 1982-1984.

	1982	1983	1984
Number of Permits Issued	199	355	258
Number of Landowners Receiving Permits	144	252	195
Percent of Landowners Receiving >1 Permit	22	25	22
Percent of Permits Specifying >1 Crop	6	9	10

Table 2. Monthly distributions (%) of damage permit issuance in Virginia, 1982-1984.

CROP	YEAR	N	MONTH											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Orchard	1982	30			3	3	17	17	10	13	10	10	13	3
	1983	39						10	10	10	10	38	18	3
	1984	44	2	9	11	11	5	9	7	11	9	14	9	2
Peanuts	1982	87				1	8	2	5	30	47	7		
	1983	185					1	4	6	20	40	23	12	
	1984	86					5	10	5	24	44	12		
Soybean	1982	37					8	27	35	16	14			
	1983	48						27	23	17	13	15	6	
	1984	41					5	46	29	5	10	5		

Table 3. Number of deer killed with damage permits as reported by Virginia game wardens, 1982-1984.

Sex	Year		
	1982	1983	1984
Female	329	1213	863
Male	184	554	444

$X^2 = 5.303$ $p = 0.07$

Fig. 1. Number of times crops were reported on deer damage permits in Virginia, 1982-1984. "Vegetables" includes cabbage, corn, peas, pumpkin and sweet potato. "Fruit" includes cantalope, grapes, strawberries, and watermelon. Other includes hay, tobacco, and trees.

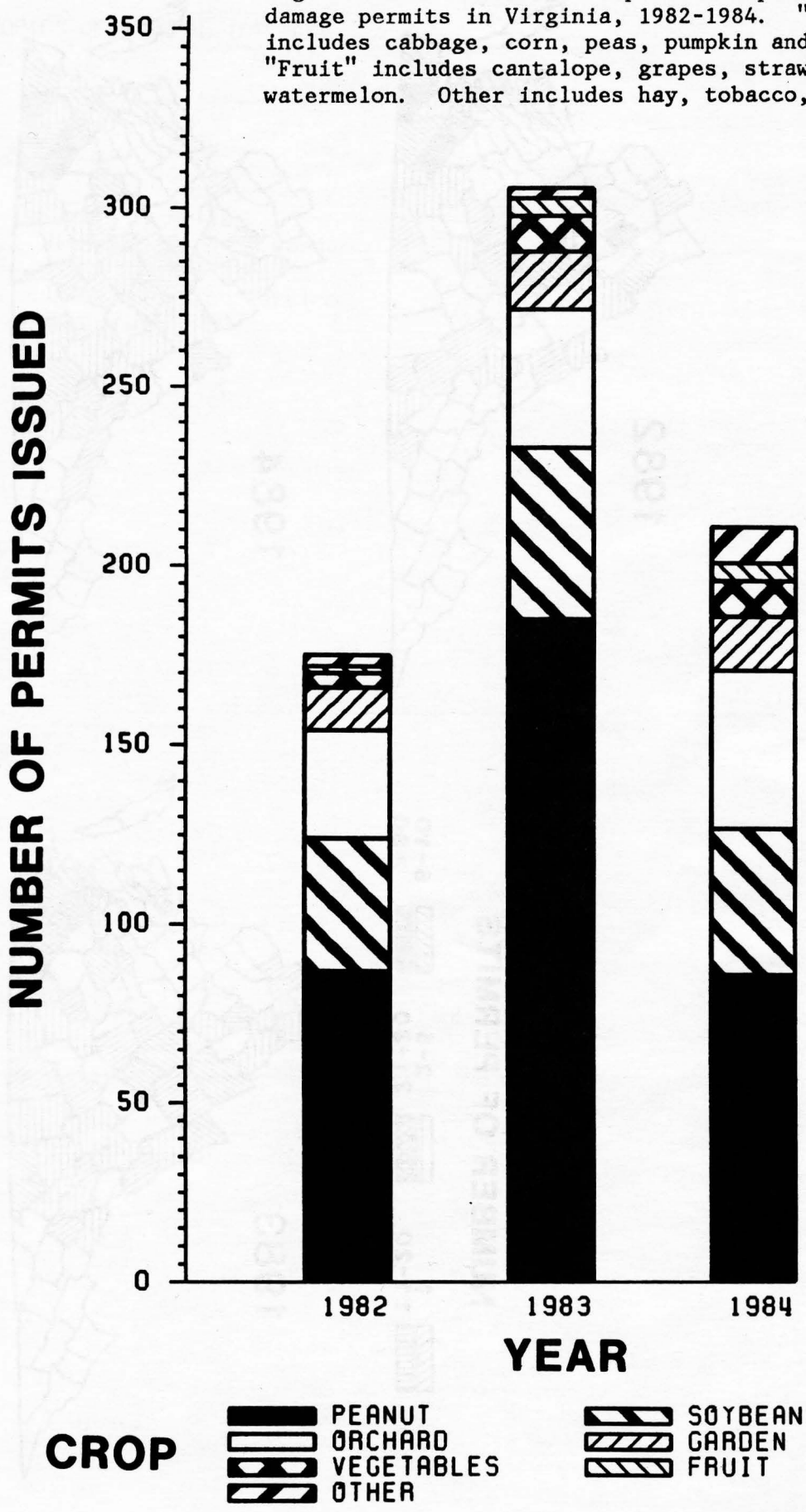

Fig. 2. Number of deer damage crop permits issued per county in Virginia, 1982-1984.