

LANDOWNERS' PERCEPTIONS OF CROP DAMAGE AND MANAGEMENT PRACTICES RELATED TO BLACK BEARS IN EAST-CENTRAL MINNESOTA

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Abstract: We mailed surveys to landowners in east-central Minnesota to evaluate their perceptions of black bears (*Ursus americanus*), crop damage caused by bears, and management strategies to mitigate damage. The survey area had more bear-related crop damage than any other part of the state. Respondents ($n = 281$) indicated that crop damage from white-tailed deer (*Odocoileus virginianus*) exceeded that from bears, but they tolerated bear damage less. Fifty-five percent of the respondents growing field corn, oats, and sweet corn, the crops most frequently damaged by bears (in that order), said they previously experienced crop loss from bears and 50% reported having bear-damaged crops in 1991, the year prior to our survey. Respondents estimated an average annual bear-related loss of 11% of their corn and oats, valued (in total for all respondents) at \$63,000. Direct measurements of damaged fields indicated that survey respondents accurately reported the percent of farms with damage, but they overestimated the amount of damage. Respondents who had experienced damage were more likely to perceive an increase in bear numbers and bear-related crop loss. In actions aimed specifically to reduce bear populations and hence crop damage, the Minnesota Department of Natural Resources (DNR) abolished a quota on bear hunting licenses in this area in 1987 and established a means for hunters to kill nuisance bears before the bear hunting season. Targeted hunting of depredating bears was viewed by survey respondents as the most effective damage control measure, especially among those who had experienced crop loss. Most respondents who said they had previously reported damage to a management agency were satisfied with the help that they received, even though agency assistance was generally limited to finding a hunter to kill the bears or to a discussion about bear ecology and the inefficacies of dealing with crop damage.

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Black bears probably have raided cornfields since this crop was first cultivated in North America. Records kept by early European settlers frequently refer to bears damaging corn and describe various counter-measures used to deter them (Cardoza 1976). Bounties were established on bears in some parts of eastern North America by the late 1600's to encourage their removal from agricultural areas.

Although Minnesota is one of the top corn-producing states in the United States (Wywiałowski 1996), damage by bears to corn crops was rare as late as the mid-1960s. Prior to that time, the principal range of black bears in northern Minnesota was well separated from the major agricultural areas to the south (Kinsey 1965), possibly from former persecution and elimination of bears in corn-producing areas (Surber 1941). However, by the 1980s, crop damage by bears was common in Minnesota (Garshelis 1989) as well as in neighboring Wisconsin (Stowell and Willging 1992). The proliferation of bear-related crop damage was attributable to the geographic expansion of both bears and corn. Northward expansion of corn was made possible by development of quick-maturing varieties. Southward expansion of bears was prompted by a burgeoning bear population, stemming from more restrictive hunting regulations, including a quota on hunting licenses. Consequently, nuisance com-

plaints related to bears increased during the 1980s, and years with poor production of natural bear foods triggered unprecedented nuisance activity (Garshelis 1989; D. Garshelis, unpublished data). In response to extensive crop damage in 1985 and 1986, quotas on bear hunting licenses were discontinued in agricultural areas around the periphery of the bear range in 1987 (Garshelis 1994).

The bear hunting season in Minnesota (1 Sep–mid-Oct) commences just after bears typically begin to damage crops (late Aug; Garshelis 1989; D. Garshelis, unpublished data). Landowners are allowed to kill depredating bears without prior permission, provided they report it. However, killing bears in cornfields is labor-intensive, and landowners cannot designate proxies to do it for them. To help solve crop-damage problems, programs were initiated whereby DNR personnel could issue either an early hunting license or a nuisance bear permit to someone besides the landowner to kill offending bears. The no-quota harvest combined with these additional options for killing depredating bears before the hunting season represented the principal management tools used to cope with crop damage by bears in the agricultural portion of Minnesota's bear range during the late 1980s and throughout the 1990s. Nuisance bears in more northern, heavily-forested parts of Minnesota

often were translocated (Garshelis 1994), but this was not feasible in agricultural areas where capturing was inefficient and potential release sites outside the agricultural area were too distant.

We conducted a mail survey to assess landowner's perceptions of bear damage to their crops, attitudes toward bears, and opinions about DNR's management program. Specifically, we aimed to (1) examine landowners' views of the extent and trends in bear populations and bear-related crop damage, (2) assess the relation between landowners' past experience with bear-related crop damage, their tolerance toward damage, and their recognition of bears as a component of the ecological community, and (3) evaluate the perceived efficacy of bear management and mitigation tactics concerning depredating bears.

STUDY AREA AND METHODS

We conducted this study in eastern Pine County, east-central Minnesota (46°N, 92°W). Since the mid-1980s, this area supported the highest bear harvest/area (Kontio et al. 1998) and had the highest bear-related crop damage (D. Garshelis, unpublished data) in the state. Approximately 28% of this area was agricultural land and 70% wooded or wetland (including 2 state forests). Primary crops were hay, corn, and oats.

We obtained a list of landowners who farmed (or whose land was previously farmed) in eastern Pine County from the U.S. Department of Agriculture's Agricultural Stabilization and Conservation Service (ASCS; now the Farm Service Agency). In spring 1992, we mailed surveys to 486 landowners; 436 were delivered and 50 were undeliverable. The survey posed 44 multiple-choice and fill-in-the-blank questions regarding the landowner's farming history, farming practices, previous crop damage from bears and other wildlife, methods used to reduce damage, and opinions about bears and bear management. We estimated that the questionnaire would take about 15 minutes to complete and asked that it be returned in the postage-paid mailer provided. We sent a reminder postcard 10 days after mailing the questionnaire, followed by a second copy of the questionnaire to non-respondents 2 weeks after the postcard reminder. We received 281 responses (64%).

Questionnaire responses were tallied and analyzed using a combination of descriptive and inferential statistics. Inferential techniques included chi-square tests and log-linear models for cross-classified data and analysis of variance (ANOVA) for continuous data. Sample sizes varied among individual questions because some respondents did not answer all questions.

RESULTS

Farming Practices

Information on ownership, size, and use of the property was provided on 215 of the 281 returned questionnaires. Respondents owned or leased land for an average of 24 years and farmed it for 1–65 years (\bar{x} = 26 years, median = 20 years). Farmed area averaged 104 ha (range 1–972 ha), mostly in hay. Field corn, oats, and sweet corn comprised 10%, 4%, and 0.1%, respectively, of the area farmed; 161 respondents grew or had grown ≥ 1 of these crops. For those growing corn, 42% indicated that they planted less in 1991 than in 1980, 24% said they planted more, and 34% said they planted about the same. An average of 64% of the field corn was harvested for grain and 37% for silage. This division has remained about the same since 1980 (61% of respondents) or increased toward greater use of grain and less silage (30%). Respondents indicated that they harvested corn for grain in October (63%) or November (34%), but usually harvested for silage in September (90%). Oats were harvested in July (31%), August (59%), or September (10%).

Crop Damage

Eighty-nine of the 161 respondents (55%) who had grown corn or oats had experienced bear-related crop damage; 50% had bear-related crop damage in 1991, the year preceding our survey. Damage also was reported for clover or hay crops (n = 4), cattle (n = 2), and honey or beehives (n = 2).

Respondents (83%) sensed an increase in bear-related damage since 1980. This perceived increase began in 1986 (mean) or 1987 (mode). Persons who had experienced damage were more likely to feel strongly that bear damage had increased during the 1980s (χ^2 = 27.6, 3 df, P < 0.001).

Crop damage first became apparent in August (52/80 = 65% of respondents) or September (30%). Field corn was the crop most frequently damaged by bears (81 of 89 respondents = 91%), followed by oats (49/89 = 55%), and sweet corn (14/89 = 16%). The average annual monetary loss from bear damage also was greatest for field corn and least for sweet corn (Table 1).

Bears damaged an estimated 317 ha of the cropland of all survey respondents annually, which was only 1.6% of the 19,600 ha that they farmed, but 11.2% of their combined field corn, sweet corn, and oats. The likelihood of experiencing bear damage was unrelated to the area farmed in these 3 crops (1-way ANOVA: field corn P = 1.0, n = 87; oats P = 0.46, n = 60; sweet corn P = 0.48, n = 27; all 3 crops combined P = 0.49, n = 112). The total

Table 1. Bear-related crop damage in eastern Pine County, Minnesota, as reported by respondents to a 1992 mail survey.

Crop	Area farmed (ha) ^a			Area damaged (ha/yr) ^b				Monetary loss (\$/yr)			
	\bar{x}	range	<i>n</i>	\bar{x}	median	range	<i>n</i>	\bar{x}	median	range	<i>n</i>
Field corn	23.0	<1–89	87	3.0	2.0	0.2–18	76	732	450	50–4,500	70
Oats	13.6	2–47	60	1.8	1.2	0.08–8	46	237	150	30–1,000	43
Sweet corn	0.9	<1–12	27	0.6	0.4	0.04–2	12	183	150	25–300	10

^a Excludes respondents who did not plant field corn, oats, or sweet corn.

^b Excludes respondents who reported no damage. Some respondents reported area damaged but not area farmed or vice-versa; thus, the overall percent of each crop damaged cannot be calculated from the tabulated values for area damaged and area farmed.

monetary loss/year among all survey respondents was about \$63,200: \$51,200 for field corn, \$10,200 for oats, and \$1,800 for sweet corn. Bear-related crop loss for individual farmers varied greatly (Table 1).

Only 23 of 84 respondents (27%) identified bears as the species causing the most crop damage. Most respondents considered white-tailed deer the greatest problem (57 of 84 responses = 68%), followed by bears and raccoons (*Procyon lotor*; 4 respondents = 5%). Some landowners commented that bears often were blamed for damage that they did not cause.

Bear Ecology

Respondents' perceptions of the size and trend of the local bear population was influenced strongly by previous damage to their crops. Persons who reported bear damage were much more likely to rate the bear population as high and less likely to rate the population as low than individuals who had not experienced damage ($\chi^2 = 32.36$, 3 df, $P < 0.001$). Most respondents (153/196 = 78%) thought the bear population had risen during the 1980s, and this perception was stronger among those who had experienced bear-related crop damage than those who had not ($\chi^2 = 26.66$, df = 3 [4 categories of agreement or disagreement of a perceived population increase], $P < 0.001$).

Most landowners (63%) believed that bears were important in the ecology of Pine County, although, again, opinions varied by whether the respondent previously experienced damage by bears ($\chi^2 = 16.25$, 4 df, $P = 0.003$). Persons reporting damage were more likely to strongly disagree (as opposed to moderately disagree, moderately agree, or strongly agree) that bears were an important ecological component of the county. A positive relationship also existed between the landowner's view of the importance of the bear's ecological role and the landowner's tolerance for bear damage; this relationship was independent of the relationship between previous bear damage and the landowner's opinion of the bear's ecological role (best fitting model: [12] [23], $G^2 = 2.45$,

2 df, where 1 = tolerance to bear damage, 2 = opinion of ecological role, and 3 = previous bear damage).

Management and Mitigation Practices

Most people (72/83 = 87%) who had experienced damage said that if they were to report it, they would do so to the DNR. However, only 46 of 86 (53%) who had experienced bear-related crop damage in the past had reported it; 28 (61%) of these were satisfied with the response they received.

We asked landowners which of 3 measures they preferred for dealing with bear-related crop damage. Most (117 of 192 = 61%) favored the targeted hunting of crop-raiding individuals. Although landowners can legally kill these bears, 42% of survey respondents (32/76) admitted that many ($\bar{X} = 87\%$) of the bears killed as nuisances on their property were never reported to the DNR, as required. Landowners who had experienced damage were more likely than those without damage to agree strongly that shooting crop-raiding individuals was effective in controlling crop damage ($\chi^2 = 8.45$, 3 df, $P = 0.038$). Fewer respondents (20%) felt that unrestricted harvesting of bears during the hunting season (to reduce the overall population) was the best solution, and the fewest respondents (8%) thought that financial assistance for damage control techniques was the best option (11% listed other alternatives). Farmers seemed to be aware that effective damage control techniques were not available. Thirty-five of 71 respondents believed electric fencing would reduce crop damage, but electric fencing was viewed as too costly even by those who considered it effective (32/35 responses). Only 3 landowners had actually tried electric fencing to reduce damage and 2 of these found the fencing to be ineffective. Eight other respondents tried scare devices (scarecrows, guns, or explosives) or dogs, and one planted an alternative source of food near the cornfield.

Monetary compensation was viewed as the best mitigation for crop damage already incurred. Those who had experienced crop damage were more likely to agree

strongly with the need for compensation ($\chi^2 = 18.7$, 3 df, $P < 0.001$).

DISCUSSION

Crop damage caused by bears can be assessed in 3 ways: (1) recording complaints reported to authorities, (2) sampling crop fields and directly measuring damaged areas, or (3) surveying landowners. Each method has its merits and drawbacks.

Assessing damage through registered complaints is relatively simple, but reliability of results depends on reporting rates for those experiencing damage and recording rates among agency personnel, both of which can be low and variable (Garshelis 1989). In our study, only slightly more than half the landowners who experienced damage indicated that they had at some time reported it, and we assume that even among these landowners, not all incidents were reported. Thus, reported complaints may grossly underestimate the true level of damage. Indeed, the estimated yearly crop loss of >\$60,000 reported by respondents to our survey, who represented just a portion of landowners in one county, was >10x the yearly crop loss estimate recorded by DNR personnel from bear-related damage complaints made by landowners statewide (\$6,000; Garshelis 1989).

In contrast, mail surveys tend to yield overestimates of crop loss due to an inherent non-response bias (those who had experienced little or no damage are less likely to return a questionnaire) and inflated opinions of damage by landowners. Studies of crop damage caused by other species of wildlife indicated that farmers overestimated their losses (Wakely and Mitchell 1981) and often misidentified the species responsible for damage (Gabrey et al. 1993). Direct measurement of crop fields produces more accurate damage assessments, but this process is tedious and costly. In fall 1992, G. Ostheimer (University of Minnesota, St. Paul, Minnesota, USA, unpublished data) made complete ground surveys for damage in 61 cornfields on 40 farms in our survey area in eastern Pine County. He observed bear damage in 30 fields (49%) on 21 farms (52%). These results compared well with responses to our mail survey, where 50% of farmers who grew corn or oats indicated that they had experienced bear-related crop damage during 1991 and 55% indicated crop damage sometime in the past. Our mail survey thus accurately portrayed the number of farmers experiencing bear damage, but the amount of damage reported was apparently inflated. Respondents estimated that, on average over the previous 5 years, 11% of corn and oat fields were damaged by bears, whereas, Ostheimer (unpublished data) found from direct examination that

the *largest* extent of damage to any crop field in eastern Pine County was only 4.2%. Ostheimer observed, as have others (Klenner 1987, Maddrey and Pelton 1995), that most crop damage from bears was near the edges of fields, which may have given farmers the impression of more extensive damage than actually existed. Maddrey and Pelton (1995) also compared bear-related corn damage assessed by farmers (in North Carolina) to measured damage and found farmers' estimates to be too high (1.2% perceived vs. 0.6% measured).

Our study, like those of Maddrey and Pelton (1995) and Clark et al. (1991), further indicated that farmers' assessments of crop damage and their general attitudes toward bears were strongly linked to their past experience with bear-related crop loss. A history of persistent crop damage tends to alter people's perceptions about bears. Similarly, surveys of farmers about deer damage have shown that those who had experienced crop loss had different attitudes and perceptions about deer than those who had not previously experienced damage (Decker and Brown 1982, Decker et al. 1984).

Two results of our survey were particularly noteworthy and unexpected. First, although we explicitly asked about bear damage, and our survey area had the highest bear-related crop damage in the state, landowners indicated that deer damaged more crops than bears. Maddrey and Pelton (1995) reported similar results, although their study was in an area where per capita damage from bears was less severe. Across the U.S., deer cause far more damage to field crops than any other species of wildlife (Conover and Decker 1991, Conover 1994, Wywialowski 1994), and corn damage by deer in Minnesota is among the highest of any state (Wywialowski 1996). Nevertheless, farmers in our study area complained less about deer damage than bear damage. DNR personnel who routinely dealt with damage complaints indicated that farmers tolerated deer damage more than bear damage because most farmers were deer hunters (but not bear hunters) and thus enjoyed having deer on their property. Also, farmers perceived bears as more wasteful in that they trampled large amounts of corn, whereas deer damaged only the corn they ate. A high tolerance for deer damage among farmers also has been observed in other studies (Brown et al. 1978, Decker and Brown 1982, Craven et al. 1992). In our study, landowners who appreciated the bear's ecological role had a greater tolerance for damage, regardless of their past experience with bear-related crop loss. Corn farmers in Massachusetts, even ones who experienced bear damage, respected the bear's ecological value and had a high level of tolerance for damage (Jonker et al. 1998). This suggests that ecological information provided by the DNR may increase toler-

ance for bear damage. Many state agencies provide some sort of information to landowners experiencing bear-related damage (Warburton and Maddrey 1994), but a link between ecological information and landowner tolerance for such damage had not previously been reported.

A second surprising result of our study was that landowners were generally satisfied with the damage-related assistance they had received, mainly from the DNR. This result was unexpected because effective and practical abatement methods for bear-related crop damage are limited or nonexistent (Calvert, Warburton and Maddrey 1994, Jonker et al. 1998). DNR personnel generally handled complaints by trying to find a hunter to remove the offending bear or bears, which farmers agreed was the best solution to the problem. The fact that farmers who had experienced crop loss were the ones who most strongly favored this option suggests that it worked to some degree. Sometimes, though, because of the sheer number of bears, unavailability of hunters, or both, DNR personnel could do little more than explain to the landowners that, due to poor mast production, bears were especially hungry and had no alternative but to eat their corn and that there was no effective way to keep them out. Apparently, this ecological message was appreciated by many of the complainants (C. Rossow, DNR Conservation Officer, Willow River, Minnesota, USA, personal communication, 1998). Although many landowners who had experienced damage would have preferred monetary compensation, this is not permitted under Minnesota law, where only damage by gray wolves (*Canis lupus*) and elk (*Cervus elaphus*) is reimbursed. Landowners are compensated for damage caused by black bears in 11 states and provinces in North America (Wagner et al. 1997), including Wisconsin (Hygnstrom and Hauge 1989, Stowell and Willging 1992). These programs, although generally popular among farmers (Conover 1994), can be extraordinarily expensive and often tend to escalate; the monetary allocation for such a program might be better used to subsidize costly abatement methods like electric fencing, trained guard dogs, or capture and translocation. These options were rarely used in Minnesota to prevent crop damage because, as others elsewhere have found (Vaughan et al. 1989, Calvert et al. 1993), they are economically impractical. In contrast, the special hunting programs designed to increase harvests in agricultural areas and target specific depredating bears seem to give Minnesota farmers a feeling that the species is economically and aesthetically valuable (because hunters prize the recreational opportunity and use the meat), and that the agency responsible for bear management is concerned about their welfare. Similarly, Horton and Craven (1997) found that farmers in Wisconsin who were

issued special permits to shoot depredating deer gained satisfaction, possibly from a heightened sense of empowerment, even though they recognized that the program did little to reduce crop damage.

Although their estimates of crop loss and assessments of populations of depredating species of wildlife may be inaccurate, landowner's attitudes and perceptions are as much a part of wildlife management as biological and ecological data. A companion field study of bears by Kontio et al. (1998) in our survey area indicated that the high bear density there was sustained by high reproduction, which was likely attributable to abundant foods, including both natural mast and human crops. Thus, although the DNR is mandated to manage the bear population, farmers, by providing an enhanced food source, are partly responsible for the high bear numbers. Whereas some vocal individuals gave the impression to the DNR and state legislature (who were thus prompted to fund our study) that the bear problem in Pine County was exorbitant, results of our survey indicated that most farmers thought otherwise and that they understood the circumstances and appreciated attempts to mitigate losses. Landowner surveys are increasingly used to gauge tolerance for wildlife-related damage and shape management actions (Craven et al. 1992). In our case and others (e.g., Saltiel and Irby 1998), survey results indicated that the problem was less severe than originally thought.

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LITERATURE CITED

- BROWN, T.L., D.J. DECKER, AND C.P. DAWSON. 1978. Willingness of New York farmers to incur white-tailed deer damage. *Wildlife Society Bulletin* 6:235-239.
- CALVERT, R., D. SLATE, AND P. DEBOW. 1993. An integrated approach to bear damage management in New Hampshire. *Proceedings of the Eastern Black Bear Workshop* 11:96-107.
- CARDOZA, J.E. 1976. The history and status of the black bear in Massachusetts and adjacent New England states. Massachusetts Division of Fisheries and Wildlife Research

- Bulletin 18, Westborough, Massachusetts, USA.
- CLARK, J.D., D.L. CLAPP, K.G. SMITH, AND T.B. WIGLEY. 1991. Black bear damage and landowner attitudes toward bears in Arkansas. *Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies* 45:208–217.
- CONOVER, M.R. 1994. Perceptions of grass-roots leaders of the agricultural community about wildlife damage on their farms and ranches. *Wildlife Society Bulletin* 22:94–100.
- , AND D.J. DECKER. 1991. Wildlife damage to crops: perceptions of agricultural and wildlife professionals in 1957 and 1987. *Wildlife Society Bulletin* 19:46–52.
- CRAVEN, S.R., D.J. DECKER, W.F. SIEMER, AND S.E. HYGSTROM. 1992. Survey use and landowner tolerance in wildlife damage management. *Transactions of the North American Wildlife and Natural Resources Conference* 57:75–88.
- DECKER, D.J., AND T.L. BROWN. 1982. Fruit growers' vs. other farmers' attitudes toward deer in New York. *Wildlife Society Bulletin* 10:150–155.
- , G.F. MATTFELD, AND T.L. BROWN. 1984. Influence of experience with deer damage on farmers' perception of deer population trends. *New York Fish and Game Journal* 31:38–44.
- GABREY, S.W., P.A. VOHS, AND D.H. JACKSON. 1993. Perceived and real crop damage by wild turkeys in northeastern Iowa. *Wildlife Society Bulletin* 21:39–45.
- GARSHELIS, D.L. 1989. Nuisance bear activity and management in Minnesota. Pages 169–180 in M. Bromley, editor. *Bear people conflicts — proceedings of a symposium on management strategies*. Northwest Territories Department of Renewable Resources, Yellowknife, Northwest Territories, Canada.
- . 1994. Minnesota status report. *Eastern Workshop on Black Bear Research and Management* 12:26–30.
- HORTON, R.R., AND S.R. CRAVEN. 1997. Perceptions of shooting-permit use for deer damage abatement in Wisconsin. *Wildlife Society Bulletin* 25:330–336.
- HYGSTROM, S.E., AND T.M. HAUGE. 1989. A review of problem black bear management in Wisconsin. Pages 163–168 in M. Bromley, editor. *Bear people conflicts—proceedings of a symposium on management strategies*. Northwest Territories Department of Renewable Resources, Yellowknife, Northwest Territories, Canada.
- JONKER, S.A., J.A. PARKHURST, R. FIELD, AND T.K. FULLER. 1998. Black bear depredation on agricultural commodities in Massachusetts. *Wildlife Society Bulletin* 26:318–324.
- KINSEY, C. 1965. The black bear in Minnesota. Pages 179–212 in J.B. Moyle, editor. *Big game in Minnesota*. Minnesota Department of Conservation, Division of Game and Fish, Technical Bulletin Number 9, St. Paul, Minnesota, USA.
- KLENNER, W. 1987. Seasonal movements and home range utilization patterns of the black bear, *Ursus americanus*, in western Manitoba. *Canadian Field-Naturalist* 101:558–568.
- KONTIO, B.D., D.L. GARSHELIS, E.C. BIRNEY, AND D.E. ANDERSEN. 1998. Resilience of a Minnesota black bear population to heavy hunting: self-sustaining population or population sink? *Ursus* 10:139–146.
- MADDREY, R.C., AND M.R. PELTON. 1995. Black bear damage to agricultural crops in coastal North Carolina. *Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies* 49:570–579.
- SALTIEL, J., AND L. R. IRBY. 1998. Perceptions of game damage in Montana by resource agency personnel and agricultural producers. *Wildlife Society Bulletin* 26:84–91.
- STOWELL, L.R., AND R.C. WILLGING. 1992. Bear damage to agriculture in Wisconsin. *Proceedings of the Eastern Wildlife Damage Control Conference* 5:96–104.
- SURBER, T. 1941. How animal habitats have changed. *The Conservation Volunteer* 1(6):5–9.
- VAUGHAN, M.R., P.F. SCANLON, S.E.P. MERSMANN, AND D.D. MARTIN. 1989. Black bear damage in Virginia. *Proceedings of the Eastern Wildlife Damage Control Conference* 4:147–154.
- WAGNER, K.K., R.H. SCHMIDT, AND M.R. CONOVER. 1997. Compensation programs for wildlife damage in North America. *Wildlife Society Bulletin* 25:312–319.
- WAKELEY, J.S., AND R.C. MITCHELL. 1981. Blackbird damage to ripening field corn in Pennsylvania. *Wildlife Society Bulletin* 9:52–55.
- WARBURTON, G.S., AND R.C. MADDREY. 1994. Survey of nuisance bear programs in eastern North America. *Eastern Workshop on Black Bear Research and Management* 12:115–123.
- WYWIALOWSKI, A.P. 1994. Agricultural producers' perceptions of wildlife-caused losses. *Wildlife Society Bulletin* 22:370–382.
- . 1996. Wildlife damage to field corn in 1993. *Wildlife Society Bulletin* 24:264–271.