Farmland Wildlife Populations and Research Group
Madelia Research Center
35365 - 800th Avenue
Madelia, Minnesota 56062-9744
(507) 642-8478

LANDOWNER ATTITUDES AND PERCEPTIONS REGARDING WILDLIFE BENEFITS OF THE CONSERVATION RESERVE PROGRAM (CRP)

Martin D. Mitchell[1], Richard O. Kimmel, Roxanne M. Franke[2], and N. Nicole Moritz[1]

SUMMARY OF FINDINGS

Landowner perceptions of farmland programs are important in their successful implementation. Our purpose was to survey landowners who were participating in the CRP and those who were non-participants in 1997 and 2006 to determine: 1) if there were differences in how each group perceived the CRP and its associated environmental impacts, and 2) if these perceptions change from 1997 to 2006. We found that all landowners had a dramatically enhanced sense of environmental awareness regarding wildlife habitat and particularly ring-necked pheasant (*Phasianus colchicus*) populations relative to the CRP in 2006. Attitudes of landowners in south-central Minnesota generally paralleled findings of a recent USGS study that addressed perceptions of CRP participants throughout the Corn Belt, though certain qualifications applied in our findings. Finally, perceptual differences between participants and non-participants noticeably narrowed from 1997 to 2006, indicating increased awareness of the intended conservation benefits of the CRP.

INTRODUCTION

Agricultural programs are dependent on both government legislation from which the programs originate and landowners who implement these programs. Landowner acceptance of agricultural programs is paramount for success. In the 1960s, there were high sign-ups indicating strong landowner interest for annual set-aside programs (Berner 1988). Concurrently, there was reduced interest in the Cropland Conversion Program of 1962 and the Cropland Adjustment Program of 1965, which were multi-year land retirement programs designed after the popular Soil Bank Conservation Reserve (Berner 1988, Kimmel & Berner 1998). A multi-year land retirement option was not available again until the Conservation Reserve Program (CRP) was authorized in 1985 and reauthorized in 1996 (Kimmel & Berner 1998). In Minnesota, a sign-up of 0.76 million ha (1.9 million acres) of CRP during the 1980's demonstrated the landowner interest in this program. Currently, almost 0.72 million ha (1.8 million acres) are enrolled in Minnesota (USDA 2006).

Several studies have described characteristics of CRP participants (e.g., Force and Bills 1989, Hatley et al. 1989, Mortensen et al. 1989). Miller and Bromley (1989) evaluated interest of CRP participants in improving wildlife habitat and stressed improved communication between farmers and wildlife professionals. Kurzejeski et al. (1992) found that when wildlife information was available, landowner participation in wildlife conservation measures increased.

More recent studies have focused on CRP's socio-economic effects and its perceptions of the program on the physical environment. Leistritz et al (2002) examined the socio-economic impacts of CRP in 6 different agricultural sub-regions of North Dakota. This study centered on surveying CRP participants and community leaders from the agri-business sector who were not participants in CRP. In another North Dakota study, Bangsund et al (2004) modeled the effects of enhanced hunting relative to the opportunity costs of CRP participants. Finally, the USGS (2003) conducted a national survey of CRP participants to determine their perceptions of wildlife, vegetation, and the general impacts and

[1] Minnesota State University, Department of Geography, Mankato, MN 56001 USA
[2] Minnesota State University, Department of Biology, Mankato, MN 56001 USA

impressions of the CRP on the rural landscape.

The purpose of our investigation was to survey landowners in the Corn Belt region of south-central Minnesota to better understand their attitudes and perceptions about CRP, and its impact on wildlife abundance, and to see how such attitudes have changed or remained constant over the past 10 years.

METHODS

In 1997 we surveyed landowners in south-central Minnesota with questions regarding land ownership, enrollment in CRP, opinions on whether CRP improved habitat for wildlife, and factors influencing land-use decisions (Kimmel et al. 1997). A 25-question, 6-page survey was first mailed to 308 landowners on April 18, 1997. Using plat books, we selected landowners who owned land located on study areas used for an on-going investigation of avian population responses in the CRP (Haroldson, in press). Since 1990, we have monitored abundance of ring-necked pheasants, gray partridge (*Perdix perdix*), and meadowlarks (*Sturnella* spp.) on these study areas (Kimmel et al. 1992).

In February 2006, we prepared a similar, but smaller 14-question, survey that was implemented by telephone interview to 60 landowners located in south-central Minnesota. We attempted, whenever possible, to include the same landowners from the 1997 survey sample. With both studies, we divided the landowners on an approximate 50/50 ratio into CRP participants and non-participants to identify differences in perceptions between these two groups.

RESULTS

Following 4 mailings, 2 postcard reminders (after the 1st and 2nd mailings), and follow up phone calls, 219 of the 308 surveys were returned. The final survey mailings and phone reminders were conducted in July 1997. Undeliverable surveys and deceased landowners accounted for 44 unreturned surveys. The response rate for deliverable surveys (n=264) was 83.0%. Our telephone-based survey in February 2006 had a 100% compliance rate with 31 CRP participants (52%) and 29 non-participants (48%) comprising the final sample.

In 1997, land enrolled in CRP per farm averaged of 32.8 ha (81.9 acres) between 1985-1997. In 2006, this figure dropped to 14.8 ha (37 acres). Landowners with CRP owned an average of 156 ha (390 acres) in 1997 and 160 ha (399 acres) in 2006. Landowners without land enrolled in CRP owned an average of 112 ha (280 acres) both in 1997 and 2006.

In 1997, the most common answers for not enrolling eligible lands into CRP related to higher potential income from crops than CRP payments (68%) and increased crop prices (56%). In 2006, the most common reply for non-participation was ineligibility (41%) followed by the opportunity costs of growing crops (28%).

Landowners with CRP in 1997 indicated they enrolled land because of: a) concern for soil erosion (73%); b) provision of wildlife habitat (67%); c) most profitable use of land (52%); d) low risk associated with payments (36%); and e) easiest way to meet conservation compliance (36%). Personal retirement (15%), and reduced labor (15%) were secondary factors. Most landowners (73%) indicated their selection of a cover crop for CRP land was to benefit wildlife. In 2006, landowners indicated erosion (36%), conservation/buffer strips (33%), and wildlife (29%) as the most popular factors for program participation.

In 1997, 35% of landowners with CRP and 27% of landowners without CRP indicated wildlife was an important consideration in their choice of farming practices. By contrast, in 2006 94% of the participants considered wildlife as important when selecting a farming practice. As for 2006 non-participants, we found 67% considered wildlife as important when selecting a farming practice.

Most landowners with CRP in 1997 (93.7%) indicated that CRP improved pheasant habitat in the vicinity of their farm. The majority of landowners without CRP (70.5%) also indicated improved pheasant populations. A majority of all landowners (52%) indicated CRP improved habitat for white-tailed deer (*Odocoileus virginianus*) and gray partridge (*Perdix perdix*). Fewer landowners (38%) indicated CRP improved habitat for meadowlarks.

For 2006, 98% of all respondents agreed with the statement: "the CRP has improved the overall wildlife habitat in Minnesota." Moreover, 92% of those surveyed answered they agreed with the statement: "The CRP has improved wildlife habitat in your area." There were no significant differences between participants and non-participants. Again, pheasants (85%) and white-tailed deer (34%) were the two major perceived beneficiaries.

DISCUSSION

Landownership amounts between participants and non-participants did not change between 1997 and 2006. In 1997, the most common reasons for not enrolling were directly related to anomalously high prices for corn and soybeans. In 2006, ineligibility was the leading factor. This occurred after USDA tightened the criteria for CRP eligibility and made the program more competitive for the receipt of rental payments. On the national level, these changes favored the Great Plains states within the prairie pothole region.

The average size of CRP fields declined from 33 to 15 ha (82 to 37 acres) in south-central Minnesota. Interestingly, statewide aggregate acreage in 2006 was only about 40,000 ha (100,000 acres) below the late 1980s peak. However, CRP lands are presently more concentrated in the Red River valley in northwestern Minnesota (Lopez et al. 2000).

The most significant changes in landowner perception between 1997 and 2006 concern wildlife perceptions. In 1997 approximately one-third of the CRP participants indicated wildlife was important in farming considerations, increasing to 94% in 2006. A similar pronounced increase from 27% in 1997 to 67% in 2006 occurred with non-participants as well. This change is indicative of heightened environmental awareness of the CRP especially for and appreciation for pheasants and to a lesser extent, white tailed deer, but not for nongame species such as meadowlarks. Interestingly, meadowlarks have been found to sustain increased populations in areas with CRP grasslands (Kimmel et al. 1992).

Our findings paralleled a national study conducted by the USGS (2003) that examined CRP participants and their environmental perceptions of the program. This study found that in the Corn Belt 73% of landowners agreed that CRP had positive changes on wildlife and 59% agreed the program provided additional opportunities to view wildlife. Our 2006 survey found that 92% of our respondents (participants and non-participants) agreed with the statement that CRP "improved wildlife" in the local area and 98% to Minnesota at-large.

The USGS (2003) found that CRP was often viewed by participants as a source of weeds (33%) and attracted unwanted permissions for hunting (23%). Our 2006 survey found only 3% of all surveyed "strongly agreed" with these criteria, although approximately 30% "agreed" at a more moderate level. Consequently, landowners in south-central Minnesota mirrors the Corn Belt regional findings yet the intensity of these negative attributes is dissimilar.

The USGS (2003) survey also found that about 14% of the participants felt CRP added to an unkempt appearance. In our 2006 survey, the participants matched the USGS (2003) regional finding. However, approximately 25% of our non-participants felt CRP fostered an unkempt farm appearance. It is possible that the latter could be due to ignorance. Non-participants may recognize a CRP field as unorderly relative to the virtually manicured appearance of heavily cultivated corn and soybeans that dominate the regional landscape. Unlike, Reinvest in Minnesota (RIM) lands, CRP fields are typically not denoted by signage advertising the program.

Leistritz et al (2002) found that non-participants, (i.e. local leaders, agri-business professionals) in North Dakota felt CRP drained money from local economies because land taken out of production does not require the same amount of purchased inputs (fertilizers, insecticides, etc.) as cropland, and encouraged population loss through retirement and relocation elsewhere. Although we did not survey "local leaders" as defined by Leistritz et al. (2002), the majority of our non-CRP participants in 1997 (52%) felt the CRP was at least somewhat important in stabilizing rural incomes. In 2006, about 65% of our non-participants said the CRP was financially good for farmers. As for retirement and its perceived impact on population loss, our 1997 survey found retirement to be inconsequential when making a CRP decision. We did not survey for this criterion in 2006.

In summary, our most significant findings were: 1) in 2006, 98% of all landowners found that CRP benefited wildlife in Minnesota and that pheasants were the major beneficiaries, and 2) more landowners in 2006 than in 1997 considered wildlife populations when making farm related decisions. Our survey results paralleled the USGS (2003) regional findings, but with some qualifications. Overall, both the non-CRP and CRP participants find the CRP to be a popular program. Approximately 56% of those surveyed in 2006 would change absolutely nothing if given the chance to re-authorize the CRP, while the remaining 44% recommended only minor changes.

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ESTIMATING WHITE-TAILED DEER ABUNDANCE USING AERIAL QUADRAT SURVEYS

Brian S. Haroldson, Robert G. Osborn[1], and John H. Giudice

SUMMARY OF FINDINGS

We estimated white-tailed deer (*Odocoileus virginianus)* abundance in select permit areas using stratified and 2-dimensional systematic quadrat surveys to evaluate the impact of deer season regulation changes on deer population levels and to recalibrate population models. Precision was similar between sampling designs when an adequate number of animals was observed. When few animals were observed, and their distribution was aggregated into relatively few clusters, precision of stratified surveys was poor. Understanding deer distribution across the landscape is critical to selecting an appropriate sampling design and obtaining accurate and precise abundance estimates.

Management goals for animal populations are frequently expressed in terms of population size (Lancia et al. 1994). Accurate and precise estimates of animal abundance allow documentation of population trends, provide the basis for setting harvest quotas (Miller et al. 1997), and permit assessment of population and habitat management programs (Storm et al. 1992).

In Minnesota, white-tailed deer populations exceed management goals in many permit areas (PAs). A conventional approach of increasing the bag limit within the established hunting season framework has failed to reduce deer densities. As a result, the Department of Natural Resources is currently testing the effectiveness of 3 non-traditional harvest regulations to increase the harvest of antlerless deer and reduce overall population levels (Grund et al. 2005). In addition, wildlife managers in Minnesota's farmland zone have expressed concern regarding the accuracy of deer population estimates derived from simulation modeling (Osborn et al. 2003). Because population estimates are subject to drift as model input errors accumulate over time, periodic model recalibration is recommended (Grund and Woolf 2004). The objective of this study is to provide independent estimates of deer abundance in select PAs. These data will be used to evaluate the impact of deer season regulation changes on deer abundance and to recalibrate population models.

METHODS

We estimated deer populations in PAs using a quadrat-based, aerial survey design. Quadrat surveys have been used successfully to estimate populations of caribou (*Rangifer tarandus*; Siniff and Skoog 1964), moose (*Alces alces*; Evans et al. 1966), and mule deer (*O. heimonus*; Bartmann et al. 1986) in a variety of habitat types. In PAs where the local wildlife manager had prior knowledge about deer abundance and distribution, we employed a stratified, random sampling design, with quadrats stratified into 2 abundance classes (high, low). In other areas, we employed a 2-dimensional systematic sampling design (Cressie 1993, D'Orazio 2003). Systematic designs are typically easier to implement, maximize sample distribution, and often result in estimates that are more precise than those obtained using simple or stratified random sampling designs (Cressie 1993, D'Orazio 2003).

Within each PA, quadrats were delineated by Public Land Survey section boundaries and a 20% sample was selected for surveying. We excluded quadrats containing navigation hazards or high human development, and selected replacement quadrats in stratified PAs. Replacement quadrats were unavailable in the systematic PAs because of the rigid, 2-dimensional design. We used OH-58 helicopters during most surveys.

[1] Present address: Hayden-Wing Associates, 2308 South 8th Street, Laramie, WY 82070, USA

However, a Cessna 182 airplane was used in 3 PAs dominated by intensive row-crop agriculture. To improve visibility, we completed surveys after leaf-drop by deciduous vegetation, and when snow cover measured at least 15 cm. A pilot and 2 observers searched for deer within each quadrat until they were confident all animals had been observed. We used a moving-map software program (DNR Survey) coupled to the aircraft global positioning system receiver to identify quadrat boundaries, guide quadrat navigation, and log deer locations and aircraft flight path. We estimated deer abundance from stratified surveys using SAS Proc SURVEYMEANS (SAS 1999) and from systematic surveys using formulas from D'Orazio (2003).

RESULTS AND DISCUSSION

We completed 5 surveys during January-February 2005, and 10 surveys during January-March 2006 (Table 1). Survey results from Carlos Avery Wildlife Management Area (PA 235) and St. Croix State Park will not be reported here because sampling design varied from that reported previously to account for the small geographic size of these 2 units.

Fixed-wing surveys were conducted in PAs 252, 421, and 423. In the latter 2 areas, population estimates were substantially lower than expected, based on long-term deer harvest rates. Several possibilities may explain this result: 1) quadrats were stratified incorrectly, 2) deer were clustered in unsampled quadrats, 3) deer were wintering outside PA boundaries, 4) sightability was biased low using fixed-wing aircraft, and/or 5) kill locations from hunter-killed deer were incorrect.

In terms of precision and relative error, systematic and stratified designs appear to provide similar results, with the exception of PAs 421, 423, and 201 (Table 1). In PA 421, all high strata quadrats were surveyed, resulting in a sampling variance of zero. In addition, because few deer were observed in low strata quadrats, sampling variance was low and, therefore, overall precision of the population estimate was high. It is unlikely that this design (i.e., sampling 100% of high strata quadrats) will be feasible in all areas, especially if deer are more uniformly distributed throughout the landscape.

In contrast, survey precision in PAs 423 and 201 was very poor. Few deer were observed during either survey (144 and 56, respectively). Most quadrats contained no deer, and nearly all observations occurred within 1 or 2 quadrats.

Clearly, understanding deer distribution across the landscape is critical to selecting an appropriate sampling design and obtaining accurate and precise abundance estimates. Over the next several months, we plan to complete survey analysis and make recommendations for next year's sampling protocol. Analysis will include *post-hoc* evaluation of habitat features present in quadrats containing deer. In addition, the prevalence of winter feeding by landowners, and its impact on deer distribution, will also be examined to determine if pre-survey stratification flights (Gasaway et al. 1986) are warranted.

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Sampling design	Year	Permit area	Sampling rate (%)	Population estimate		CV (%)	Error (%)[a]	Density Estimate	
				N	90% CI			Mean	90% CI
Systematic	2005	252	16	2,999	2,034 – 3,969	19.5	32.2	2.9	2.0 – 3.8
		257	16	2,575	1,851 – 3,290	16.9	28.1	6.2	4.5 – 8.0
	2006	204	16	3,432	2,464 – 4,401	17.0	28.2	4.8	3.4 – 6.1
		209	17	6,205	5,033 – 7,383	11.4	18.9	9.7	7.9 – 11.6
		210	17	3,976	3,150 – 4,803	12.5	20.8	6.5	5.1 – 7.8
		256	17	4,670	3,441 – 5,899	15.9	26.3	7.1	5.3 – 9.0
		236	16	6,774	5,406 – 8,140	12.1	20.2	18.2	14.5 – 21.9
Stratified	2005	206	20	2,486	1,921 – 3,051	13.7	22.5	5.3	4.1 – 6.5
		342	20	3,322	2,726 – 3,918	10.8	17.7	9.5	7.8 –11.2
		421	20	631	599 – 663	3.0	5.0	0.8	0.8 – 0.9
	2006	201	20	274	100 – 449	37.6	61.9	1.7	0.6 – 2.8
		420	20	2,000	1,349 – 2,652	19.7	32.3	3.1	2.1 – 4.1
		423	20	472	179 – 764	37.4	61.5	0.9	0.3 – 1.4

Table 1. Deer population and density estimates derived from aerial surveys in Minnesota, 2005-2006.

[a] Relative precision of the population estimate (goal: 90% CI that is within +/- 20% of the true population size). Calculated as 90% CI bound ⁄ *N*.

EVALUATING ALTERNATIVE REGULATIONS FOR MANAGING WHITE-TAILED DEER IN MINNESOTA—A PROGRESS REPORT

Marrett D. Grund, Louis Cornicelli, David C. Fulton[1], Brian S. Haroldson, Emily J. Dunbar, Sonja A. Christensen[2], and Michelle L. Imes

SUMMARY OF FINDINGS

The increasing number of white-tailed deer (*Odocoileus virginianus*) in many deer permit areas of Minnesota is posing significant challenges to wildlife managers. Our primary objectives in this investigation are to: 1) quantify impacts of 3 alternative deer harvest regulations have on age and sex structures of hunter-killed deer and deer populations, and 2) measure hunter and landowner attitudes regarding alternative deer harvest regulations. We outline methods employed and progress made during the first year of the alternative deer management project. Over the past year, we accomplished all objectives defined in the project proposal and anticipate continued success during the upcoming year.

The increasing number of white-tailed deer (*Odocoileus virginianus*) in many deer permit areas of Minnesota is posing significant challenges to wildlife managers. Supply of antlerless permits offered to hunters exceeds demand, and desired annual antlerless harvests are frequently not achieved. In Minnesota, the primary approach for managing overabundant deer is through allocating bonus permits, which allows hunters to take 1-4 additional antlerless deer. Minnesota Department of Natural Resource (DNR) harvest data from the 2005 hunting season suggest bonus permits are not being used efficiently under the existing seasonal framework. During 2005, 72% of successful hunters killed 1 deer, 21% of successful hunters killed 2 deer, and 7% of hunters killed >2 deer. Allowing hunters to harvest >1 deer has little impact on the total numerical harvest, because the regulation only affects about 1 out of 4 successful hunters.

Alternative harvest strategies that emphasize harvesting antlerless deer during the hunting season may increase both number and proportion of adult females in the overall harvest. Increased harvest of adult females would reduce deer densities in areas where traditional harvest strategies using bonus permits have not been successful. Our primary objectives were to: 1) quantify impacts of 3 alternative deer harvest regulations on age and sex structures of hunter-killed deer and deer populations, and 2) measure hunter and landowner attitudes regarding alternative deer harvest regulations.

STUDY AREAS

For the most part, this study is being conducted in Minnesota's transition zone. The transition zone is a loosely defined region between Minnesota's forest and farmland zones. The zone extends from northwest to southeast Minnesota and primarily encompasses hunting zones 2 and 3. Virtually all deer permit areas in hunting zones 2 and 3 allowed bonus tags in 2005. We originally proposed 3 blocks of deer permit areas to evaluate an early antlerless-only hunting season (Figure 1). However, an early antlerless-only season has not yet been adopted by DNR in the central study area. We are currently evaluating earn-a-buck and antler-point restriction regulations in 7 state parks distributed throughout Minnesota.

METHODS

General Hunter Survey

[1]Minnesota Cooperative Fish and Wildlife Research Unit, 1980 Folwell Avenue, 200 Hodson Hall, St. Paul, MN 55108
[2]Present address: Pennsylvania Cooperative Fish and Wildlife Research Unit, 419 Forest Resources Building, Pennsylvania State University, University Park, PA 16802

At the time of license purchase, hunters were asked where they intend to hunt most often and those data were retained in an electronic license system (ELS) database. We spatially-stratified our study area into 4 groups (Figure 2), which were based primarily on the Minnesota ecological classification system. Hunters were selected at random from the ELS database. In total, 1,500 surveys were sent to hunters in each of the 4 groups, yielding a total sample size of 6,000.

The survey contained 4 sections. The first section contained questions to assess recent hunter experiences and general perceptions about hunting deer in Minnesota. The second section included questions to quantify hunter support for alternative deer hunting regulations and the third section focused on past deer hunting experiences. In the final section, hunters were presented with 5 scenarios related to Minnesota deer management. In total, there were 7 choices within each scenario but hunters were only given 3 choices (at random), which they were asked to rank (preference 1, 2, 3). While each choice was assigned at random, the same number of total choices was represented in all 6,000 surveys. The option of 'doing nothing' was not a choice under any scenario as the intent of the instrument was to gauge acceptance of regulation change; however, the option of not hunting or moving to another area were offered as a choices.

The initial mailing was conducted on 15 October 2005. Second and third mailings to non-respondents were conducted on 15 November 2005 and 15 December 2005, respectively.

Check Station Operations

In Minnesota, successful hunters were required to register each deer harvested within 24 hours of the close of the deer-hunting season. Based on historical registration data and in consultation with DNR Area Wildlife Managers, we identified 40 registration stations most likely to register the maximum number of deer within or near 1 of our study areas. We trained approximately 150 college students and DNR staff to sex and estimate age classes of deer (fawn, yearling, adult) based on tooth replacement and wear (Severinghaus 1949) from jaws viewed *in situ*. Primary incisors were removed from all deer having bicuspid third premolars so that age-at-death could be estimated by year using cementum annuli techniques. Antler characteristic data were also obtained from antlered deer.

Study Area Hunter Survey

Hunters participating in 1 of our treatment hunts were identified through the ELS database. We also identified hunters declaring to hunt in nearby deer permit areas to serve as a control group. Identical to the aforementioned choice survey, hunters were randomly selected from this population to be surveyed. Sample sizes differed among treatment groups and were dependent on numbers of hunters participating within a particular hunting regulation. A total of 3,629 hunters were randomly selected to receive this survey.

The survey contained 3 sections. The first section contained questions to determine where hunters hunted in each hunting season. The next section of questions was designed to determine hunting techniques, hunter behavior, and hunting motivation. The final section of questions focused on hunting experiences and support for deer hunting regulations after the hunter had experienced hunting under the regulation.

The initial mailing was conducted on 6 March 2006. Second and third mailings to non-respondents are planned for April and May 2006.

Deer Population Monitoring

Aerial Surveys.--Deer populations were estimated from the air using helicopter quadrat surveys. Each deer permit area was divided into 2.6-km^2

quadrats (sections from Public Land Survey data). A twenty percent sample of these quadrats was surveyed using either a 2-dimensional systematic random sampling design (Cressie 1993, D'Orazio 2003), or a stratified random sampling design. Surveys were conducted when approximately 100% of the ground was covered with snow and was anticipated to last several days. Complete snow cover improved visibility and ensured that enough time was available to allow the survey to be completed. Quadrats were flown until observers were confident they had seen all deer within each quadrat. Density estimates were calculated using standard formulas (Hayek and Buzas 1997).

Ground Surveys.--Deer populations were estimated from the ground using spotlight quadrat surveys. Similar to aerial surveys, deer permit areas were partitioned using Public Land Survey Data and 20% of the quadrats were selected using a stratified random sampling design. Roads adjacent to selected quadrats served as transects for ground surveys. The field season for conducting ground surveys is 1 April 2006 through 15 May 2006, or until all selected quadrats are searched. The surveys began approximately 30 minutes prior to sunset and continued for approximately 4 hours. During surveys, 2 observers searched for deer using hand-held spotlights while a pickup truck traveled at speeds of 24–32 km/hour. Observers determined distance to centers of deer clusters (i.e., groups) with a laser range finder, and determined angles to centers of clusters using a prismatic compass. Geographic positioning system (GPS) units were used to facilitate locating transects in the field and to monitor locations of observers throughout the survey. Clusters were separated using nearest neighbor criterion (LaGory 1986), location of deer, and their behavior. In general, a group of deer behaving similarly in close proximity to each other e.g., traveling together in a field) was considered a cluster.

Vegetation Surveys

Vegetation sampling was conducted in Itasca State Park, MN from 14 July – 21 July 2005. Itasca State Park was divided into a 16 x 16 grid. Three sampling plot arrays were selected using a random number generator. Each sampling plot array contained a 50-m^2 subplot and 4, 1-m^2 subplots nested within the 250-m^2 plot (Figure 3). Plots were permanently marked by hammering 0.6-m pieces of rebar at the center and at each corner of the 250-m^2 sampling plot, at each corner of the 50-m^2 subplot, and at 1 pair of diagonal corners of each 1-m^2 subplots.

Slope, aspect, topographic position, and visual evidence of natural disturbance history (fire scars, insect/disease infestation, blow downs, etc.) were recorded for each sampling plot array. At each corner of the 250-m^2 plot, all trees (> 1.5-m tall and/or between 2.54 and 12.7 cm dbh) within a 6-m radius of the permanent marker were identified to species, and height and dbh recorded. Trees were also recorded as dead or alive.

At each permanent marker of the 50-m^2 subplot, trees and shrubs (> 1.5-m) were sampled within a 2-m radius. A tally of living and dead trees, according to species and height classes, was recorded. A count of shrubs according to species and height classes was also recorded.

In each 1-m^2 subplot, percent cover of all woody and herbaceous species (<2.54 dbh and <1.5-m tall) was recorded using Daubinmier cover classes. We also recorded percent cover of bryophytes and lichens, tree seedlings, and rock and litter. The height of each woody or herbaceous plant was also recorded. An estimate of understory cover was measured using a density board and recording the number of squares obscured at eye level in each cardinal direction. Litter depth was measured and recorded. Percent overstory cover was estimated using a spherical densitometer at the center of the subplot and a densitometer at 5 5-m intervals along transects in each cardinal direction from the subplot center. Browsing intensity was recorded for each plant and was based upon percent of stems browsed and height of plant. The number of sterile and flowering or fruiting Canada mayflower (*Maianthemum canadense*) was also recorded. Photographs were taken above each plot and also in each cardinal direction to record forest structure.

RESULTS

General Hunter Survey

After 3 mailings, we achieved a response rate of approximately 60% (Table 1). Analysis is planned for May 2006 with results available in summer 2006.

Check Station Operations

Staff examined 3,492 male and 2,230 female deer at registration stations during fall 2005. Including both genders, there were 1,322 deer aged as fawns. Antler characteristic data were recorded from 2,625 deer. We sent 2,448 primary incisors to Matson's Laboratory (Milltown, Mont., U.S.) for cementum annuli aging.

Study Area Hunter Survey

The initial mailing of the survey was underway in April 2006. No data were available at the time of this writing.

Aerial Surveys

Results from the aerial survey can be reviewed in Haroldson et al. (2005).

Ground Surveys

Ground surveys began on 1 April 2006 in northwestern deer permit areas and on 3 April 2006 in the north-metro deer permit areas (Figure 1). Only 13% of the surveys were complete when this report was written. Therefore, no results are presented.

Vegetation Surveys

Data obtained from vegetation surveys have been entered into a database. No analyses have been performed because these data will be collected and analyzed across years.

ACKNOWLEDGEMENTS

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Table 1. Survey mailing dates and return rates associated with the general hunting survey conducted in fall 2005, Minnesota.

Mailing	Date	Total Returned	Response Rate
First	15 Oct 2005	1,543	26.5
Second	15 Nov 2005	2,542	43.7
Third	15 Dec 2005	3,331	59.8

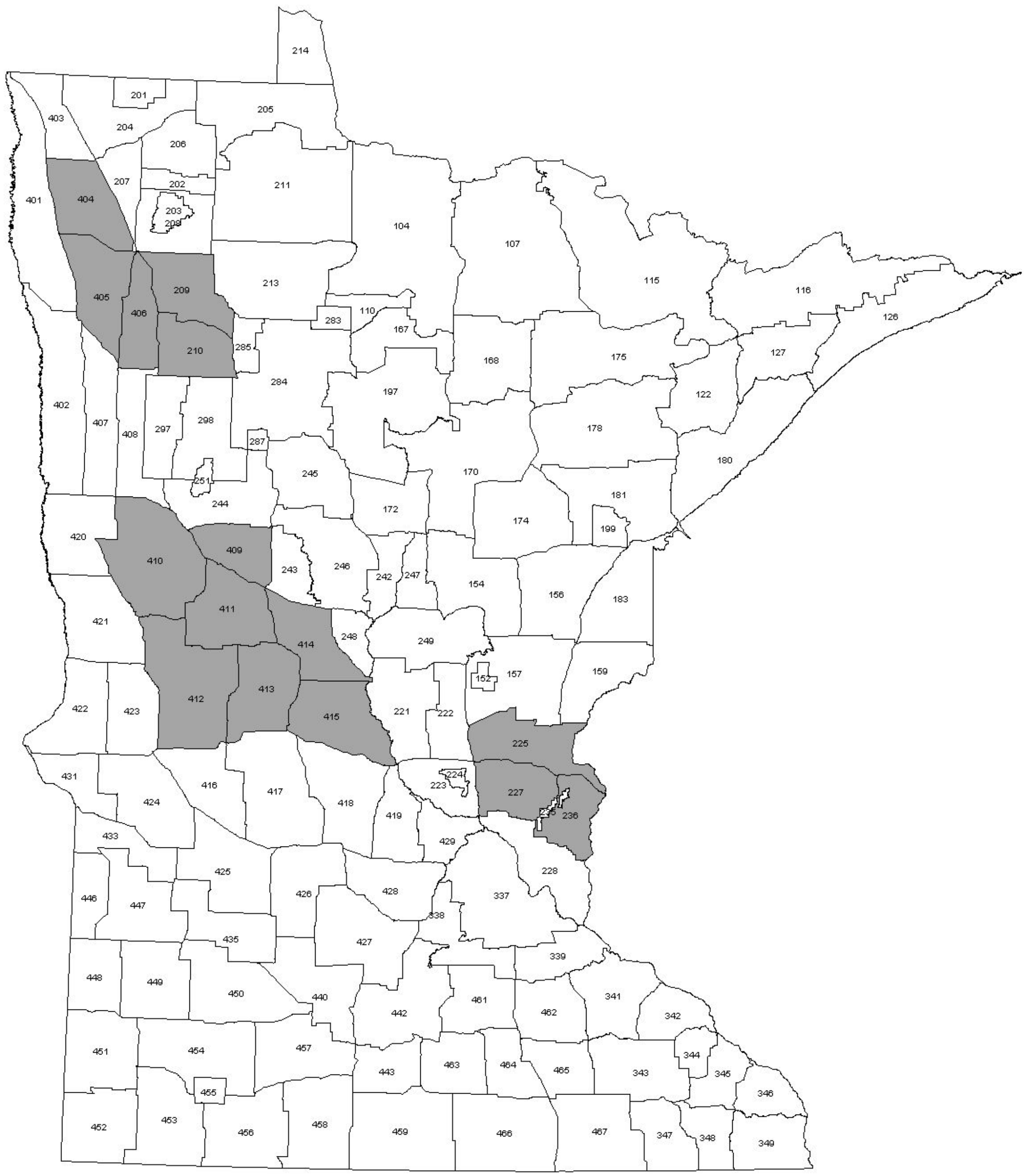

Figure 1. Blocks of deer permit areas where October antlerless-only seasons were proposed for evaluation as part of the alternative deer management project, Minnesota, 2005-2010.

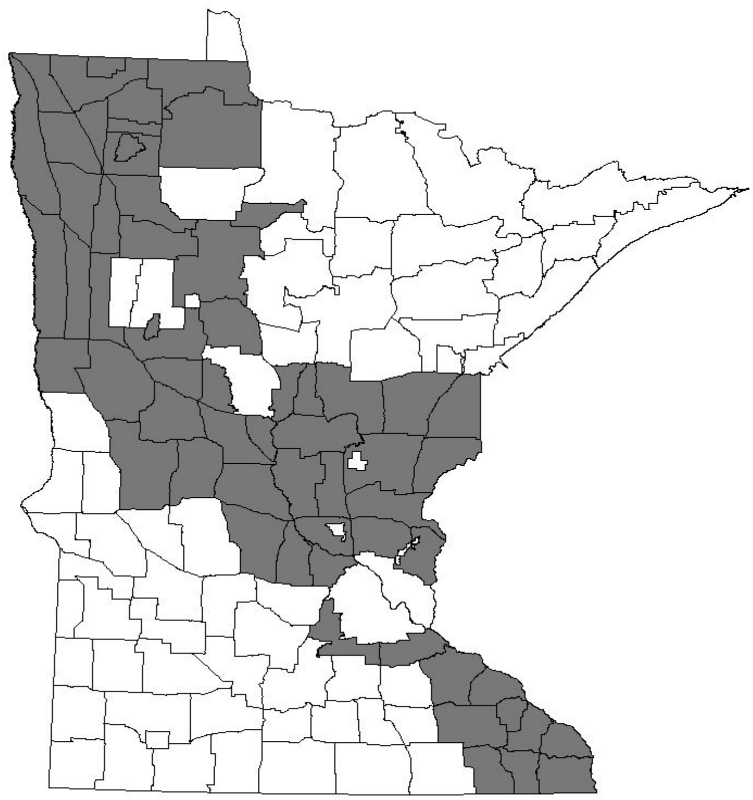

Figure 2. Surveys were sent to hunters declaring to hunt in shaded deer permit areas for the general hunter survey, Minnesota, 2005.

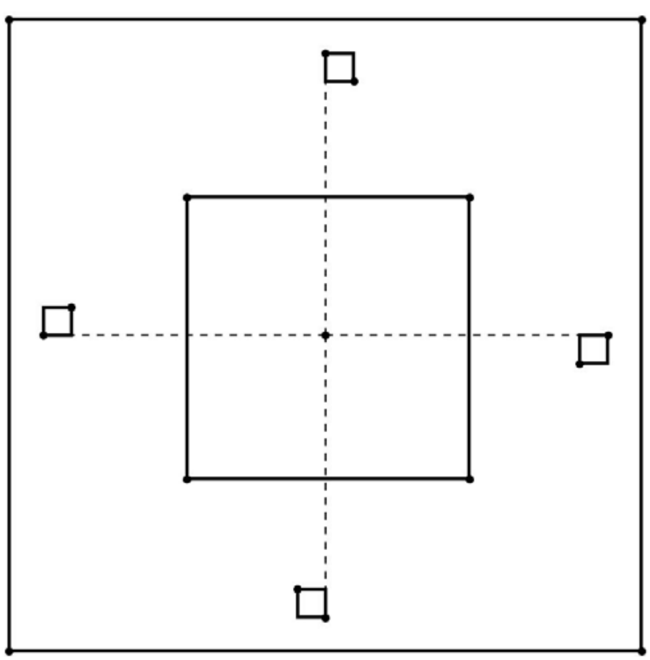

Figure 3. Design of a sampling plot array used at Itasca State Park, Minnesota, 2005. Dots indicate locations of 17 permanent markers.

THE VALUE OF FARM PROGRAMS FOR PROVIDING WINTER COVER AND FOOD FOR MINNESOTA PHEASANTS

Kurt J. Haroldson, Tim J. Koppelman[1], Michelle L. Imes[1], and Sharon L. Goetz

SUMMARY OF FINDINGS

The purpose of this study is to determine how much winter habitat is needed to sustain local populations of ring-necked pheasants (Phasianus colchicus) over a range of winter conditions. We estimated relative abundance of pheasant populations on 36 study areas using roadside surveys. In addition, we estimated amounts of winter cover, winter food, and reproductive cover on each study area by cover mapping to a geographic information system (GIS). During 2003-2005, pheasant population indices varied in association with weather and habitat. A preliminary evaluation indicated that mean pheasant indices were positively related to habitat abundance in most, but not all, regions. Four consecutive mild winters have hampered our ability to estimate winter habitat needs. Future work will include continued pheasant surveys for at least 1 additional year, improved estimates of habitat abundance, and more complex analysis of the association between pheasant indices and habitat parameters. Final products of this project will include GIS habitat models or maps that managers can use to target habitat development efforts where they may yield the greatest increase in pheasant numbers.

Preferred winter habitat for ring-necked pheasants (*Phasianus colchicus*) in the Midwest includes grasslands, wetlands, woody cover, and a dependable source of food (primarily grain) near cover (Gates and Hale 1974, Trautman 1982, Perkins et al. 1997, Gabbert et al. 1999). However, emergent wetlands and woody habitats that are large enough to provide shelter during severe winters have been extensively removed from agricultural landscapes, and grasslands and grain stubble are often inundated by snow. During severe winters, pheasants without access to sufficient winter habitat are presumed to perish or emigrate to landscapes with adequate habitat. Birds that emigrate >3.2 km (2 miles) from their breeding range are unlikely to return (Gates and Hale 1974).

Almost 400,000 ha (1 million acres) of cropland in Minnesota's pheasant range are currently retired under the Conservation Reserve Program (CRP). Wetland restorations, woody habitats and food plots are eligible cover practices in the CRP, but most appear inadequate in size, design or location to meet pheasant habitat needs. Furthermore, small woody covers commonly established on CRP lands may reduce the quality of adjacent grass reproductive habitat without providing intended winter cover benefits.

Pheasants use grasslands for nesting and brood rearing, and we previously documented a strong relationship between grassland abundance and pheasant numbers (Haroldson et al. 2006). However, information is lacking on how much winter habitat is needed to sustain pheasant populations during mild, moderate, and severe winters. The purpose of this study is to quantify the relationship between amount of winter habitat and pheasant abundance over a range of winter conditions. Our objectives are to: 1) estimate pheasant abundance on study areas with different amounts of reproductive cover, winter cover, and winter food over a time period capturing a range of winter severities (≥5 years), 2) describe annual changes in availability of winter cover as a function of winter severity, and 3) quantify the association between mean pheasant abundance (over all years) and amount of reproductive cover, winter cover, and winter food.

METHODS

We selected 36 study areas of contrasting land cover in Minnesota's core pheasant range to ensure a wide range of habitat configurations. Study areas averaged 23 km^2 (9 $miles^2$) in size, and were selected to vary in the amount of winter cover, winter food, and reproductive cover. We defined winter cover as cattail (*Typha spp.)* wetlands ≥4 ha (10 acres) in area (excluding open water), dense shrub swamps ≥4 ha (10 acres) in area, or planted woody shelterbelts ≥0.8 ha (2 acres) in area, ≥60 m (200 feet) wide, and containing ≥2 rows of conifers (Gates and Hale 1974, Berner 2001). Winter food was defined as grain food plots left unharvested throughout the winter and located ≤0.4 km (1/4 mile) from winter cover (Gates and Hale 1974). Reproductive cover included all undisturbed grass cover ≥6 m (20 feet) wide. To facilitate pheasant surveys, 9 study areas were selected in each of 4 regions located near Marshall, Windom, Glenwood, and Faribault (Figure 1).

We estimated amounts of winter cover, winter food, and reproductive cover on each study area by cover mapping to a GIS from 2003 aerial photographs. In addition, we mapped large habitat patches within a 3.2-km (2-mile) buffer around study area boundaries to assess the potential for immigration to and emigration from study areas. We used Farm Service Agency's GIS coverages of farm fields (Common Land Units) as base maps, and edited field boundaries to meet the habitat criteria of this project. Cover types were verified by ground-truthing all habitat patches visible from roads. Because cover mapping of cattail wetlands, shrub swamps, and undisturbed grasslands is still in progress, we made preliminary estimates of the amounts of these habitats from GIS coverages of the National Wetlands Inventory (NWI), Wildlife Management Areas (WMAs), Waterfowl Production Areas (WPAs), and CRP enrollments. We recognize that not all cattail wetlands, shrub swamps, and undisturbed grasslands are included in these GIS coverages.

We plan to estimate availability of winter cover during moderate–severe winters using aerial surveys. When fallen or drifted snow has inundated small (4–6 ha [10–15 acre]) cattail wetlands for ≥2 weeks, a sample of winter cover patches on all affected study areas will be inspected by helicopter to determine 1) availability of any remaining cover within the patch, and 2) presence of pheasants within the patch.

We estimated relative abundance of pheasant populations on each study area using roadside surveys (Haroldson et al. 2006). Roadside surveys consisted of 16–19 km (10–12 mile) routes primarily on gravel roads (≤ 6 km [4 miles] of hard-surface road). Observers drove each route starting at sunrise at an approximate speed of 24 km/hour (15 miles/hour) and recorded the number, sex, and age of pheasants observed. Surveys were repeated 10 times on each study area during spring (20 April – 20 May) and summer (20 July – 20 August). Surveys were conducted on mornings meeting standardized weather criteria (cloud cover <60%, winds ≤16 km/hour [10 miles/hour], temperature ≥0°C [32°F], dew present) 1–2 hours before sunrise; however, surveys were completed even if conditions deteriorated after the initial weather check. We attempted to survey all study areas within a region on the same days, and observers were systematically rotated among study areas to reduce the effect of observer bias.

Observers carried Global Positioning System (GPS) receivers while conducting roadside surveys. GPS receivers were used to record the time and position of observers throughout each survey (track logs), and to record the location of observed pheasants (waypoints). We inspected all track logs for each observer to ensure that surveys were conducted at the correct time, location, and speed of travel.

For each study area and season, we calculated a population index (pheasants counted/route) from the total number of pheasants counted/total survey distance driven over all 10 repetitions. We standardized the index to pheasants/161 km (pheasants/100 miles) to adjust for variation in survey distance among study areas. We evaluated temporal trends in pheasant abundance by calculating mean percent change in population indices by region and in total. We interpreted trends as statistically significant when 95% confidence intervals of percent change did not include 0.

To evaluate the effect of habitat on pheasant abundance, we calculated a cover index for each study area:

CI = [(UG/Max)x4 + (WCwFP/Max)x4 + (WCwoFP/Max)x2 + (FP/Max)] / 11

where UG = undisturbed grass (% of study area)

WCwFP = winter cover near a food plot (number of patches)

WCwoFP = winter cover without a nearby food plot (number of patches)

FP = food plot (number of patches)

Max = maximum observed value among all 36 study areas.

The cover index combined the effects of reproductive cover, winter cover, and winter food into a single weighted average (weight based on a preliminary estimate of relative importance). Potential values of cover index ranged from 0.0 (poorest habitat) to 1.0 (best habitat). We acknowledge that the cover index is an oversimplification, and we used it only to make simple, 2-dimentional plots for this early progress report. For each region, we evaluated the association of cover indices to pheasant population indices using simple linear regression.

RESULTS

We identified and mapped 318 patches of winter cover on the 36 study areas and surrounding 3.2-km (2-mile) buffers. Severity of winter weather was low during all 4 winters (2002-06) of this study. As a result, even the least robust patches of winter cover (e.g., 4-ha [10-acre] cattail wetlands) remained available to pheasants throughout the 4 winters of this study.

Spring 2005 surveys

Observers completed all 360 scheduled surveys (10 repetitions on 36 study areas) during the spring 2005 season. Despite strong efforts by surveyors to select days that best met weather standards, weather conditions were not consistent among surveys, ranging from excellent (calm, clear sky, heavy dew) to poor (wind >16 km/hour [10 miles/hour], overcast sky, no dew, or frost). Over all regions, 91% of the surveys were started with at least light dew present, which was much greater than 2004 (78%) and 2003 (84%). However, only 60% of surveys were started under clear to partly cloudy skies (<60% cloud cover), and only 38% reported wind speeds <6 km/hour (4 miles/hour). Seven percent of surveys were started on mornings with wind >16 km/hour (10 miles/hour), and 11% were started with temperatures <0^{o}C (32^{o}F). Among regions, Glenwood experienced the least dew (17% of surveys started with no dew), the most wind (16% of surveys started with wind speed >16 km/hour [10 miles/hour]), and the greatest cloud cover (50% of surveys started with cloud cover ≥60%).

Pheasants were observed on all 36 study areas during spring 2005, but abundance indices varied widely among areas from 15.0–293.7 pheasants observed per route (Table 1). Over all study areas, the mean pheasant index was 104.9 birds/route, a nonsignificant change from spring 2004 (Table 2). Total pheasants/route varied among regions from 57.3 in the Faribault region to 167.6 in the Windom region (Table 2). Compared to 2004, total indices changed significantly only in the Faribault region, where they decreased 28% (95% CI: –3 to –53%).

Hens were relatively abundant among study areas in spring 2005. The overall hen index averaged 58.3/route, a nonsignificant change from 2004 (Table 2). Among regions, the hen index ranged from 23.8/route in Faribault to 102.6/route near Windom. Hen indices were not significantly different from 2004 in any region (Table 2). The observed hen:rooster ratio varied from 0.3 to 2.9 among study areas (Table 1). Fewer hens than roosters were observed on 3 study areas in the Marshall region, 4 areas in Glenwood, and 7 areas in Faribault.

Summer 2005 surveys

Observers completed 359 of the 360 surveys during the summer 2005 season. Weather conditions during the summer surveys ranged from excellent (calm, clear sky, heavy dew) to poor (light or no dew, overcast sky, or rain). Over all regions, 81% of the surveys were started with medium-heavy dew present, which was lower than 2004 (87%) and equal to 2003 (81%). Sixty-six percent were started under clear skies (<30% cloud cover), and 69% reported wind <6 km/hour (4 miles/hour). In comparison, 91% of the statewide August Roadside Surveys were started under medium-heavy dew conditions, 84% under clear skies, and 71% with winds <6 km/hour (4 miles/hour). The less desirable weather conditions reported in this study probably reflects the limited availability of 10 suitable survey days within the 31-day period.

Pheasants were observed on all 36 study areas during 2005, but abundance indices varied widely from 2.5–372.3 pheasants observed per route (Table 3). Over all study areas, the mean pheasant population index was 150.9 birds/route, an 82% (95% CI: 49–115%) increase from 2004. Total pheasant indices varied among regions from 90.5 birds/route in the Faribault region to 190.5 birds/route in Marshall (Table 4). Compared to 2004, total indices increased significantly in the Marshall, Glenwood, and Faribault regions, but not Windom (Table 4).

The overall hen index (26.3 hens/route) increased 63% (95% CI: 15–111%) from last year, and varied among regions from 14.8 in the Faribault region to 37.4 near Windom (Table 4). Hen indices increased 64% (95% CI: 5–123%) in the Glenwood region, but were not significantly higher than 2004 in the Marshall, Faribault, or Windom regions (Table 4). In contrast, overall and regional cock indices fell to their lowest levels in the 3-year study (Table 4), but declines from last year were significant only in the Windom (95% CI: –23 to –53%) and Faribault regions (95% CI: –8 to –52%). The observed hen:rooster ratio varied from 0.0 to 8.0 among study areas (Table 3), and averaged 2.8 overall. Fewer hens than roosters were observed on 1 study area in the Glenwood and Windom regions and 2 areas in the Faribault region.

The 2005 overall brood index (23.6 broods/route) increased 102% (95% CI: 63–141%) from 2004, with regional indices ranging from 12.6 in Faribault to 35.0 in Marshall (Table 4). Regional brood indices increased significantly in all regions except Windom (Table 4). Mean brood size averaged 5.1 chicks/brood overall, but varied among regions (4.2 in Marshall, 6.1 in Glenwood, 5.0 in Windom, and 5.5 in Faribault). Mean brood size in 2005 increased over that in 2004 in the Glenwood and Faribault regions, declined in Marshall, and was unchanged in Windom (Table 4). On average, 55.3 broods were observed for every 100 hens counted during spring surveys, a 207% (95% CI: 127–287%) increase from last year. This brood recruitment index (broods/100 spring hens) varied among regions from 30.2 in Windom to 77.2 in Marshall. Brood recruitment indices increased significantly in all regions except Windom (Table 4).

Habitat associations

The mean pheasant index (total pheasants/route averaged over summer 2003–2005) was positively related to the cover index in all regions except Glenwood (Figure 2). Cover index explained 42% of the variation in pheasant indices in the Marshall region, 34% in Windom, 13% in Faribault, and 0% in Glenwood.

DISCUSSION

A high spring hen population in 2005 was expected given the mild winter of 2004-05 (the 4th consecutive mild winter). Furthermore, warm weather during the reproductive period was apparently conducive for increased nest success as the proportion of spring hens in 2005 that successfully recruited a brood into the summer population was twice that of 2004. Furthermore, average brood size increased significantly. Thus, the summer 2005 pheasant index was 82% above the 2004 index.

At this early stage in our evaluation, we cannot explain the weak association between summer pheasant indices and habitat abundance on the Glenwood and Faribault study areas (Figure 2). However, preliminary habitat estimates based on GIS coverages of the NWI, WMAs, WPAs, and CRP enrollments appear to have omitted much more winter and reproductive cover on the Glenwood and Faribault study areas than on Marshall and Windom study areas. Habitat estimates will be improved as we finish cover mapping the study areas. In addition, future analyses of pheasant-habitat associations will use multiple regression models that treat reproductive cover, winter cover, and winter food as independent predictor variables.

Our study design requires at least 1 severe winter to estimate pheasant winter cover needs. After 4 consecutive mild winters, we have observed relatively high, stable pheasant populations on all study areas. We expect pheasant populations to decline following a severe winter, with the largest declines on study areas with the least amount of winter cover. Unless the coming winter (2006-07) is severe, we may consider extending the study. However, the potential loss of two-thirds of CRP contracts expiring during 2007-09 will confound our ability to estimate winter cover needs.

We plan to continue to survey pheasant populations during spring and summer 2006-07. In addition, we will continue annual cover mapping of all 36 study areas. During the next moderate-severe winter, we will assess winter habitat availability in relation to snow depth and drifting. Finally, we will attempt to build a multiple regression model using data extracted from a previous pheasant habitat study (Haroldson et al. 2006).

ACKNOWLEDGMENTS

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Table 1. Pheasant population indices and sex ratios (female:male) after 10 repeated surveys (n) on 36 study areas in Minnesota, spring 2005.

			Birds/route[a]			
Region	Study area	n	Total	Cocks	Hens	F:M ratio
Marshall	1	10	133.3	61.0	72.3	1.2
	2	10	103.3	53.8	49.6	0.9
	3	10	184.5	88.8	95.6	1.1
	4	10	172.0	55.5	116.5	2.1
	5	10	45.8	25.0	20.8	0.8
	6	10	164.2	57.5	106.6	1.9
	7	10	85.5	35.9	49.5	1.4
	8	10	71.3	36.6	34.7	0.9
	9	10	33.3	14.9	18.4	1.2
Glenwood	10	10	47.0	28.0	19.0	0.7
	11	10	43.2	19.5	23.7	1.2
	12	10	142.9	72.9	70.0	1.0
	13	10	61.7	33.0	28.7	0.9
	14	10	66.7	32.5	34.2	1.1
	15	10	205.6	91.2	114.4	1.3
	16	10	56.2	35.2	21.0	0.6
	17	10	22.3	14.0	8.3	0.6
	18	10	114.8	35.6	79.2	2.2
Windom	19	10	293.7	75.3	218.4	2.9
	20	10	232.0	113.4	118.6	1.0
	21	10	120.1	44.6	75.5	1.7
	22	10	225.6	93.9	131.8	1.4
	23	10	228.7	105.9	122.8	1.2
	24	10	119.0	43.5	75.5	1.7
	25	10	130.8	43.0	87.9	2.0
	26	10	110.5	43.9	66.7	1.5
	27	10	47.8	21.7	26.1	1.2
Faribault	28	10	118.9	52.8	66.0	1.3
	29	10	92.2	54.4	37.9	0.7
	30	10	32.3	18.5	13.7	0.7
	31	10	65.7	49.0	16.7	0.3
	32	10	66.1	35.6	30.5	0.9
	33	10	42.2	31.9	10.3	0.3
	34	10	48.2	30.3	18.0	0.6
	35	10	34.8	21.4	13.4	0.6
	36	10	15.0	7.5	7.5	1.0

[a]Route length standardized to 161 km (100 miles).

Table 2. Regional trends (% change) in pheasant population indices on 36 study areas in Minnesota, spring 2003–2005.

Region	Group	n	Birds/route[a] 2003	2004	2005	% change 2004-2005	95% CI
Marshall	Total pheasants	9	87.2	116.3	110.4	8	±35
	Cocks	9	43.1	47.4	47.7	11	±33
	Hens	9	44.1	68.9	62.7	8	±44
Glenwood	Total pheasants	9	100.9	113.0	84.5	-10	±30
	Cocks	9	48.7	47.2	40.2	3	±36
	Hens	9	52.2	65.9	44.3	-20	±28
Windom	Total pheasants	9	162.3	179.7	167.6	3	±23
	Cocks	9	69.4	75.8	65.0	-11	±16
	Hens	9	92.9	103.9	102.6	19	±37
Faribault	Total pheasants	9	70.3	86.0	57.3	-28	±25
	Cocks	9	37.1	47.1	33.5	-28	±16
	Hens	9	33.2	38.8	23.8	-18	±46
All	Total pheasants	36	105.2	123.8	104.9	-7	±13
	Cocks	36	49.6	54.4	46.6	-6	±12
	Hens	36	55.6	69.4	58.3	-3	±18

[a]Route length standardized to 161 km (100 miles).

Table 4. Regional trends (% change) in pheasant population indices on 36 study areas in Minnesota, summer 2003–2005.

Region	Group	n	Birds/route[a] 2003	2004	2005	% change 2004-2005	95% CI
Marshall	Total pheasants	9	142.6	114.9	190.5	119	±95
	Cocks		12.7	13.5	10.5	15	±61
	Hens		25.6	20.5	32.3	168	±190
	Broods		22.3	16.8	35.0	172	±122
	Chicks/brood		4.6	4.8	4.2	–10	±7
	Broods/100 spring hens		59.9	29.8	77.2	260	±246
Glenwood	Total pheasants	9	139.9	57.9	135.7	140	±87
	Cocks		9.2	8.3	8.0	24	±48
	Hens		23.5	12.3	20.7	64	±59
	Broods		20.2	8.3	17.2	122	±103
	Chicks/brood		5.0	4.1	6.1	38	±18
	Broods/100 spring hens		44.7	14.7	42.8	240	±146
Windom	Total pheasants	9	283.5	180.1	187.0	9	±38
	Cocks		25.9	23.6	13.8	–38	±15
	Hens		50.9	36.3	37.4	3	±32
	Broods		36.2	24.2	29.4	29	±48
	Chicks/brood		5.4	5.0	4.6	–8	±11
	Broods/100 spring hens		47.1	29.1	30.2	35	±78
Faribault	Total pheasants	9	164.6	54.4	90.5	60	±29
	Cocks		9.5	13.0	8.0	–30	±22
	Hens		23.6	13.1	14.8	16	±24
	Broods		23.6	6.8	12.6	85	±20
	Chicks per brood		5.5	5.0	5.5	23	±22
	Broods/100 spring hens		85.4	18.6	71.0	293	±175
All	Total pheasants	36	182.6	101.8	150.9	82	±33
	Cocks		14.3	14.6	10.1	–7	±19
	Hens		30.9	20.5	26.3	63	±48
	Broods		25.6	14.0	23.6	102	±39
	Chicks/brood		5.1	4.7	5.1	10	±9
	Broods/100 spring hens		59.3	23.1	55.3	207	±80

[a]Route length standardized to 161 km (100 miles).

Table 3. Pheasant population indices and sex ratios (female:male) after 10 repeated surveys (n) on 36 study areas in Minnesota, summer 2005.

Region	Study area	n	Birds/route[a] Total	Cocks	Hens	F:M ratio	Chicks/ route[a]	Broods/ route[a]	Chicks/ brood	Broods/100 summer hens	Broods/100 spring hens
Marshall	1	10	174.8	13.1	27.5	2.1	134.2	29.7	4.5	108.2	41.1
	2	9	189.8	6.9	34.7	5.0	148.1	39.8	3.7	114.7	80.3
	3	10	101.9	14.6	18.4	1.3	68.9	14.6	4.7	78.9	15.2
	4	10	258.0	9.5	56.5	5.9	192.0	46.0	4.2	81.4	39.5
	5	10	156.7	12.1	27.1	2.2	117.5	35.0	3.4	129.2	168.0
	6	10	302.8	8.5	50.9	6.0	243.4	55.7	4.4	109.3	52.2
	7	10	145.5	6.4	25.5	4.0	113.6	27.3	4.2	107.1	55.0
	8	10	274.0	14.0	32.0	2.3	228.0	48.0	4.8	150.0	138.5
	9	10	111.4	9.6	18.4	1.9	83.3	19.3	4.3	104.8	104.8
Glenwood	10	10	133.0	3.0	15.0	5.0	115.0	14.0	8.2	93.3	73.7
	11	10	53.4	8.5	10.2	1.2	34.7	7.6	4.6	75.0	32.1
	12	10	167.6	5.7	28.6	5.0	133.3	21.9	6.1	76.7	31.3
	13	10	113.9	6.1	17.4	2.9	90.4	17.4	5.2	100.0	60.6
	14	10	201.8	7.5	25.9	3.5	168.4	29.8	5.6	115.3	87.2
	15	10	223.3	8.4	38.1	4.6	176.7	28.8	6.1	75.6	25.2
	16	10	65.7	11.0	11.0	1.0	43.8	8.6	5.1	78.3	40.9
	17	10	2.5	2.5	0.0	0.0	0.0	0.0	.	.	0.0
	18	10	260.2	19.4	39.8	2.0	200.9	26.9	7.5	67.4	33.9
Windom	19	10	175.8	18.4	36.3	2.0	121.1	26.3	4.6	72.5	12.0
	20	10	259.6	11.4	65.4	5.7	182.8	54.0	3.4	82.5	45.5
	21	10	202.1	9.5	43.2	4.6	149.5	33.7	4.4	78.0	44.6
	22	10	125.5	17.6	30.2	1.7	77.6	19.0	4.1	62.7	14.4
	23	10	372.3	18.8	73.3	3.9	280.2	57.4	4.9	78.4	46.8
	24	10	96.0	14.0	16.0	1.1	66.0	14.0	4.7	87.5	18.5
	25	10	180.4	11.7	32.2	2.8	136.4	22.4	6.1	69.6	25.5
	26	10	249.1	14.9	36.0	2.4	198.2	34.2	5.8	95.1	51.3
	27	10	22.6	7.8	4.3	0.6	10.4	3.5	3.0	80.0	13.3
Faribault	28	10	110.4	13.2	20.8	1.6	76.4	20.8	3.7	100.0	31.4
	29	10	57.3	10.7	3.9	0.4	42.7	5.8	7.3	150.0	15.4
	30	10	95.2	4.4	12.5	2.8	78.2	11.3	6.9	90.3	82.4
	31	10	84.3	11.8	16.7	1.4	55.9	11.8	4.8	70.6	70.6
	32	10	82.2	5.1	20.3	4.0	56.8	15.3	3.7	75.0	50.0
	33	10	179.9	3.5	28.2	8.0	148.1	23.8	6.2	84.4	230.2
	34	10	163.2	11.8	22.4	1.9	128.9	20.2	6.4	90.2	112.2
	35	10	20.4	6.2	2.7	0.4	11.5	1.8	6.5	66.7	13.2
	36	10	21.7	5.0	5.8	1.2	10.8	2.5	4.3	42.9	33.3

[a]Route length standardized to 161 km (100 miles).

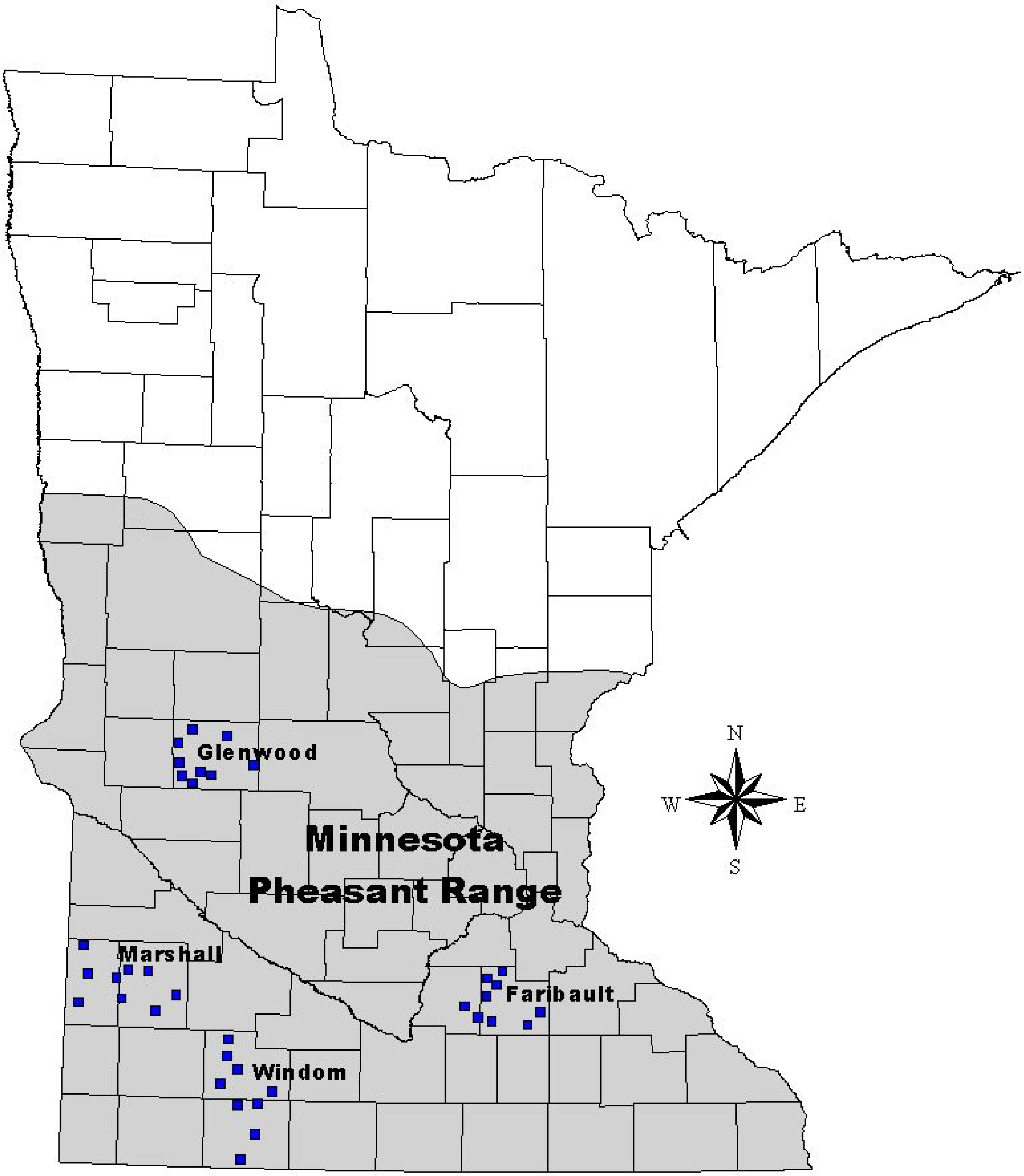

Figure 1. Locations of winter-habitat study areas within Minnesota's pheasant range, 2003-2005.

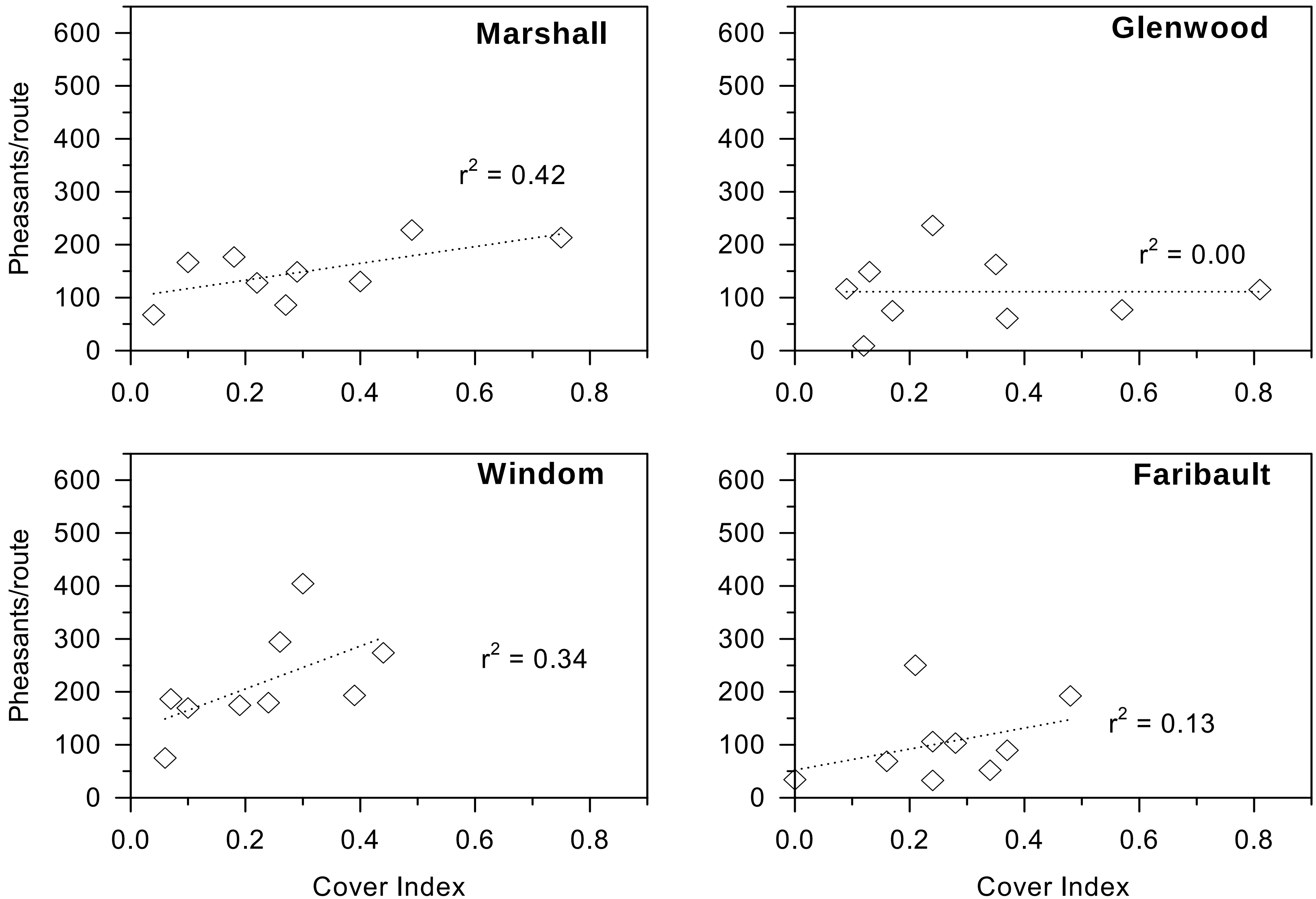

Figure 2. Relationship between relative pheasant abundance (pheasants counted/route) and amount of habitat (cover index) on 9 study areas in 4 regions in Minnesota during summer 2003-05. Route length was standardized to 161 km (100 miles).

2005 MINNESOTA SPRING TURKEY HUNTER AND LANDOWNER SURVEY

Allison M. Boies[1], Sharon L. Goetz, Richard O. Kimmel, and John D. Krenz

SUMMARY OF FINDINGS

Increased spring wild turkey (*Meleagris gallopavo)* hunter densities have resulted in concerns regarding hunt quality, hunter safety, and landowner tolerance of turkey hunters. This study assesses hunter satisfaction and landowner attitudes at current spring turkey hunter densities in Minnesota. A spring turkey hunter and landowner survey was conducted in 10 hunting permit areas (PAs) during the 2005 season to evaluate hunter satisfaction and landowner attitudes about turkey hunters at varying hunter densities. Spring 2005 surveys showed overall landowner attitudes were positive, and most hunters found it easy to gain access to private land. Interference by hunters or other individuals was infrequent. Based on hunter satisfaction and landowner attitudes, 2005 results showed hunt quality was high at a hunter density of 0.63 hunters/km^2 (1.62 hunters/mi^2) of huntable habitat. After completion of the spring 2006 hunter and landowner survey in 10 additional PAs, we will conduct further analysis to determine the relationship between hunter density, landowner attitudes, and hunter interference.

INTRODUCTION

It is important to carefully allocate permit numbers to ensure hunter safety, limit hunter access problems, ensure landowner and hunter satisfaction, maintain hunt quality, and best manage the wild turkey population. Kimmel (2001) noted that season management strategies in Minnesota initially restricted numbers of hunting permits to protect developing wild turkey populations. Currently, permit numbers are restricted to ensure hunt quality. Interference and hunting access are the most important factors that define a high-quality hunt (Smith et al. 1992). Dingman (2006) found that current hunter interference levels were shown to not significantly affect hunter satisfaction. Managers in southeastern Minnesota have expressed concern that increasing hunter densities would impact landowner tolerance of turkey hunters, which could lead to hunting access issues (G. Nelson, Minnesota Department of Natural Resources, personal communication).

For the spring 2005 turkey hunting season PA 343 had the highest hunter density at 0.63 hunters/km^2 of huntable habitat (forested areas with a 50 m buffer; 0.95 hunters/km^2 of forested habitat). Kubisiak et al. (1995) found that increasing hunter densities in southeastern Wisconsin to 1.16 hunters/km^2 (3.0 hunters/mi^2) of forested habitat had little impact on either hunters or landowners. Subsequently, Wisconsin Department of Natural Resources has increased hunter densities to 2.3 hunters/km^2 (>6 hunters/mi^2) of forested habitat in some areas (K. Warnke, Wisconsin Department of Natural Resources, personal communication). Hunter interest groups, in particular the Minnesota Chapter of the National Wild Turkey Federation, are aware of higher turkey hunter densities in Wisconsin and are requesting that the Minnesota Department of Natural Resources increase spring wild turkey hunting permit numbers. The goal of the first year of this 2-year study was to collect data to evaluate hunter access, safety, interference, and hunt quality on 10 PAs. Data from this survey will be used to determine relationships between hunter density and other variables such as hunter interference and landowner attitudes.

METHODS

Permit Area Selection

[1] Department of Biological Sciences, Minnesota State University-Mankato, Mankato, MN 56001, USA

We selected 10 PAs that had a range of hunter densities for the 2005 hunter and landowner surveys (Figure 1). These PAs included the highest hunter densities found in Minnesota during the spring 2005 turkey hunting season. Sampling criteria required selected PAs to contain more than 15 permits per hunting time period, be located in south-central or southeastern Minnesota, and contain a range of hunter densities.

Hunter and Landownctioner Selection

Hunters were randomly selected using Minnesota's Electronic License System database of spring turkey hunting permit recipients. Hunters were only sampled from the first 6 hunting time periods due to an unrestricted archery turkey hunting season during the last 2 time periods.

A sample of landowners was drawn from each selected PA using a database developed from county tax parcel data. Criteria for surveyed landowners included: ownership of at least 100 acres of land that intersects huntable turkey habitat, parcels located outside of city limits, and exclusion of non-agricultural businesses and organizations. Each parcel was evaluated with ArcView (Environmental Systems Research Institute, Redlands, CA, USA). County parcel shapefiles (taxpayer address, parcel size, and parcel location) were obtained from county tax role data. A huntable turkey habitat shapefile was used to determine location of wild turkey habitat in each selected PA (Ramseth 2004). A city limit shapefile that identifies subdivisions and limits was also obtained for each county. The shapefiles were all projected in UTM zone 15 coordinate system (Manual 1) from Lambert Conformal Conic.

County parcel shapefiles were queried to eliminate parcels of land that were less than 100 acres in size or that fell within city limits. Parcels of land that intersected the shapefile of huntable turkey habitat in each PA were selected in ArcView. The resulting database file was then exported to Microsoft Excel and queried by name and address to eliminate duplicate records, government entities, and out-of-state mailing addresses.

Survey Methodology

The hunter survey instrument evaluated hunter satisfaction at varying hunter densities. The survey consisted of questions regarding hunter success, access, satisfaction, number of days hunted, time period, and interference from other hunters (Appendix A). For the spring 2005 wild turkey hunter survey, 2,144 surveys were mailed to a sample of turkey hunt permit holders in 10 PAs (Figure 1). The selected hunters were mailed a survey and return envelope on the last day of the last time period of the spring turkey hunting season, (27 May 2005). A second and third mailing were then sent to non-respondents at 3-week intervals (20 June 2005 and 12 July 2005).

The landowner survey instrument evaluated landowner attitudes about hunters at various hunter densities. The survey contained questions regarding landowner attitudes about allowing access for spring turkey hunting, trespass, and the number of hunters requesting permission (Appendix B). For the spring 2005 landowner survey, 2,077 surveys were mailed 5 days after the close of the hunting season to landowners in 10 PAs randomly picked from all landowners meeting selection criteria. Selected landowners were sent a survey and a return envelope on 1 June 2005. Three additional mailings were sent to non-respondents at 4 and 5-week intervals (29 June 2005, 5 August 2005, and 3 September 2005).

RESULTS

We received a response rate of 74% for the hunter survey. The average number of turkeys seen by hunters was 21.6. The average number of turkeys shot at was 0.8. Hunters were more successful at harvesting turkeys in the morning (81%) than in the afternoon (19%). A total of 38% of hunters were successful at harvesting a turkey.

The majority of hunters hunted on private land (75%) and of these hunters, an average of 0.66 landowners refused access. Access to a hunting location was reported as either extremely easy (42%) or somewhat easy (38%) for the majority of hunters (Figure 2). Overall, 98% of hunters felt other hunters did not put them in danger at any time while hunting.

Overall, 91% (1,403) of hunters saw 0-2 hunters that were not part of their own hunting group. The rate of interference from other hunters was 13% (Figure 3), and 10% from non-hunters. Interference rates from other hunters in all the PAs were below 21% (Table 1). Eighty-four percent (1,261) of turkey hunters rated hunt quality average or above average (Figure 4).

We received a response rate of 64% for the landowner survey. The top 2 reasons for landownership were farming and preserving the land for the future. Ninety-seven percent of landowners reported they did not lease their land for spring turkey hunting. Overall, 65% of landowners reported seeing turkeys on their land in the past year.

Ninety-five percent of landowners did not personally hunt turkeys on their land during spring 2005. Overall, 36% of landowners were asked for permission to hunt their land by each of the following groups: family (450), acquaintances (415), and strangers (310; Figure 5). Thirty-one percent of landowners did not allow any hunters to hunt their land from the following groups: family (388), acquaintances (358), and strangers (208; Figure 6). Landowners who allowed 1 or more hunters on their property were more likely to allow friends or family (38.4%) compared to acquaintances (37.8%) or strangers (19.3%; Figure 6).

The majority (71%) of landowners reported that the number of hunters asking permission to hunt stayed the same over the past 5 years (Figure 7). Landowners most often (67%) neither agreed nor disagreed that there were too many hunters wanting to hunt their land (Figure 8). Seventy-six percent of landowners did not have hunter trespass problems on their land during the spring hunting season. Overall, 70% of landowners did not post their land to control hunter access.

DISCUSSION

Hunter access was not indicated as a problem for turkey hunters in 10 PAs during the 2005 spring season in Minnesota. Most hunters used private land for hunting and the majority found access to be easy. Hunter requests for hunting access were rarely denied. Hunters saw few individuals while hunting, and interference rates were low, which likely led to greater hunter safety and satisfaction. Hunt quality ratings were high.

Landowner attitudes about spring wild turkey hunters were positive. Trespassing issues were very low and posting land was not used to control hunting. Landowner perception of hunter density did not indicate they felt too many hunters were asking for permission to hunt. The majority of landowners did not feel that hunter density had increased over the past 5 years.

The data indicated that hunters were not concerned with access issues, interference rates, and safety. Landowner attitudes about hunters were positive and indicated that landowners did not feel pressured by hunters requesting access. The study indicated hunter satisfaction and landowner tolerance of hunters was positive in all the sampled PAs including PA 343, which had the highest hunter density in Minnesota in spring 2005. Thus, hunter density during the spring turkey season does not appear to be an issue for hunters or landowners at current levels, even in 2 PAs that had permit increases of $\geq$ 25% for the 2005 hunt.

In the second year of the project we will survey spring turkey hunters and landowners during the 2006 season in 10 additional PAs (Figure 1). The 2005 and 2006 landowner and hunter survey results will be used to determine impacts of hunter density and other variables on hunter interference and landowner tolerance of hunters. We will compare hunter interference and landowner attitude responses at varying hunter densities. This study will help to allocate permits at levels that will ensure a quality spring wild turkey hunt.

ACKNOWLEDGEMENTS

We would like to thank J. Krenz and J. Guidice for statistical and study design consulting, T. Klinkner for assisting in survey mailings, and B. Abel for data entry.

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Table 1. Hunter interference rates from the 2005 spring turkey hunter survey in Minnesota.

Permit Area	**Hunter Density** (hunters/buffered mi^2)	**Interference Rate** (%)	**Hunt Quality**
337	0.92	0.07	7.56
339	0.87	0.15	6.94
343	1.61	0.10	7.66
344	1.51	0.20	6.32
348	1.10	0.13	6.92
349	1.62	0.15	6.64
443	0.87	0.10	6.49
463	0.29	0.05	6.66
464	0.42	0.09	6.49
466	0.43	0.13	7.09

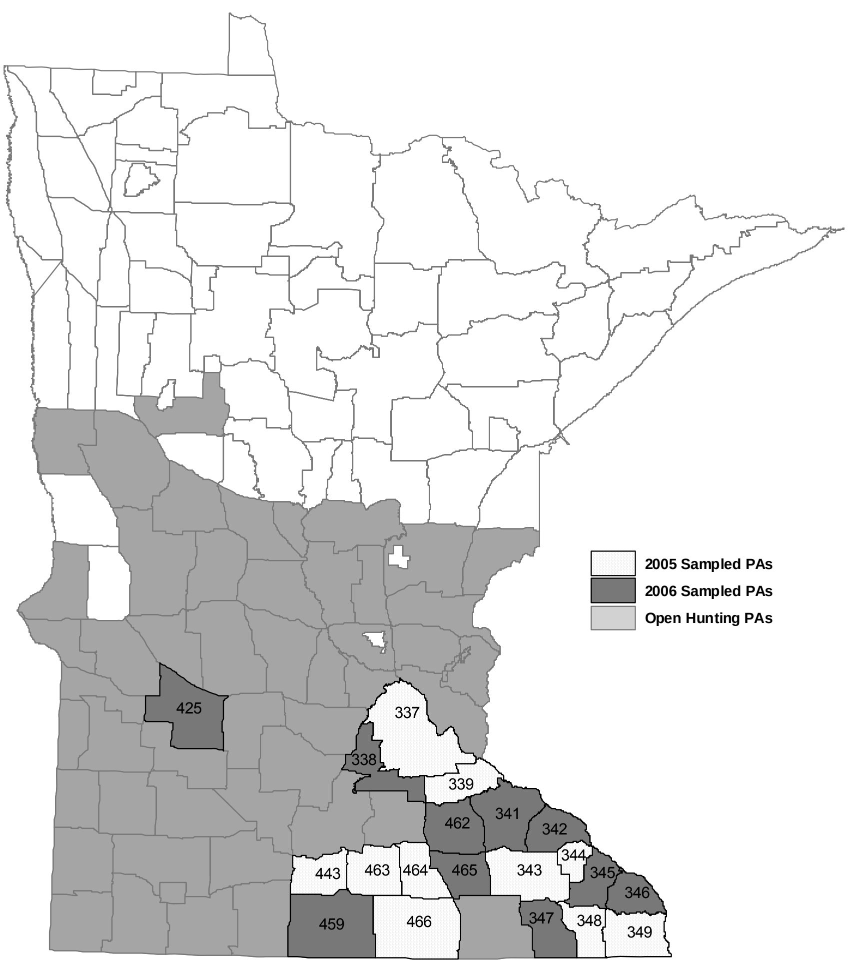

Figure 1. Permit areas (PAs) sampled during the 2005 and 2006 Minnesota spring turkey hunter and landowner survey.

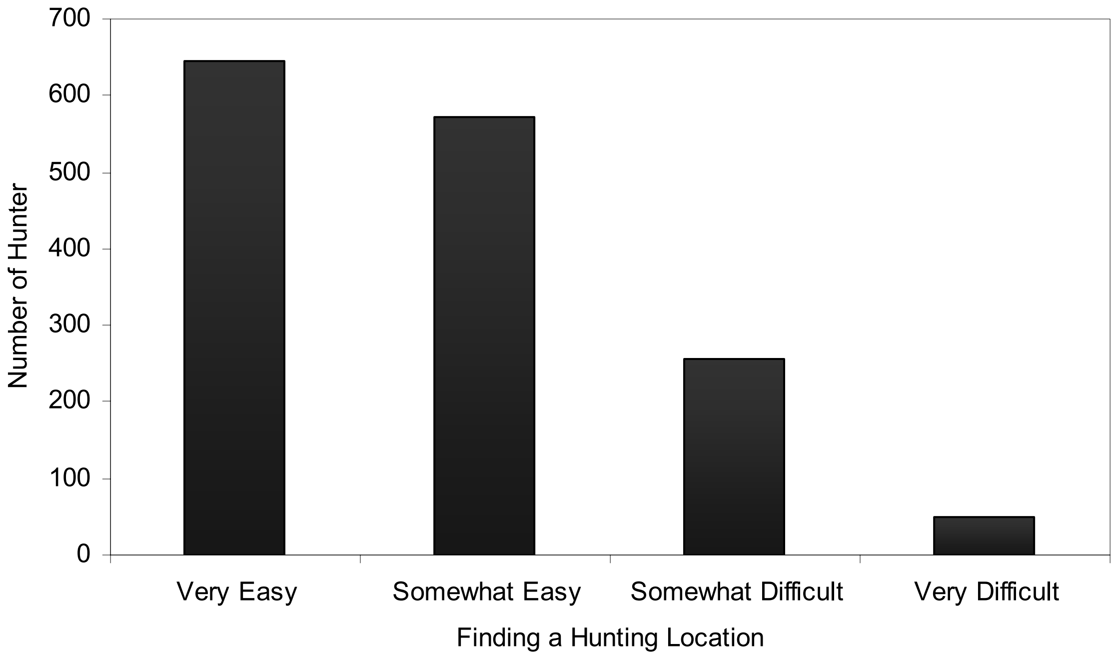

Figure 2. Difficulty ratings of finding a hunting location by Minnesota spring wild turkey hunters, April-May 2005.

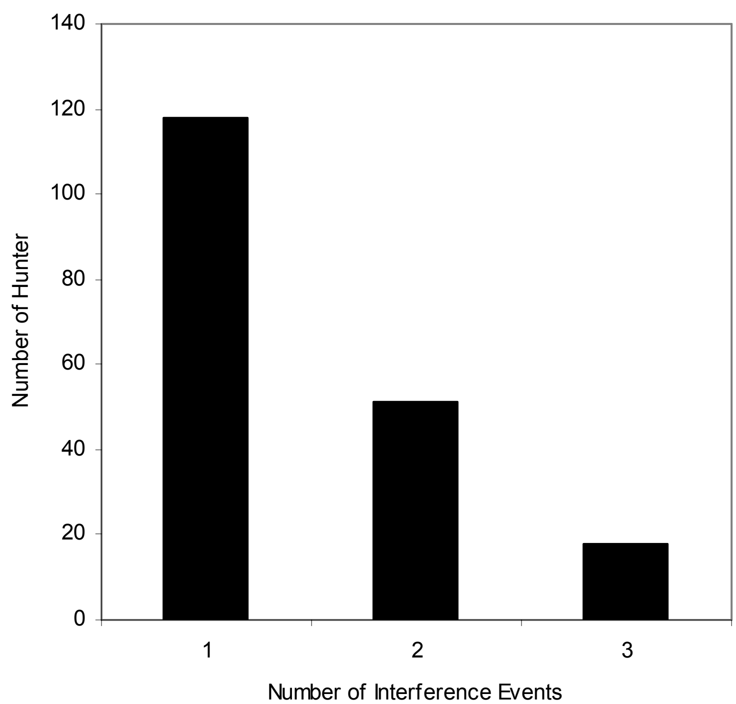

Figure 3. Number of times hunters were interfered with by other hunters while hunting during the Minnesota spring wild turkey season, April-May 2005.

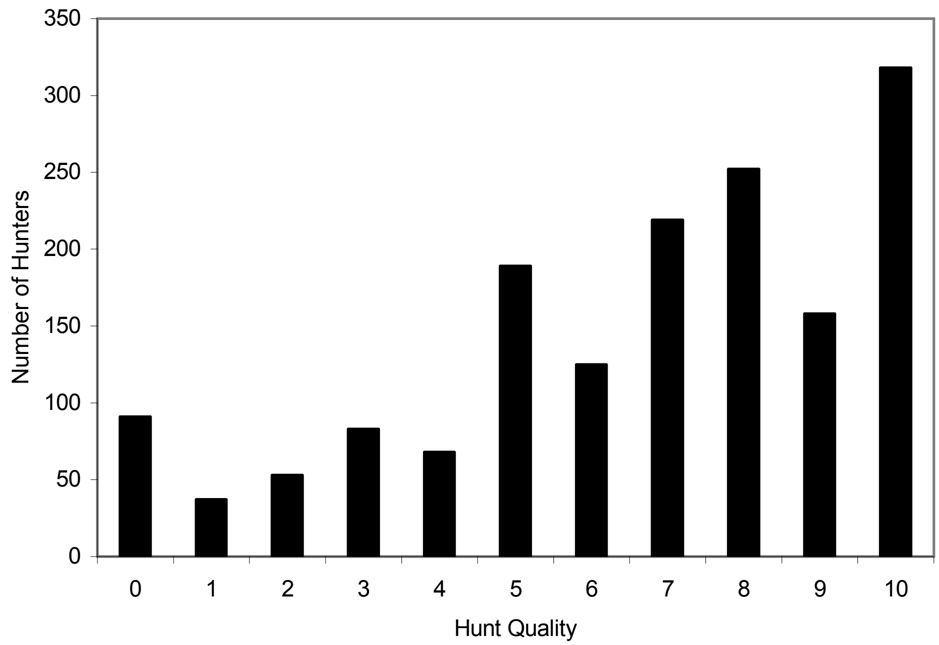

Figure 4. Hunt quality for the Minnesota spring wild turkey hunting season, April-May 2005.

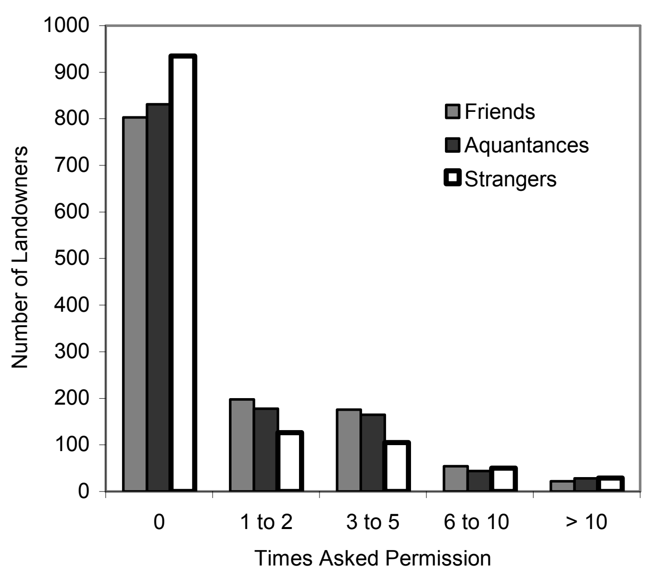

Figure 5. Number of times landowners were asked for permission to hunt their land by hunters for the Minnesota spring wild turkey season, April-May 2005

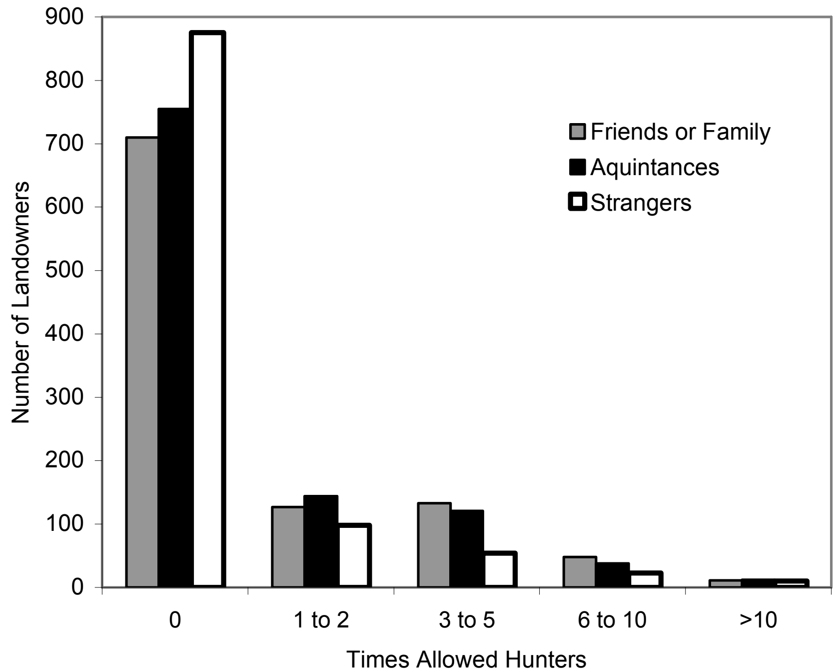

Figure 6. Number of times landowners granted hunting permission on their land during the Minnesota spring wild turkey season, April-May 2005.

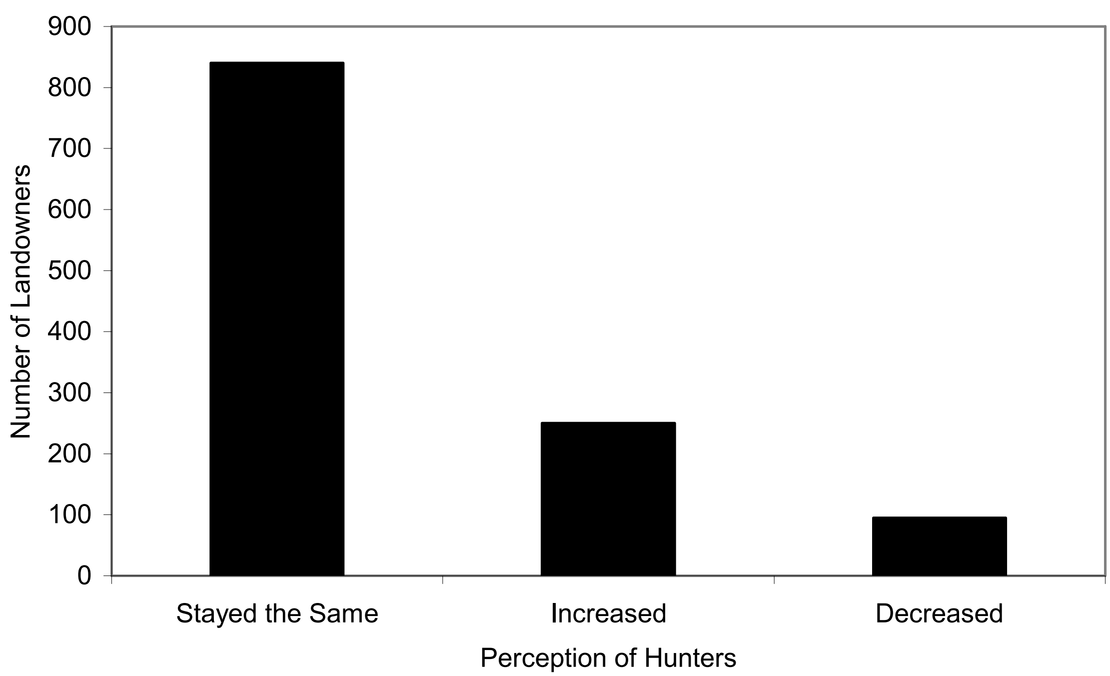

Figure 7. Landowner perception of the number of hunters requesting permission to hunt their land over the past 5 years, April-May 2005.

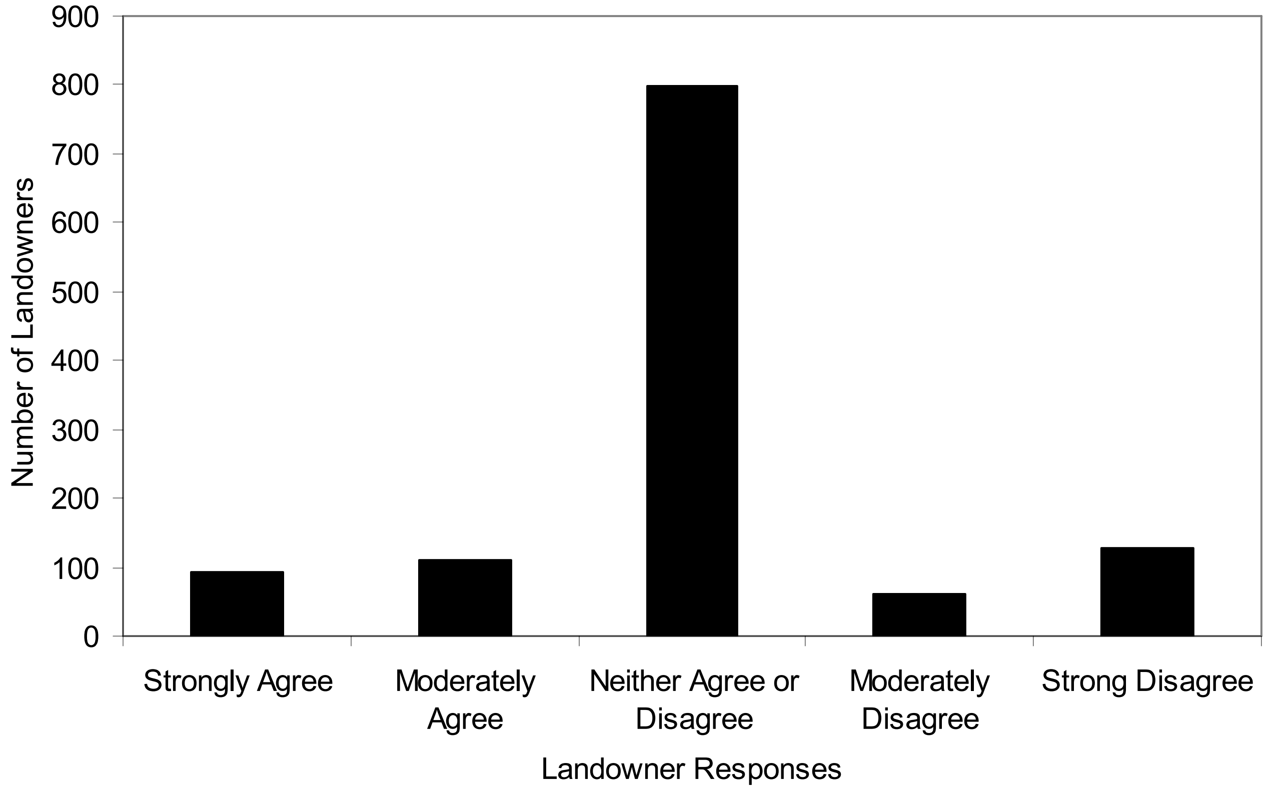

Figure 8. Landowner responses when asked if too many hunters wanted to hunt their land during the Minnesota spring wild turkey season, April-May 2005.

Appendix A. Hunter instrument for the 2005 Minnesota spring wild turkey hunting season survey.

Minnesota Spring Turkey Hunter Survey
*Please respond to all questions based on the
SPRING 2005 TURKEY SEASON.

1. Did you hunt turkeys in Minnesota during the spring 2005 season? Yes____ No*____
   *If no, you do not need to continue but please return survey.

2. Which wild turkey permit area did you hunt in? __________

3. Did you have a landowner permit or a regular lottery permit?
   Landowner____Regular Lottery____

4. Which season did you hunt? April 13-17___ April 18- 22___ April 23-27___ April 28-May 2___ May 3-7___ May 8-12___ May 13-19___ May 20-26___

5. How many days did you hunt turkeys during spring 2005? __________

6. How did you hunt turkeys in 2005? Shotgun only____ Bow Only____ Shotgun and Bow___

7. How many turkeys did you see while turkey hunting in 2005? __________

8. How many turkeys did you shoot at? __________

9. Were you successful in bagging a turkey? Yes*____ No____
   *If yes, was it killed in the morning or afternoon? AM____ PM____
   *If yes, with what weapon did you harvest your turkey? Shotgun____ Bow____

10. How difficult was it for you to find a place to hunt during the spring 2005 wild turkey hunting season? (check one answer)
    Very easy____ Somewhat easy____ Somewhat difficult____ Very difficult____

11. Did you hunt on public land or private land during the spring 2005 season?
    Public____ Private*____ Both____
    *If you hunted on private land, how many landowners turned down your request for permission? ____

12. Did you at any time feel you were put in danger by other hunters while turkey hunting?
    Yes____ No____

13. On average, how many hunters, other than members of your own party, did you see each day while you were actually in the field hunting during spring 2005?
    ____

14. How many times did hunters, other than members of your own party, interfere with your hunting during spring 2005? __________

15. How many times did people **other than hunters** interfere with your hunting during spring 2005? ___

16. Rate the quality of your turkey hunting experience during spring 2005 on a scale of 0-10 (check one number):

    Poor Quality Average Quality Excellent Quality

    0____ 1____ 2____ 3____ 4____ 5____ 6____ 7____ 8____ 9 ____ 10____

Appendix B. Landowner instrument for the 2005 Minnesota spring wild turkey hunting season survey.

Minnesota Spring Turkey Hunt Landowner Survey

*Please respond to all questions based on your land in County for the SPRING 2005 Turkey Hunting Season.

1. How many total acres of land do you own in «COUNTY» County?

   Acres Cropland__________ Acres Woodland __________ Other Acres__________

2. How long have you owned your land?

   ☐ 0-5 years ☐ 6-10 years ☐ > 10 years

3. Is your primary residence on this land?

   ☐ Yes ☐ No

4. Which of the following are reasons why you own this property? (Please check all that apply)

   ☐ I use it to make a living farming.
   ☐ I use it for non-hunting recreational purposes.
   ☐ I want to preserve the land for the future.
   ☐ I like the wildlife that lives on my land.
   ☐ I use it for hunting.
   ☐ I am using this land for investment or development.
   ☐ Other. Please specify:______________________________________

5. Do you currently lease out any of your land for farming, spring turkey hunting, or other hunting? (Please check one response for each item.)

For farming	☐ Yes	☐ No
For spring turkey hunting	☐ Yes	☐ No
For other hunting	☐ Yes	☐ No

6. Have you seen wild turkeys on your land in the past year?

   ☐ Yes ☐ No

7. Did you personally hunt wild turkeys on your land during spring 2005?

   ☐ Yes ☐ No

8. During the spring of 2005, how many turkey hunters **asked permission to hunt** on your land that were family or friends, acquaintances, or strangers? (Please check one box for each category.)

Friends or Family	☐ 0	☐ 1-2	☐ 3-5	☐ 6-10	☐ >10
Acquaintances	☐ 0	☐ 1-2	☐ 3-5	☐ 6-10	☐ >10
Strangers	☐ 0	☐ 1-2	☐ 3-5	☐ 6-10	☐ >10

9. During the spring of 2005, how many turkey hunters did you **allow to hunt** on your land that were family or friends, acquaintances, or strangers? (Please check one box for each category.)

Friends or Family	☐ 0	☐ 1-2	☐ 3-5	☐ 6-10	☐ >10
Acquaintances	☐ 0	☐ 1-2	☐ 3-5	☐ 6-10	☐ >10
Strangers	☐ 0	☐ 1-2	☐ 3-5	☐ 6-10	☐ >10

10. Over the past 5 years do you think the number of hunters requesting permission to hunt wild turkeys during the spring season on your land has increased, decreased, or stayed the same?

☐ Increased
☐ Decreased
☐ Stayed the same

11. How do you feel about the following statement: There are too many spring turkey hunters requesting permission to hunt on my land?

☐ Strongly agree
☐ Moderately agree
☐ Neither agree or disagree
☐ Moderately disagree
☐ Strongly disagree

12. How do you feel about the number of hunters requesting permission to hunt on your land?

☐ Way too many
☐ Too many
☐ Just Right
☐ Too few
☐ Way too few

13. Did you have a problem with hunters trespassing on your property during the 2005 spring turkey hunt?

☐ Yes ☐ No

14. Do you post signs on your land in an effort to control hunter access?

☐ Yes ☐ No

Please provide any additional comments.

2005 MINNESOTA SPRING WILD TURKEY ARCHER SURVEY

Sharon L. Goetz, Bryan J. Abel, and Allison M. Boies[1]

SUMMARY OF FINDINGS

The addition of an archery season during the last 2 time periods (G and H) of the 2005 spring wild turkey (*Meleagris gallopavo*) hunting season lead to concerns about potential impacts on hunter density and hunt quality. An archer survey instrument modified from the traditional spring turkey hunter survey was used to collect information on hunting pressure, hunter density, and interference rates by permit area hunted. The addition of 2,210 archers on the landscape did increase hunter density in some permit areas, however interference rates and hunt quality did not appear to be negatively impacted in the 25 permit areas open for the archery season.

INTRODUCTION

Spring wild turkey (*Meleagris gallopavo*) hunter surveys are conducted after the completion of the spring hunting season to gather hunter information, such as hunter interference rates that are used in the spring permit allocation model (Kimmel 2001). Estimates of hunt quality obtained from these surveys are used in making future spring hunting management decisions.

Beginning in 2005, resident and nonresident turkey hunters were able to purchase an archery license for the final 2 time periods (G and H) for any permit area with ≥50 permits available per time period. Both hunters unsuccessful in the lottery and those who never applied are eligible for the archery season. This survey was conducted to provide information regarding the 25 permit areas that qualified for the archery season, and potential impacts on hunter density and interference rates. Although successful lottery applicants can use a bow during the regular season, this survey focuses on archers who purchased an archery season permit.

METHODS

Hunters who purchased archery licenses were randomly selected from the Electronic License System (ELS) database of spring turkey hunting recipients. A total of 2,210 hunters purchased an archery license. The survey instrument (Appendix A), modified from precious spring wild turkey hunter surveys, was mailed to 496 archery license holders. Three survey mailings were conducted with second and third mailings were sent to non-respondents. The first mailing was sent 6 June 2005, the second on 29 June 2005, and the final on 9 August 2005.

RESULTS

Overall 366 surveys were returned for a response rate of 74%. Of the survey respondents, 332 (91%) stated they hunted the spring 2005 archery season.

All 25 permit areas open to the archery season were hunted by archery hunters, along with 3 others that were not designated for archery hunting (Permit areas 228, 235, 410; Figure 1). Permit areas 236 and 343 were each hunted by 10% of the sample (~33 hunters). Permit areas 337, 341, and 442 each accounted for 4-6% of the sample with 14, 14, and 19 hunters, respectively. All other permit areas hunted accounted for less than 4% of the sample each, and hunter numbers ranged from 1 to 11. A total of 94 hunters (28%) did not specify or entered invalid permit area information.

Spring 2005 archery hunters hunted an average of 4.2 days, saw an average of 11.3 wild turkeys, and shot at an average of 0.5 turkeys. Based on survey results, there were 48 wild turkeys registered in 13 different permit areas (Figure 2) for a success rate of 14.5%.

[1]Department of Biological Sciences, Minnesota State University-Mankato, Mankato, MN 56001, USA

Experienced bow hunters tagged a majority of the wild turkeys registered, with 46 successful hunters stating they had archery hunted big game in the past. Only 14% (54) of respondents stated they had never archery hunted prior to spring 2005.

Morning proved to be the best time to harvest a turkey with 42 turkeys shot, compared to 6 turkeys harvested in the afternoon. The majority of archers hunted private land (88%), 14% hunted both public and private land, while only 6% hunted solely on public land. Hunters spending most of their time hunting during time period G (13-19 May) shot 58% of the harvested turkeys (28); with 15 turkeys harvested by hunters focusing effort in time period H (20-26 May). Twenty-six hunters stated they hunted both time periods equally.

The majority of hunters found it was very easy (41%) or somewhat easy (36%) to find a place to hunt (Figure 3). Hunters who gained access to private land were refused by an average of 0.7 landowners.

A majority of the hunters (71%) did not see another hunter while in the field. Only 11% of spring archery hunters experienced at least one interference event. Hunt quality was rated average or above by 80% of archers (Figure 4).

DISCUSSION

The opening of an archery season, an additional spring turkey hunting opportunity, during the last 2 time periods (G and H) of the 2005 season raised concerns about potential impacts on hunter density and hunt quality, particularly in areas that already have hunter densities >0.4 hunter/km^2 (>1 hunter/mi^2) of huntable turkey habitat. Based on survey responses, hunting pressure by archers was spread evenly across seasons and time periods. Permit areas 236 and 343 had the most archers with approximately 33 individuals (10%) hunting each area. The majority of turkey hunters indicated little interference by other hunters and non-hunters, even though the addition of the archery season increased the chance of more individuals being in the woods compared to previous spring seasons. Most spring archery hunters rated the experience as average to excellent and many respondents commented that they were highly in favor of the new archery season.

At current participation levels, the archery season, although increasing hunter density in some permit areas, does not seem to have impacted hunter interference or hunt quality in eligible areas. As awareness and popularity of the new archery season grows and more individuals purchase an archery license, there is still potential for interference and hunt quality impacts in future seasons. We plan to continue to monitor impacts of the archery season on hunting pressure, hunter density, and interference rates by conducting the archery survey in spring 2006.

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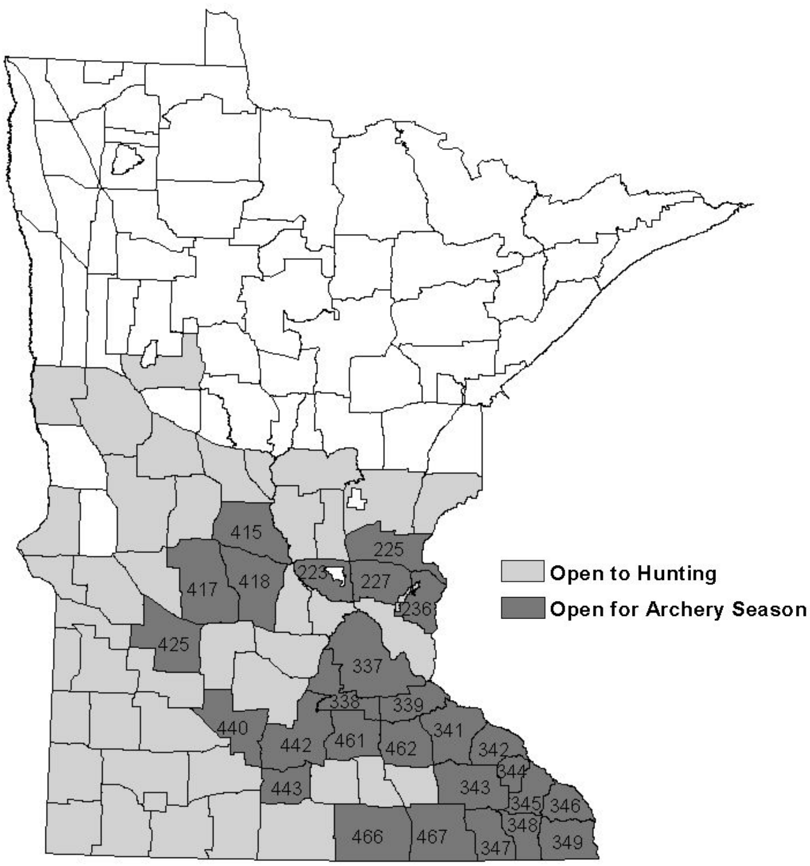

Figure 1. Permit areas open to the 2005 spring wild turkey archery season in Minnesota.

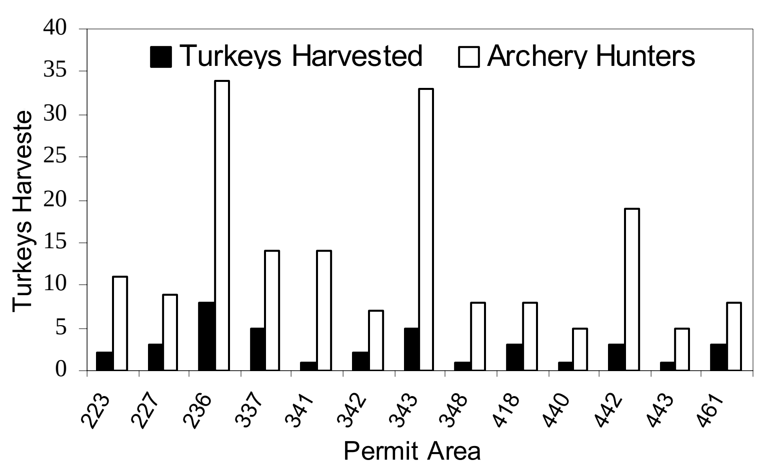

Figure 2. Turkeys harvested and the number of archery hunters by permit area for the 2005 spring archery season in Minnesota.

Figure 3. Difficulty of finding a place to hunt by 2005 spring wild turkey archery hunters in Minnesota.

Figure 4. Quality of the hunt experienced by 2005 spring wild turkey archery hunters in Minnesota.

Appendix A. Hunter instrument for the 2005 Minnesota spring wild turkey archery season survey.

Minnesota Spring Turkey Archery Survey
*Please respond to all questions based on the
SPRING 2005 TURKEY SEASON.

1. Did you hunt turkeys in Minnesota during the spring 2005 season? Yes____ No*____
   *If no, you do not need to continue but please return survey.

2. Which wild turkey permit area did you hunt the most? _______
   List all other permit areas you hunted
   ____

3. Have you bowhunted big game or wild turkeys in the past? Yes*____ No____
   *If yes, how many years have you bowhunted:

   turkey__________ deer__________ other__________

4. Which time period did you hunt the most? May 13-19___ May 20-26___

5. How many days did you hunt turkeys during spring 2005? __________

6. How many turkeys did you see while turkey hunting in 2005? __________

7. How many turkeys did you shoot at? __________

8. Were you successful in bagging a turkey? Yes*____ No____
   *If yes, was it killed in the morning or afternoon? AM______ PM_______

9. How difficult was it for you to find a place to hunt during the spring 2005 wild turkey hunting season? (check one answer)
   Very easy____ Somewhat easy____ Somewhat difficult____ Very difficult____

10. Did you hunt on public land or private land during the spring 2005 season?
    Public_____ Private*_____ Both_____
    *If you hunted on private land, how many landowners turned down your request for permission? _

11. Did you at any time feel you were put in danger by other hunters while turkey hunting?
    Yes____ No____

12. On average, how many hunters, other than members of your own party, did you see each day while you were actually in the field hunting during spring 2005? ______

13. How many times did hunters, other than members of your own party, interfere with your hunting during spring 2005? ______

14. How many times did people **other than hunters** interfere with your hunting during spring 2005? __

15. Rate the quality of your turkey hunting experience during spring 2005 on a scale of 1-10 (check one number):
    Poor Quality Average Quality Excellent Quality

    0____ 1____ 2____ 3____ 4____ 5____ 6____ 7____ 8____ 9 ____ 10____

Additional comments can be written on the back.

SURVIVAL AND HABITAT USE OF EASTERN WILD TURKEYS TRANSLOCATED TO NORTHWESTERN MINNESOTA.

Sharon L. Goetz, Brett J. Goodwin[1], and Chad J. Parent[1]

SUMMARY OF FINDINGS

Translocations of eastern wild turkeys (*Meleagris gallopavo slyvestris*) in Minnesota have increased the range as far north as a line from the St. Croix River Valley south of Duluth through the Lake Mille Lacs area and northwest to Mahnomen and Norman Counties in northwestern Minnesota. There is continued public interest for expanding wild turkey populations northward. To assess the potential for transplanting wild turkeys farther north, information on survival, habitat use, and potential depredation in agricultural areas will be explored in a 2-year research project. In winter 2006, 9 of 23 (39%) released turkeys survived the winter in Red Lake County and 7 of 22 (32%) in Pennington County.

INTRODUCTION

The current distribution of eastern wild turkeys (*Meleagris gallopavo slyvestris*) in Minnesota extends well beyond the ancestral range identified by Leopold (1931). Translocations of wild turkeys in Minnesota have increased the range from the St. Croix River Valley south of Duluth through the Lake Mille Lacs area and northwest to Mahnomen and Norman Counties in northwestern Minnesota. The Minnesota Department of Natural Resources (DNR) has had public interest for expanding wild turkey populations northward. However, additional research is needed to provide information regarding wild turkey ecology in northern habitats, the impact of winter severity on wild turkeys at the population level, and effective management techniques for northern populations.

Physiologically, wild turkeys should be able to survive northern Minnesota winters if food is available (Haroldson 1996, Haroldson et al. 1998). However, wild turkeys' ability to find food can be limited by deep snow in northern regions (Porter et al. 1983, Haroldson et al. 1998). Severe winter weather has also been associated with decreased recruitment as reduced hen body condition impacts hatching success (Porter et al. 1983). Additionally, it is becoming more apparent that wild turkeys' tolerance for human contact increases when snow conditions intensify the need for food (Kulowiec and Haufler 1985, Gillespie 2003, Moriarty and Leuth 2003). As human tolerance increases, the potential for agricultural depredations and urban turkey problems increase. Ultimately, the ecological northern limit of wild turkey distribution will likely be determined by interactions of temperature, food availability (influenced by snow cover), and habitat quality (Haroldson 1996). The objective of this 2-year study is to collect information on survival, habitat use, and potential depredation in agricultural areas before wild turkeys are transplanted into additional northwestern Minnesota counties.

STUDY AREA

We used remotely sensed data (i.e. land cover maps, aerial photos, etc.) and Geographic Information System software to identify potential wild turkey habitat in northwestern Minnesota north of the current turkey range. Landscape composition and configuration were considered in determining potential release sites that met wild turkey habitat requirements, while decreasing potential for unwanted human/turkey interactions. Landscapes with a good mix of open and forested habitats were selected, while areas where feedlots and domestic turkey farms were located were avoided. Sites that allow for future expansion of turkey

[1] University of North Dakota, 213 Starcher Hall, Grand Forks, ND 58202, USA

populations were prioritized for wild turkey study areas. Two release sites were chosen, one each in Red Lake and Pennington counties (Figure 1).

The Red Lake County release site near Red Lake Falls, Minnesota (RLF) is located in the Hardwood Hills Ecological Classification System subsection. The major land use in this subsection is agriculture with upland hardwoods surrounding lakes, on beach ridges, and steep slopes. The turkey release site is near the confluence of the Red Lake and Clearwater rivers.

Forested beach ridges and wet swales are common features of the Aspen Parkland subsection where the Pennington County release site near Thief River Falls (TRF) is located. The release site will be located on a beach ridge. Beach ridges and river corridors provide opportunity for turkey expansion by following the north-south running beach rides and traveling along riparian corridors.

The average number of days per year where snow depths were greater than or equal to 30 cm (12 inches) varies from 30 to 40 days in the portions of Pennington and Red Lake county surrounding the release sites (MCWG 2005).

METHODS

Wild turkeys were captured from established flocks in Minnesota during January-March 2006 using rocket nets (Bailey 1980). Trapping was conducted by DNR trapping crews. Captured wild turkeys were weighed, aged (juvenile or adult), leg-banded, equipped with a backpack style radio-transmitter, and released within 1-3 days following capture. Transmitters (95 - 104 g, 40 cm whip antenna) have an approximate battery life of 3 years and a mortality sensitive switch (Advanced Telemetry Systems-ATS, Isanti, MN, USA). Only females were radioed because hens are easier to catch, more susceptible to winter stress, and have greater influence on recruitment to the following years population.

Radioed hens were monitored 3 to 4 times/week during winter. Winter was defined as 1 January through 31 March (Kane et al. 2003, Kassube 2005). Birds were located via triangulation from known locations on roads using ≥3 bearings for each location. When transmitters were retrieved soon after mortality signals occurred, efforts were made to determine cause of death by field sign (Thogmartin and Schaeffer 2000).

RESULTS

Fifty-nine females and 21 males were released at the 2 sites from 19 January 2006 to 2 March 2006. At the RLF site 29 radioed hens and 10 males were released, while 30 radioed hens and 9 males were released at the TRF site. Fourteen hens died within 7 days of their release, the typical censor period for wild turkeys with radio transmitters. With these individuals censored, 9 of 23 (39%) turkeys survived the winter season at the RLF site and 7 of 22 (32%) at the TRF site. Both avian and mammalian predation has been identified in addition to a turkey that was likely killed by a car collision.

We plan to release additional turkeys to fill each site to sample size during winter 2007. We will continue to monitor seasonal survival in addition to collecting data regarding wild turkey habitat use, recruitment, and landowner attitudes about wild turkeys.

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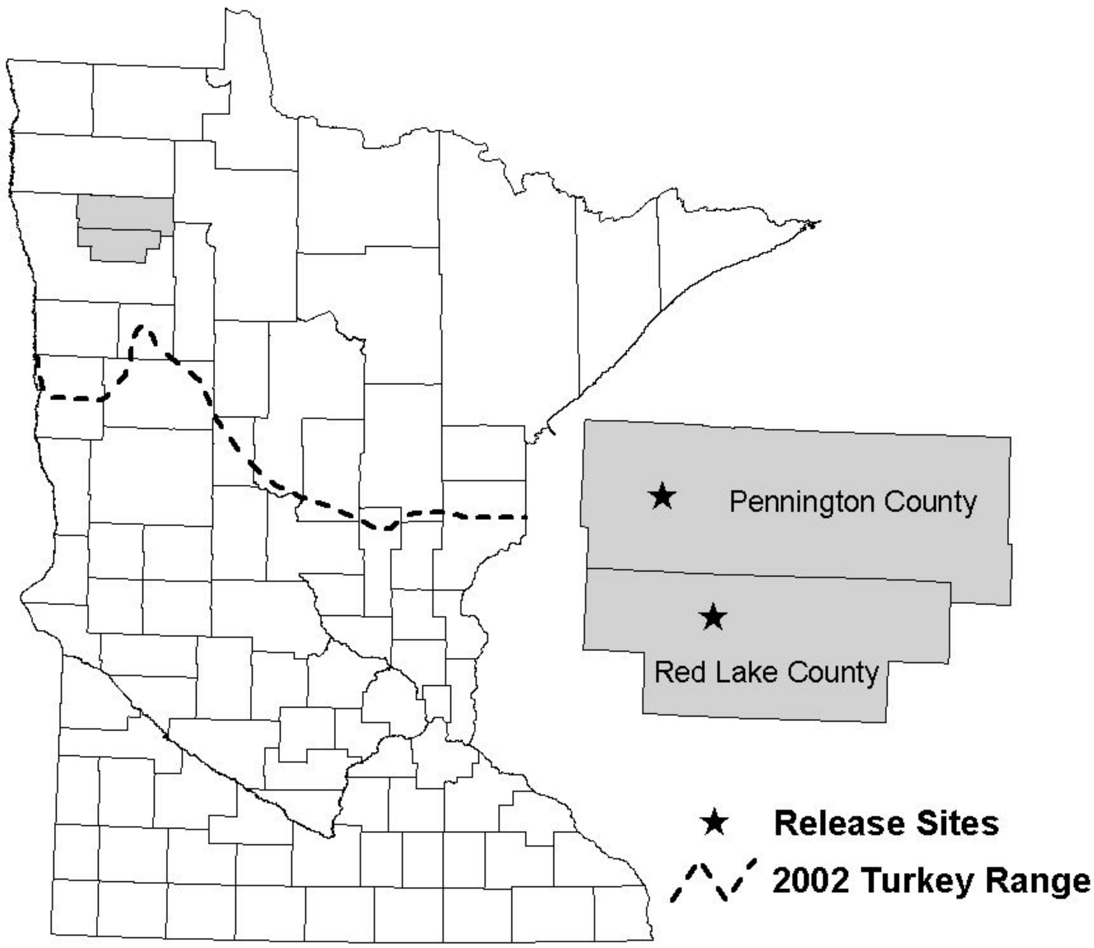

Figure 1. Wild turkey release site locations in northwestern Minnesota, January-March 2006.