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PILOT SEASON UPDATE: COMPARING COLLECTION METHODS FOR MONITORING PRAIRIE INVERTEBRATE ABUNDANCE AND DIVERSITY

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SUMMARY OF FINDINGS

Invertebrates play critical functional roles in the prairie community from pollination to serving as essential food sources for grassland birds and other animals. Numerous trapping techniques exist for monitoring insect communities (Toermaelae 1982, Standen 2000, Schauff 2001, Epsky et al. 2008), but determining which method is most suitable depends on a variety of factors, such as landscape, habitat, and desired insect communities. One goal of this project was to evaluate insect collection methods to estimate diversity and abundance of invertebrates in grassland habitats, and to use the developed protocol to monitor invertebrate communities in both native prairies and planted grasslands. The pilot season of this project was conducted on 2 native prairie sites paired with 2 planted grassland sites located in south-central Minnesota. Sweep sampling was the least time-consuming and easiest sampling method, whereas vacuum sampling was the most physically demanding for this habitat type. Approximately 240 samples have been sorted with an average sorting time of 22 minutes per sample. Hymenoptera was the most common Order found at the 2 sites that have been analyzed. The results from this project will provide information to facilitate more effectively monitoring components of native prairie and surrogate grasslands, and will be used in a larger study to identify grassland management techniques that improve prairie and surrogate grassland habitat for Species of Greatest Conservation Need (SGCN) and other wildlife.

INTRODUCTION

Because many invertebrates are associated with native prairie and play critical functional roles, they have been identified as a key animal group to be monitored (Kremen et al. 1993). Fifteen insect species and 8 spider species, including the red-tailed prairie leafhopper (*Aflexia rubranura*), Dakota skipper (*Hesperia dacotae*), and *Marpissa grata* – a species of jumping spider, are prairie-associated of SGCN. Furthermore, invertebrates are an essential food for grassland birds and their broods (Buchanan et al. 2006). Yet, information on prairie invertebrates and how habitat management techniques may impact their populations is sparse.

Recent acceleration of efforts to maintain or restore prairies have accentuated the need for long term-data collection, storage, and analysis using a consistent set of monitoring protocols to: (1) detect changes and long-term trends (status and trend monitoring) and (2) evaluate the success of prairie management and restoration activities (effectiveness monitoring). Estimates of invertebrate diversity and abundance are the best measures of habitat quality for prairie invertebrates. In addition, some invertebrate species with a close functional relationship to prairie plant species may serve as indicators of prairie condition and quality.

Numerous sampling techniques exist for monitoring invertebrate communities (Toermaelae 1982, Standen 2000, Schauff 2001, Epsky et al. 2008). The purpose of this project is to identify efficient methods for monitoring the status and trends of invertebrate communities across a range of grassland habitats from high quality prairies to planted grasslands, and for monitoring the effectiveness of management treatments intended to maintain or improve quality of grassland habitats. Our objectives were to: (1) evaluate the effectiveness of 3 invertebrate sampling methods (i.e., pitfall traps versus sweep-nets versus vacuum-sampler) for estimating invertebrate diversity and abundance; and (2) identify invertebrate taxa that may serve as indicator species for trend and effectiveness monitoring of

grassland habitats. This proposal expands on 2 studies currently in progress. The first is a study on vegetation and bird diversity on high-quality prairie sites in western Minnesota. The second is a study evaluating methods for establishing and maintaining forbs in existing species-poor grasslands (Tranel 2009).

METHODS

Four study sites located in southern Minnesota were chosen for insect sampling during the pilot study (Figure 1). Two sites were on Wildlife Management Areas (WMA) representing low vegetation diversity stands of restored native grass, and 2 sites were high diversity prairie remnants located on Scientific and Natural Areas (SNA). Samples were collected using 3 methods: pitfall traps, sweep-nets, and vacuum-sampling. We recorded weather parameters, including ambient temperature, wind speed, percent humidity, and cloud cover during each sampling event. Ten 50-m transects were randomly established with a sampling point flagged every 10 m for a total of 5 points along each transect. Locations of all sampling points were recorded using a handheld Global Positioning System (GPS) unit.

Pitfall traps were dug at each sampling point using a garden bulb digger to avoid disturbing surrounding vegetation. Two 532-ml plastic cups were placed in each hole and filled with water containing a small amount of dish soap to break the surface tension. A yellow plastic funnel was placed over each cup opening to attract pollinators and help prevent incidental catch of small rodents and amphibians. Traps were set out for 5-day sampling periods in June, July, and August. Samples were labeled, placed in heavy duty Ziploc bags, and immediately frozen after collection.

Vacuum samples were collected on transects parallel and 1.5 m to the side of transects containing pitfall traps. Vacuum samples were collected using a Stihl BG86 handheld leaf blower/vacuum. The end of the vacuum was modified to fit a fine mesh-bottomed collection chamber to prevent suctioned insects and debris from entering the bag of the machine. A 75-L plastic garbage can was cut in half and covered in fine mesh with an elasticized hole in the top to place the vacuum tube to create an insect enclosure in which to vacuum. This insect enclosure was placed at each vacuum sampling point and the vacuum was operated on full power for 15 seconds within the enclosure.

Two sweep-net samples were collected using standard muslin insect sweep-nets on transects parallel and 3 m to the side of transects containing pitfall traps. The first sample starting point began 5 m from the beginning of the transect. The second sample starting point began 5 m before the beginning point of the transect. Each sample included 15 sweeps while walking the transect. A back-and-forth motion counted as 1 sweep and a typical 15-sweep transect was approximately 20 m long. We attempted the use of photo extractors (Molano-Flores 2002) to use light to attract live insects from sweep-net samples out of the vegetative debris and into a clean container. However, we had limited success using this device and found sorting dead insects in the laboratory to be more efficient.

All samples were stored in a freezer until we were ready to sort them. The pitfall samples were removed from the bags and thawed in containers 1 day prior to sorting. Once thawed, specimens were sorted from organic material and the catch solution and stored in 70% isopropyl alcohol in 20-ml vials. The number of samples thawed each day depended on the number that could be expected to be visually inspected and sorted the following day.

The sweep and vacuum samples were removed from the freezer, stored in 70% isopropyl alcohol, then spread on a sheet of white paper in order to facilitate sorting, and the alcohol was allowed to evaporate. The sides of the original sample bag were also rinsed with isopropyl alcohol and emptied into a small plastic weigh boat to facilitate removal of additional specimens. The evaporated portion of the sample was examined for any specimens hidden within the plant matter. The plant matter was also washed with isopropyl alcohol to remove

additional specimens. The samples were sorted under a high power light source using soft forceps to prevent any damage to the specimens.
The specimens (including all arthropods) were stored in 20-ml glass vials with 70% isopropyl alcohol. After sorting, specimens were identified to family. Each sample was separated by family, with each family in its own labeled vial. Following identification and sorting, each vial was topped off with isopropyl and the lid tightly sealed with para-film to prevent evaporation during long-term storage. Voucher specimens were maintained for each family.

RESULTS

Three sampling periods, approximately 1 month apart, were completed for each collection method. Ten transects were sampled at 3 sites for the months of June and July. Due to the prevalence of poison ivy at the Butternut SNA, we were able to sample only 5 transects at that site. Due to staff time constraints, we determined that it was not possible to collect all the samples at each site; therefore, sampling effort was reduced for the last month so that data were collected at only 2 sites, 1 restored and 1 remnant site. A total of 752 samples were collected at the 4 sites throughout all sampling periods.

To date, approximately 240 samples have been sorted with an average sorting time of 22 minutes per sample. The time to process the samples was shortest for those from the pitfall traps and averaged 10 minutes to sort and 15 minutes to identify specimens. The sweep and vacuum samples varied widely in sorting time (ranged from 35–60 minutes per sample) depending on how much plant material the sample contained. Once sorted, an additional 30–45 minutes per sample was required for identification of invertebrates in the sweep and vacuum samples.

Initial findings suggest that the vacuum samples usually contained more plant material and less identifiable invertebrates than the other sampling methods. Most of the invertebrates found in the vacuum samples were pieces of invertebrates that were dismembered by the suction of the vacuum. Vacuum-sampling in the tall-grass habitat was also physically demanding and more time-consuming than for the sweep method. The sweep samples, on the other hand, contained a large quantity of insects of a variety of families. Additionally, sweep sampling was the least time-consuming and easiest sampling method for this habitat type.

Of the small number of pitfall samples that have been completely identified (restored site, n = 5; remnant site, n = 10), Hymenoptera was the most common order found at the 2 sites that have been analyzed (Table 1; restored site, n = 910; remnant site, n = 235). Most of the individuals were in the ant family, Formicidae (restored site, n = 607; remnant site n = 184). Pitfall traps at the restored site contained more individuals (1,620) and had greater diversity (44 insect families) than at the remnant site (individuals = 676, families = 35), but half of the remnant samples have yet to be completed.

DISCUSSION

Toermaelae (1982) recommended suction-sampling for most arthropods, but found that sweep–net-sampling efficiently collected flying insects, such as Diptera and winged Hymenoptera, and pitfall traps were more effective at collecting ground-dwelling beetles, hoppers, and spiders. Borges and Brown (2003) recommended that pitfall- and suction-sampling methods be used in conjunction to get reliable estimates for herbivore guilds in grazed pastures.

In our study, vacuum-sampling was problematic, because (1) invertebrates were damaged and rendered difficult to identify, (2) samples contained large amounts of plant matter, (3) greater physical effort was needed, and (4) 2 people were required to collect these data. For those reasons, this collection method should not be used during the full study. Sweep-net-

sampling appeared to yield a large quantity of insects and was an easy collection method that required only 1 person. Pitfall traps required more initial effort to dig holes, and were more destructive to local vegetation than the other methods. Pitfall traps only required 1 person, but also required more visits to the site than the other methods. Future identification of the pilot season samples will help us determine if pitfall- and sweep-net-sampling methods are sufficient to sample the entire invertebrate community at our study sites, or if additional collection methods are necessary.

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LITERATURE CITED

Borges, P.A.V., and V.K. Brown. 2003. Estimating species richness of arthropods in Azorean pastures: the adequacy of suction sampling and pitfall trapping. Graellsia 59:7-24.

Buchanan, G. M., M. C. Grant, R. A. Sanderson, and J. W. Pearce-Higgins. 2006. The contribution of invertebrate taxa to moorland bird diets and the potential implications of land-use management. Ibis 148:615-628.

Epsky, N. D., W. L. Morrill, and R. W. Mankin. 2008. Traps for capturing insects. Pages 3887-3900 *in* J.L. Capinera, ed. Encyclopedia of entomology. Springer, A. A. Dordrecht, The Netherlands.

Kremen, C., R. K. Colwell, T. L. Erwing, D. D. Murphy, R. F. Noss, and M. A. Sanjayan. 1993. Terrestrial arthropod assemblages: their use in conservation planning. Conservation Biology 7:796-808.

Moloano-Flores, B. 2002. Critical trends assessment program monitoring protocols. Illinois Natural History Survey, Office of the Chief, Technical Report 2002-2, Champaign. 38pp.

Schauff, M. E. 2001. Collecting and preserving insects and mites: techniques and tools. Systematic Entomology Laboratory, USDA National Museum of Natural History, Washington, D. C. 68pp.

Standen, V. 2000. The adequacy of collecting techniques for estimating species richness of grassland invertebrates. Journal of Applied Ecology 37:884-893.

Toermaelae, T. 1982. Evaluation of five methods of sampling field layer arthropods, particularly the leafhopper community, in grassland. Annales Entomologici Fennici 48:1-16.

Tranel, M. A. 2009. Research proposal: establishment and maintenance of forbs in existing grass stands. Pages 267-270 *in* M. W. DonCarlos, R. O. Kimmel, J. S. Lawrence, and M. S. Lenarz, eds. Summaries of wildlife research findings. Minnesota Department of Natural Resources, Wildlife Populations and Research Unit, St. Paul.

Table 1. Total number of specimens collected in pitfall traps (to date) at 2 of the 4 study sites in southern Minnesota during summer 2010. Joseph Tauer Scenic and Natural Area was a prairie remnant site that had 5 samples identified, and Peterson Lake Wildlife Management Area was restored grassland with 10 samples identified.

		Specimen number	
		Restored	Remnant
Order	Family	*n* = 10	*n* = 5
Class: Arachnida			
Acari (Mites and Ticks)	Unidentified	138	24
Araneae (Spiders)	Unidentified	32	88
Opiliones (Daddy Long-legs)	Unidentified	9	20
Class: Malacostraca			
Isopoda	Unidentified	52	135
Class: Diplopoda			
Unidentified (Millipedes)	Unidentified	4	2
Phylon: Mulluscea/Class: Gastropoda			
Stylommatophora (Land Snails)	Unidentified	0	1
	Total Other:	235	270
Class: Insecta			
Coleoptera (Beetles)	Anthicidae (Antlike Flower Beetles)	0	1
	Carabidae (Ground Beetles)	26	10
	Chrysomelidae (Leaf Beetles)	8	2
	Cicindelidae (Tiger Beetles)	1	0
	Cryptophagidae (Silken Fungus Beetles)	1	0
	Curculionidae (Snout Beetles)	4	1
	Endomychidae (Handsome Fungus Beetles)	3	0
	Erotylidae (Pleasing Fungus Beetles)	1	0
	Lathridiidae (Minute Brown Scavenger Beetles)	47	3
	Nitidulidae (Sap Beetles)	18	1
	Phalacridae (Shining Flower Beetles)	54	2
	Scarabaeidae (Scarab Beetles)	2	0
	Silphidae (Carrion Beetles)	1	0
	Staphylinidae (Rove Beetles)	26	10
Collembola (Springtails)	Unidentified	9	3
Diptera (Flies)	Unidentified	159	54
	Syrphidae (Syrphid Flies or Flower Flies)	5	4
Ephemeroptera (Mayflies)	Unidentified	6	0
Homoptera	Aphididae (Aphids or Plantlice)	19	3
	Cercopidae (Frog Hoppers and Spittle Bugs)	9	17
	Cicadellidae (Leafhoppers)	59	40
Hemiptera (True Bugs)	Alydidae (Broad Headed Bugs)	0	2
	Lygaeidae (Seed Bugs)	5	3
	Pentatomidae (Stink Bugs)	2	1

	Thyreocoridae (Negro Bugs)	0	1
Hymenoptera (Bees,wasps,ants, etc.)	Anthophoridae (Cuckoo, Digger and Carpenter Bees)	0	1
	Braconidae	3	2
	Ceraphronidae	144	13
	Chalcidoidea (Unidentified)	57	13
	Chalcidoidea Mymaridae (Fairyflies)	11	3
	Cynipidae (Gall Wasps)	13	1
	Diapriidae	35	1
	Embolemidae	1	0
	Formicidae (Ants)	607	184
	Halictidae	1	0
	Ichneumonidae (Ichneumonids)	13	2
	Platygastridae	4	8
	Pompilidae (Spider Wasps)	1	0
	Megaspilidae	2	0
	Scelionidae	17	7
Lepidoptera (Butterflies and Moths)	Papilionidae (Swallowtails and Parnasians)	1	0
	Unidentified immature	2	1
Orthoptera (Grasshoppers, Crickets, and Katydids)	Acrididae (Short-Horned Grasshoppers)	1	1
	Gryllidae (Crickets)	5	18
Thysanoptera (Thrips)		1	0
	Total Insects:	1,385	413

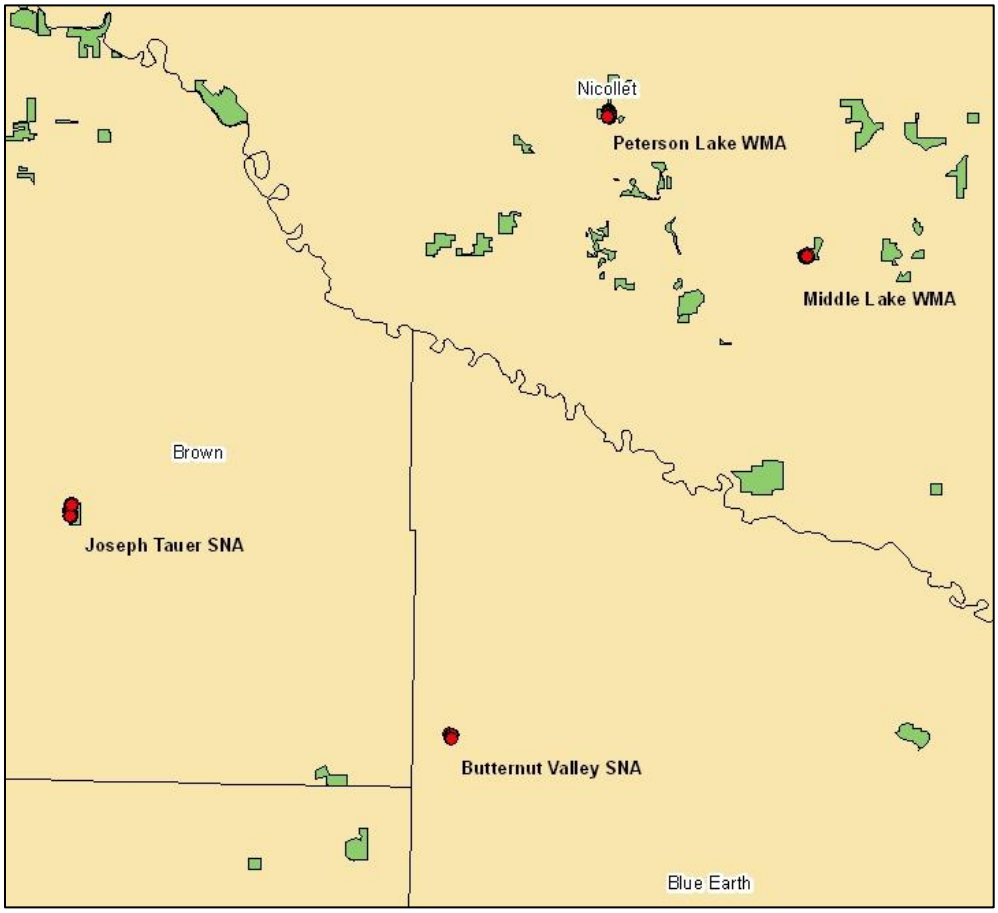

Figure 1. Map of sites where insects were sampled in summer 2010 in southern Minnesota. Wildlife Management Areas (WMA) represent low diversity grassland sites (restored) and Scenic and Natural Areas (SNA) represent high diversity prairie remnants. Green blocks represent other state owned natural areas.

ESTABLISHMENT AND MAINTENANCE OF FORBS IN EXISTING GRASS STANDS- PILOT SEASON FIRST YEAR FINDINGS

Molly A. Tranel

SUMMARY OF FINDINGS

Interseeding native forbs into reconstructed grasslands could restore plant species diversity and improve wildlife habitat. However, many managers report having limited experience with interseeding and poor success with a few early attempts. Survival of forbs interseeded directly into existing vegetation may be enhanced by management treatments that reduce competition from established grasses. In 2009, a study was initiated to investigate the effects of 2 mowing and 2 herbicide treatments on diversity and abundance of forbs interseeded into established grasslands in southern Minnesota. In January of 2009, a pilot site was interseeded and 2 mowing treatments (once or twice per season) and 2 grass-selective herbicide treatments (high and low rate) were applied during the 2009 growing season. Vegetation from the pilot site was monitored during the summer of 2010. One month after treatments were applied, mean visual obstruction readings were less in treated plots than in control plots, indicating the prescribed treatments were more effective at suppressing growth of grass. Black-eyed Susan (*Rudbeckia hirta*) was the most common seeded species in all treatments and was more frequent in the herbicide-low, mow, and herbicide-high treatments, respectively, than in the control. Results of the pilot study were used to guide a larger study on 16 sites in southern Minnesota.

INTRODUCTION

Minnesota Department of Natural Resources (MNDNR) wildlife managers indicated a need for more information on establishing and maintaining an abundance and diversity of forbs in grasslands (Tranel 2007). Forb diversity in grasslands provides the heterogeneous vegetation structure needed by some bird species for nesting and brood rearing (Volkert 1992, Sample and Mossman 1997). Forbs also provide habitat for invertebrates, an essential food for grassland birds and their broods (Buchanan et al. 2006).

The forb component on many restored grasslands has been lost or greatly reduced. Managers interested in increasing the diversity and quality of forb-deficient grasslands are faced with the costly option of completely eliminating the existing vegetation and planting into bare ground, or attempting to interseed forbs directly into existing vegetation. Management techniques that reduce competition from established grasses may provide an opportunity for forbs to become established in existing grasslands (Collins et al. 1998, McCain et al. 2010). Temporarily suppressing dominant grasses may increase light, moisture, and nutrient availability to seedling forbs, ultimately increasing forb abundance and diversity (Schmitt-McCain 2008, McCain et al. 2010). Williams et al. (2007) found that frequent mowing of grasslands in the first growing season after interseeding increased forb emergence and reduced forb mortality. Snyder et al. (unpublished data) reported that patch tilling and interseeding with forbs can increase species diversity in grass dominated stands. Additionally, Hitchmough and Paraskevopoulou (2008) found that forb density, biomass, and richness were greater in meadows where a grass herbicide was used.

In this study, we investigated the effects of 2 mowing and 2 herbicide treatments on diversity and abundance of forbs interseeded into established grasslands in southern Minnesota.

METHODS

We selected 1 pilot site in 2008 and 17 sites in 2009 for the full study. Study sites were distributed throughout the southern portion of Minnesota's prairie/farmland region on wildlife areas owned by the state and federal government. Each site was ≥4 ha and characterized by relatively uniform soils, hydrology, and vegetative composition. All sites were dominated by

relatively uniform stands of native grasses with few forbs, most of which were non-native, such as sweet clover (*Melitotus alba, M. officinalis*).

The pilot site was interseeded during January 2009 following a fall 2008 burn. For the full study, 8 sites were burned in October–November 2009 and frost interseeded during December 2009 and March 2010; 8 sites were burned and interseeded during April and May 2010, and 1 site in Faribault County that was not burned was dropped from the study. The same 30-species mix of seed was broadcast seeded at all sites at a rate of 239 pure live seeds/m^2. Seed used on spring-burned sites was cold-moist stratified for 3-5 weeks in wet sand to stimulate germination during spring 2010 and seed used on fall-burned sites was not.

Treatments

We divided sites into 10 plots of approximately equal size and randomly assigned each of 4 treatments and the control. Each site received all treatments to account for variability among sites, and each treatment was replicated twice at each site. The following treatments, designed to suppress grass competition, were applied during the first growing season after interseeding (2009 for the pilot study, 2010 for the full study) while the forbs were becoming established:

- Mowed once to a height of 10–15 cm when vegetation reached 25–35 cm in height.
- Mowed twice to a height of 10–15 cm when vegetation reached 25-35 cm in height.
- Applied grass herbicide Clethodim (Select Max®) at 108 mL/ha (9 oz/A) when vegetation reached 10–15 cm.
- Applied grass herbicide Clethodim (Select Max®) at 215 mL/ha (18 oz/A) when vegetation reached 10–15 cm.

Sampling Methods

Prior to burning and interseeding, all sites, except the pilot, were surveyed by a botanist in summer 2009 to determine species already present and general condition of each site. We sampled the pilot site in summer 2010 to determine initial success of the treatments. We randomly located 4 transects 50 m in length within each study plot and recorded map coordinates using a Global Positioning System unit. We estimated percent cover of live vegetation (Daubenmire 1959) within 76 x 31 cm^2 quadrats spaced every 5 m and litter depth was estimated every 10 m. We recorded visual obstruction readings (VOR, Robel et al. 1970) in the 4 cardinal directions at the beginning and the end of each transect. Species richness was estimated by counting the number of sampling quadrats for which each species was present (frequency). We conducted sampling on the pilot site in the summer of 2010 and will continue on the full study sites in following years.

RESULTS AND DISCUSSION

Pilot Site

Due to staff limitations, the second mowing treatment was not applied to the pilot site and herbicide treatments were *applied when the grass was taller (31 cm*) than prescribed (10-15 cm). Big bluestem (*Andropogon gerardi*) was observed most frequently in the control (90%), but appeared less frequently in the mow-once treatment (53.3%), herbicide-low treatment (72.5%), and the herbicide-high treatment (70.0%, Figure 1). Quackgrass (*Agropyron repens*) occurred most frequently in the mow-once treatment (56.7%), and was abundant in the control (50.0%), herbicide-low treatment (35.0%), and the herbicide-high treatment (45.0%, Figure 1).

Dandelion (*Taraxacum officinale*) was more frequent in the mow-once treatment (46.7%) and herbicide-high treatment (60.0%) than in the control (33.3%, Figure 2). Creeping woodsorrel (*Oxalis corniculata*) was more frequent in the herbicide-low treatment (57.5%), ,mow-once treatment (46.7%), and herbicide-high treatment (45.0%) than in the control (36.7%, Figure 2). Sweet clover was common regardless of treatment (Table 1 and Figure 2).

One year following treatments, native, seeded forbs were present in all treatments (Table 1). Black-eyed Susan was the most commonly seeded forb species in all treatments and was most common in the herbicide-low treatment (50%), but was rarely observed in the control (13.3%, Table 1). The mow-once treatment had the greatest diversity of native, seeded species and the herbicide-high treatment had the lowest diversity (Table 1).

One month after treatments were applied, mean VORs were less in treated plots than in control plots (Tranel 2009), and frequency of occurrence of big bluestem and foxtail in the first year of the pilot study (Figure 1) was reduced. These results, combined with the increased frequency of weedy, disturbance loving species in the herbicide treatments (Figure 2) suggests the prescribed treatments were effective in suppressing growth of dominant grasses. Hitchmough and Paraskevopoulou (2008) found that in treatments where grass was suppressed with a graminoid herbicide, sown forb density was higher in the second and third years after treatment and forb richness was greater 3 years after treatment. Additionally, Willliams et al. (2007) reported that in the fourth year sown forbs were twice as abundant in treatments where grass was suppressed by mowing than in untreated controls. A complete vegetation survey will be conducted on all sites in the study in summers 2011–2013 to determine the extent of forb survival, species diversity, and weed persistence.

MANAGEMENT IMPLICATIONS

The use of the pre-emergent grass-selective herbicide, Clethodim (Select Max), at 108 mL/ha (9 oz/A) and 215 mL/ha (18 oz/A) was effective at suppressing well established native and exotic grasses at the pilot site. Growth of grass was inhibited, but grass mortality was not observed even at the high application rate on any of the study sites. Because this herbicide is relatively inexpensive and requires only one application in a growing season, it could prove to be a cost effective alternative to repeated mowing in areas where grass suppression is desired. Using grass-selective herbicides followed by interseeding in order to achieve other management objectives warrants further investigation.

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LITERATURE CITED

Buchanan, G. M., M. C. Grant, R. A. Sanderson, and J. W. Pearce-Higgins. 2006. The contribution of invertebrate taxa to moorland bird diets and the potential implications of land-use management. Ibis 148:615-628.

Collins, S. L., A. K. Knapp, J. M. Briggs, J. M. Blair, and E. M. Steinauer. 1998. Modulation of diversity by grazing and mowing in native tallgrass prairie. Science 280:745-747.

Daubenmire, R. F. 1959. Canopy coverage method of vegetation analysis. Northwest Science 33:43-64.

Hitchmough, J., and A. Paraskevopoulou. 2008. Influence of grass suppression and sowing rate on the establishment and persistence of forb dominated urban meadows. Urban Ecosystems 11:33-44.

Mccain, K. N. S., S. G. Baer, J. M. Blair, and G. W. T. Wilson. 2010. Dominant grasses suppress local diversity in restored tallgrass prairie. Restoration Ecology 18:40-49.

Robel, R. J., J. N. Briggs, A. D. Dayton, and L. C. Hulbert. 1970. Relationships between visual obstruction measurements and weight of grassland vegetation. Journal of Range Management 23:295-297.

Sample, D. W., and M. J. Mossman. 1997. Managing habitat for grassland birds, a guide for Wisconsin. Wisconsin Department of Natural Resources, Bureau of Integrated Science Services, Madison.

Schmitt-Mccain, K. N. 2008. Limitations to plant diversity and productivity in restored tallgrass prairie. Ph.D. dissertation. Kansas State University, Manhattan.

Snyder, L. J., P. E. Rothrock, and R. T. Reber. Unpublished data. Interseeding forbs in a tallgrass prairie restoration: Effects of three disturbance regimes-first growing season. Randall Environmental Learning Center, Taylor University, Upland, Indiana. http://www.taylor.edu/dotAsset/104110.pdf Last accessed 20 September 2010.

Tranel, M. A. 2007. Management focused research needs of Minnesota's wildlife managers-grassland management activities. Pages 91-95 *in* M. W. DonCarlos, R. O. Kimmel, J. S. Lawrence, and M. S. Lenarz, eds. Summaries of wildlife research findings, 2006. Minnesota Department of Natural Resources, Wildlife Populations and Research Unit, St. Paul.

Tranel, M. A. 2009. Establishment and maintenance of forbs in existing grass stands-pilot season update. Pages 261-266 in M.W. DonCarlos, R.O. Kimmel, J. S. Lawrence, and M. S. Lenarz (eds.). Summaries of wildlife research findings, 2008. Minnesota Department of Natural Resources, Wildlife Populations and Research Unit, St. Paul.

Volkert, W. K. 1992. Response of grassland birds to a large-scale prairie planting project. The Passenger Pigeon 54:191-195.

Williams, D. W., L. L. Jackson, and D. D. Smith. 2007. Effects of frequent mowing on survival and persistence of forbs seeded into a species-poor grassland. Restoration Ecology 15:24-33.

Table 1. Frequency of selected forb species by treatment type at the Wood Lake, Minnesota pilot study site 1 year following treatments (2010). Sample size (*n*) is the number of quadrats placed in groups of 10 along transects within each treatment type.

Scientific name	Common name	Plant status	Presence	*n*	Frequency
Mow-once treatment					
Rudbeckia hirta	(Black-eyed Susan)	Native, seeded	8	30	26.7%
Solidago canadensis	(Canada goldenrod)	Native, volunteer	3	30	10.0%
Monarda fistulosa	(Wild bergamot)	Native, seeded	3	30	10.0%
Aster spp.	(Unidentified asters)	Native, seeded	1	30	3.3%
Zizia aurea	(Golden Alexanders)	Native, seeded	1	30	3.3%
Dalea candida	(White prairie clover)	Native, seeded	1	30	3.3%
Melitotus alba & M. officinalis	(White & yellow sweet clover)	Non-native	11	30	36.7%
Control - No treatment					
Rudbeckia hirta	(Black-eyed Susan)	Native, seeded	4	30	13.3%
Zizia aurea	(Golden Alexanders)	Native, seeded	1	30	3.3%
Monarda fistulosa	(Wild bergamot)	Native, seeded	1	30	3.3%
Amorpha canescens	(Leadplant)	Native, seeded	1	30	3.3%
Melitotus alba & M. officinalis	(White & yellow sweet clover)	Non-native	14	30	46.7%
Herbicide-low treatment					
Rudbeckia hirta	(Black-eyed Susan)	Native, seeded	20	40	50.0%
Ratibida pinnata	(Yellow coneflower)	Native, seeded	3	40	7.5%
Solidago canadensis	(Canada goldenrod)	Native, seeded	2	40	5.0%
Zizia aurea	(Golden Alexanders)	Native, seeded	1	40	2.5%
Monarda fistulosa	(Wild bergamot)	Native, seeded	1	40	2.5%
Melitotus alba & M. officinalis	(White & yellow sweet clover)	Non-native	17	40	42.5%
Herbicide-high treatment					
Rudbeckia hirta	(Black-eyed Susan)	Native, seeded	4	20	20.0%
Solidago canadensis	(Canada goldenrod)	Native, volunteer	3	20	15.0%
Asclepias syriaca	(Common milkweed)	Native, seeded	1	20	5.0%
Melitotus alba & M. officinalis	(White & yellow sweet clover)	Non-native	12	20	60.0%

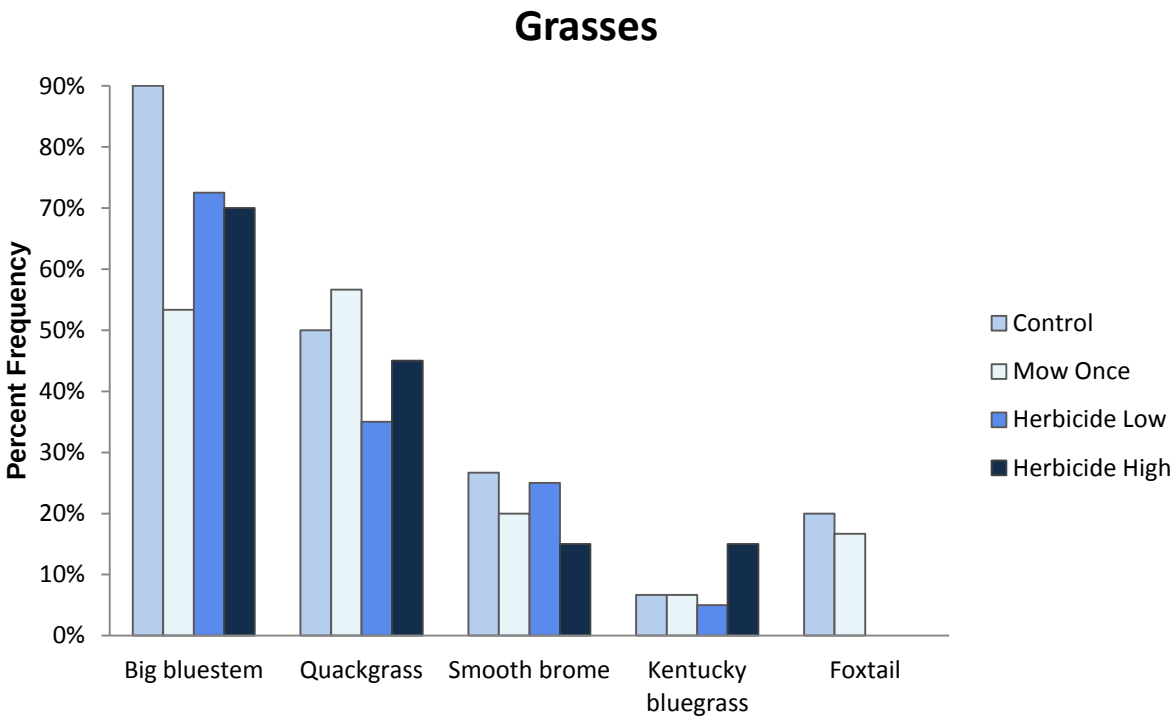

Figure 1. Percent frequency of selected grass species observed during treatment year at the pilot study site, Wood Lake, Minnesota, 2010 (*n* = 30 for mow-once and control, *n* = 40 for herbicide-low, and *n* = 20 for herbicide-high).

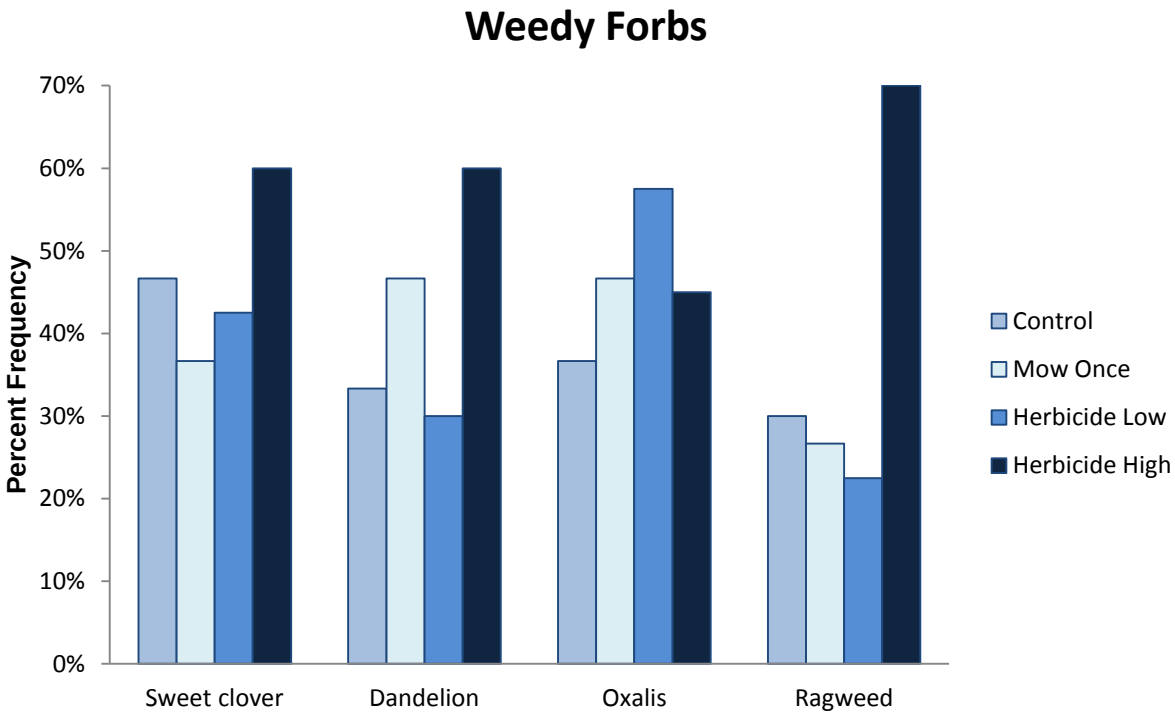

Figure 2. Percent frequency of selected weedy forb species observed during treatment year at the pilot study site, Wood Lake, Minnesota, 2010 (*n* = 30 for mow-once and control, *n* = 40 for herbicide-low, and *n* = 20 for herbicide-high).

HUNTER PERCEPTIONS AND ACCEPTANCE OF ALTERNATIVE DEER MANAGEMENT REGULATIONS[1]

Louis Cornicelli, Marrett D. Grund, and John Fieberg

ABSTRACT

Recreational hunting is the primary tool managers use to regulate deer populations, yet there is a belief that adequate hunter numbers may not exist in the future. Previous research has reported a link between regulatory acceptance, hunter satisfaction, and participation rates. Wildlife managers are often confronted with a policy paradox in that individuals desire an outcome, yet cannot agree on specific regulations. Thus, human dimensions research aimed at understanding hunter motivations and behavior is needed for effective management. In 2005, we surveyed Minnesota deer hunters (n = 6,000; 59% response) to evaluate attitudes regarding alternative deer harvest regulations. We also conducted a series of forced choice experiments in which respondents were asked to select an option from a list of representative regulations that might be adopted. Specifically, we modeled 5 deer management and population-level scenarios ranging from low populations with high buck harvest rates to populations 50% over goal density. Our results indicate that hunters preferred different regulations depending on the management scenario, but generally preferred antler point restrictions and disliked limiting buck licenses through a lottery. We also found consistency among scenarios in that a small percentage of respondents indicated they would not hunt if regulations were changed. The results from this study should help wildlife managers design deer harvest regulations that achieve management objectives and are acceptable to deer hunters.

[1] Accepted for publication in the Wildlife Society Bulletin

ASSESSING DEER HUNTER ATTITUDES TOWARDS REGULATORY CHANGE USING SELF-SELECTED RESPONDENTS[1]

Louis Cornicelli and Marrett D. Grund

ABSTRACT

State wildlife agencies are charged with managing wildlife populations of harvestable species. Opinions regarding how species should be managed differ dramatically and decisions are often made without comprehensive data. There is interest among deer hunters in Minnesota to change harvest regulations that benefit mature bucks. Beginning in 2005, our research focused on the biological and social implications of changing deer regulations. We used data collected via random surveys, public input meetings, and an internet survey to assist with the decision-making process. We observed demographic differences among respondents for the 3 data collection methods; however, the attitudinal differences were "minimal" (i.e., Cramer's $V \approx .1$). We believe that a structured public input process, even if self-selected, can help inform decision-makers. Agencies that use public input meetings should reevaluate their public input process to include an internet component if there are adequate baseline data available to make comparisons.

[1] Paper published in Human Dimensions of Wildlife 16: 174–182

SURVEY OF SOUTHEAST AND CENTRAL DEER HUNTER PREFERENCES FOR PROPOSED REGULATION CHANGES IN MINNESOTA

Emily J. Dunbar, Louis Cornicelli, and Marrett D. Grund

SUMMARY OF FINDINGS

The Minnesota Department of Natural Resources (MNDNR) Section of Wildlife conducted a survey of firearm white-tailed deer (*Odocoileus virginianus*) hunters to assess support for proposed alternative hunting regulations. Alternative regulations are designed to shift white-tailed deer harvests from yearling bucks to mature bucks and antlerless deer and may be applied in areas that exceed population goals. However, hunter support is critical before the MNDNR can implement the regulations. The southeast and central regions of Minnesota have some of the highest deer densities in the state and were chosen to determine which alternative regulations would be supported by hunters. Surveys were sent to hunters who indicated they had hunted the 3A or 3B season in the southeast region, and hunters in the central region who had hunted in deer permit areas 240, 241, 243, or 244.

Results indicate that hunters from all 3 samples were in favor of regulations that protect a majority of yearling bucks and increase the proportion of mature bucks in the deer population, but hunters from the southeast generally differed from central region hunters in their level of support for specific regulations. Elimination of buck cross-tagging was supported by more southeast hunters than central hunters. An antler point restriction regulation was supported by more hunters than opposed in the southeast, but the opposite was true in the central region. Having a youth-only season was supported by more southeast hunters than central region hunters. Few differences were found in the level of support among years of hunting experience within and among samples. For an antler point restriction regulation, there were no differences in support among the 3 samples, but hunters in the central region with 11-20 years hunting experience had lower levels of opposition than other groups of hunters. A youth-only season was supported by more hunters in the central region with 1-20 years of experience than more experienced hunters. When hunters were divided into groups based on the type of land they hunted, there were differences concerning their level of support for mature buck regulations, elimination of buck cross-tagging, and a youth-only season. Southeast 3A hunters who hunt on leased private land had higher support for mature buck regulations than either southeast 3B hunters or central region hunters. These surveys demonstrate that while most hunters in the study areas support mature buck regulations, there is not majority support for any particular strategy. Southeast hunters tended to be more supportive of eliminating buck cross-tagging, instituting an antler point restriction, and holding a youth-only season than hunters in the central region. Central region hunters tended to be split between supporting and opposing the 3 regulations we proposed in the survey.

INTRODUCTION

In 2005, the MNDNR initiated a study to determine what impact alternative deer hunting regulations (early antlerless season [EA], earn-a-buck [EAB], and antler-point restriction [APR]) would have on deer populations. Another component of the research was to assess hunter support for these hunting regulations. In 2005, a survey was mailed to 6,000 firearm deer hunters and results indicated most hunters (66%) supported the concept of increasing the proportion of antlered bucks in the population; however, no regulation had >50% support (Fulton et al. 2006). Results also suggested that hunters with more hunting experience (>40 years) were less likely to support regulations to increase the proportion of antlered bucks in the herd than those with less hunting experience . Additionally, hunters in the southeast and central regions of the state were most receptive to implementation of alternative regulations. Hunter input was needed to determine which new regulations would be supported by hunters before the MNDNR could consider implementation. The purpose of this study was to assess hunter

support for regulations meant to shift harvest from yearling bucks to antlerless deer in the southeast and central regions of the state.

METHODS

Minnesota residents aged 18 years or older who purchased a firearms license to hunt deer in each study area were included in our hunter survey. Names and addresses of hunters were provided by the electronic licensing system (ELS) maintained by the MNDNR. A total of 6,000 individuals were randomly chosen for the Zone 3A and 3B seasons from the 2008 ELS database (n = 1,500 each). The 2009 ELS database was used to select 3,000 individuals who indicated that they hunted in deer areas 240, 241, 243, and 244 (central study area). A self-administered, mail-back questionnaire with a personalized cover letter, and postage-paid return envelope was sent to individuals of the southeast sample in June 2009 and to individuals of the central sample in January 2010. The questionnaire was required 2 sides of a legal-sized piece of paper and was divided into the following categories: (1) hunter background, (2) hunting property, and (3) hunter support for past and proposed regulation changes (Appendix I). Two follow-up surveys were mailed out at 4-week intervals to non-respondents.

We studied the effect hunting experience had on supporting hunting regulations by placing hunters into 1 of the following experience categories: (1) 1-10, (2) 11-20, (3) 21-30, (4)31-40, and (5) ≥40 years. We investigated whether landownership patterns affected regulatory support by asking participants to estimate how much of their time spent hunting was located on: (1) private land they owned, (2) private land they leased for hunting, (3) private land neither owned nor leased, or (4) public land. Responses were on a 4-point scale that ranged from “none” to “all”. Respondents indicating they either spent “most” or “all” of their time hunting on any 1 type of land were included in the landownership analysis.

Data from the 3 study areas were not pooled due to the differences in seasonal framework. Questionnaires returned later than 4 weeks after the last mailing were not included in the analyses. We calculated the frequency score for each proposed regulation change (oppose = 1, support = 2, and neither = 3) in each study area based on hunter experience and type of land hunted.

RESULTS

For the southeast 3A sample, 41 surveys were undeliverable or addressed to out of state hunters (3%), leaving 1,459 potentially returnable and usable questionnaires. Of the 1,459 returnable questionnaires, 891 were returned, for a 61% response rate. For the southeast 3B sample, 44 surveys were undeliverable or addressed to out of state hunters (3%), leaving 1,456 potentially returnable and usable questionnaires. Of the 1,456 returnable questionnaires, 860 were returned, for a 59% response rate. For the central sample, 71 surveys were undeliverable or addressed to out of state hunters (2%), leaving 2,929 potentially returnable questionnaires. Of the 2,929 returnable questionnaires, 2,075 were returned, for a 71% response rate. Seventy-nine surveys were returned incomplete, for a remaining sample size of 1,996 surveys in the central region sample.

Since the response rate for southeast hunters was not >60%, a non-response survey was sent to both 3A and 3B hunters. Four hundred abbreviated surveys were sent out to hunters for each season. Non-response surveys differed from the original survey by not including questions concerning the type of hunter on the land in the opposite season, voluntary harvest restrictions, opinions on past regulation changes, and opinions on delaying the season, consolidating the 3A and 3B seasons, and a youth-only season. Fifty surveys were returned from 3A hunters and 45 surveys were returned from 3B hunters, for a response rate of 13% and 11%, respectively. The number of non-response surveys returned for each season made up only 5% of the total number of surveys returned; therefore, the results were not analyzed to compare differences.

We determined that the hunters who returned surveys did not represent the hunting population (Table 1). Younger hunters were underrepresented and older hunters were over represented, which could have skewed age-based analysis of responses. The only possible effect of the bias for this report was the analysis of how hunting experience impacts levels of support for proposed regulations. Responses were not weighted to take into account the possible bias.

A respondent profile based on demographic data was constructed for each sample (Table 2). Hunter profiles in the 3 survey samples were similar. Most respondents held only a regular firearms license, with southeast 3B hunters having fewer hunters with only a regular firearms license (68%) than southeast 3A hunters (70%) or central hunters (71%). More hunters in the southeast region had both a regular firearms license and archery license (17% and 16%) than hunters in the central sample (12%). The central sample had the highest percentage of hunters with both a regular firearms and muzzleloader license (10%). All 3 license types were held by more southeast 3B hunters (10%) than either southeast 3A hunters (6%) or central hunters (7%). Hunting experience within the particular region was similar across the samples, and ranged from 17 to 18 years. Most hunters were not a member of a deer hunting organization, but more southeast hunters were members of the Minnesota Deer Hunters Association (MDHA) than any other group, whereas more central region hunters were members of the Quality Deer Management Association (QDMA). The percentage of respondents that hunted on each type of land was similar between southeast 3A and 3B hunters, but differed between southeast and central region hunters. More central region hunters did most or all of their hunting on land that they owned (40%) than southeast region hunters (20% and 22%). A majority of southeast region hunters hunted on private land that they neither owned nor leased (58% and 62%), while a smaller percentage of central region hunters (49%) did the same. Central region hunters hunted on public land to a lesser extent (8%) than southeast region hunters (12%). Fewer hunters that bought licenses in the central region hunted (91%) than southeast hunters (98%). Respondents that hunted during a 9-day season (southeast 3B and central region) averaged the same amount of time hunting (5 days), while southeast 3A hunters who had a 7-day season averaged 4 days in the field.

Hunters were asked a series of questions about who else hunted on the private land that they hunted, any type of harvest restrictions used on the land they hunted, and their perceptions about the number of mature bucks and the size of the deer herd (central only) where they hunted (Appendix I). Similar percentages of southeast 3A and 3B hunters who hunted on private land they did not own indicated that a hunter who was not a relative of the landowner (37% and 40%) and/or a hunter who was the landowner or an immediate family member (34% and 37%) hunted on the same land as they did in the opposite deer season. For central hunters, the landowner or immediate family member (75%) and/or a hunter who was a relative (35%) also hunted on the same land during the season as the respondent. Hunters in southeast 3A and 3B who hunted on land they owned responded that family that did not own the property (31%) and/or friends who did not own the property (38% and 31%) hunted on their property in the opposite deer season. Central hunters who hunted on property they owned indicated that family who did not own the property (61%) and/or friends who did not own the property (39%) hunted on their land during the same deer season. Voluntary restrictions on deer harvest were rarely used by hunters in the study areas. In southeast 3A and 3B, 61% and 63% of hunters who hunt on private land indicated that there were no harvest restrictions and 52% of central hunters responded likewise. The most common harvest restriction for all 3 samples was a buck harvest that was limited to large antlered bucks, but any antlerless deer could be taken (20-22%). Hunters from all 3 samples agreed (40-42%) that there were about the same number of mature bucks now that there were 5 years ago. Central hunters were also asked about their perception of the deer herd in the areas where they hunt now as compared to 5 years ago and what they thought of the deer population currently. Most hunters perceived that there were fewer deer now than 5 years ago (49%) or about the same now as compared to 5 years ago (36%). More hunters felt that the deer population was “about right” (54%) than “too low” (32%).

Southeast region respondents were asked about their level of support for regulation changes that have occurred concerning their seasonal framework (Table 3). In general, more hunters support than oppose the changes that have occurred since 2003. Most hunters in both seasons supported having youth participate in both seasons, with 67% of 3A hunters slightly or strongly supporting the change, and 65% of 3B hunters either slightly or strongly supporting the change. Shortening the 3A season by 2 days was not a popular change for most hunters (43% and 45% either strongly or slightly opposed), but lengthening the 3B season was either strongly or slightly supported by more hunters (56% and 54%). Allowing antlerless harvest during the traditional 3A "buck season" was supported by a majority of southeast hunters (58% either strongly or slightly supported the change). More hunters were in favor of the current season (51% or 48% either strongly or slightly support) than opposed (34% either strongly or slightly opposed).

The majority of questions pertaining to proposed regulations were common between the 2 zones, but southeast surveys included questions concerning consolidation of the A and B seasons and restoration of the past seasonal framework, whereas central surveys asked hunters' opinions on limiting the number of buck licenses and enacting mature buck regulations in a specific area versus statewide. Responses to proposed regulations that were asked on only 1 or 2 surveys were summarized in Appendix I. Level of support for proposed regulations that were on all 3 surveys is summarized in Table 4. Overall, hunters in both regions were in favor of regulations that protect a majority of yearling bucks and increase the proportion of mature bucks in the deer populations (52-53%), and oppose delaying the start of the deer firearms season by 1 week (55-56%). But southeast 3A and 3B hunters generally differed from central hunters in level of support for other proposed regulations. Elimination of buck cross-tagging was supported by more southeast 3A and 3B hunters ($\geq$50%) than central hunters (45%). Having a youth-only season in October was supported by more southeast hunters (54%) than central hunters (41%). Delaying the start of the firearms season until late November was opposed by more hunters than delaying the season by 1 week, but southeast hunters were less opposed (72%) to the proposed regulation than central hunters (82%). An antler point restriction regulation was supported by more southeast hunters than opposed, but the opposite was true in the central region. In southeast 3A, 45% of hunters supported the regulation, whereas 41% opposed it, and in 3B, 48% of hunters supported the regulation and 37% of hunters opposed. In central, the opinion was split between support (43%) and opposition (46%).

One of the last questions on the southeast survey asked hunters about losing access to property if the 3A and 3B seasons were consolidated (Appendix I). Respondents were split, with 45% of 3A hunters responding that they either strongly or slightly disagreed with the statement about losing access and 41% either strongly or slightly agreed with it. For 3B hunters, the split was narrower, with 43% of hunters either strongly or slightly disagreeing with the statement and 42% either strongly or slightly agreeing with it. One of the final questions on the central survey asked hunters about their satisfaction with their 2009 firearms deer hunt (Appendix I). More hunters in central region were satisfied with their hunt than dissatisfied. Forty-nine percent of hunters were either very or slightly satisfied and 31% of hunters were either very or slightly dissatisfied with their hunt last year.

The hunting experience in a specific season (for southeast hunters) or specific deer permit area (for central hunters) and the type of land hunted was used to analyze hunter's level of support for the proposed regulations (mature buck regulations, elimination of buck cross-tagging, delaying the season, antler point restriction, and a youth-only season). Hunters' responses for each survey are summarized in Tables 5-10. Few differences were found among years of hunting experience within or among samples (Tables 5-7). There were differences in the level of support among hunters when asked about delaying the start of the season until late November. Central hunters were much more opposed to delaying the start of the season than southeast hunters. At every level of experience, $\geq$80% of central hunters opposed the regulation, whereas only hunters with 40+ years of hunting experience in southeast 3B season had $\geq$80% opposition. For an antler point restriction regulation, there were no differences in

support among the 3 samples, but hunters in the central region with 11-20 years hunting experience had lower levels of opposition (40%) than other levels of experience. A youth-only season was supported by more hunters (40-42%) in the central region with 1-20 years of experience than hunters with greater years of experience.

When hunters were divided into groups based on the type of land they hunted most or all of the time, there were differences concerning their level of support for mature buck regulations, elimination of buck cross-tagging, and a youth-only season (Tables 8-10). Overall, hunters who hunt on private land they own or on private land they neither own nor lease had >50% support for each sample, but there were differences among the sample in regards to leased land and public land. Southeast 3A hunters who hunt on private land they leased had much higher support for mature buck regulations (67%) than either 3B hunters (33%) or central hunters (44%). Public land hunters in the central region had higher levels of support (60%), than southeast 3B hunters (53%) for mature buck regulations. Southeast 3A hunters who leased private land had much higher levels of support for mature buck regulations (67%), than hunters who neither owned nor leased land they hunted (51%). There were differences in level of support for the elimination of buck cross-tagging within southeast 3A and among the 3 samples. Elimination of buck cross-tagging had higher levels of support for southeast 3A hunters who hunted on private land they owned (54%) and public land hunters (57%), than hunters who lease land (43%) or who neither lease nor own the land they hunt (49%). Overall, hunters in the central and southeast 3B samples had higher levels of opposition to buck cross-tagging than southeast 3A hunters. Hunters in the southeast region had higher levels of support for a youth-only season than hunters in the central region. In the southeast region, there were lower levels of support for hunters who hunt on leased land (33% and 39%), but in the central region, hunters in this category had the highest level of support among central region hunters (47%). Hunters in the central region who hunted primarily on land they owned had lower levels of support (36%) than hunters on other types of private land (47% and 45%) and public land (43%).

DISCUSSION

While a majority of hunters in both regions support mature buck regulations, they generally do not agree which alternative regulations should be enacted. Delaying the start of the season 1 week or until late November was not supported by hunters in either study area, but support for the elimination of buck cross-tagging, antler point restriction, and a youth-only season differed between areas. Southeast hunters tended to be more supportive of eliminating buck cross-tagging, instituting an antler point restriction, and conducting a youth-only season than hunters in the central region. Central region hunters, on the other hand, tended to be split between supporting or opposing the 3 regulations. Even though central region hunters did not strongly support the proposed alternative regulations, a majority did support mature buck regulations. One possible explanation is that a regulation that would be supported by more hunters was not on the questionnaire. An early antlerless season was not included in our survey, but could be considered a mature buck regulation (Fulton et al. 2006). They reported that an early antlerless season had the highest support (49.9%) of the alternative regulations tested for all hunters statewide. In 2007 and 2008, an early antlerless season was in place in all or part of the central study area. Hunters in the central study area, if given the choice of the familiar early antlerless season, may have supported this regulation over the other regulations. Further work is needed to assess central region hunter support of mature buck regulations not addressed in these surveys.

LITERATURE CITED

Fulton, D. C, L. Cornicelli, and M. D. Grund. 2006. 2005 Survey of deer hunter satisfaction and preferences for regulation changes in Minnesota. Unpublished project report. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul. 81pp.

Table 1. Age-biased sampling of southeast and central region white-tailed deer hunters, Minnesota, 2008 and 2009.

	Southeast hunters		Central hunters	
Age (yr)	% of Licenses	% of Sample	% of Licenses	% of Sample
18-29	23.4	17.1	24.4	20.0
30-39	18.4	15.4	19.6	17.4
40-49	22.0	21.8	23.7	26.0
50-59	19.1	22.3	19.6	20.5
60+	17.1	23.5	12.7	16.1

Table 2. Profile of white-tailed deer hunter respondents, Minnesota, 2008 (southeast region) and 2009 (central region).

	Southeast 3A hunters			Southeast 3B hunters			Central hunters		
Demographic Characteristics	*n*	Percent	Mean	*n*	Percent	Mean	*n*	Percent	Mean
License Type									
Regular	606	70		561	68		1,406	71	
Regular + archery	145	17		130	16		237	12	
Regular + muzzleloader	57	7		58	7		202	10	
All 3 types	56	6		80	10		136	7	
Hunting experience (yr)	828		18	801		18	1871		17
Member of hunting group									
No	715	85		717	88		1,744	88	
Yes – MDHA	30	24		30	30		153	12	
Yes – BWA	14	11		9	9		0	0	
Yes – QDMA	9	7		2	2		65	27	
Yes – Other	22	18		20	20		34	14	

Table 2. continued.

Land hunted – most or all									
Private – I own	188	22		166	20		792	40	
Private – I lease	24	3		23	3		62	3	
Private – Neither	487	58		509	62		956	49	
Public	101	12		97	12		151	8	
Hunter characteristics									
Hunt last season?									
Yes	808	98		780	98		1,898	91	
Days hunted (days)									
1	22	3	4	9	1	5	66	3	5
2	132	17		90	12		323	17	
3	152	19		118	15		227	12	
4	145	19		141	18		306	16	
5	135	17		149	19		304	16	
6	48	6		78	10		211	11	
7	146	19		84	11		152	8	
8				39	5		72	4	
9				68	9		242	13	

Table 3. Level of support for past white-tailed deer harvest regulation changes in southeast region, Minnesota, 2008.

Regulations	*n*	Strongly oppose	Slightly oppose	Neither	Slightly support	Strongly support	Don't know
Allowing youth to hunt both 3A and 3B season							
3A Hunters	809	10%	7%	12%	15%	52%	4%
3B Hunters	783	9%	8%	16%	17%	48%	3%
Shortening the 3A season by 2 days							
3A Hunters	809	31%	12%	16%	12%	25%	4%
3B Hunters	776	32%	13%	16%	13%	22%	5%
Lengthening the 3B season by 2 days							
3A Hunters	813	18%	8%	16%	14%	42%	3%
3B Hunters	774	17%	8%	17%	14%	40%	4%
Allowing antlerless harvest during 3A							
3A Hunters	816	19%	9%	11%	17%	41%	3%
3B Hunters	778	17%	10%	13%	16%	42%	2%
The current season structure							
3A Hunters	818	19%	15%	13%	18%	33%	3%
3B Hunters	779	19%	15%	14%	16%	32%	3%

Table 4. Support for select proposed white-tailed deer harvest regulations for southeast 3A (2008), 3B (2008), and central region hunters (2009), Minnesota.

Regulations	*n*	Oppose	Support	Neither
DNR should enact regulations that protect a majority of yearling bucks and increase the proportion of mature bucks in the deer population				
Southeast 3A hunters	803	30%	52%	18%
Southeast 3B hunters	765	27%	53%	20%
Central hunters	1,940	31%	52%	17%
Eliminate buck cross-tagging				
Southeast 3A hunters	822	38%	51%	11%
Southeast 3B hunters	788	41%	50%	9%
Central hunters	1,977	45%	45%	10%
Delay the start of firearms deer season one week				
Southeast 3A hunters	824	55%	32%	13%
Southeast 3B hunters	784	56%	31%	14%
Central hunters	1,981	56%	31%	12%
Delay the start of firearms deer season until late November				
Southeast 3A hunters	824	72%	17%	11%
Southeast 3B hunters	786	72%	18%	10%
Central hunters	1,978	82%	10%	8%
Institute an antler point restriction				
Southeast 3A hunters	819	41%	45%	14%
Southeast 3B hunters	780	37%	48%	14%
Central hunters	1,971	46%	43%	11%
Conduct a 4-day youth-only season in mid-October				
Southeast 3A hunters	817	29%	54%	17%
Southeast 3B hunters	776	30%	54%	16%
Central 2 hunters	1,971	44%	41%	15%

Table 5. Hunter support of proposed white-tailed deer harvest regulations according to hunting experience in the southeast 3A region sample, Minnesota, 2008.

	Enact regulations to protect yearling bucks		Eliminate buck cross-tagging		Delay start of season 1 week		Delay start of season until late November		Institute antler point restriction		Conduct 4-day youth-only hunt	
Years	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
1-10												
Oppose	85	29%	106	35%	160	54%	199	67%	114	39%	83	28%
Support	155	53%	160	54%	101	34%	58	20%	140	47%	165	55%
Neither	50	17%	33	11%	36	12%	40	13%	42	14%	51	17%
11-20												
Oppose	58	30%	72	37%	107	54%	147	75%	78	40%	63	33%
Support	104	54%	98	50%	65	33%	29	15%	94	48%	94	49%
Neither	32	16%	26	13%	25	13%	21	11%	25	13%	34	18%
21-30												
Oppose	48	33%	58	38%	85	56%	114	75%	60	40%	40	27%
Support	73	50%	72	48%	44	29%	21	14%	68	45%	86	57%
Neither	24	17%	21	14%	23	15%	17	11%	23	15%	24	16%
31-40												
Oppose	31	33%	48	51%	60	62%	74	76%	46	48%	26	27%
Support	47	50%	40	42%	28	29%	18	19%	36	38%	56	58%
Neither	16	17%	7	7%	9	15%	5	5%	14	15%	15	15%
40+												
Oppose	11	22%	21	43%	26	53%	35	71%	22	46%	11	23%
Support	22	45%	24	49%	16	33%	9	18%	18	38%	26	54%
Neither	16	33%	4	8%	7	14%	5	10%	8	17%	11	23%

Table 6. Hunter support of proposed white-tailed deer harvest regulations according to hunting experience in the southeast 3B region sample, Minnesota, 2008

	Enact regulations to protect yearling bucks		Eliminate buck cross-tagging		Delay start of season 1 week		Delay start of season until late November		Institute antler point restriction		Conduct 4-day youth-only hunt	
Years	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
1-10												
Oppose	75	29%	104	39%	150	56%	187	70%	96	36%	77	29%
Support	134	51%	138	51%	80	30%	47	17%	124	47%	147	55%
Neither	53	20%	27	10%	37	14%	35	13%	46	17%	43	16%
11-20												
Oppose	59	28%	87	40%	119	55%	156	73%	84	39%	72	33%
Support	110	53%	111	51%	64	30%	39	18%	105	48%	115	53%
Neither	40	19%	19	9%	33	15%	20	9%	28	13%	28	13%
21-30												
Oppose	33	23%	61	42%	72	49%	100	68%	50	35%	42	30%
Support	81	56%	67	46%	57	39%	34	23%	77	53%	77	54%
Neither	31	21%	18	12%	17	12%	13	9%	17	12%	23	16%
31-40												
Oppose	25	31%	37	45%	45	54%	64	77%	32	39%	25	31%
Support	42	53%	41	49%	26	31%	14	17%	40	48%	41	51%
Neither	13	16%	5	6%	13	15%	5	6%	11	13%	15	19%
40+												
Oppose	13	28%	21	43%	32	67%	41	84%	20	42%	10	20%
Support	27	57%	24	49%	9	19%	3	6%	20	42%	31	63%
Neither	7	15%	4	8%	7	15%	5	10%	8	17%	8	16%

Table 7. Hunter support of proposed white-tailed deer harvest regulations according to hunting experience in the central region sample, Minnesota, 2009.

	Enact regulations to protect yearling bucks		Eliminate buck cross-tagging		Delay start of season 1 week		Delay start of season until late November		Institute antler point restriction		Conduct 4-day youth-only hunt	
Years	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
1-10												
Oppose	227	29%	343	44%	436	55%	626	80%	364	47%	313	40%
Support	418	54%	355	45%	242	31%	83	11%	324	41%	337	43%
Neither	126	16%	88	11%	109	14%	76	10%	93	12%	132	17%
11-20												
Oppose	134	29%	202	43%	273	58%	382	80%	189	40%	198	42%
Support	254	55%	222	47%	133	28%	49	10%	231	49%	197	42%
Neither	76	16%	48	10%	68	14%	42	9%	51	11%	75	16%
21-30												
Oppose	102	34%	156	51%	176	58%	261	86%	152	50%	149	49%
Support	147	49%	129	43%	89	30%	24	8%	121	40%	115	38%
Neither	48	16%	18	6%	36	12%	17	6%	29	10%	39	13%
31-40												
Oppose	58	31%	82	44%	105	56%	157	84%	86	46%	102	55%
Support	91	49%	85	45%	63	34%	20	11%	86	46%	58	31%
Neither	36	19%	21	11%	19	10%	10	5%	15	8%	27	14%
40+												
Oppose	42	40%	50	46%	58	53%	95	87%	58	54%	60	56%
Support	44	42%	52	48%	45	41%	7	6%	37	34%	40	37%
Neither	20	19%	6	6%	6	6%	7	6%	13	12%	8	7%

Table 8. Hunter support of proposed white-tailed deer harvest regulations according to land hunted in southeast 3A region sample, Minnesota, 2008.

	Enact regulations to protect yearling bucks		Eliminate buck cross-tagging		Delay start of season 1 week		Delay start of season until late November		Institute antler point restriction		Conduct 4-day youth-only hunt	
Type of Land	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Private land I own												
Oppose												
Support	49	30%	57	34%	83	49%	119	72%	71	43%	42	25%
Neither	87	54%	93	56%	62	37%	29	18%	71	43%	88	53%
	25	16%	17	10%	23	14%	17	10%	22	13%	37	22%
Private land I lease												
Oppose	5	24%	7	33%	14	67%	17	81%	9	43%	8	38%
Support	14	67%	9	43%	5	24%	3	14%	8	38%	7	33%
Neither	2	10%	5	24%	2	10%	1	5%	4	19%	6	29%
Private land neither owned\leased												
Oppose	138	30%	198	42%	277	58%	340	71%	184	39%	138	29%
Support	240	51%	232	49%	141	30%	80	17%	225	47%	258	55%
Neither	89	19%	46	10%	59	12%	58	12%	67	14%	77	16%
Public land												
Oppose	91	94%	25	28%	42	47%	64	72%	31	35%	36	35%
Support	6	6%	48	54%	36	40%	16	18%	42	48%	48	48%
Neither	0	0%	16	18%	11	12%	9	10%	15	17%	17	17%

Table 9. Hunter support of proposed white-tailed deer harvest regulations according to land hunted in southeast 3B region sample, Minnesota, 2008.

	Enact regulations to protect yearling bucks		Eliminate buck cross-tagging		Delay start of season 1 week		Delay start of season until late November		Institute antler point restriction		Conduct 4-day youth-only hunt	
Type of Land	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Private land I own												
Oppose												
Support	27	19%	46	32%	84	59%	101	72%	45	32%	40	29%
Neither	77	55%	82	58%	39	27%	22	16%	78	55%	72	52%
	35	25%	14	10%	19	13%	17	12%	19	13%	26	19%
Private land I lease												
Oppose	7	39%	10	53%	13	72%	12	67%	10	53%	6	33%
Support	6	33%	7	37%	3	17%	4	22%	6	32%	7	39%
Neither	5	28%	2	11%	2	11%	2	11%	3	16%	5	28%
Private land neither owned\leased												
Oppose	142	30%	204	42%	265	54%	358	73%	187	38%	149	31%
Support	250	53%	239	49%	155	32%	85	17%	226	47%	265	55%
Neither	84	18%	48	10%	69	14%	49	10%	73	15%	69	14%
Public land												
Oppose	22	30%	36	49%	43	57%	51	68%	29	40%	17	23%
Support	39	53%	32	43%	22	29%	16	21%	39	53%	44	60%
Neither	12	16%	6	8%	10	13%	8	11%	5	7%	13	18%

Table 10. Hunter support of proposed white-tailed deer harvest regulations according to land hunted in the central region sample, Minnesota, 2009.

	Enact regulations to protect yearling bucks		Eliminate buck cross-tagging		Delay start of season 1 week		Delay start of season until late November		Institute antler point restriction		Conduct 4-day youth-only hunt	
Type of Land	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Private land I own												
Oppose												
Support	243	34%	324	44%	427	58%	610	83%	335	46%	363	49%
Neither	370	51%	350	47%	230	31%	76	10%	332	45%	265	36%
	111	15%	63	9%	81	11%	52	7%	68	9%	107	15%
Private land I lease												
Oppose	17	34%	25	50%	19	38%	37	76%	20	40%	17	35%
Support	22	44%	20	40%	22	44%	8	16%	23	46%	23	47%
Neither	11	22%	5	10%	9	18%	4	8%	7	14%	9	18%
Private land neither owned\leased												
Oppose	268	31%	410	46%	518	58%	738	83%	417	47%	349	39%
Support	446	51%	390	44%	255	29%	74	8%	361	41%	396	45%
Neither	159	18%	91	10%	121	14%	79	9%	110	12%	144	16%
Public land												
Oppose	34	26%	53	40%	70	53%	103	77%	60	45%	60	45%
Support	79	60%	64	48%	45	34%	18	14%	54	41%	57	43%
Neither	19	14%	16	12%	18	14%	12	9%	18	14%	15	11%

Profile of Respondents – Zone 3A Deer Hunters

Demographic Characteristics	*n*	Percent
Did you hunt during the 2008 firearm deer season?		
Yes	808	98%
No	14	2%
Total	822	
Did you hunt another season in 2008?		
No	606	70%
Yes – Archery	145	17%
Yes – Muzzleloader	57	7%
Yes – All	56	6%
Total	864	
Which one permit area did you hunt most often during the firearms deer season?		
338	38	5%
339	28	4%
341	82	11%
342	74	10%
343	93	13%
344	57	8%
345	56	8%
346	81	11%
347	72	10%
348	72	10%
349	80	11%
Total	733	
During 2008, how many days did you hunt during the firearms season?		
1	22	3%
2	132	17%
3	152	19%
4	145	19%
5	135	17%
6	48	6%
7	146	19%
Average	4	
Total	780	

Including 2008, how many years have you been hunting deer in Zone 3?

1-10	315	38%
11-20	205	25%
21-30	154	19%
31-40	100	12%
>40	50	6%
Average	18	
Total	828	

Are you a member of an organized deer hunting group? If yes, which group(s) do you belong to?

No	715	85%
Yes	125	15%
MDHA	30	24%
BWA	14	11%
QDMA	9	7%
Other	22	18%
Total	840	

How much of your deer hunting did you do on each of the following types of land during the 2008 firearm deer hunting season?

	n	None	Some	Most	All
Land I own	840	69%	8%	8%	15%
Land I lease	834	97%	1%	1%	1%
Neither own\lease	841	27%	14%	15%	15%
Public land	840	71%	16%	4%	4%

Hunting Behavior and Attitudes

	n	Percent
If you hunted on private land that you did not own during the 3A season, to the best of your knowledge who hunted that land during the 3B season:		
Landowner and\or immediate family	230	34%
Hunter who is not a relative of the landowner	246	37%
Hunter who is a relative of the landowner	146	22%
Nobody else hunts on this property during 3B	108	16%
Don't know	115	17%
Total	671	

If you hunted on private land that you own during the 3A season, who hunted on your property during the 3B season?

Another party that also owns the property	28	9%
Friends that do not own the property	120	38%
Family that does not own the property	98	31%
Any hunter who asks permission	25	8%
Nobody else hunts my property during the 3B season	81	25%
Don't know	48	15%
Total	318	

Please indicate if any voluntary harvest restrictions apply to the property you hunted.

Antlerless harvest restricted but can take any buck	28	4%
Buck harvest restricted to only large antlered bucks but can take any antlerless deer	162	22%
Buck harvest restricted to only large antlered bucks and antlerless harvest restricted	22	3%
No restrictions on the type of deer that can be harvested	445	61%
Don't know	76	10%
Total	733	

Which statement best describes the number of mature bucks over the past five years in the Zone 3A area you hunted?

Fewer mature bucks now than 5 years ago	202	25%
About the same number of mature bucks now as 5 years ago	343	42%
More mature bucks now than 5 years ago	136	17%
Don't know	131	16%
Total	812	

Please indicate your level of agreement with the following statement, "If the 3A and 3B deer seasons were consolidated into one 16-day season, I (and\or my hunting party) would lose access to the property we currently hunt".

Strongly Disagree	292	36%
Slightly Disagree	70	9%
Slightly Agree	98	12%
Strongly Agee	234	29%
Don't Know	121	15%
Total	815	

Beginning in 2003, the DNR has made several changes to the 3A and 3B seasons. Please indicate your level of support for the changes that have already occurred.

	n	Strongly oppose	Slightly oppose	Neither	Slightly support	Strongly support	Don't know
Allowing youth to hunt both the 3A and 3B seasons	809	10%	7%	12%	15%	52%	4%
Shortening the 3A season by 2 days (total of 7 days)	809	31%	12%	16%	12%	25%	4%
Lengthening the 3B season by 2 days (total of 9 days)	813	18%	8%	16%	14%	42%	3%
Allowing antlerless harvest during the 3A season	816	19%	9%	11%	17%	41%	3%
The current season structure that is currently in place, which is the 7-day 3A and 9-day 3B season	818	19%	15%	13%	18%	33%	3%

Please indicate your support or opposition to the following statements about potential deer management changes. Responses of 'neither' mean you neither support nor oppose the proposed regulation and would continue to hunt your traditional location if regulations were changed. Please check one box on each line.

	n	Oppose	Support	Neither
DNR should enact regulations that protect a majority of yearling bucks and increase the proportion of mature bucks in the deer population	803	30%	52%	18%
Eliminate buck cross-tagging (both seasons)	822	38%	51%	11%
Delay the 3A deer season one week	824	55%	32%	13%
Delay the 3A deer season until late November	824	72%	17%	11%
Consolidate the 3A and 3B deer seasons	825	57%	32%	11%
Institute an antler point restriction (both seasons)	819	41%	45%	14%
Conduct a 4-day youth-only season in mid-October	817	29%	54%	17%
DNR should restore the 3A season to 9 days	820	38%	42%	20%
DNR should restore the 3B season to 7 days	820	43%	33%	24%

Profile of Respondents – Zone 3B Deer Hunters

Demographic Characteristics	*n*	Percent
Did you hunt during the 2008 firearm deer season?		
Yes	780	98%
No	14	2%
Total	794	
Did you hunt another season in 2008?		
No	561	68%
Yes – Archery	130	16%
Yes – Muzzleloader	58	7%
Yes – All	80	10%
Total	829	
Which one permit area did you hunt most often during the firearms deer season?		
338	44	6%
339	23	3%
341	111	15%
342	90	12%
343	76	10%
344	45	6%
345	52	7%
346	75	10%
347	58	8%
348	58	8%
349	92	13%
Total	724	
During 2008, how many days did you hunt during the firearms season?		
1	9	1%
2	90	12%
3	118	15%
4	141	18%
5	149	19%
6	78	10%
7	84	11%
8	39	5%
9	68	9%
Average	5	
Total	776	

Including 2008, how many years have you been hunting deer?

1-10	150	22%
11-20	176	26%
21-30	155	22%
31-40	122	18%
>40	86	12%
Average	24	
Total	689	

Including 2008, how many years have you been hunting deer in Zone 3?

1-10	283	35%
11-20	230	29%
21-30	151	19%
31-40	84	10%
>40	53	7%
Average	18	2%
Total	801	

Are you a member of an organized deer hunting group? If yes, which group(s) do you belong to?

No	717	88%
Yes	100	12%
MDHA	30	30%
BWA	9	9%
QDMA	2	2%
Other	20	20%
Total	817	

How much of your deer hunting did you do on each of the following types of land during the 2008 firearm deer hunting season?

	n	None	Some	Most	All
Land I own	823	70%	9%	8%	12%
Land I lease	824	96%	1%	1%	2%
Neither own\lease	826	22%	14%	19%	46%
Public land	822	70%	17%	4%	8%

Hunting Behavior and Attitudes

	n	Percent
If you hunted on private land that you did not own during the 3B season, to the best of your knowledge who hunted that land during the 3A season:		
Landowner and\or immediate family	257	37%
Hunter who is not a relative of the landowner	272	40%
Hunter who is a relative of the landowner	156	23%
Nobody else hunts on this property during 3B	92	13%
Don't know	124	18%
Total	688	
If you hunted on private land that you own during the 3B season, who hunted on your property during the 3A season?		
Another party that also owns the property	23	7%
Friends that do not own the property	100	31%
Family that does not own the property	99	31%
Any hunter who asks permission	37	12%
Nobody else hunts my property during the 3B season	86	27%
Don't know	60	19%
Total	319	
Please indicate if any voluntary harvest restrictions apply to the property you hunted.		
Antlerless harvest restricted but can take any buck	25	4%
Buck harvest restricted to only large antlered bucks but can take any antlerless deer	143	20%
Buck harvest restricted to only large antlered bucks and antlerless harvest restricted	22	3%
No restrictions on the type of deer that can be harvested	442	62%
Don't know	80	11%
Total	712	
Which statement best describes the number of mature bucks over the past five years in the Zone 3B area you hunted?		
Fewer mature bucks now than 5 years ago	191	24%
About the same number of mature bucks now as 5 years ago	318	40%
More mature bucks now than 5 years ago	134	17%
Don't know	146	19%
Total	789	
Please indicate your level of agreement with the following statement, "If the 3A and 3B deer seasons were consolidated into one 16-day season, I (and\or my hunting party) would lose access to the property we currently hunt".		
Strongly Disagree	258	33%
Slightly Disagree	80	10%
Slightly Agree	111	14%
Strongly Agree	218	28%

Don't Know	116	15%
Total	783	

Beginning in 2003, the DNR has made several changes to the 3A and 3B seasons. Please indicate your level of support for the changes that have already occurred.

	n	Strongly oppose	Slightly oppose	Neither	Slightly support	Strongly support	Don't know
Allowing youth to hunt both the 3A and 3B seasons	783	9%	8%	16%	17%	48%	3%
Shortening the 3A season by 2 days (total of 7 days)	776	32%	13%	16%	13%	22%	5%
Lengthening the 3B season by 2 days (total of 9 days)	774	17%	8%	17%	14%	40%	4%
Allowing antlerless harvest during the 3A season	778	17%	10%	13%	16%	42%	2%
The current season structure that is currently in place, which is the 7-day 3A and 9-day 3B season	779	19%	15%	14%	16%	32%	3%

Please indicate your support or opposition to the following statements about potential deer management changes. Responses of 'neither' mean you neither support nor oppose the proposed regulation and would continue to hunt your traditional location if regulations were changed. Please check one box on each line.

	n	Oppose	Support	Neither
DNR should enact regulations that protect a majority of yearling bucks and increase the proportion of mature bucks in the deer population	765	27%	53%	20%
Eliminate buck cross-tagging (both seasons)	788	41%	50%	9%
Delay the 3A deer season one week	784	56%	31%	14%
Delay the 3A deer season until late November	786	72%	18%	10%
Consolidate the 3A and 3B deer seasons	779	56%	33%	11%
Institute an antler point restriction (both seasons)	780	37%	48%	14%
Conduct a 4-day youth-only season in mid-October	776	30%	54%	16%
DNR should restore the 3A season to 9 days	776	40%	41%	19%
DNR should restore the 3B season to 7 days	773	43%	34%	23%

Profile of Respondents – Zone 2 Deer Hunters

Demographic Characteristics	*n*	Percent
Did you hunt during the 2009 firearm deer season?		
Yes	1,981	99%
No	15	1%
Total	1,996	
Did you hunt another season in 2009?		
No	1,406	71%
Yes – Archery	237	12%
Yes – Muzzleloader	202	10%
Yes – All	136	7%
Total	1,981	
Which one permit area did you hunt most often during the firearms deer season?		
240	725	39%
241	383	20%
243	303	16%
244	408	22%
Other	53	3%
Total	1,872	
During 2009, how many days did you hunt during the firearms season?		
1	66	3%
2	323	17%
3	227	12%
4	306	16%
5	304	16%
6	211	11%
7	152	8%
8	72	4%
9	242	13%
Average	5	
Total	1,903	
Including 2009, how many years have you been hunting deer with a firearm?		
1-10	391	20%
11-20	437	22%
21-30	438	22%
31-40	374	19%
>40	319	16%
Average	26	
Total	1,959	

Including 2009, how many years have you hunted deer in the area listed in 1C?

1-10	792	42%
11-20	475	25%
21-30	305	16%
31-40	188	10%
>40	111	6%
Average	17	
Total	1,871	

Are you a member of an organized deer hunting group? If yes, which group(s) do you belong to?

No	1,744	88%
Yes	239	12%
MDHA	153	64%
BWA	0	0%
QDMA	65	27%
Other	34	14%
Total	1,983	

How much of your deer hunting did you do on each of the following types of land during the 2009 firearm deer hunting season?

	n	None	Some	Most	All
Land I own	1962	54%	6%	11%	30%
Land I lease	1959	95%	2%	1%	2%
Neither own\lease	1965	40%	11%	9%	40%
Public land	1959	79%	13%	3%	5%

Hunting Behavior and Attitudes

	n	Percent
If you hunted on private land that you did not own during the firearm season, to the best of your knowledge who hunted that land the firearm season:		
Landowner and\or immediate family	1,009	75%
Hunter who is not a relative of the landowner	396	30%
Hunter who is a relative of the landowner	464	35%
Nobody else hunts on this property during 3B	111	8%
Don't know	47	4%
Total	1,339	

If you hunted on private land that you own during the firearm season, who hunted on your property?

Another party that also owns the property	259	27%
Friends that do not own the property	378	39%
Family that does not own the property	596	61%
Any hunter who asks permission	36	4%
Nobody else hunts my property during the 3B season	139	14%
Don't know	33	3%
Total	971	

Please indicate if any voluntary harvest restrictions apply to the property you hunted.

Antlerless harvest restricted but can take any buck	217	12%
Buck harvest restricted to only large antlered bucks but can take any antlerless deer	360	20%
Buck harvest restricted to only large antlered bucks and antlerless harvest restricted	125	7%
No restrictions on the type of deer that can be harvested	934	52%
Don't know	158	9%
Total	1,794	

Which statement best describes your perception of deer population size over the past five years in the deer area you hunted?

Fewer deer now than 5 years ago	973	49%
About the same number of deer now as 5 years ago	707	36%
More deer now than 5 years ago	186	9%
Don't know	115	6%
Total	1,981	

Which statement best describes the number of mature bucks over the past 5 years in the deer area you hunted?

Fewer mature bucks now than 5 years ago	682	34%
About the same number of mature bucks now as 5 years ago	790	40%
More mature bucks now than 5 years ago	291	15%
Don't know	222	11%
Total	1,985	

Do you believe the deer population in the area you hunt is,

Too Low	627	32%
About right	1,078	54%
Too High	139	7%
Don't know	138	7%
Total	1,982	

Overall, how satisfied were you with your 2009 firearms deer hunt?

Very Dissatisfied	274	14%
Slightly Dissatisfied	334	17%
Neither	390	20%
Slightly Satisfied	457	23%
Very Satisfied	503	26%
Total	1,958	

Please indicate your support or opposition to the following statements about potential deer management changes. Responses of 'neither' mean you neither support nor oppose the proposed regulation and would continue to hunt your traditional location if regulations were changed. Please check one box on each line.

	n	Oppose	Support	Neither
In general, would you oppose or support a regulation that would increase the proportion of antlered bucks in the area you hunt most often	1,946	23%	56%	21%
DNR should enact regulations that protect a majority of yearling bucks and increase the proportion of mature bucks in the deer population	1,940	31%	52%	17%
Eliminate buck cross-tagging	1,977	45%	45%	10%
Delay the firearm deer season one week	1,981	56%	31%	12%
Delay the firearm deer season until late November	1,978	82%	10%	8%
Institute an antler point restriction (both seasons)	1,971	46%	43%	11%
Conduct a 4-day youth-only season in mid-October	1,971	44%	41%	15%
Limit the number of buck licenses	1,973	69%	21%	10%