HABITAT EVALUATION AND MANAGEMENT GUIDELINES FOR SHARP-TAILED GROUSE LEKS IN THE NARCISSE WILDLIFE MANAGEMENT AREA

By

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and visibility data at active leks were measured to help develop lek habitat management guidelines. The experimental restoration tested the effectiveness of larger restored lek sites compared to smaller restored lek sites. Two leks sites were restored of 22.2 ha and 19.6 ha. Over two spring seasons, these lek sites were unsuccessful at attracting displaying male sharp-tailed grouse and females. These larger lek sites were not as successful as smaller (ie. 3 to 9 ha) lek sites that had been restored in 1987. In addition, costs for manipulation were approximately double for the larger restored sites.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Numerous environmental factors influence wildlife habitat. These factors vary in time and space and interact in complex ways to favour or hinder the function of wildlife (Bailey 1984). With wildlife habitat dependent on the type and extent of its vegetation cover, any change, positive or negative, may affect wildlife.

Due to natural processes, vegetation within an area is subject to change over time. This change, called succession, changes the diversity and abundance of plant species, furthermore affecting the composition and distribution of wildlife species within the community (Smith 1980). Bailey (1984) noted that habitat for a species, including a change of habitat, can be a limiting factor for its population.

The latter statement can be applied to the Narcisse Wildlife Management Area (NWMA) (Figure 1). Scattered throughout the region are areas in various stages of vegetative succession. The region contains aspen (*Populus tremuloides*) forests, bur oak (*Quercus macrocarpa*) ridges and scattered white spruce (*Picea glauca*) interspersed with open grasslands, hay fields

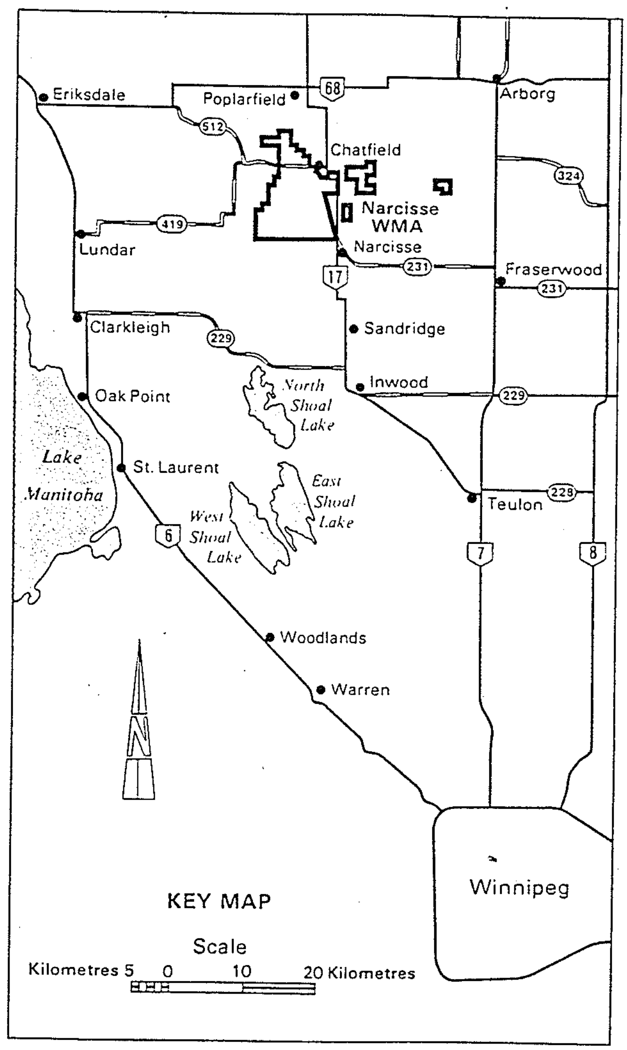


Figure 1. Location of NWMA in Manitoba, Canada (50 47'N, 97 34'W) (NWMA pamphlet, Manitoba Dept. Nat. Res. 1992).

and wetlands that provide suitable habitat for many wildlife species including the prairie sharp-tailed grouse (Tympanuchus phasianellus campestris) (Berger 1989). Sharp-tailed grouse are native to Manitoba and a part of Manitoba's wildlife heritage. However, due to forest succession and the loss of grasslands, this resource is not as plentiful as it once was (Berger 1992).

The reasons for focusing this study within the Narcisse Wildlife Management Area (NWMA) were:

a) sharp-tailed grouse management was a primary objective for the NWMA;

b) vegetation within the NWMA showed a natural succession with positive and negative affects on sharp-tailed grouse lek habitat;

c) historical information on lek location and vegetation was available; and

d) a range of habitat enhancement techniques could be tested at NWMA that could be applicable to other south Interlake Wildlife Management Areas.

1.2 PROBLEM STATEMENT

Habitat loss is a major contributing factor affecting sharp-tailed grouse. In the south Interlake region of Manitoba, human intervention by the prevention and suppression of wild fire has encouraged aspen succession.

If succession continues, grassland habitat necessary for sharp-tailed grouse mating will be substantially reduced in the short-term. This resultant lack of open grasslands may reduce the reproductive success of sharp-tailed grouse in the south Interlake region of Manitoba.

Analysis of aerial photographs (Berger 1989) have shown changes in vegetation over time at NWMA. A decline in visibility on leks because of aspen encroachment, along with a loss of grassland vegetation, has resulted in sharp-tailed grouse abandoning dancing grounds.

Hunting and viewing opportunities are linked closely with sharp-tailed grouse abundance. As the numbers of grouse decline, such opportunities decrease. Revenue from license fees will diminish, and enjoyment of the outdoor experience will vanish for future generations of Manitoba's (Berger 1992). Consequently, a need has surfaced for the development of management guidelines for enhancing sharp-tailed grouse habitat at NWMA.

1.3 OBJECTIVES

The purpose of this study was to develop management guidelines for sharp-tailed grouse lek habitat at NWMA. The application of these guidelines should assist in sustaining sharp-tailed grouse populations throughout the south Interlake.

SPECIFIC OBJECTIVES INCLUDED:

1. to review seasonal habitat requirements for sharp-tailed grouse within the NWMA;
2. to investigate techniques for enhancing sharp-tailed grouse habitat;
3. to locate dancing grounds (historical, abandoned and active) at the NWMA and to describe their vegetative characteristics;
4. to develop management guidelines for sharp-tailed grouse habitat enhancement at NWMA; and
5. to implement and monitor the effectiveness of the guidelines at NWMA during 1991-1992.

1.4 PRACTICUM DELIMITATIONS

This was a two year study in which baseline data was gathered. Habitat change over time was considered to have a positive effect (ie. woody cover to open habitat), or negative effect (ie. open habitat to woody cover) on habitat. Therefore, no quantification of habitat change was determined.

Spring lek habitat was the focus of this study. Winter habitat was only briefly discussed in the literature review section. Further, determination of sharp-tailed grouse winter habitat requirements at NWMA was not within the scope of this study.

It was assumed that further studies would be conducted in this area in subsequent years. Thus, management recommendations were presented in this report to aid in present sharp-tailed grouse management as well as provide basic information for future studies.

1.5 DEFINITION OF TERMS

The following terms will be used throughout this study.

Bare ground: encompasses dead vegetative litter/matter, bare soils and rock/gravel cover types.

Brood: a group of young birds produced over one hatching. Also defined as all the surviving offspring in one family.

Cover: the percentage of ground surface covered by a plant (Smith 1980).

Forb: any plant species not falling under the categories of either grasses or woody vegetation.

Grasses: herbs with fruit in the form of grains. Encompasses true grasses and grass-like species (Smith 1980).

Grazing: the act of allowing animals to consume vegetation on an area of land. Sometimes used as a vegetative control.

Habitat: the range of environments in which a species occurs (Smith 1980).

Historical: belonging to or typical of the past.

Lek: an open, elevated grassland area on which birds of a certain species, notably sharp-tailed grouse, gather for sexual display and mating.

Manipulation: the conversion of an unsuitable area into an area suitable for a specific purpose or function. To restore vitality of a given area. Usually converted by mechanical, fire, chemical or natural means.

Prescribed burn: the application of fire to natural fuels on a pre-determined area to accomplish planned management objectives (Miller 1979).

Shear-blading: the mechanical removal of surface vegetation using a bulldozer equipped with a blade of some sort. Usually accomplished in winter.

Succession: an act in which one thing is followed interruptedly by another. Relating to this research it would be vegetative change.

Woody vegetation: encompasses shrubs, saplings and tree species.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

There are many subspecies of sharp-tailed grouse in North America. Each has different habitat preferences and is affected by alterations to their habitat. The Northern sharp-tailed grouse (T. p. northern) is found throughout open areas of the Boreal Forest in the Hudson Bay lowlands (Evans 1968). The Columbian sharp-tailed grouse (T. p. columbianus) inhabits areas with hills or benchlands and slopes less than 50 degrees (Miller and Graul 1980). According to Miller and Graul (1980) regions of British Columbia, Washington, Utah, Montana, Colorado, Wyoming, and Idaho all have a Columbia sharp-tailed grouse population. Evans (1968) states that the Plains sharp-tailed grouse (T. p. jamesi) occurs in eastern British Columbia, Alberta, Saskatchewan, Wyoming, southwest Manitoba, North Dakota, South Dakota, and Nebraska. All of these subspecies have declined in numbers over the years due to alterations of their habitat (Berg et al. 1987).

The prairie sharp-tailed grouse (T.p. campestris) historically inhabited the areas of Saskatchewan, Manitoba, Minnesota, Michigan, Wisconsin, Ontario, Iowa, and Illinois

(Miller and Graul 1980). Figure 2 shows the past and present distribution of this subspecies. Extirpation of the prairie sharp-tailed grouse occurred in Illinois and Iowa between 1900 and 1934 (Miller and Graul 1980). Regions of Minnesota, Wisconsin and Michigan also showed population declines over the years. Major reasons for population declines have been land-use changes, plant succession and fire suppression (Miller and Graul 1980).

Prairie sharp-tailed grouse in Canada appear to have stable populations in some areas and unknown populations in other areas. However, a survey by Miller and Graul (1980) predicted a reduction in population ranges in Minnesota, Wisconsin, Michigan and Manitoba during the 1980's.

In Minnesota, sharp-tailed grouse populations are concentrated in northwest and east central regions of the state (Berg et al. 1987). Overall declines from 1981 to 1992 in northwest and east central ranges approximate 50% and 66%, respectively over this period (Berg 1993 pers. comm.).

Current sharp-tailed grouse (ie. both prairie and plains sharp-tailed grouse) are limited to areas in the Interlake, southwestern, and a very small portion of southeastern Manitoba. Sharp-tailed grouse are produced on about 2.0 million acres (809,716.6 ha) of Crown land throughout Manitoba. WMA's comprise some key land which

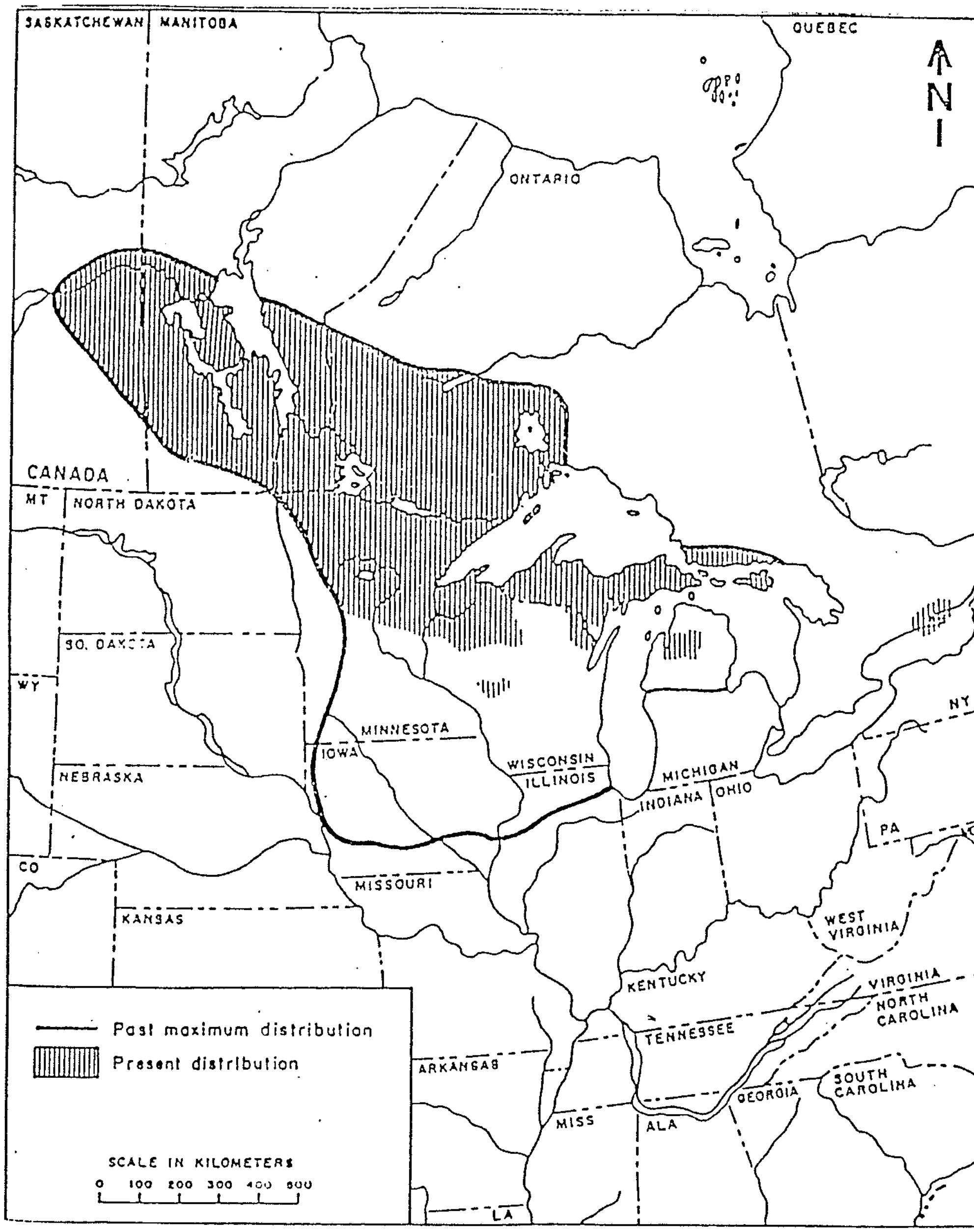


Figure 2. Past and present distribution of prairie sharp-tailed grouse in North America (Miller and Graul 1980).

support sharp-tailed grouse populations, but only about 200,000 acres (80,917.6 ha) are located in prime sharp-tailed grouse range, or are within WMA's designated for sharp-tailed grouse management (Berger 1992). Community pastures, totalling about 250,000 acres (101,214.6 ha) also provide sharp-tailed grouse within the high population density areas (Berger 1992). Wildlife refuges, ecological reserves, Provincial and Federal parks do not support significant populations of sharp-tailed grouse and data are not available for sharp-tailed grouse populations within native Indian Reserves (Berger 1992).

Before the 1960's, only noted information was available on sharp-tailed grouse populations in Manitoba. It suggested that sharp-tailed grouse were present in large numbers on their present-day range (Berger 1992). Province wide surveys initiated in the 1960's, showed that sharp-tailed grouse in Manitoba were not uniform in distribution. Variations in habitat quality and quantity were possibly the main reason behind the differences. Today, management efforts are devoted to analyzing sharp-tailed grouse populations over the short-term. Various local population trends between the 1960's and 1970's are available. Over the last 20 years however, sharp-tailed grouse population data are very limited (Berger 1992).

2.2 ASPEN SUCCESSION AND HABITAT DEGRADATION

Loss or large scale alterations to a species' habitat may influence its numbers. Prairie sharp-tailed grouse have been adversely affected by woody succession onto open grassland areas (Ammann 1963). Populations may be extirpated from areas altogether as a result of succession.

Succession occurs as seral communities replace one another until a climax community is achieved (Barbour et al. 1980). Figure 3 shows the pathway of different types of succession. The aspen parkland of Manitoba, in which NWMA is located, is characterized by the occurrence of aspen as both the dominant seral and climax tree species (Berger 1989).

An aspen stand is very resilient. Vegetative growth occurs through production of root suckers and seed; however suckering is by far the most productive. When a stand of aspen is killed by fire, broken by wind, girdled, defoliated or harvested, and the dominance of the auxin hormone produced by growing branch tips ceases, primordial root tissues will develop into suckers (Barbour et al. 1980). Under favourable conditions this sucker regeneration often exceeds 50,000 stems/ha, and may grow at a rate exceeding 4cm/day, often reaching heights of 1.2 to 1.8 metres in the

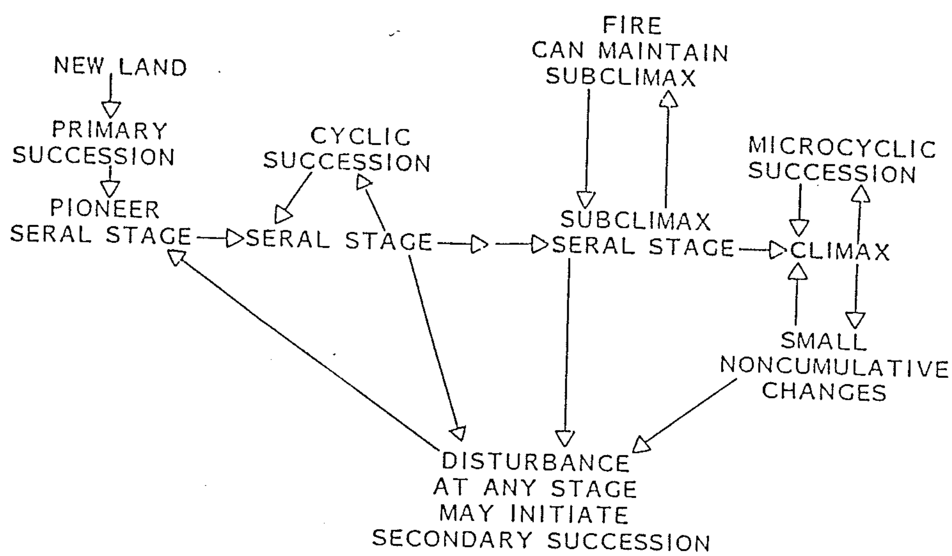


Figure 3. Diagrammatic pathway of different types of succession (Barbour et al. 1980).

first growing season (Gullion 1986). Berger (1989) found aspen regrowth in the NWMA to be 1.0 to 1.5 metres in the first growing season after mechanical removal.

Barbour et al. (1980) state that suckering production and growth will continue as long as carbohydrate reserves remain. However, if the reserves are exhausted by timely, repeated destruction of suckers through continued browsing, cutting, burning or herbicide application, suckering will be reduced (Barbour et al. 1980). If periodic disruption is not maintained, succession of a species, such as aspen, will quickly encroach into grassland areas (Berger 1989). Moyles (1981) maintains that in east-central Alberta, aspen has expanded into a grassland community as a result of suppression of large-scale burning over the last 12 years. Annual spring burning for 25-30 years in one area of Alberta eliminated few species, increased diversity of herbaceous cover species, and maintained forest cover at about pre-settlement levels (10%); in unburned areas, aspen forest cover increased from 5% in 1940 to 68% in 1975 (Anderson and Bailey 1980).

Succession can have a negative affect on prairie sharp-tailed grouse habitat and lek use. In Wisconsin, Hamerstrom et al. (1961) noted that natural forest succession, fire protection, pine plantations and modern farming methods have decreased the extent of prairie sharp-tailed grouse habitat. In Michigan, small isolated colonies of sharp-tailed grouse disappeared in the late 1950's as a result of encroachment of woody cover into forest openings (Ammann 1963). Furthermore, Miller and Graul (1980) believed prairie sharp-tailed grouse range reductions were due to vegetative succession (enhanced by fire suppression) in the lake states, intensive grazing and aspen encroachment in Canada and housing developments in Michigan. In Minnesota, Berg et al. (1987) emphasized that increased agriculture development has resulted in the succession of grassland to cropland and intensified fire suppression has resulted in the succession of brushland to forest; therefore greatly reduced prairie sharp-tailed grouse range in Minnesota. As a result of this habitat reduction, hunter harvests and prairie sharp-tailed grouse populations declined between 1949-1986 to record lows in Minnesota (Berg et al. 1987).

These patterns of habitat loss and degradation are also evident in Manitoba, especially in the south Interlake region. Human intervention through fire suppression has promoted aspen succession and decreased the attractiveness of many areas for sharp-tailed grouse. According to Suggett (1991) grasslands in several Interlake WMA's have been encroached on by woody growth, making them more attractive to ruffed grouse (Bonasa umbellus), than for sharp-tailed grouse. Berger and Baydack (1992) presented evidence that in NWMA there appears to be an inverse relationship between areas of aspen closed forest and areas of grasslands. From

1970 to 1986, the total number of leks within NWMA declined from 12 to 5 which may correspond with the surrounding lek area of closed aspen forest increasing by 4.5%/year and grassland decreasing by 4.5%/year (Berger and Baydack 1992). In fact, between 1965 and 1986, total area of closed aspen forest increased by 36%, open aspen forest increased by 2.5%, grassland decreased by 37.5%, shrubs increased by 2.3% and marsh decreased by 1.1% all in the immediate area of all leks in the NWMA (Berger and Baydack 1992).

Caldwell (1976) maintained that lek abandonment occurred in the aspen parkland of Canada when there was less than 58% of open grassland cover within 0.8 kilometres of a lek centre. Suitable open grassland areas have to be available for a lek site to be maintained. This is critically important to a population's reproductive success (Hamerstrom 1963, Pepper 1972, Berg et al. 1987, and Baydack 1988).

2.3 HABITAT REQUIREMENTS

Prairie sharp-tailed grouse show habitat preferences that satisfy required needs. Ammann (1957, 1963), Hamerstrom (1963), Evans (1968), Sexton (1979), Bergerud and Gratson (1988), Baydack (1988), and Berger (1989) all emphasized that specific vegetative cover provides habitat for mating displays, nesting, feeding, space, water, escape cover, and winter survival functions. Habitat management should account for the seasonal and functional cover preferences that certain complexes provide for prairie sharp-tailed grouse.

Prairie sharp-tailed grouse have specific habitat preferences. Figure 4 demonstrates their optimum vegetation habitat preference. Moyles (1981) and Swenson (1985) note that a mosaic of plant communities, particularly grassland with a shrub/forb mixture and open wooded areas are preferred. These grassland areas may result from fire, logging and mining. Berg et al. (1987) indicate that once woody vegetation becomes established over the grassland area, the habitat will be of little value to sharp-tailed grouse. According to Swenson (1985) local migrations will occur so birds can use preferred habitats. Pepper (1972) emphasizes the importance of sizeable acreage of natural grass-shrub vegetation to sharp-tailed grouse. This is particularly important during the reproductive season. Berger (1989) noted that the Prairie sharp-tailed grouse is a species of prairie-forest transition zones or parkland, and shows specific preference for different plant communities at various times of the year.

2.3.1 BREEDING HABITAT

A lek, known also as a dancing ground or arena, is the

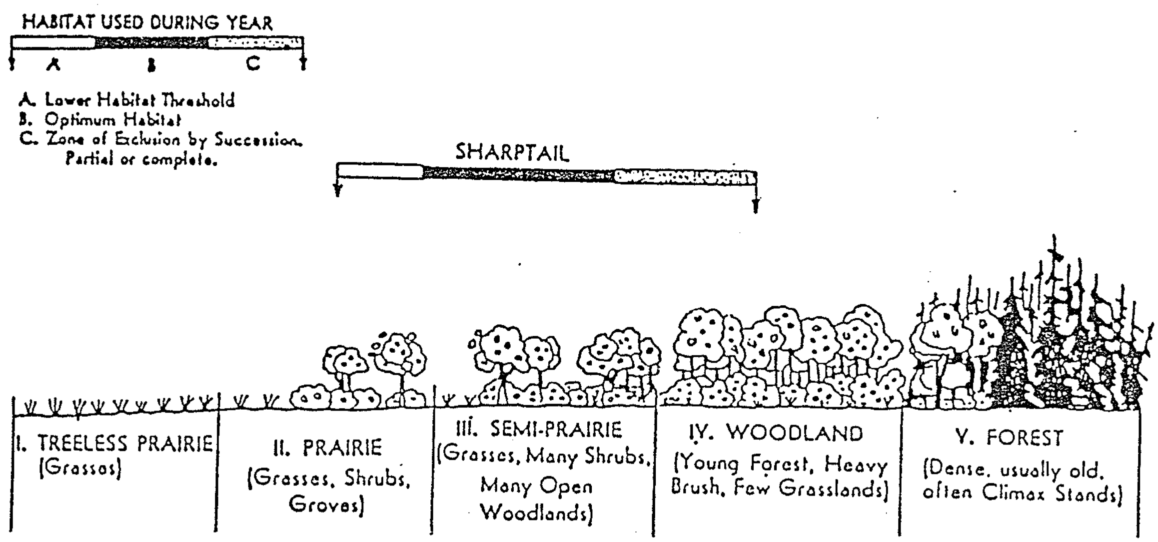


Figure 4. A schematic representation of prairie sharp-tailed grouse tolerance to different community types (Berg et al. 1987).

centre of breeding activity where males congregate and court to attract females (Berger 1989). Male sharp-tailed grouse attend and display at leks for approximately 2 months in spring and approximately 2 months in fall. Beginning in late August or early September, males begin reappearing on dancing grounds for the morning display period. Attendance at dancing grounds is erratic with males arriving about 15 minutes after sunrise and usually on clear, calm mornings. This pattern continues through autumn, declines during the winter, and begins again in early spring. However, about the 1st of April a marked change in behaviour is noted; attendance becomes regular and arrival earlier (about 30 minutes before sunrise). Attendance and displaying increases throughout April, peaks early May, and declines to nil after the first week of June (Moyles and Boag 1981).

Male sharp-tailed grouse displays include dancing, cooing, bowing, and running parallel to each other (Figure 5). Females observing these displays, then move onto the lek and choose a preferred mating partner. These traditional areas, used year after year, are a key element of the sharp-tailed grouse habitat complex (Berg et al. 1987).

Leks are usually found on open, grassy knolls or ridges covered with sparse vegetation. Ammann (1957) reports that display grounds in Michigan are relatively open, elevated

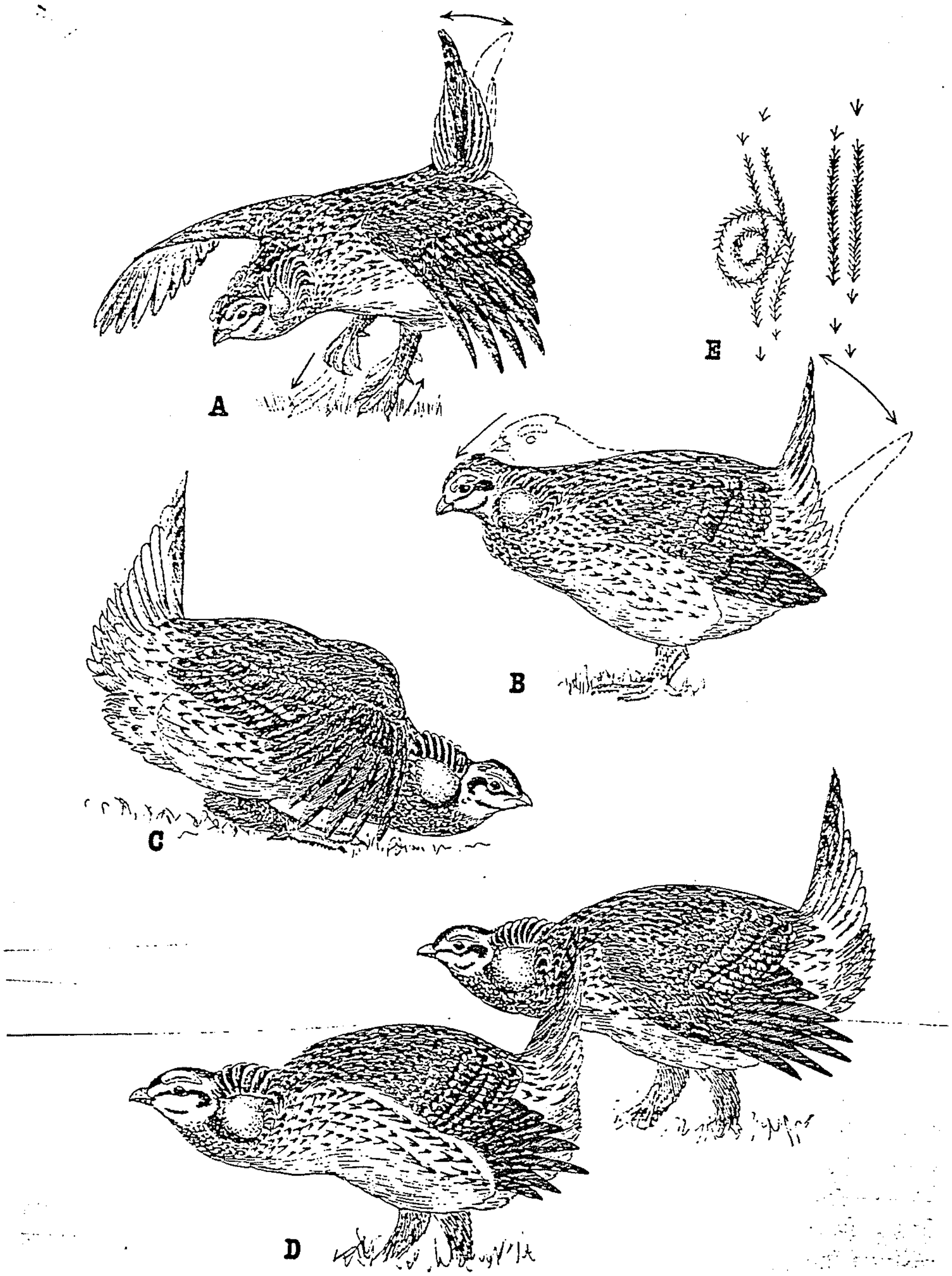


Figure 5. Male displays of sharp-tailed grouse including (a) dancing, (b) cooing, (c) bowing, and (d) running parallel. Tracks made while dancing also shown (e) (Johnsgard 1983).

sites having low or sparse vegetation. In Saskatchewan, Pepper (1972) concluded that leks were 0.8 to 4 km (0.5 to 2.5 miles) apart and often on the same location as those of previous years. Leks were usually on a small knoll or flat area providing a broad horizontal view of the surroundings. In Manitoba, Baydack (1988) and Berger (1989) maintained that leks were generally elevated (less than 1% slope) with a flat to undulating surrounding topography.

Rodgers (1992) suggested that in Kansas, artificial leks were dominated by a short-grass area 30-50 m in diameter. Berg et al. (1987) reported that a lek was 30-50 m and can be as large as 0.4 ha (1.0 acre) of open area. The lek site was located on the highest land that was at least 183-270 m from woody vegetation over 4 feet tall (Berg et al. 1987). Baydack (1988) indicated that escape cover was within 500 m and trees for perching within 400 m of each lek. Thus, the key characteristics of a typical lek and its surrounding area are: 1) unhindered visibility; 2) low spring vegetation heights; 3) nearby escape cover (less than 500 m away) and; 4) nearby female perching and nesting sites.

A relationship exists between vegetative cover type, density, and lek use. Berg et al. (1987) states that if woody vegetation adjacent to the lek grows and encroaches into the open area, abandonment is inevitable. In Saskatchewan, Pepper (1972) found that male attendance and their degree of activity appeared to be correlated with low herbaceous cover characteristics (ie. increased visibility) in the general vicinity of the lek. Leks were not found in treed or shrubby areas because these vegetation forms obstruct the wide horizontal view required for mating activity (Pepper 1972).

Researchers have examined the amount of woody cover that dancing sharp-tailed grouse will tolerate, with Ammann (1957) reporting that woody cover rarely exceeded 30% of the surface area of his Michigan leks. The sharp-tailed grouse's intolerance to trees near the dancing ground was also quantified by Berg (1981) in his study of Minnesota leks where he reported that average distance from the centre of the dancing ground to dense brush was 210.3 metres and to trees was 274.3 metres.

Availability of dancing grounds is important for successful management of sharp-tailed grouse. In Manitoba, Berger (1989) stated that ideal vegetative cover surrounding leks be no more than 44% closed aspen forest, 15% open aspen forest, at least 23% prairie and 15-17% shrub.

The literature describes an ideal plot size for recreated sharp-tailed grouse lek habitat. Berger (1989) in Manitoba, created successful sharp-tailed grouse habitat of varying sizes (3.28 ha, 3.65 ha, 5.45 ha, 9.45 ha) and recommended larger plots of a minimum of 10 ha in size and a maximum of 20 ha in size be developed. He hypothesized that larger sites would attract more grouse. Caldwell (1976) suggested in his study that smaller leks were vacated as a result of emigration to larger ones within 0.7 km. During the mating season, large open grassland areas are important to sharp-tailed grouse. Prairie grouse require large acreage of grassland, if maximum populations are to occur. Land area on which a sharp-tailed grouse population is to be managed should comprise at least 24 ha of grass and shrub within 1.6 km (1.0 mile) radius in order to attract breeding males (Pepper 1972).

In summary, successful lek creation and management depends on the proximity and quality of suitable vegetation, escape cover, topography, open grassland areas and nesting habitat. Suitable open grassland areas have to be maintained for sharp-tailed grouse to perform their breeding functions. The lek and surrounding habitat are critically important for the breeding success of the population (Hamerstrom 1963, Pepper 1972, Berg et al. 1987, Baydack 1988, Berger 1989).

2.3.2 NESTING AND BROOD-REARING HABITAT

The lek provides habitat for part of the breeding function. Successful reproduction also requires appropriate nesting and brood-rearing habitat within close proximity of the lek. As spring progresses forest habitat is used less by females. Figure 6 shows the daily use of habitat types by females during pre-incubation at NWMA (Sexton 1979). Females made greatest use of open habitats (grass and grass-shrub) during the morning and evening. From mid-morning to late afternoon habitat types with a greater portion of woody species were used.

The female sharp-tailed grouse will usually nest within 0.5 mile (0.8 km) of a dancing ground in dense grass or low brush cover (Berg et al. 1987). Most sharp-tailed grouse nests are either under some overhead cover, such as a shrub or tree or within a few feet of such cover (Evans 1968). Nests are found close to a source of seeds, buds and berries since hens usually feed close to the nest site (Evans 1968). Thus, females select areas according to their requirements and move to areas that will satisfy these needs.

Dixon (1979) suggested that in Manitoba, sharp-tailed grouse select nesting sites with a moderately open overstory of woody vegetation and a dense understorey of dead grass and herbaceous cover. Kirsch and Kruse (1973) also suggested that hens nesting in North Dakota, in a given habitat type, were usually surrounded by additional vegetation of the same type in North Dakota. Sexton (1979) found that in the NWMA, 11 out of 14 nests were in grass-shrub habitat. Pepper (1972) found 81% of nests in low shrub cover. Suggett (1991) maintains grassland cover is preferred in Manitoba for nesting and brushy or woody sites

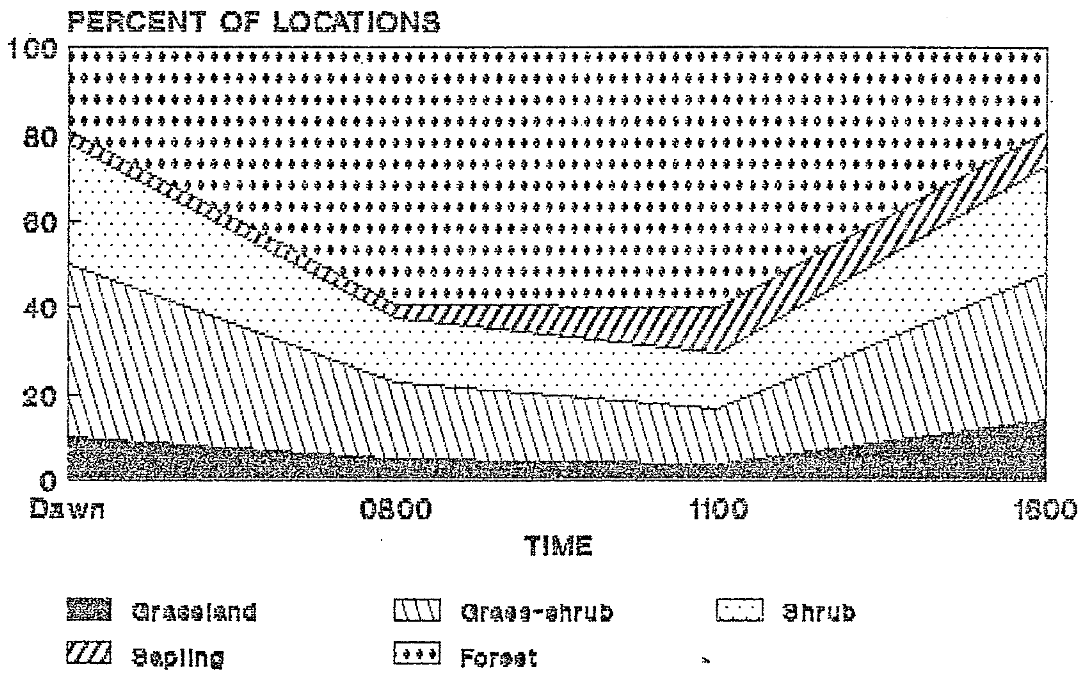


Figure 6. Daily use of habitat by female sharp-tailed grouse during pre-incubation at NWMA (Sexton 1979).

are only used where grassland cover is unavailable. Thus, close proximity to the lek, dense grass or low brush cover, proximity to food and availability of overhead cover are key elements of good sharp-tailed grouse nesting habitat.

Females with broods frequent grassland and grassland-low shrub transition zones (Moyles 1981). Evans (1968) determined that 65% of sharp-tailed grouse broods occupied mixed grass and shrub communities. In Wisconsin, 80% of prairie sharp-tailed grouse observations occurred in mixtures of grass and widely scattered trees or clumps of brush, cultivated lands or grasslands (Hamerstrom 1963). Sexton (1979) found that brood-rearing females in NWMA selected grassland or grassland shrub areas (Figure 7). This habitat type, used extensively by broods and females, contains a variety of grasses, forbs, and shrubs, and provides broods with food and cover. Forest habitat was used only 20% of the time while brood rearing in the NWMA.

Habitat selection by brood-rearing females may be related to food preferences by broods. Shrubs seem to be a far more important part of brood habitat than trees and this seems to be related to food availability (Hamerstrom 1963). Forbs support a more varied insect fauna than grasses and provide shade and water (in plant tissue or via dew) for chicks (Berger 1989). According to Hamerstrom (1963) there is no precise blueprint for ideal sharp-tailed grouse brood-rearing habitat.

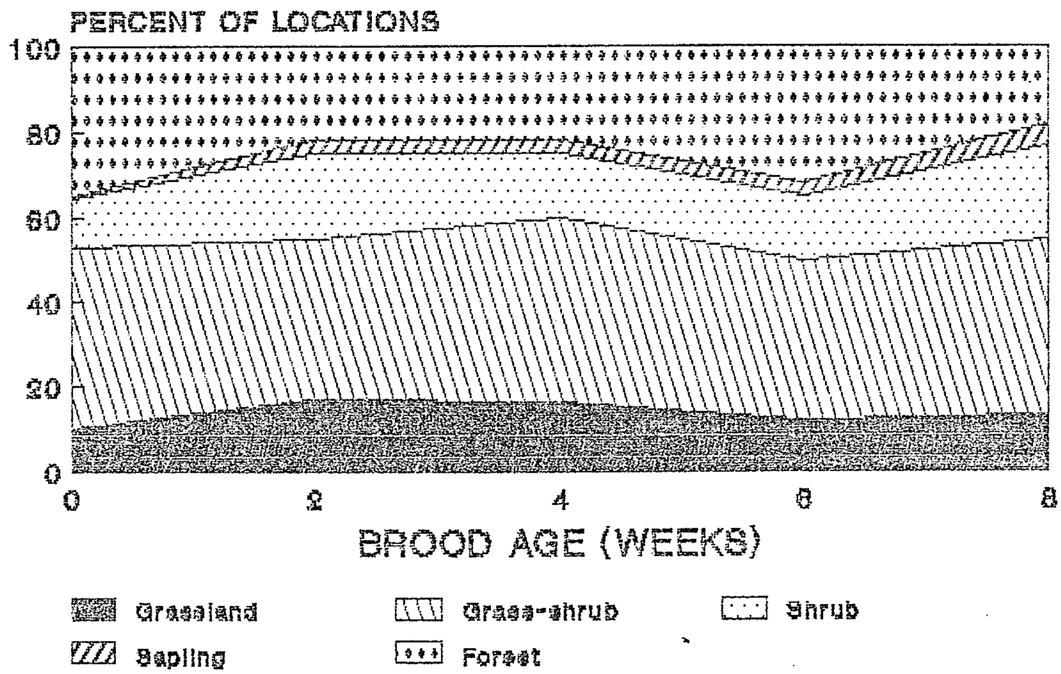


Figure 7. Habitat types used by females with broods during post-nesting at NWMA (Sexton 1979).

Succession can impact nesting cover and leks resulting in a shift of nesting efforts to other areas. Females have been known to nest and to raise broods in areas of adequate habitat surrounding other existing leks. According to Caldwell (1976), females carry out this behaviour to maintain the population. Furthermore, males from the broods may become associated with that particular lek and thus sustain the hierarchy of the male population. This yearly recruitment of males is important to population maintenance and continued use of traditional leks.

Broodless females used forest and shrub habitat extensively, but seldom used grasslands (Sexton 1979). Figure 8 demonstrates the habitat used by broodless females at NWMA (Sexton 1979). The difference between habitats used by brooding and broodless females are related to differences in their food requirements. Broodless females meet their food and cover requirements in relatively dense cover and rarely use open areas, whereas brooding females must meet the changing requirements of the young as well as themselves, resulting in a more variable habitat use pattern (Sexton 1979, Caldwell 1976, Pepper 1972).

2.3.3 WINTERING HABITAT

The winter season is an important time of year for sharp-tailed grouse. Bergerud and Gratson (1988) suggested

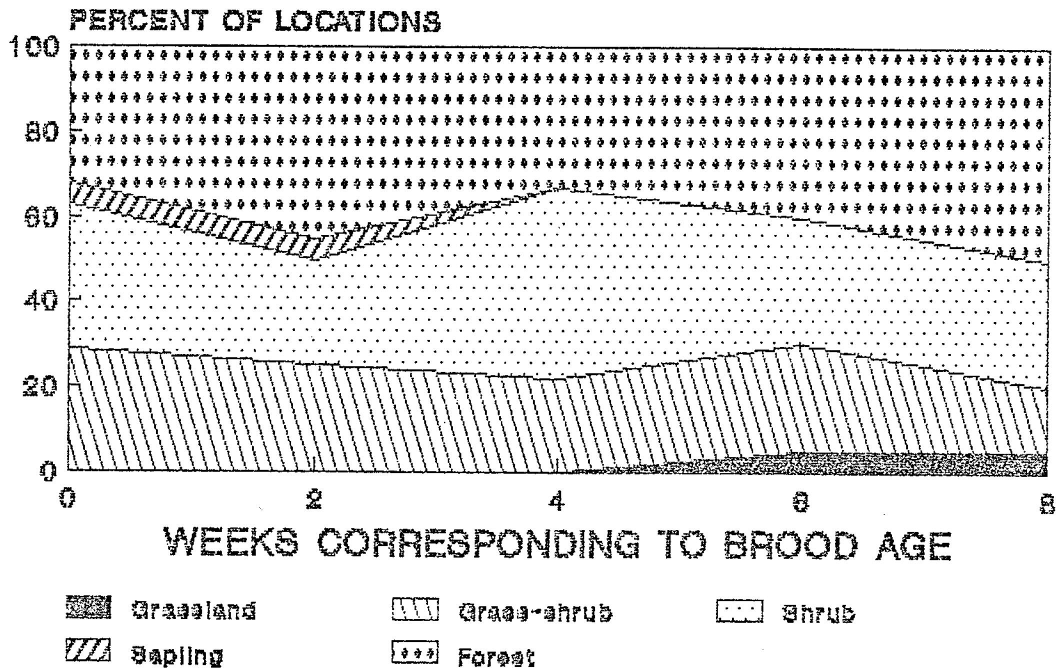


Figure 8. Habitat types used by broodless females at NWMA (Sexton 1979).

that 40-50% of sharp-tailed grouse die between August and the next spring (juvenile mortality: 50-70%; adult mortality: 40-55%). Some species of grouse are relatively secure over winter; for example spruce grouse in Alberta do well in coniferous cover and white-tailed ptarmigan survive well in tall willows (Braun 1969, Keppie 1979). However, many other species of grouse inhabit less secure cover, and are preyed upon by more effective predators and, as a result, suffer high winter losses.

The grouse's major tactic to escape detection by predators is to move to cover. As winter weather conditions reduce the availability of food and cover in open grassland vegetation, sharp-tailed grouse are normally forced to move to forested or marshy habitats to satisfy daily energy and cover needs (Gregg 1987, Bergerud 1988). Bergerud (1988) suggested that prairie sharp-tailed grouse and sage grouse use shrubs for winter cover, snow burrow, and take advantages of large flocks.

Areas with trees and/or small shrubs are preferred by sharp-tailed grouse for food and escape cover in western Idaho during snow covered periods (Marks and Marks 1988). When snow is deep and grain becomes unavailable, sharp-tailed grouse prefer the catkins, twigs, and buds of trees such as paper birch, aspen, Juneberry, hazel, and bog birch, as well as the fruit of mountain ash, sumac, common juniper, rose, and black chokecherry. Of all these, the buds and catkins of birch and aspen are most important. Sexton (1979) reported that winter habitat at NWMA are a shrub-forest complex used for cover, with aspen tree buds and catkins used for food. Thus the availability of grain or native food sources in the form of fruiting shrubs or deciduous trees is an important component of winter habitat.

2.4 PRAIRIE SHARP-TAILED GROUSE HABITAT MANAGEMENT TECHNIQUES

In the face of vegetative succession, prairie sharp-tailed grouse habitat can be maintained or restored through habitat manipulation. The use of a specific manipulation technique depends upon many factors such as desired management objectives, financial and manpower availability, and environmental regulations governing techniques to be used.

Sharp-tailed grouse thrive in open grassland interspersed between brushland. These open grassland areas provide clear horizontal visibility free of vegetative obstruction. Sharp-tailed grouse require this vegetative condition during the spring in order to satisfy their breeding requirements. Therefore, these open areas should be kept free of woody vegetation, especially trembling aspen.

There are many habitat management techniques that can be used to maintain or restore this open grassland habitat. Mechanical removal of unwanted vegetation is a technique used by resource managers for vegetation management. Shearblading and/or mowing has been used by electrical utilities across North America to maintain a low vegetative community along hydro electric line rights-of-way (Manitoba Hydro, 1992).

These same treatments have been incorporated into wildlife management to carry out vegetative management objectives. For example, Berger (1989) used a mechanical technique for the treatment of aspen which had moved onto open grassland sharp-tailed grouse habitat in NWMA. Mechanical winter bulldozing removed aspen cover followed by summer mowing removing aspen regrowth. Two years of summer (mid August) mowing reduced aspen encroachment. After initial bulldozing and second year of mowing, mowing was recommended to be carried-out every third year to keep aspen encroachment in check (Berger 1989, Manitoba Hydro 1992). According to Berg et al. (1987), where burning is not feasible, mechanical shearing, and to a lesser extent herbicides, are used in Minnesota to rejuvenate grass-brushland habitat. Brush clearing techniques (ie. bulldozing and mowing) are very expensive and time consuming (Baydack et al. 1988). However, when conditions do not permit use of other more economical techniques, bulldozing and mowing are effective alternatives.

Even when conditions do exist for more economic alternatives, bulldozing may be the only feasible means to initially clear woody covered areas. Fire, grazing, and herbicide top kill vegetation, but can not remove it. Therefore, fire, grazing, and herbicide may only be useful as a secondary treatment after the initial bulldozing has occurred.

If maintaining active leks is a management objective, then mowing, fire, grazing, and herbicide can be a useful vegetation management tool to control woody (aspen) encroachment into open grassland areas. Timing and frequency of treatment application will vary and be dependent on various site environmental factors such as precipitation, soil type and moisture, temperature, site topography, and vegetation type and its proximity to site (Wright and Bailey 1982). The ultimate choice of treatment however, should depend upon cost effectiveness.

Herbicides have been used as a vegetation management technique by resource managers since the early 1950's (Manitoba Hydro, 1992). Herbicide top kills the above ground parts of vegetation, but does not remove it. Therefore, herbicides are usually used in association with an initial vegetation removal technique. According to Wayne Ortiz (1993 pers. comm.), after two years of herbicide, repeat applications are necessary every five years to ensure woody vegetation control.

There are various methods of herbicide application which provide selective (ie. stump or basal application) or blanket (ie. foliage application) control of vegetation. The specific herbicide application method used ultimately depends on the vegetation management objectives.

Herbicides are a useful tool in aspen management. Aspen should be treated at the peak of the growing season (ie. June-August) when nutrient reserves are in the green portions of the tree (Brinkman and Roe 1975). The root system will die off during winter, which will prevent later suckering.

Selective control of woody vegetation encroachment on sharp-tailed grouse open lek habitat is a management goal in NWMA. Many have used herbicides to control woody encroachment into wildlife openings. McCaffery et al. (1974) in Wisconsin used Picloram pellets (Tordon 10K) to selectively control unwanted aspen in wildlife openings. The pellets were found to be more convenient, economical, and effective than mechanical and liquid herbicide application. Bovey et al. (1972) and McCaffery et al. (1974) noted that Picloram effectively killed aspen after two years of application and no new aspen suckering occurred.

Two consecutive yearly applications of 2,4-D and 2,4-D plus 2,4,5-T at .45 kg/ha gave good control of aspen encroachment for a 5 year period in the Aspen Parkland of

Saskatchewan (Bowes 1975). In addition, Bowes (1975) noted that after two years a 90-95% reduction of aspen regeneration was provided. Further, effective control of suckering for at least 5 years was also provided.

In summary, herbicide, due to its environmental affects and public perception, is not used as much today as in the past. However, herbicides are effective at woody vegetation control. Its application usually requires repeated treatment within 5 years for woody vegetation control (Manitoba Hydro 1992). The use of herbicide should therefore be selective, environmentally sound, and usually requires some other initial or subsequent vegetation removal treatment.

Another vegetation control technique which is very much misunderstood by society (ie. general public and professionals) is prescribed burning. Fire can be used to remove unwanted vegetation and promote a desired vegetative community. Fire top kills vegetation, but does not remove the suckering root system. For example, the 1989 forest fires in Manitoba killed a great deal of woody vegetation, but left the vegetation standing. Therefore, the use of fire should be considered as a secondary treatment. That is, some other initial treatment such as mechanical removal should be applied to remove large unwanted vegetation. Then, fire can be applied as a vegetation management technique. However, a lower growing vegetation community can be effectively maintained by fire without the initial mechanical removal of vegetation (Kirsch and Kruse 1973, Wright and Bailey 1982, Owensby 1984).

Saskatchewan, Manitoba, Minnesota, Wisconsin, and Michigan have adopted the use of prescribed fire as part of their management of sharp-tailed grouse habitat. Berg et al. (1987) suggested periodic prescribed burning of tall brush and woody growth as the most economical and efficient way to control brushland, and to maintain and improve sharp-tailed grouse habitat. In Michigan, Ammann (1963) reported positive management measures on sharp-tailed grouse habitat by burning 2,815 ha and noted that fire and lek use by males was related. Sexton and Gillespie (1979) also found that at NWMA, burning a traditional but abandoned lek site, revitalized its use. Sexton and Gillespie (1979) also noted continued use of burned lek areas, the day after the burn, suggesting burning and mowing had no adverse affects on the use of dancing grounds.

Kirsch and Kruse (1973) found two to three times as many nests on spring burned areas compared to unburned areas in North Dakota. Depending on the amount of woody growth, areas should be burned once every 5 to 7 years (Berg et al. 1987). Berger (1989) also recommended a prescribed burn every three to five years for grouse habitat at NWMA. Vogl (1965) maintained that burns are required every 2-3 years in Minnesota; 2-3 years in Illinois; and 4-5 years in North

Dakota. However, soil type and depth, temperature, vegetation, and climate have to be taken into consideration before initiating a burn. Table 2.1 provides recommended prescribed burning guidelines for grassland, shrub and aspen in the Northern Great Plains and aspen Parkland of Canada.

Fire affects vegetation in different ways. One of the simplest and least expensive practices to improve poor quality grassland is prescribed burning. The costs of a prescribed burn are related to equipment and manpower requirements, and the size of the burn area. Costs and work hours per unit of effort are high for fires of less than 4 ha but were essentially the same for larger burns of 16 ha to 113 ha (Higgins et al. 1989). Grass species actively growing when an area is burned are much more susceptible to injury or death than dormant species or those just initiating growth (Higgins et al. 1986). Bailey and Anderson (1978) found a complex relationship exists between prescribed fire and plains rough fescue in the aspen Parklands of central Alberta. The first growing season, after early spring burning, significant changes in plant communities occurred. Spring burns reduced cool season grass and increased warm season grass yields. Spring burning also increased the cover and frequency of most forbs (Anderson and Bailey 1980).

Summer burns resulted in a change in plant communities the following year. According to Anderson and Bailey (1980)

Table 2.1: Prescribed burning guidelines in the Northern Great Plains and aspen Parkland in Canada (Bailey and Wright 1982).

Vegetation	Min. Temp. (Celsius)	Wind Speed (km/hr)	Max Rel. Humidity	Drying Days
Grassland	7 degrees	3.2 - 19.3	65%	1
Shrubland	13 degrees	3.2 - 19.3	50%	4
Aspen Forest	15 - 18 degrees	6.4 - 19.3	30-40%	10-14

and Wright and Bailey (1982), summer burns reduced warm season grass and increased cool season yields the following year. Summer burns also affect woody vegetation by actively reducing following year vigour (Wright and Bailey 1982).

Shrubs and trees react to burns differently. If fire occurs before active shrub growth, an increase of shrub growth results. Spring burns usually increase sprouting and fall burns promote a taller regrowth next year. To cut back shrub growth, several summer burns are required over a 3-5 year cycle (Wright and Bailey 1982).

Trees, specifically aspen, will be either enhanced or inhibited by fire, depending on the timing and frequency of burns. Aspen are most susceptible to serious damage in early to mid-summer when carbohydrate levels are lowest. Early spring before leaf out, autumn or winter burns, when reserves are relatively high, results in a vigorous sprouting response (Higgins et al. 1989). Therefore, to control aspen growth, frequent late spring burns combined with other treatments such as mowing or herbicide during July through August, can effectively maintain open grassland areas free of aspen (Wright and Bailey 1982).

Besides aspen, other species that sprout in great numbers after fire include western snowberry (Symphoricarpos occidentalis), willow (Salix sp.), roses (Rosa sp.), wild raspberry (Rubus idaeus), saskatoon (Amelanchier alnifolia), mountain maple (Acer glabrum), hazel (Corylus sp.), alder

(Alnus sp.), wild gooseberry (Ribes sp.), bearberry (Arctostaphlus uva-ursi), serviceberry (Amelanchier sp.), and cherries (Prunus sp.) (Wright and Bailey 1982). The herb component of the understorey changes significantly after a fire; pioneer species such as thistle and goldenrod are the first to colonize the clearings (Daubenmire 1947). Ferns, blueberries and grasses (Poa, Festuca, Stipa, and Agrostis spp.) invade the clearings soon after pioneer species by vegetative sprouting or suckering, and viable seed buried in the soil (Johnson 1981).

Suppression of fire has led to forest invasion of grasslands within NWMA. The principal woody invader is trembling aspen, which, in the absence of fire or other disturbance, will actively encroach into grasslands. Where moisture is sufficient, trembling aspen will eventually develop dense forest stands, thereby replacing the grassland species (Palidwor 1990). According to Kirsch and Kruse (1973) there exists enough basic information to use fire as an effective management tool for controlling woody species and maintaining good quality sharp-tailed grouse habitat.

Many have researched the use of grazing techniques in controlling aspen encroachment onto open grassland areas. Grazing has been applied as a secondary or maintenance treatment in controlling aspen encroachment. In addition, before implementing the use of grazing its effects on other wildlife species (ie. during nesting), its financial cost, and the availability of a water supply must be considered. However, with these factors considered, many have found that grazing is a successful sharp-tailed grouse habitat management tool.

A technique suggested by Berg et al. (1987) was use of light to moderate grazing of brush or woodland on a rotational basis between June 15 - September 15. Grazing would help control natural succession and maintain the open habitat required by sharp-tailed grouse. Bailey (1986) and Bailey and Fitzgerald (1990) reported that after burning aspen in central Alberta, short duration, heavy grazing in early June and late August was an effective, economical sharp-tailed grouse habitat improvement tool. The first rotation is six weeks after the spring burn (early June) and lasts ten days, then the area is rested for forty days followed by another seven days of grazing in early August. Stocking is heavy and brush declines dramatically after two years of this practice. Fitzgerald and Bailey (1984) suggested heavy grazing by sheep or cattle may be an effective low cost control measure, especially where logs, stumps, and rocks inhibit mechanical operation.

However, in order for grazing to be an effective vegetation management technique for use in sharp-tailed grouse habitat management, many factors need to be considered. Firstly, the timing and intensity of the grazing treatment may cause more harm than good. Waterfowl and upland game bird species actively nesting or using the area for cover can be affected during the grazing period (Dornfeld and Doty 1989). Wildlife managers should weigh the cost of benefitting one species over the loss to others.

Next, in order for grazing to be effective, water sources must be in close proximity. Water sources are important to grazing cattle as well as to sheep and goats (George Bonnefoy 1993 pers. comm.). In NWMA, a consistent water supply is limited, and the cost of creating a water source may not be warrantted.

Finally, sharp-tailed grouse habitat located on large expanses of rangeland in Alberta and Minnesota have been successfully improved with grazing. In NWMA, large areas for grazing and sharp-tailed grouse use are not available, resulting in sharp-tailed grouse lek habitat that is very much smaller in size. Therefore, problems arise with water supply and land availability, and detrimental affects of grazing on other wildlife species. Wildlife managers must take these factors into consideration before implementing a grazing technique for aspen encroachment control.

Sharp-tailed grouse habitat management can benefit from the use of treatment combinations. Which treatments to use or combine will depend upon management objectives, financial and manpower availability, site topography, and regulations on use of technique in area.

If the objective is to recreate sharp-tailed grouse habitat, an initial mechanical (bulldozing) treatment will be required for aspen removal, followed by a secondary treatment. This lek site recreation will undoubtedly be expensive. However, if the objective is to maintain existing sharp-tailed grouse lek habitat, then the initial mechanical treatment is not required, thereby reducing cost considerably. If an area has lost significant sharp-tailed grouse habitat, initial cost of recreating habitat is expensive in the short-term, however long-term maintenance cost of developed habitat will be reduced, because no new habitat will be required to be created.

Many treatment combinations have been successful in vegetation management. Berger (1989) in NWMA was successful at recreating sharp-tailed grouse lek sites by using a mechanical combination of winter bulldozing and late summer mowing. The treatment was costly, but was the only alternative available.

Spring burning and summer herbicide application has been used to successfully reduce aspen encroachment onto open grassland areas in the aspen parkland of Alberta (Noval and Lerohl 1986, Bailey and Anderson 1979, Bailey et al. 1985). All found approximately 81% of aspen regeneration to be dead by the third year after burn and spray treatment. Fitzgerald et al. (1986) and Bailey et al. (1990) found spring burning followed by short duration, heavy grazing in June and August, successfully controlled aspen invasion onto open rangelands in the aspen parkland of Alberta.

In all technique combinations, factors such as financial and manpower availability, site topography, effects on other wildlife species, and environmental regulations in the area should be taken into consideration before implementation of any treatment.

2.4.1 COST OF HABITAT MANIPULATION TREATMENTS

The type and amount of vegetation to be controlled usually determines what treatment is needed. However, other factors such as financial and manpower availability, and environmental regulations in the area are equally important. Table 2.2 outlines the costs of habitat manipulation treatments in 1993 dollar values over a 20 year management period for NWMA. Costs are based on a 20 ha. plot size. Actual costs will decrease with an increase in plot size.

Costs listed in Table 2.2 are associated with sharp-tailed grouse lek site recreation. All treatments have an initial mechanical bulldozing treatment followed by a secondary maintenance treatment. Bulldozing is a one time treatment costing $191.00/ha, which includes bulldozer (D8F Cat with Romex shearblade) rental, labour, taxes, and fuel cost (G & L Construction 1993 pers. comm.). Secondary treatments vary in timing and frequency of application throughout the 20 year management period. Timing and

Table 2.2. Cost and type of aspen management techniques for use in the Aspen Parkland of Manitoba.

TREATMENT TYPE AND COST OVER A 20 YEAR MANAGEMENT PERIOD

TIME	BULLDOZING AND MOWING	BULLDOZING AND BURNING	BULLDOZING AND HERBICIDE	BULLDOZING AND GRAZING
YEAR 1	272.00	200.00	269.00	666.00 (-42.00)
YEAR 2	81.00	9.00	78.00	52.00 (-42.00)
YEAR 3	81.00	9.00	*	*
YEAR 4	*	*	*	*
YEAR 5	*	*	*	52.00 (-42.00)
YEAR 6	81.00	9.00	*	*
YEAR 7	*	*	78.00	*
YEAR 8	*	*	*	52.00 (-42.00)
YEAR 9	81.00	9.00	*	*
YEAR 10	*	*	*	*
YEAR 11	*	*	*	52.00 (-42.00)
YEAR 12	81.00	9.00	78.00	*
YEAR 13	*	*	*	*
YEAR 14	*	*	*	52.00 (-42.00)
YEAR 15	81.00	9.00	*	*
YEAR 16	*	*	*	*
YEAR 17	*	*	78.00	52.00 (-42.00)
YEAR 18	81.00	9.00	*	*
YEAR 19	*	*	*	*
YEAR 20	*	*	*	52.00 (-42.00)
TOTAL	839.00	263.00	581.00	1030.00 (-336.00)

NOTE:
All costs are in (1993) dollar values.
* represents no management cost during that particular year.
Dollar value in brackets represents income to Province through grazing.
Mechanical bulldozing combined with mowing, burning, herbicide, and grazing treatments are in per hectare costs.

frequency of treatment application follows reviewed literature recommendations for NWMA.

Mowing cost of $81.00/ha includes tractor and mower (4 foot rotary mower) rental, labour, fuel, and taxes. Mowing cost in subsequent years may be reduced because less effort will be required as increased control of encroached aspen is achieved.

Prescribed burning costs of $9.00/ha includes labour, supplies, fire guarding, equipment check, taxes, and phone calls (Kent Whaley 1993 pers. comm.). Cost does not include travel mileage.

Herbicide cost of $78.00/ha includes application equipment (Big A Terragator) rental, herbicide, labour, fuel, travel mileage, and taxes (A & M Soil Service 1993 pers. comm.). Aerial and ground herbicide application were equal in cost.

Grazing cost was assumed at $423.00/ha of conventional barbed wire fencing. Fencing was a one time cost and included labour, supplies, and custom work. Maintenance cost of $52.00/ha of fencing was assumed and included labour and material repairs. More economical fencing such as electrical fencing could be used with a capital and operating cost of $178.00/ha and annual operating and maintenance cost of $22.00/ha (Manitoba Agriculture 1992).

Costs in Table 2.2 assume that the landowner pays a grazing fee of $0.30/cow/day for 10 cows/ha of land grazed twice over/year (Manitoba Agriculture 1992). The grazing charge to the landowner of $42.00/year would approximately cover annual maintenance and operational costs of the fence (Table 2.2). Capital cost of the land was not accounted for in Table 2.2.

If maintaining existing sharp-tailed grouse lek habitat, the initial treatment and cost of mechanical bulldozing can be eliminated, thereby reducing management costs considerably. For example, if burning existing lek habitat is a management objective, the cost would be $9.00/ha every third year. Since most sharp-tailed grouse leks in NWMA are approximately 4 ha, the cost every three years would be $36.00 or $252.00/lek site over a 20 year period.

Table 2.2 offers a cookbook approach to sharp-tailed grouse habitat management techniques. Treatment timing and frequency are recommended for vegetative communities in the aspen parkland of Manitoba. Grazing treatment as a management tool for use in NWMA is not recommended due to large areas of land and water supply being unavailable, and its possible detrimental affects on other wildlife species in the area. In summary, use of a specific treatment should consider manpower and financial availability and regulations on treatment use in area.

2.4.2 HABITAT MANIPULATION MANAGEMENT FOR SHARP-TAILED GROUSE

Management guidelines for sharp-tailed grouse habitat manipulation have been developed by many researchers. These assumptions are organized into the following 4 guidelines.

Firstly, the creation of a lek should be done on a historical lek area or an area of known sharp-tailed grouse activity (Berger 1989, Rogers 1992). Manipulation should create an area that resembles a historical lek. The lek site should have high visibility (ie. 70-100%) from lek centre to at least 100 metres away (Jones 1968, Baydack 1988). Vegetative cover should be maintained at low heights (ie. <10 cm) to enable males to display and females to observe (Baydack 1988). In addition, vegetative cover within a 100 metres from lek centre should be dominated by a native grass/forb/bare ground cover complex.

Secondly, visibility should be maintained at 70-100% to 100 metres away and decreased to 30-60% at distances greater than 100 metres away from lek centre in order to satisfy escape/feeding cover (Jones 1968).

Next, visibility greater than 200 metres away from lek centre should be low and cover type should indicate a shrub/tree or dominant tree vegetative complex.

Finally, re-establishing a grouse population to historical areas may require the use of grouse vocalization recordings and decoys to attract the birds (Rogers 1992). These habitat management guidelines should concentrate on areas within 200 metres of the lek centre (Berg et al. 1987, Berg 1990, Berger 1989).

CHAPTER 3

DESCRIPTION OF NARCISSE WMA

3.1 INTRODUCTION

The study area (Figure 9) was the Narcisse Wildlife Management Area (NWMA) in the south Interlake region of Manitoba, approximately 120 km north of Winnipeg near the town of Chatfield (50° 47'N, 97° 34'W). The area comprises almost 12,000 ha of land designated for management of big game, upland game birds and furbearers as well as consumptive and non-consumptive recreational use (Dixon 1979). The area is classified an Aspen-parkland community (Bossenmaier and Vogel 1974).

3.1.1 PHYSIOGRAPHY

The central Interlake is a relatively flat remnant basin of glacial Lake Agassiz (Weir 1983). The study area lies along the central ridge portion of the region with the land sloping gently east and west towards Lakes Winnipeg and Manitoba, respectively. Lying across the general direction of the landfall is a ridge and swale topography orientated in a north-west and south-east direction resulting in poor drainage (Sexton 1979).

The area is home to many wildlife species, notably elk

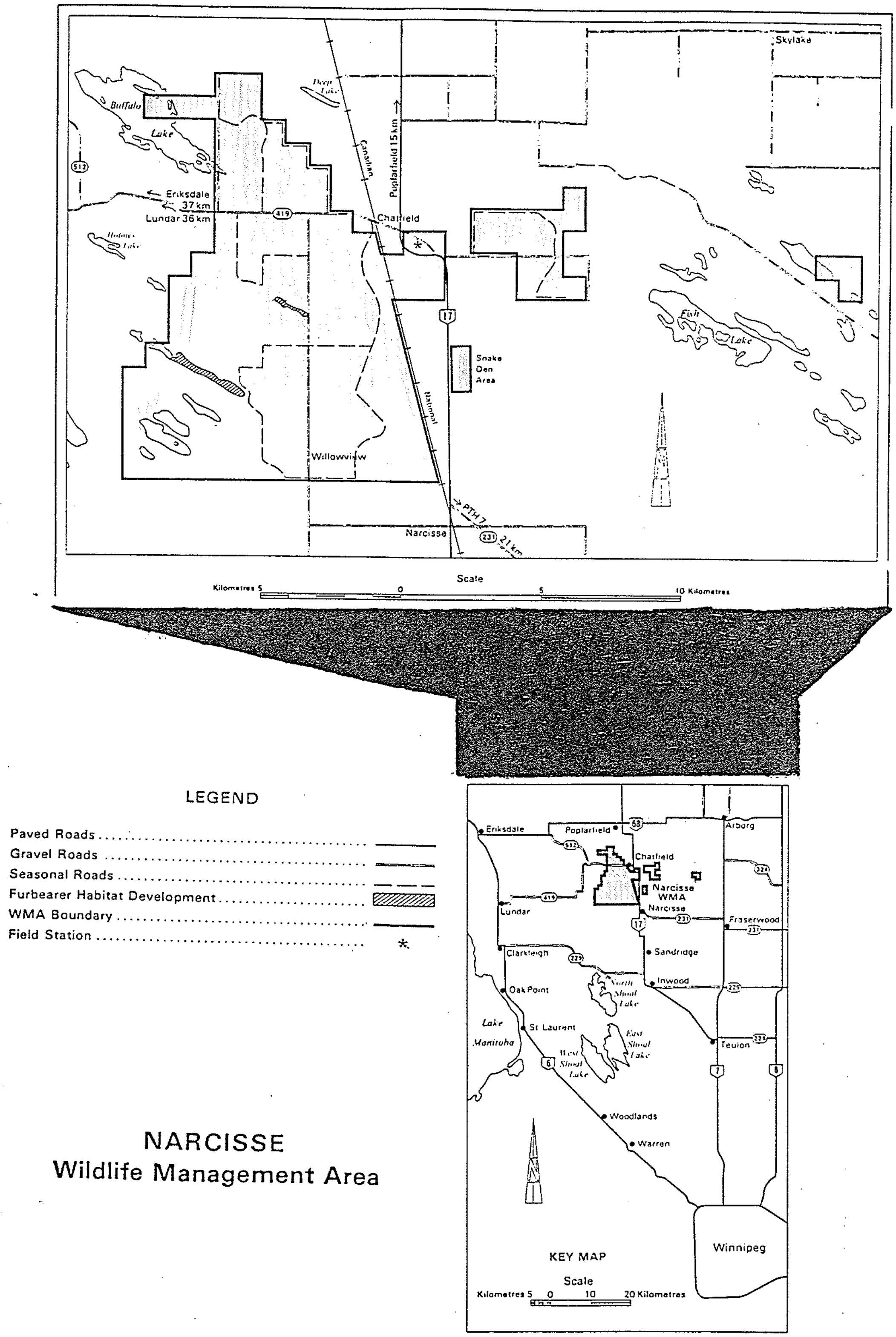


Figure 9. Location of the Narcisse Wildlife Management Area, in the south Interlake region of Manitoba.

(<u>Cervus canadensis</u>), white-tailed deer (<u>Odocoileus virgiunianus</u>), coyote (<u>Canis latrans</u>), snowshoe hare (<u>Lepus americanus</u>), red fox (<u>Vulpes vulpes</u>), a variety of raptors and waterfowl, red-sided garter snake (<u>Thamnophis sirtalis parietalis</u>), ruffed grouse (<u>Bonasa umbellus</u>) and sharp-tailed grouse. Sexton (1979) and Berger (1989) provided a list of common avian and mammalian species found in the NWMA (Appendix A).

Past studies in the area include research on white-tailed deer (Collins 1974), ruffed grouse (Rusch et al. 1976, 1978), sharp-tailed grouse (McKay and Carmicheal 1970, Sexton and Gillespie 1979, Sexton 1979, Berger 1989, Berger and Baydack 1992) and habitat mapping using remote sensing (Dixon and Sexton 1978). Present studies include research on red-sided garter snakes, snowshoe hares, and sharp-tailed grouse.

Sexton (1979) and Berger (1989) provided a list of plant species commonly found in NWMA, with the dominant tree species being trembling aspen. Other common tree species, shrubs, forbs and grasses found are listed in Appendix B.

3.1.2 CLIMATE

The climate in this part of Manitoba is classified as sub-humid continental (Weir, 1983). Average annual precipitation, which includes both rain and snow, is between

457.2 mm - 508.0 mm. The average summer temperature is 18.9° celsius with winter temperatures falling between -17.8° to -25.9 celsius. Throughout the area, winds blow predominantly from the northwest with variations in wind directions occurring in spring and summer (Weir, 1983).

3.1.3 GEOLOGY AND SOILS

The underlying bedrock of the region is Silurian dolomitic limestone of the Interlake Group (Baillie 1951). Near Chatfield, exposed outcrops have been assigned to the Inwood formation (Weir 1983). A surface mantle of water-modified glacial till covers the bedrock (Sexton 1979). Soil coverage is thin and stony on ridge tops and thicker in swales.

Near Chatfield soil types have been assigned to the Garson association and consist of grey wooded, dark grey, peaty meadow and half bog soils (Weir 1983). Soils are generally thin (8-30 cm), stony, high in lime content and imperfectly drained.

3.1.4 RECREATIONAL USE OF NWMA

Visitors use NWMA to satisfy various needs. Easily accessible trails allow hiking, cross-country skiing, and horseback riding. NWMA offers naturalists and recreationalists an opportunity for bird watching, or an occasional glimpse of an elk, white-tailed deer or a grouse. In addition, NWMA's red-sided garter snake hibernacula are an international attraction that provides visitors with an opportunity to observe the unique mating rituals. In summary, NWMA provides a wide variety of outdoor recreational opportunities.

3.1.5 NWMA: LAND USE AND VEGETATION

Agricultural settlement of the Narcisse-Chatfield area occurred in the early 1900's. Settlement resulted in establishment of livestock orientated subsistence farms. Few sharp-tailed grouse were present in the area prior to settlement (Berger 1989). Land development for agricultural production, and harvest of trees for lumber and fuel wood intensified as settlement increased. Occurrence of fire and clearing of land changed the area from coniferous forest and aspen into primarily an Aspen parkland (Berger 1989). With chronic agricultural production problems because of stoniness, low fertility and general droughtiness of soils, few viable economic farm units remained by 1968 (Dixon 1979).

In 1963, the Prairie Farm Rehabilitation Administration (PFRA) community pasture was established in the area. In 1965, 13,260 acres (5,300 ha) were opened to cattle grazing.

The grazing had a positive affect on sharp-tailed grouse since it opened up vast areas and created and maintained grassland habitat (Berger 1989).

Habitat improvement projects focusing on enhancing white-tailed deer habitat in NWMA were initiated in 1972. The projects involved clearing and discing trails, seeding old fields and establishing 340 ha of forage consisting of alfalfa (Medicago sativa), Alsike clover (Trifolium hybridum) and wheatgrass (Agropyron spp.) (Dixon 1979). With the increase of grassland habitat, the area was enhanced for sharp-tailed grouse.

Other habitat improvement projects were carried out in 1972. Two blocks of land were designated as sharp-tailed grouse management areas and prescribed burns were conducted in spring 1972. The first burn (250 ha) was conducted approximately 4 km south of Chatfield. The fire enhanced sharp-tailed grouse habitat as it burned over leks 8,9,10,11 and 12 (sec. 3.2). The second burn occurred 3 km west of Chatfield and north of PR 419, and burned over lek 13 (Berger 1989). Other fires, either prescribed or accidental, burned in the area between 1967 and 1989.

Between 1900 and 1968, cultivation of small acreage, clearing land and wild fires were the major cause of habitat change in NWMA. This change kept the grassland relatively free of aspen and resulted in a habitat complex likely ideal for the prairie sharp-tailed grouse population around the

NWMA from the early to mid-1900's (Berger 1989).

Since the early 1970's, open grassland areas in NWMA have become closed in by aspen encroachment. Abandonment of farm units and fire suppression have resulted in loss or degradation of sharp-tailed grouse habitat in the area. Vegetation succession of the aspen parkland is progressing towards an aspen climax community (Bird 1961) which does not favour sharp-tailed grouse populations.

In NWMA, Berger and Baydack (1992) found aspen cover increased by 81% and prairie decreased by 81%, since the 1970's, on abandoned leks. Berger also found aspen encroachment in NWMA to be 1.8% per year on active leks. Once aspen cover began to increase from 44% to 56% the lek began to present signs of abandonment (Dixon 1979, Berger and Baydack 1992). Furthermore, any vegetation change resulting in a greater than 56% aspen cover on a lek site, resulted in sharp-tailed grouse abandoning a lek.

Loss of sharp-tailed grouse habitat through vegetation change in NWMA is a problem that should be addressed if sharp-tailed grouse populations are to be maintained. Development of habitat management guidelines to control aspen encroachment and maintain open grassland habitat should provide sharp-tailed grouse with the required habitat complexes to satisfy their breeding and cover needs.

3.2 LOCATION OF LEKS WITHIN NWMA

Identification and validation of leks and sharp-tailed grouse dancing ground numbers in NWMA were carried-out through literature reviews and personal communications. During spring 1990, 1991 and 1992, lek identification and lek attendance counting were carried out using techniques developed by Cannon and Knopf (1981). Lek identification and attendance counts were also carried out on known leks within NWMA. Lek attendance was established by observing bird activity or evidence of display, ie. trampled vegetation, droppings and or feathers. Comparison of findings to that of Sexton (1979) and Berger (1989) was conducted, with leks in the NWMA categorized as historical/abandoned, stable or newly developed (Figure 10).

Distances between leks were measured during 1990 and 1991. Distances between active leks ranged from 1 to 6 km , with average distance calculated at 3.4 km. Distances between historical leks ranged from 0.5 to 1.5 km. The loss or decline of male and female attendance on and/or surrounding a lek was considered to be a useful tool for measuring habitat quality on or near the lek.

3.2.1 DESCRIPTION OF LEKS WITHIN NWMA

During spring 1990 and 1991, lek reconnaissance

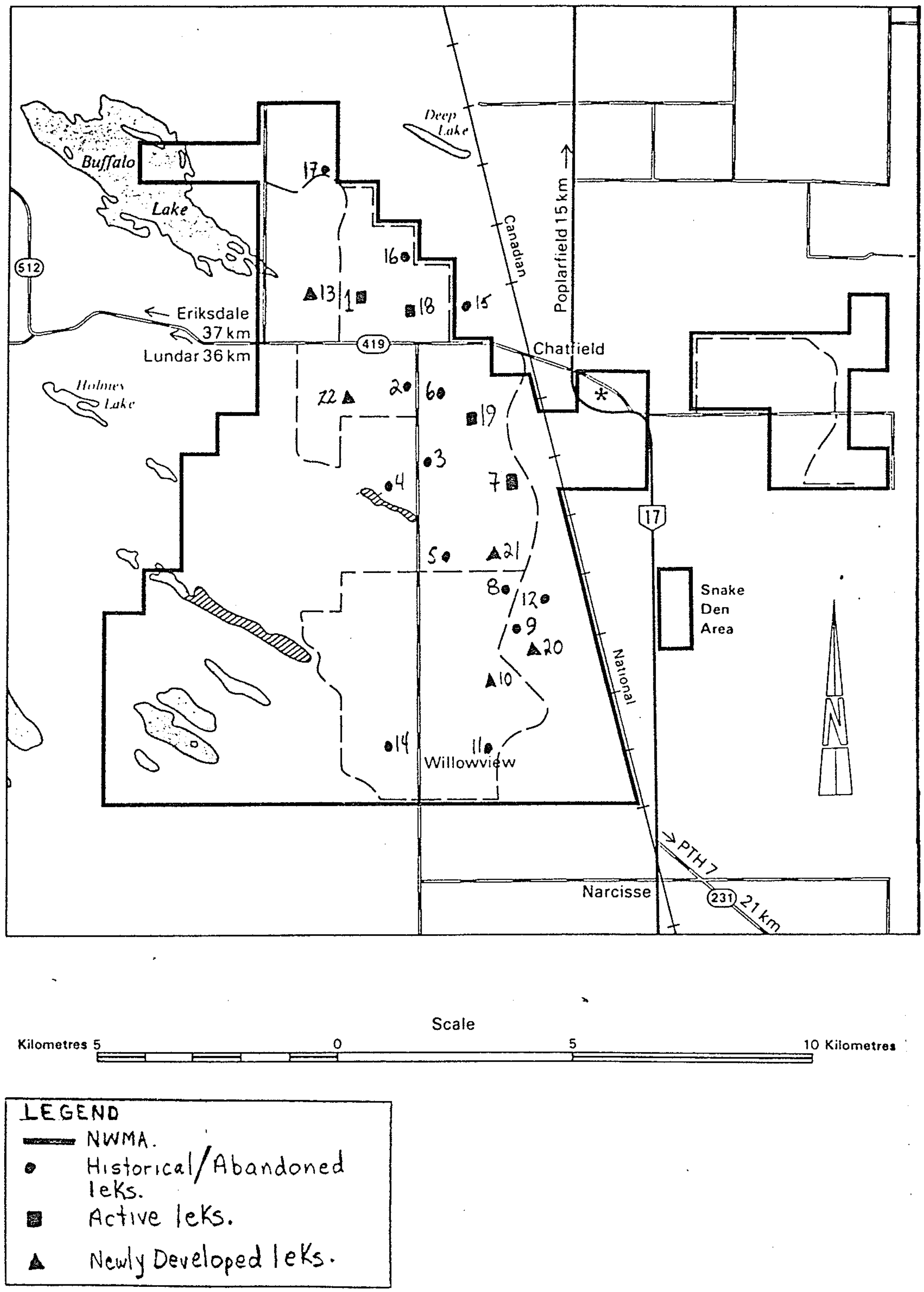


Figure 10. Study area within NWMA, numbers indicate location of historical/abandoned (2,3,4, 5,6,8,9,11,12,14,15,16,17), active (1,7 18,19) and newly developed leks sites (10,13,20,21,22).

was carried out within NWMA to monitor grouse attendance on and in close proximity to leks. From 1989 - 1991, the total number of active leks within NWMA increased to six (active leks #1,11,17,18,19,20 - Figure 10). The increase was due to activity on historical lek #17. Lek #17 is located northwest of Chatfield and was found to have 3-5 males displaying during 1990 and 1991. In 1991, 2 females were sighted perched in nearby tress observing the display of males on the lek. However, in spring 1992 no grouse activity was observed on lek #17. In addition, Leks #11 and #20 were abandoned in 1992, resulting in a decline to 3 active leks in NWMA.

A description of the 3 active leks (#1,18,19) and two abandoned (#11,20) leks, located and verified within NWMA follows. Lek #1 is located on a perennial forage field. In 1989, the lek had 6-13 males displaying (Berger 1989). During spring 1990 and 1991, 6-10 males were observed displaying on lek #1. During 1992, spring lek reconnaissance resulted in 1-3 males displaying.

Lek #11 (abandoned 1992) is located south of Chatfield and according to Berger (1989) 1-27 males have been displaying since 1970. During spring counts in 1990 and 1991, a maximum of 3 male sharp-tailed grouse were found displaying on lek. Three sharp-tailed grouse (unknown sex) were flushed in late May 1991 in very close proximity to the lek. Spring 1992, no grouse activity was observed on lek

#11.

Lek #18 is located west of Chatfield and is frequently burned by fires from the town landfill site. The lek became active in 1979 with 18-25 males displaying yearly (Berger 1989). During 1990 and 1991 spring counts, 10-15 males were observed displaying. During 1992, spring lek reconnaissance resulted in the observation of 3-8 male sharp-tailed grouse displaying on the lek. Only on one occasion were female (2) sharp-tailed grouse observed on the dancing ground.

Lek #19 is located south of Chatfield and became active in 1979 as well. According to Berger (1989) 8-21 males displayed yearly between 1979 - 1989. During 1990 and 1991 spring counts, 23-25 and 15-18 males displayed on leks, respectively. During spring 1990, a high female attendance (4-8) was observed on or in close proximity to the lek. In spring 1992, 12-15 male sharp-tailed grouse were observed displaying.

Lek #20, now considered abandoned, is also located south of Chatfield. Berger (1989) recreated this lek and observed 9-12 males displaying from 1987 to 1989. Furthermore, females of varying age were visiting the site in 1988 (Berger 1989). In 1990 and 1991, 3-5 males were observed displaying on the lek. However, no females were observed. During 1992, spring lek reconnaissance resulted in no observations of male displays or female attendance. Lek #20 was partially mowed in 1990, but not in 1991 or

1992. Therefore, heavy aspen regrowth on site has reduced visibility which may have caused the lack of grouse use of site.

Two leks, #14 and #15, both acknowledged by Sexton (1979) and Berger (1989,) were located during spring 1990 and 1991. However, no males or females were observed displaying or in attendance at these leks. Spring 1992 lek reconnaissance also revealed no displaying or attendance activity by sharp-tailed grouse. It is likely that leks #14 and #15 have been abandoned in favour of leks #11 and #18.

Historical/abandoned leks #2,#3,#4,#5,#6,#8,#9,#12,#13 and #16 were located through a literature review and personal communication. All leks were abandoned between 1976 and 1986. The result of spring 1990, 1991 and 1992 monitoring of abandoned leks, was that these are still leks unoccupied by sharp-tailed grouse. All lek areas experienced heavy woody encroachment and reduced horizontal visibility.

Historical lek #10 was active during 1970-1982 with 6-30 males displaying during this time. Abandonment of this lek occurred in 1983. Lek #10 recreated by Berger (1989) had 2 sharp-tailed grouse males displaying in 1988, but there was no observance of male activity found during 1990-1992. In addition, recreated lek #21 had no visual display of male sharp-tailed grouse during spring 1990, 1991 and 1992 lek reconnaissance. Leks #10 and 21 have heavy aspen encroachment occurring and therefore have practically no horizontal visibility.

Lek #7 (recreated by Berger 1989) has very good horizontal visibility. However, a mature aspen bluff located less than 50 metres from lek centre may cause visibility obstruction. This may be the reason for lack of male display activity during 1990 and 1991, although droppings were discovered over the lek in both years and two females were possibly observed perched in nearby trees in close proximity to lek #7 in spring 1991. These females were possibly resting or nest searching. Caldwell (1976) maintained that in Manitoba female sharp-tailed grouse first look for optimal nesting cover and then breed at the nearest lek. Since lek #7 was a historical lek, the sign of female attendance could prove to be a positive sign for lek re-establishment. During spring 1992 lek reconnaissance, 2 male sharp-tailed grouse were observed displaying. Therefore, the active lek count in NWMA has improved to four (#1,7,18,19).

The decline in the total number of leks and a decline in the mean number of males per lek could be attributed to the 10 year cycle. The last high in the population for sharp-tailed grouse would have occurred in approximately 1977 (Manitoba Depart. Nat. Res. 1975). According to Berger (1989) the 10 year cycling suggested the next peak in the cycle to occur in 1987. However, although the peak in the cycle did not occur during this time, sharp-tailed grouse population did increase in 1987 and 1988 (Berger 1989). With drops in bird attendance on dancing grounds in NWMA since 1990, evidence may suggest the peak in the cycle may have occurred between 1988 and 1989. If this is true, then during this study (1991-1993), sharp-tailed grouse population would be in a low part of the population cycle.

3.2.3 VEGETATIVE CONDITIONS OF LEKS IN NWMA

Negative vegetation succession (ie. grassland to aspen) has occurred throughout NWMA's sharp-tailed grouse habitat since the early 1970's. Vegetation change has resulted in loss of preferred breeding habitat.

In 1986, abandoned leks #2,3,8,9 and 12 had 80%, 73% 81%, 76%, and 86% of their total area dominated by aspen respectively (Berger 1989). The abandonment of these 5 leks under conditions of aspen domination at lek sites relates to findings in Appendix C. That is, if aspen forest increased to over 56%, a lek was abandoned. This rate of vegetation change on abandoned lek sites was used by Berger and Baydack (1992) to set guidelines for optimal percentage of habitat required by sharp-tailed grouse in NWMA (Appendix C).

3.2.4 VEGETATIVE DIFFERENCES BETWEEN USED AND ABANDONED LEKS

Comparison of habitat factors between active, declining or abandoned leks is a useful tool in developing management guidelines for sharp-tailed grouse habitat. Many have implemented this technique to either develop or improve management guidelines. Berg et al. (1987) had developed management guidelines in 1987 by comparing leks in Minnesota. Berg (1990) improved these guidelines by comparing leks again in 1990. Rodgers (1992) recreated lek sites in Kansas through habitat improvement and attracted grouse through grouse vocalizations recordings and decoys. Waage (1989) recreated lek sites on abandoned mining areas in Montana. Recreation was carried-out by comparing vegetative cover, visibility distance and size of lek sites before and after abandonment. Leks were reestablished by simulating these habitat factors into habitat manipulation. Berger (1989) in NWMA, compared stable and abandoned leks to establish habitat requirements for sharp-tailed grouse leks. Berger then developed these habitat requirements into a habitat revitalization strategy and created (with some success) 4 new leks sites in NWMA.

3.2.5 METHODS

Measurement of vegetation cover at leks was accomplished by using the Jones cover board method (Jones 1968) and Daubenmire method (Daubenmire 1959). The Jones cover board method measured the visibility of cover used by grouse from lek centre to 200 metres away along 4 transect directions (north, south, east and west). Measurements were conducted at 6 inches above ground level at 10 metres from the cover board.

The Daubenmire method measured density and composition of vegetation from lek centre and radiating out at 60 degree intervals, up to 200 metres away from lek centre. Vegetation composition was indicated by low (0-38%), medium (39-69%) and high (70-100%) cover values.

Related literature by Berg et al. (1987), Baydack (1988), Waage (1989), Berg (1990), Rogers (1992) and more specifically Berger (1989) was used in conjunction with Figures 11,12,13, and 14 which display the vegetative cover differences between used and abandoned leks within NWMA. Measurements were conducted from August to September 1991 and August 1992. Since fall 1991, 3 leks (#11,17 and 20) appear to be abandoned. These leks have been receiving less and less use by grouse since 1990, therefore the leks were considered declining. During 1992, these leks were not used during spring counts, and therefore considered abandoned.

Examination of Figures 11,12,13, and 14 outlines 3 important habitat factors which distinguish between active and abandoned leks. These three factors are visibility,

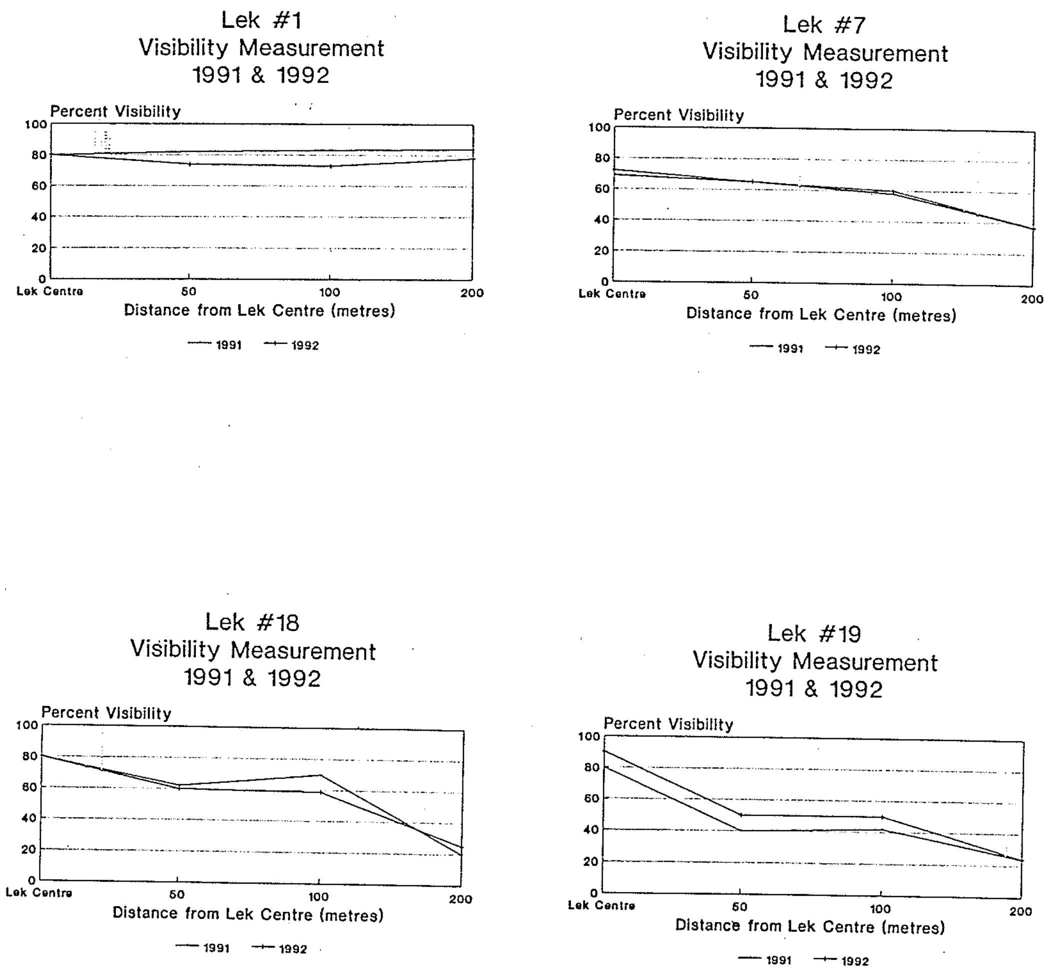


Figure 11. Active lek habitat visibility condition for 1991 and 1992 in NWMA.

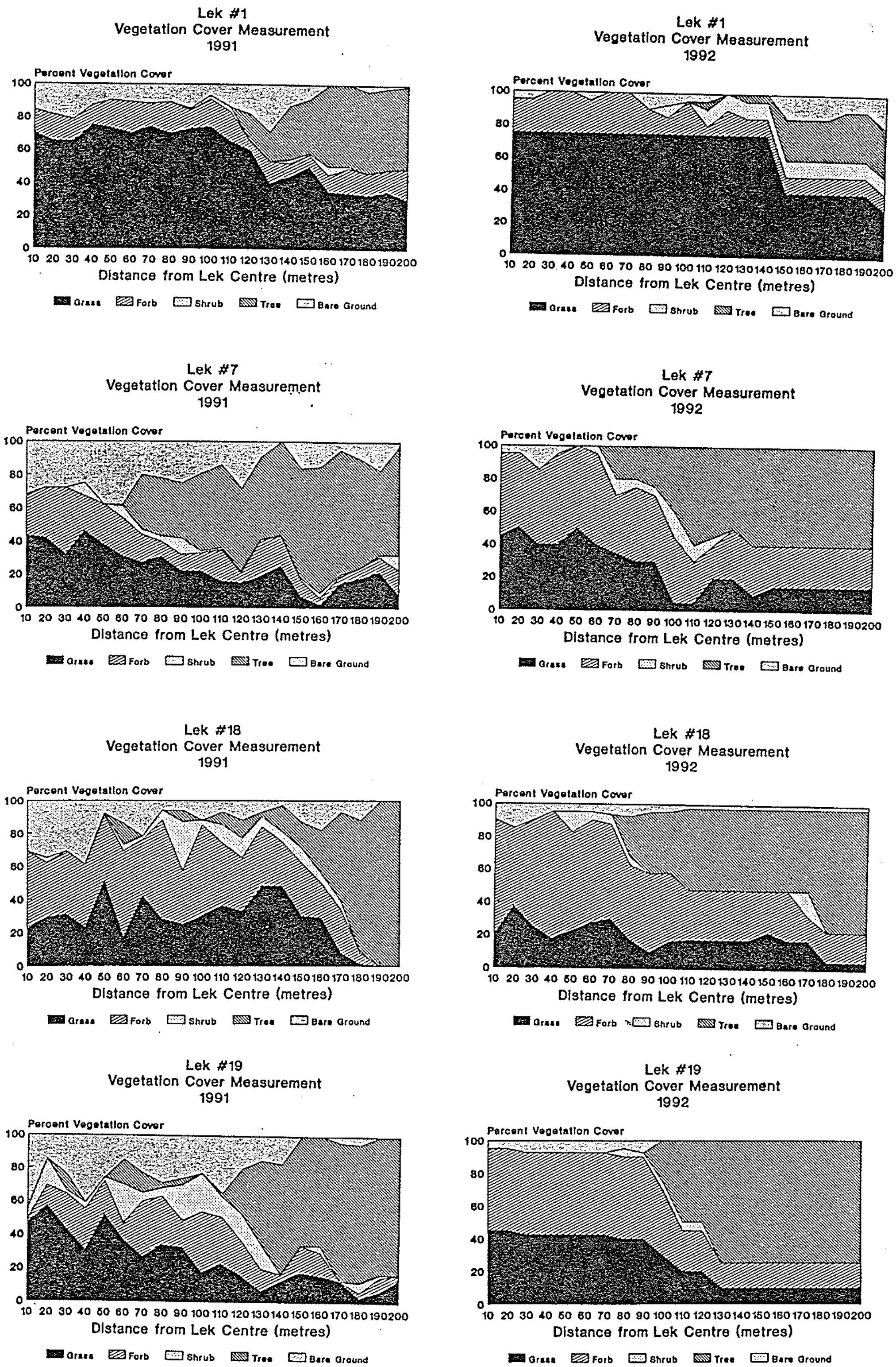
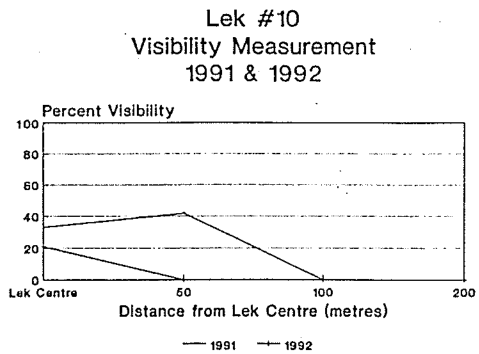
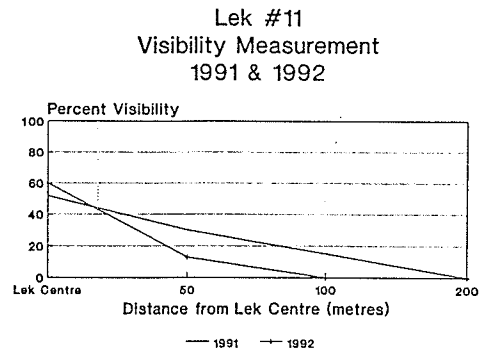
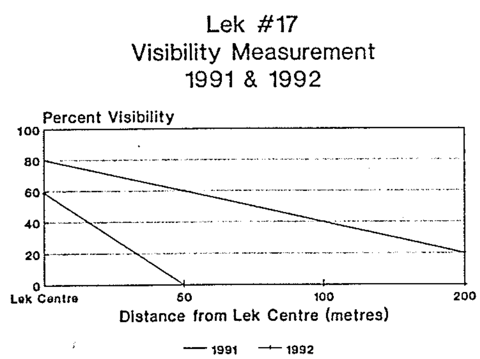


Figure 12. Active lek Daubenmire vegetation condition for 1991 and 1992 in NWMA.







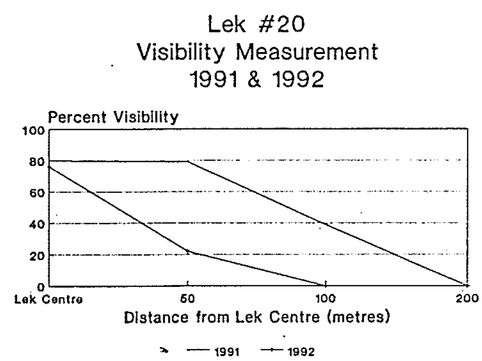


Figure 13. Abandoned lek habitat visibility condition for 1991 and 1992 in NWMA.

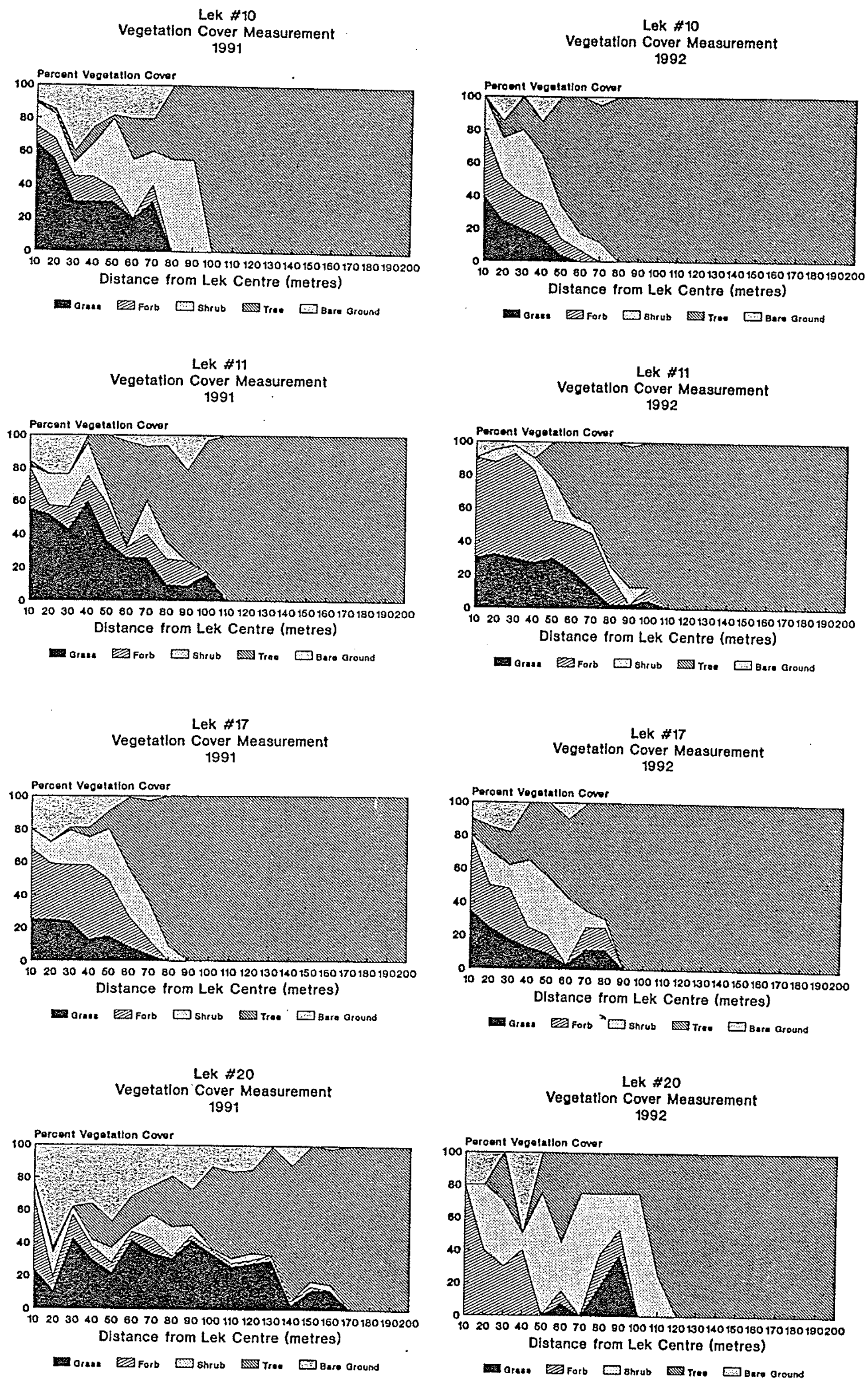


Figure 14. Abandoned lek Daubenmire vegetation condition for 1991 and 1992 in NWMA.

vegetative cover type and distance from centre of the lek to 200 m away. Visibility was found to be important to grouse for meeting their breeding (high visibility) and escape cover (lower visibility) requirements. Baydack (1988) observed that all active leks had high visibility (70-90%) with vegetative height no higher than 10 centimetres and a slope to provide a broad horizontal view of the surroundings. Ammann (1957), Pepper (1972), and Caldwell (1976) all confirm these findings.

Jones (1968) confirms these findings and emphasized visibility on leks averaged 83% to distances up to 100 metres from lek centre. Active leks in NWMA had high visibilities of 55-95% (average 68%) maintained to distances of greater than 100 metres. Lek #19 was the only active lek with low (45%) visibility at 100 m away. An explanation for this low visibility may be due to a high woody species around 80-100 m distance in one area of the lek, or because of its irregular shape.

Berger's (1989) visibility data is similar to the results of this study. All existing leks show similar high visibility at lek centre extending to 100 metres away. From approximately 125 metres away visibilities began to decline. This reduction in visibility with distance is similar to the visibility results of this study. However, lek 10 which is now abandoned, had high visibility up to 100 metres away from lek centre in 1989 (Berger 1989). In 1991 and 1992, 0%

visibility was measured at 100 metres from lek centre. This is evidence of the result of discontinued habitat management on lek #10. The lek site has become encroached upon by woody species and eventually was abandoned.

Figure 15 provides an average of Figures 11,12,13, and 14. A noticeable visibility difference was observed on all abandoned leks in NWMA. Visibility between 0-80% (average between 26-47%) was observed up to 200 metres away from lek centre. With lek centre visibility averaging between 53-60% (Figure 15) and declining with distance, it provides evidence that corresponds to the literature on lek abandonment and produces a picture of declining habitat quality. Once visibility is decreased, grouse may abandon a site because the habitat required to meet specific breeding and behaviourial needs has declined in quality.

Reduction in visibility to less than 40% (average 37% Figure 15) was indicated from approximately 150-200 metres away from active lek centres. The reduction in visibility was the result of increased shrub/tree cover. Many confirm these findings (Ammann 1957, Berg et al. 1987, Baydack 1988, Berger 1989) and state that reduced visibility is required to satisfy cover and nesting needs. Jones (1968) reported that less than 39% visibility was indicated at nesting and escape cover habitat for sharp-tailed grouse. Therefore, visibility on active lek sites in NWMA should be high (70-100%) between 100-150 metres away from lek centre and then

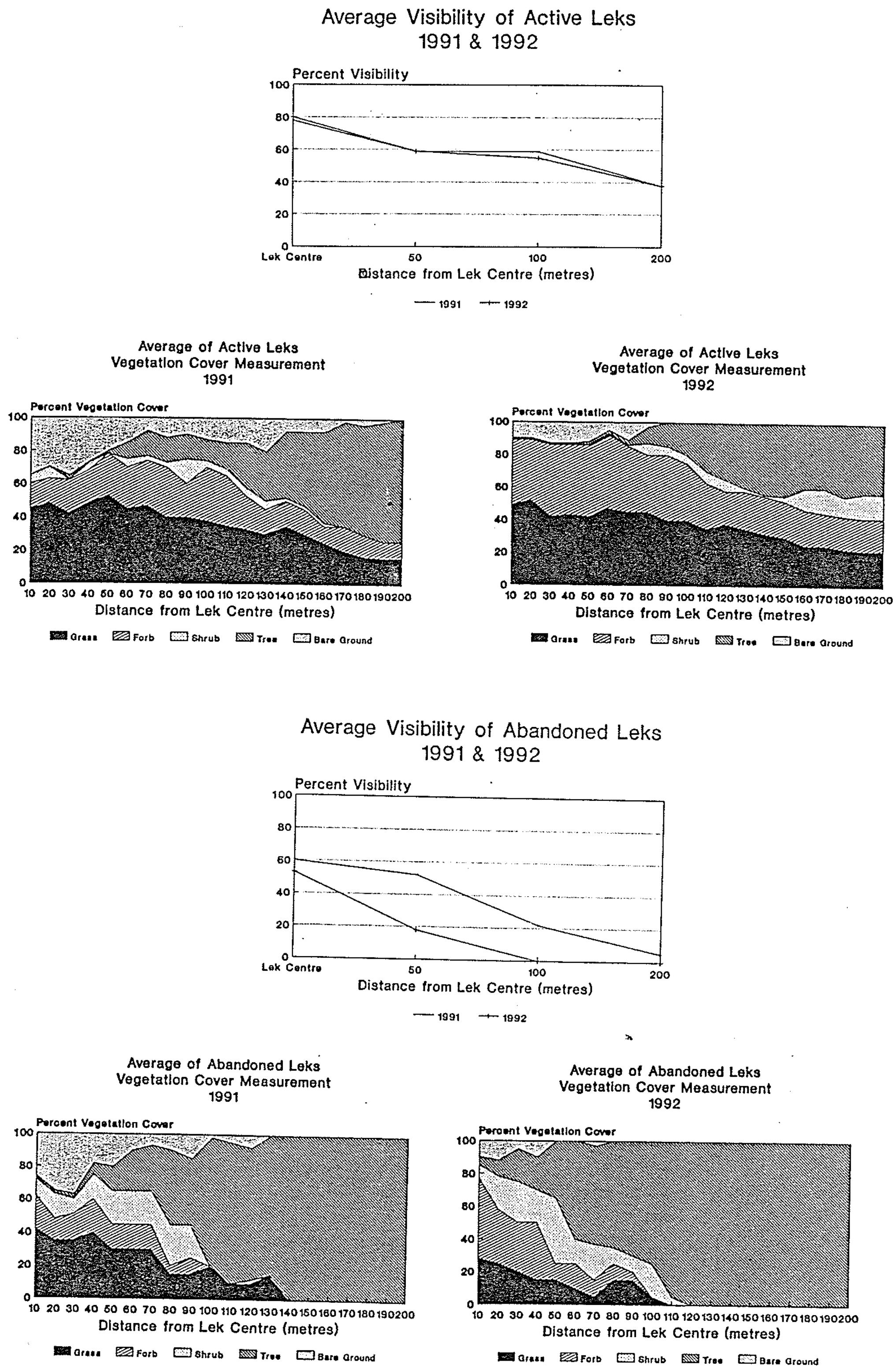


Figure 15. Average of active and abandoned lek habitat condition for 1991 and 1992 in NWMA.

allowed to decline to less than 40% from 150 metres away in order to satisfy sharp-tailed grouse breeding and cover requirements at a lek site. Active leks from Figure 15 show a decline of tree cover from 1991 to 1992. This may reveal positive response of present aspen management through the use of summer mowing. Mowing efforts after three years on active leks sites in NWMA have been reduced in cost and work effort, which indicates positive signs for mowing as an effective vegetation management tool (D. Roberts 1993 pers. comm.).

Lek edge is defined by the display areas (DA) and display perimeters (DP). Display areas were 10-50 metres away from lek centre on active leks in southwest Manitoba (Baydack 1988). Research indicates visibility limits which defines the DA and DP. DA visibility was approximately 71.8% and DP visibility was approximately 52.2% (Baydack 1988). Therefore, visibility should be maintained at a high level (>70%) for lek DA. Active leks in NWMA have a DA of 40-80% up to 50 metres from lek centre. When the visibility begins to decline, the area is considered the DP. Active leks in NWMA, have DP from 50-100 metres. At distances greater than 100 metres from lek centre on active leks in NWMA visibility declines to <40% levels (Figure 15).

DA visibility below 70% values may result in sharp-tailed grouse responses due to habitat quality reduction. These responses are assumptions based on visibility measurements. Firstly, grouse will reduce their display area to maintain high visibility. An example of this may be seen on active lek #19. Sharp-tailed grouse will continue reducing the DA until a distance of approximately 15 metres from the lek centre is reached. Secondly, male sharp-tailed grouse attendance will decline due to the crowding effect. Thirdly, the lek will be abandoned when DA is <15 metres with visibility reduced to <50%. In NWMA, the abandoned leks display these characteristics (Figure 15).

Habitat cover type on a lek site has a close relationship to visibility as well as distance. From Figure 15, all active leks in NWMA are dominated by a medium to high percentage of a grass/forb (many species) and scrub (dominated by bearberry) grassland species composition as well as bare ground from lek centre to approximately 150 metres away. This type of vegetative cover maintains the visibility requirements of an active lek and therefore, confirms this close relationship. Berg et al. (1987) suggested at least 180-270 metres of open, highly visible habitat from the lek centre. Caldwell (1976) suggested that in Manitoba "large" (up to 200 metres) open grassland areas are important to sharp-tailed grouse. Berger (1989) found in NWMA leks, a combination of grasses, forbs, and bare ground was evident up to 100 metres away from lek centre. Active leks in NWMA met these established cover requirements.

Abandoned leks in NWMA displayed low percentages of grass/forb complexes and these grass/forb complexes were located at a lesser distance from lek centre. In addition, abandoned leks experienced a much higher shrub/tree composition at distances closer to lek centre which also extended to 200 metres away.

Berger (1989) stated that once woody cover attains values greater than 56% the lek is likely to be abandoned. Abandoned leks in NWMA reveal values of woody cover greater than 56% at distances less than 60 metres from lek centre. The vegetative cover between abandoned leks in the study and Berger's (1989) Appendix C is somewhat similar. This relationship reveals the need for establishing a habitat management program to control woody succession on sharp-tailed grouse habitat in NWMA.

These findings were used to develop preliminary guidelines for sharp-tailed grouse habitat management in NWMA. Habitat visibility and vegetative cover were based on a vegetation analysis, associated literature and lek reconnaissance in NWMA.

CHAPTER 4

LEK SITE RESTORATION

4.1 INTRODUCTION

Sites in NWMA targeted for potential habitat improvement were based on the following three criteria. Firstly, the site had to be a historical lek site or an area of known sharp-tailed grouse attendance or activity. Secondly, the site must have shown evidence of vegetation change from grass/brushland to forest. Thirdly, the site had to be within 1.6 to 2.4 km from other active lek sites.

Two sites were selected for habitat manipulation in NWMA based on these three criteria. Site #13 was a historical lek which had 6-13 male sharp-tailed grouse displaying yearly up to 1976. It had been abandoned from 1977 to present. It is approximately 1.1 to 1.8 km from other active lek sites in NWMA. Since 1977, negative vegetative succession in the form of aspen encroachment has changed habitat thereby reducing visibility, habitat quality and lek site attractiveness. Appendix D, provides an aerial photograph of the vegetative change on sites #13 and #22 from 1961 to 1981.

The second site chosen for habitat manipulation was site #22, which is 1.8-2.4 km from active lek sites in NWMA. Site #22 was not known to have any lek activity from 1970-

1991. However, grouse sightings and attendance surrounding the area were known during this time (B. Cameron 1991 pers. comm.). Vegetative cover was heavy enough to restrict visibility from the centre of the slightly elevated portion of the open area. The site did have large areas of aspen encroachment which restricted visibility and may have made the site unattractive for sharp-tailed grouse use.

4.2 LEK SITE MANIPULATION

Lek habitat was modified based upon Berger's (1989) strategy, the reviewed literature, and upon habitat manipulation guidelines for sharp-tailed grouse (sec. 2.4.1). In February, 1991, the two selected sites were cleared of standing aspen by a bulldozer (D20F International with a Romex shearblade). Cleared material was piled at least 30 metres from standing aspen in order to minimize fire hazard. Consideration was given to minimize soil disturbance by keeping the shearblade raised above top soil level (5-10 cm high). Temperature was recorded at -20 to -25 degrees Celsius (bulldozing should be carried-out on the coldest days in order to snap and not bend the aspen). The extent of manipulation was intended to resemble historical vegetative conditions of selected sites.

Manipulation of site #13 was conducted in the area of historical lek #13. The total area cleared (by bulldozer) of standing aspen was approximately 22 ha. Site #22 was cleared of approximately 20 ha of aspen to create open habitat. Between 3 and 10 September, 1991, a tractor equipped with a 5 foot rotary mower was used to cut back suckering aspen. Lek sites mowed (trimmed) were approximately 42 ha in total size. Areas with rock, which could not be mowed, were trimmed manually with brush saws.

During mid August 1992, mowing was carried out by Manitoba Department of Natural Resources (Wildlife Branch) to reduce suckering aspen, and maintain the required visibility and vegetative height on both sites as described by habitat management guidelines. Size of areas mowed were approximately 4 ha each on both sites. Total area mowed was 8 ha.

The total time and cost of manipulation over the two years is outlined in Table 4.1. Total time of bulldozing aspen was recorded at 100 hours at a total cost of $8,000.00. Cost per hectare was approximately $191.00 for bulldozing aspen. Mowing suckering aspen and other selected vegetative regrowth accounted for 41 hours at a total cost of $3,420 or $81.00 per hectare. Second year mowing completed by MDNR was carried-out on 8 ha at a cost of $648.00. Therefore, total cost of the two year manipulation was $12,068.00 or $242.33 per hectare for 49.8 hectares of habitat.

Table 4.1 Cost of Habitat Manipulation of Recreated Lek Sites #13 and #22 in NWMA During 1991 and 1992.

Area Size (ha)	**Bulldozing Cost (1993 $)**	**Mowing cost (1993 $)**
Site #13: 22.2 ha Site #22: 19.6 ha Total Size: 41.8 ha	Total Cost: $8,000.00 * Total Cost/ha: $191.00/ha	1st year: $3,420.00 or $81.00/ha 2nd year: $648.00 for 8 ha Total Cost: $4,068.00 ** or $81.00/ha

Total Cost of Manipulation = $12,068.00 or $242.00 /ha for 49.8 ha

* Denotes bulldozing cost which includes operator labour, machine rental and fuel.

** Denotes mowing cost which includes mower rental, fuel, and labour.

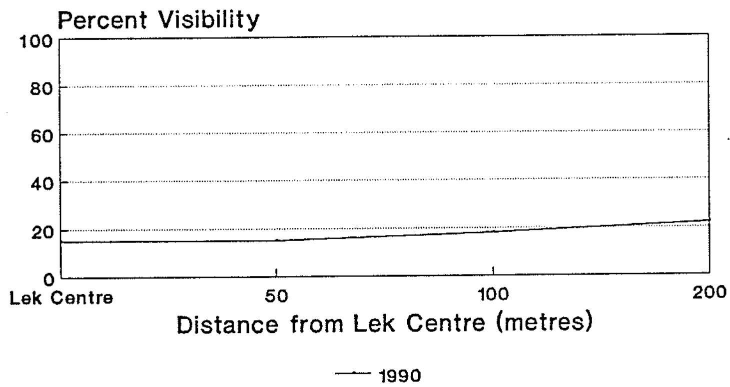
Note: Cost values are rounded-off to the nearest dollar.

4.3 VEGETATION ANALYSIS OF MANIPULATED SITES

Jones cover board and Daubenmire vegetation samples were taken from May to September, 1991 and in late August, 1992. Measurements were used to determine site visibility and vegetation cover composition on manipulated sites. In addition, these values were compared to values of active and abandoned leks in NWMA for analysis.

Jones cover board visibility samples on sites #13 and #22, before manipulation (ie. fall 1990), are shown in Figure 16. Visibility on sites were measured at approximately 20% throughout the full 200 m. This measurement indicated heavy visual obstruction by vegetation. After bulldozing and before mowing (1991), visibility was 0% for the full 200 metres from site centre. Low visibility was caused by aspen suckering or 1st year growth. First year growth of aspen from the spring of 1991 to fall of 1991 in an area left unmowed on manipulated sites #13 and #22, suggested that suckering aspen had the ability to grow approximately 1-1.5 m in a single growing season within the study area. The result of suckering aspen following manipulation was reported in the work of Berger (1989) in NWMA to also be between 1-1.5 m in one growing season. After mowing (for both 1991 and 1992), visibility values on site #22 indicated 80% visibility from site centre to approximately 100 metres away. After 100 metres away,

Lek #13
Pre-manipulation Visibility Measurement
1990



Lek #22
Pre-manipulation Visibility Measurement
1990

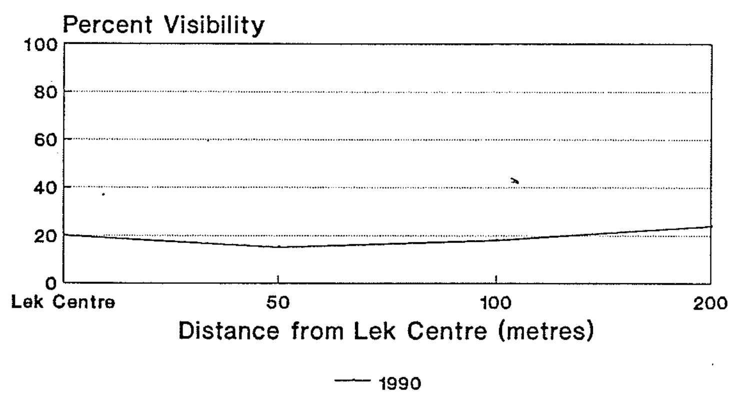


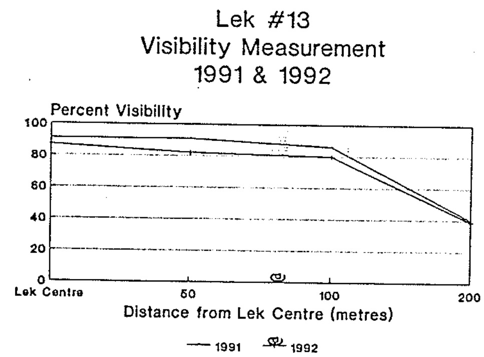
Figure 16. Recreated lek sites pre-manipulation visibility in NWMA.

visibility declined and a value of approximately 40% was indicated at 200 metres away from site centre.

Figure 17 and 18 provide habitat vegetation conditions for 1991 and 1992 in NWMA. The decline of visibility is a result of patches of shrub and tree vegetation from 150-200 metres away. The important factor is that visibility is high (>70%) up to 100 metres away from site centre (Figure 18).

Site #13 cover board values were similar to site #22. Site centre visibility (for both 1991 and 1992 measurements) indicated a value of >90% with visibility maintained at or above 85% up to 100 metres away from site centre. Visibility declined to 39% at 200 metres away which was covered by patchy shrub and aspen vegetation (Figure 17).

Daubenmire samples of vegetation cover were taken up to 200 metres away from site centre, after bulldozing manipulation on both sites. This resulted in aspen cover values of 90% with the remaining 10% indicated by shrub, forb and bare ground cover. After mowing, cover values changed. Figure 18 represents vegetation cover values at site #22. High values for grass and forbs dominated the site up to 140 metres away from site centre in both 1991 and 1992. This revealed an open area with no aspen present except for an indication of aspen cover at approximately 60 m away. This may be the result of manipulated areas being irregular in size. After 140 metres



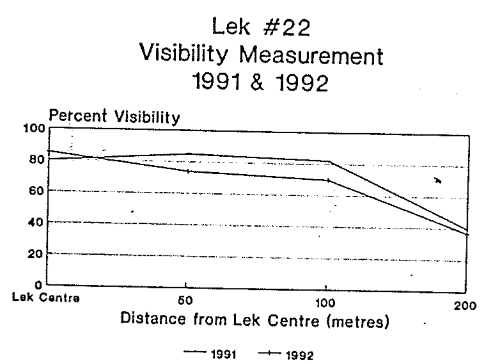
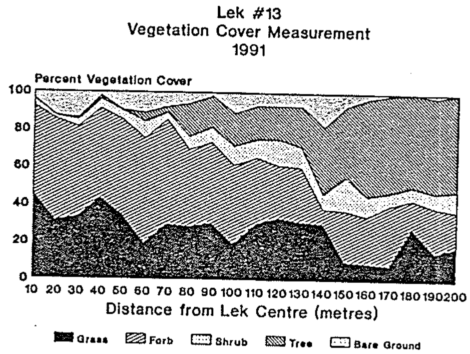
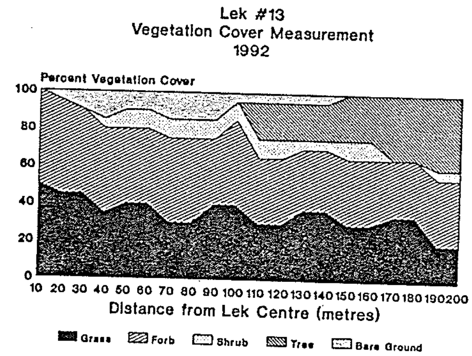
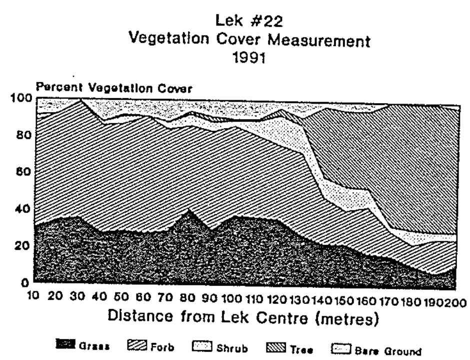


Figure 17. Recreated lek sites habitat vegetation visibility for 1991 and 1992 in NWMA after manipulation.







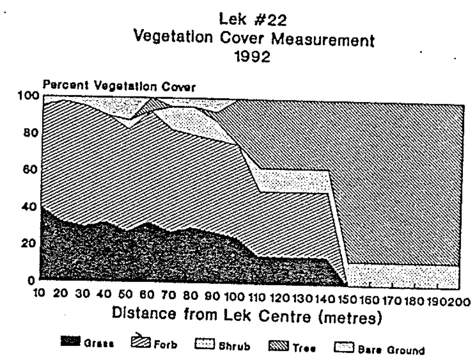


Figure 18. Recreated lek sites Daubenmire vegetation condition for 1991 and 1992 in NWMA after manipulation.

changes occurred. Medium tree cover values are present but not dominant. Shrub cover values are also observed at 10-15% .

Figure 18 indicates cover values at site #13. High values of grass in conjunction with forb cover are found from site centre up to 130 metres away. However, 1992 measurements reveal a more dominant grass/forb complex up to 200 metres away from site centre. After 130 metres away, these cover values are maintained at medium levels for 1991 and high values for 1992. Site #13 indicated a more pronounced cover of shrub/tree in 1991 compared to 1992. Shrub cover was maintained at 5-10% throughout the site in both years. Tree cover was observed at low values from 80-130 metres away from site centre. After 130 metres away, tree and shrub cover values began to increase to medium levels.

Comparing Figure 17 against Figure 15 reveals visibility at recreated sites to be similar with active leks in NWMA. Similar values of a grass/forb complex up to 200 metres away from recreated site centre is revealed by comparing vegetative cover values of the recreated sites to that of active leks in NWMA (Figure 18 vs Figure 15). Medium to high levels of shrub/tree cover on recreated sites provides similarity to that of active leks in NWMA. Figures 18 and 15 reveal shrub/tree cover beginning at justified values and at distances greater than 130-150 metres away from lek site centre.

4.4 SHARP-TAILED GROUSE RESPONSE TO MANIPULATION

Monitoring of recreated sites to determine sharp-tailed grouse attendance at or near sites was done during July-December 1991, and January-September 1992. Table 4.2 provides the results of sharp-tailed grouse attendance on manipulated sites #13 and #22 during 1991 and 1992. No visual dancing display or mating was observed on sites during spring monitoring. Although there were no sharp-tailed grouse observations in the spring of 1992 (except for 2 sightings on May 21), sharp-tailed grouse droppings, trampled vegetation, and grouse feathers were observed on both sites.

Sharp-tailed grouse use of manipulated sites during the summer, fall, and winter seasons was assumed to satisfy feeding and cover needs. Younger sharp-tailed grouse were observed on two occasions in proximity of site #22. This may indicate that nesting and brood-rearing activities took place on or around the manipulated site.

Berger (1989) observed dancing males on recreated lek site #20 (ie. between 9-12 males from 1987-1989), as well as occasional female attendance. His other three recreated sites were unsuccessful at attracting dancing males, but general observations of feeding and cover use by sharp-

Table 4.2 Observations of sharp-tailed grouse use of manipulated sites #13 and #22 during 1991 and 1992 in NWMA.

Date	Grouse Sightings Site # 13	Grouse Sightings Site #22
1991:		
July 12	4 on site	no sighting
July 19	3 on site	1 large grouse with 5 smaller grouse on trail next to site
July 26	4 on site	no sighting
Sept. 3	3 on site	2 flushed from site
Sept. 4	no sighting	4 small grouse on trail next to site
Nov. 21 (a)	4 on site	no sighting
Dec. 28	4 adjacent to site in trees	no sighting
1992:		
Jan. 2	2 in tree next to site	2 large grouse in tree next to site
Feb. 8	no sighting	2 large grouse on trail next to site
April 28	no sighting	no sighting
April 30	no sighting	no sighting
May 3	no sighting	no sighting
May 5	no sighting	no sighting
May 21 (b)	2 on site	no sighting
May 27	no sighting	no sighting
July 24	3 on site	1 on site
Sept. 11	no sighting	no sighting

Legend:

a -- pers. comm. D. Roberts, MDNR, Wildlife branch 1991.
b -- pers. comm. D. Roberts, MDNR, Wildlife branch 1992.

tailed grouse were noted (Berger 1989).

Berger's (1989) recreated lek sites were smaller in size (ie. 3.28, 3.65, 5.45, 9.45 ha), totalling approximately 20 ha, in comparison to this study (ie. 19.6 and 22.2 ha). Berger's total cost of habitat manipulation was $6,116.00 for 20 ha. Berger's sites were more successful than this study's sites at establishing a site for dancing male sharp-tailed grouse. It may appear that sites larger than Berger's may not be as effective in attracting dancing males and female attendance, and therefore, may not be as cost effective. Other contributing factors, such as decline of sharp-tailed grouse use of active leks or population declines, may be related to the lack of sharp-tailed grouse response on larger areas. In addition, the 10 year cycle of sharp-tailed grouse population was at a low during this study. It is possible that in times of a cycle high, the manipulation may have been more successful. Habitat management may consider targeting efforts in times of population highs, in order to provide and maintain good quality habitat. However, this was not studied in the scope of this research.

In addition to recreated sites being attractive to sharp-tailed grouse, sites also attracted use by other wildlife species. Table 4.3 provides general observations of wildlife use of manipulated sites #13 and #22 during 1991 and 1992. These observations were only general in context

Table 4.3 General observations of other wildlife species using manipulated sites #13 and #22 during 1991 and 1992 in NWMA.

Wildlife Type Observed	Site #13	Site #22
White-tailed deer	5	2
Red-tailed hawk	3	1
Coyote	3	0
Sand-hill crane	0	2
American Kestrel	1	0
Ruffed grouse	0	1
Snowshoe hare	0	1
Ground squirrel, Insects, and Songbirds	Numerous observations	Numerous observations

and no detailed surveys of other wildlife use of sites was conducted.

4.5 EFFECTIVENESS OF MANIPULATION IN NWMA

Manipulation of sites #13 and #22 were based on preliminary sharp-tailed grouse habitat management guidelines reviewed in the literature for NWMA. Guidelines were implemented in an effort to reduce habitat loss through the clearing of aspen, and creating open grassland areas similar to its historical extent.

Open areas created represented a clear horizontal visibility (ie. >70%) up to a distance between 100-130 metres away from site centre on both sites during 1991 and 1992. Visibility declined on both at approximately 150-200 metres away from site centre during 1991 and 1992. This data conforms to the established distance and visibility requirements of a lek site by Ammann (1957), Jones (1968), Berg et al. (1987), Baydack (1988), Berger (1989) and Rodgers (1992). The established habitat guideline data also conformed to the active lek's habitat values within NWMA.

Vegetative cover type on manipulated sites indicated similar cover values and types to the related literature. High indexes of grass and forb cover were observed up to 130-140 metres away from the sites centre on both sites. This relates directly with studies by Ammann (1957), Hamerstrom et al. (1961), Berger (1989) and Berg (1990) who found that open low level vegetative cover was required for breeding purposes at distances less than 200 metres away from lek centre. Shrub cover combined with tree cover increased from 150 metres away from site centre on both sites. Berger (1989) found that bulldozing and mowing did not alter plant species cover of low vegetation. Manipulation did change the cover and density of shrub and tree cover, which was the primary purpose of the treatment. Comparison of vegetation at lek sites #13 and #22 to that of active leks in NWMA showed similarities in vegetative cover. Dominant species on recreated lek sites were grass species, bare ground and forbs (bearberry and others). Similar species were found on active lek sites. Berger's (1989) vegetation cover data on both active leks and his recreated lek sites were similar in species composition to recreated sites #13 and #22.

Sharp-tailed grouse responded to manipulation by using the sites during various stages of manipulation. Use of sites by sharp-tailed grouse was observed occasionally throughout the fall 1991, winter 1991 and 1992, and summer 1992. If these birds were males an important assumption could be applied. Many authors maintain that male sharp-tailed grouse identify with lek sites not only in the spring but also in the fall (Ammann 1957, Hamerstrom and Hamerstrom 1951, Rodgers 1992).

Female sharp-tailed grouse response to the recreated sites was possibly observed with and without broods. This was a positive sign for the manipulation treatment as well as for the recognition of primary attachment to manipulated areas. Sexton (1979) and Caldwell (1976) found that females nested and raised broods in close proximity to the lek site in which mating took place. Under this assumption, good nesting and brood rearing habitat was in close proximity to the newly created lek sites. Therefore, by creating and maintaining large open areas of grassland habitat, habitat would be provided for breeding purposes as well as encouraging females to use area for nesting and brood-rearing activities. Since a brood and juvenile sharp-tailed grouse were possibly observed in close proximity to both sites, the predicted assumption may hold true.

The type of manipulation implemented was an alternative to other techniques that could not be applied in the region. The mechanical manipulation technique used was successful in creating open habitat although it proved to be costly. Total cost of manipulation was $12,068.00 (see table 4.1). The majority of manipulation cost were related to bulldozing the sites. Other, less expensive manipulation techniques such as prescribed burning ($9.00/ha) could be implemented in place of mowing to produce similar result of controlling aspen encroachment. However, this treatment can only be used as a secondary stage treatment and if climatic conditions prevail. Mowing seems to provide an effective means (ie. secondary treatment) of cutting back aspen regeneration and maintaining grassland habitat after two years of treatment when other alternative are not available. Mowing has also been effective in maintaining openness at other active leks in NWMA (ie. #7 and #19). According to D. Roberts (pers. comm. 1993) mowing treatment costs (ie. manpower and financial) are reduced considerably after two years of application. Therefore, the combination of bulldozing and mowing treatments to create and maintain the required sharp-tailed grouse habitat has been effective, but costly. Other treatment combinations which have been reviewed in chapter 2 can be used as an alternative treatment. However, decisions as to which treatment to use will ultimately depend upon financial availability and environmental regulations governing treatment use in the area.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY AND CONCLUSION

This research provides sharp-tailed grouse management agencies and other resource users with a clear understanding of sharp-tailed grouse habitat loss in NWMA. Aspen encroachment into open grassland habitat represents lek habitat loss for sharp-tailed grouse in NWMA.

Progressing aspen succession is thought to be a primary limiting factor to a grouse population (Berger 1989). Evidence of vegetation change from "good" to "bad" for sharp-tailed grouse (ie. grassland to aspen cover) was evident in NWMA since the early 1960's (Sexton and Dixon 1979, Berger 1989). The habitat loss assumption was found to exist from 1990 to 1992, with active lek use in NWMA declining from 6 to 4. Lek use decline has corresponded with a reduction of male sharp-tailed grouse attendance in the area during spring counts by approximately 40% between 1990 and 1992.

Habitat manipulation treatments to combat habitat loss and improve sharp-tailed grouse population were reviewed. Habitat management guidelines were developed for sharp-tailed grouse leks (Table 5.1 and Figure 19). Application

Table 5.1 Sharp-tailed grouse habitat management guidelines.

1. Three criteria should be followed for lek site selection:

(a) the site should be the location of a historical lek or area of known sharp-tailed grouse activity;

(b) the site should show evidence of vegetative change from "good" to "bad" (ie. grassland to tree cover) habitat; and

(c) the site should be in close proximity to other active lek sites (ie. 1.6 to 2.4 km in distance).

2. After delineating the historical extent of a site, manipulation through winter bulldozing (ie. during the coldest time in winter, January or February) can be used to clear standing aspen. Cleared material should be piled approximately 30 metres from standing vegetation to minimize fire hazard.

3. After bulldozing, vegetative regrowth can be mowed during mid August (ie. approximately 150 metres away from site centre). Mowing should cut-off standing vegetation as close to ground level as possible. Maintenance vegetation control should be undertaken annually for 2-3 years after bulldozing, and then be carried out every 3-5 years.

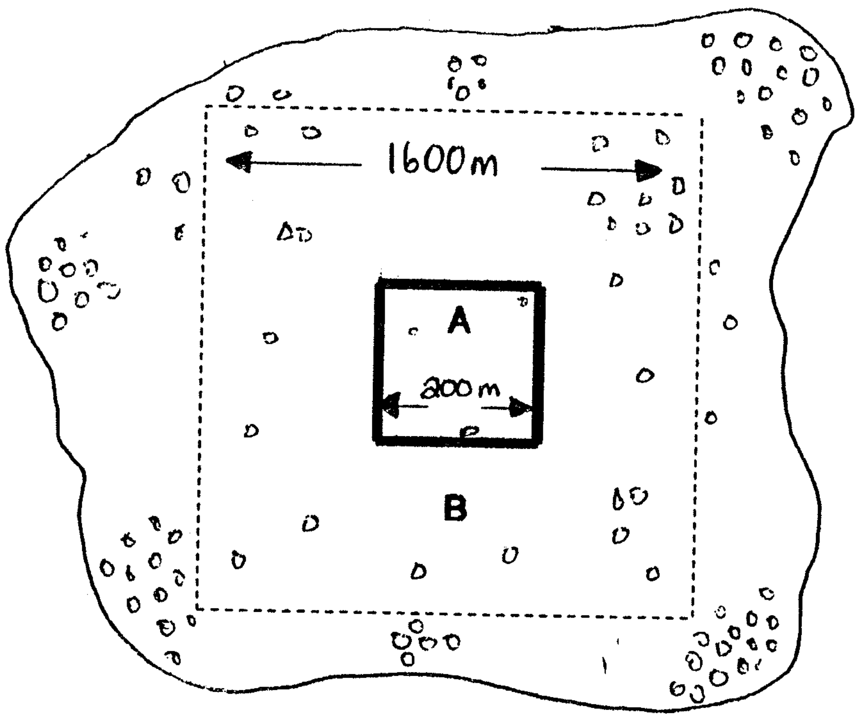
4. Area mowed should ensure visibility values of greater than 70% from site centre to 130 metres. Thus, mowing should be carried out to 150 metres to ensure this visibility. After 150 metres away visibility can decrease to approximately 40%. To ensure visibility values, measurements can be carried out using the Jones cover board method.

Table 5.1 Sharp-tailed grouse habitat management guidelines.

5. Vegetative cover differences should be maintained to ensure visibility and cover type quality. From site centre to 150 metres away, vegetative cover should be dominated by a high grass, forb, and bare ground cover complex. After 150 metres away cover should begin to increase from a low growing vegetative community to a shrub and tree cover type. To ensure cover type consistency in measurements, the Daubenmire method can be used.

Figure 19 demonstrates a pictorial representation of lek habitat along with habitat management guideline prescriptions.

Note: These guidelines were developed for sharp-tailed grouse habitat in NWMA. However, they may be applied to other sharp-tailed grouse habitat in the area with similar vegetative and soil types.



Example of vegetation distribution in one square mile of habitat, showing 200 metres of open area where the dancing ground would be located (A), and scattered clumps of woody vegetation greater than 200 metres away from dancing ground centre (B). The perimeter may contain some hardwoods (aspen), but could also contain shrubby species of prairie cinquefoil, dogwood and snowberry. This cover type would provide grouse with escape cover and nesting habitat. Visibility in area A should be greater than 70% up to 130-140 metres away from centre then allowed to decrease to approximately 40% from 150 metres away (B). Associated vegetative cover in area A should be dominated by low scrub such as bearberry and ground cedar, native forbs, and native grass species such as <u>Stipa</u>, and <u>Poa</u>. This will maintain areas visibility and food requirements of grouse. Habitat surrounding the area B may contain all recommended plant species listed above, but not in a continuous fashion. For example, managers should not allow area B, and surrounding area, to grow into solid aspen / shrub complexes. The habitat must be open with a mixture of vegetation types in order for sharp-tailed grouse to meet their food, water, cover and space needs (diagram after Berg 1990).

Figure 19. Pictorial representation of sharp-tailed grouse lek habitat with associated visibility, vegetative cover, and distance guidelines.

of these guidelines was recommended for sharp-tailed grouse leks in NWMA.

An experimental habitat restoration was carried-out as a result of the literature review. Although the experimental manipulation proved costly ($12,068.00 for 49.8 ha), it was effective at creating sharp-tailed grouse habitat. Mowing as a secondary manipulation treatment has proven to be both cost and time effective at controlling aspen encroachment in NWMA. Mowing cost of $81.00/ha are reduced after a few years of mowing treatments for lek site maintenance. According to D. Roberts (pers. comm. 1993) present lek habitat management through mowing in NWMA costs considerably less than $81.00/ha (ie. approximately $41.00/ha) and required less man hours of labour time.

Manipulation techniques to control aspen encroachment varied in time, cost, and length of use. Bulldozing proved costly, but was the only treatment available at this time for aspen removal as an initial treatment for lek site restoration. Fire, grazing, and herbicide treatments can control low vegetative communities, but were not suitable to remove large standing aspen or shrubs. Once initial bulldozing removed aspen, secondary treatments such as fire, grazing, and herbicide can be applied.

Fire can be both cost and time efficient as well as effective at aspen control. Herbicide treatment could be effective at controlling aspen encroachment, but costly when compared to fire. Herbicide treatments are often not selective and result in total destruction of non-target vegetative species. Grazing could be costly at controlling aspen encroachment. The high costs of establishing a grazing system are directly attributed to fencing. Grazing was also not feasible in NWMA. This was due to the lack of water, land availability, and present grazing policy which does not allow for such a treatment to be carried-out on WMA's. In addition, grazing has showed detrimental effects on nesting waterfowl and upland game bird species, as well as its detrimental effects on white-tailed deer browse habitat (Dornfeld and Doty 1989).

In times of fire prevention, bulldozing and mowing can provide effective control of aspen encroachment and provide habitat for sharp-tailed grouse. Where lek site restoration is not a management goal, but maintaining existing active leks are, then fire or mowing can provide similar effective results. The selection of a habitat management treatment should consider desired management objective, time, financial and manpower availability, and regulations on treatment use in area before actual application of treatment takes place.

The location of, and observation of activity, on leks from 1990 to 1992 resulted in active leks declining from 12 to 4. This information may justify the assumption of sharp-tailed grouse habitat loss through aspen encroachment in

NWMA. Responsible management agencies should ensure the maintenance of these existing active sharp-tailed grouse leks in NWMA. The necessity for particular vegetative complexes on active lek habitat are required to satisfy certain behaviourial needs for sharp-tailed grouse in NWMA. Active sharp-tailed grouse leks in NWMA, except for lek #19, occur on elevated areas and present a clear horizontal visibility of greater than 70% up to a minimum of 100 metres and a maximum of 130 metres from lek centre. Lek site visibility declines from 150 metres to 200 metres away from lek centre. Visibility values of approximately 37% at these distances were similar to other researchers findings (Baydack 1988, Berg et al. 1987, 1990, Berger 1989, 1992, Rodgers 1992).

Vegetative cover of grasses, forbs, and bare ground dominated active leks in NWMA from lek centre to 130 metres away. Berger's (1989) lek research values were similar in cover types. The low growing vegetative community maintained the visibility required by sharp-tailed grouse on leks. Distances of approximately 150 metres to 200 metres away from lek centre contained high cover values of shrub/tree vegetative complexes. Cover type similarities were recorded by Berger (1989) in NWMA. A low growing vegetative community, through proper and timely habitat management, can be maintained. Fire and/or mowing present two treatment options to satisfy this vegetation management objective.

Management of recreated sites should follow these visibility and cover type requirements. Berger (1989) used comparisons of active and abandoned lek sites visibility and cover types to recreate small lek sites (ie. between 3-9 ha) in NWMA, with some success. Berg et al. (1987) and Rodgers (1992) have also followed similar comparisons to recreate successful lek sites in Minnesota and Kansas respectively. Similar lek comparisons combined with mechanical treatments were carried-out in NWMA between 1990 and 1992. Larger lek sites (ie. approximately 20 ha) were recreated using established habitat management guidelines outlined in Table 5.1 and Figure 19. However, the lek site recreation was not successful. Many factors can be attributed to lack of success such as a low in sharp-tailed grouse population, recreated lek sites to large, study time to short, or climatic factors.

The lek site restoration was successful at creating open grassland habitat not available in the past, but unsuccessful at producing displaying males. Therefore, the assumption that larger recreated lek sites would attract more sharp-tailed grouse activity did not produce positive results. Larger sites were not as successful compared to Berger's (1989) smaller lek sites. In addition, the cost of larger sites was much more than the cost of smaller lek site recreation. Once again, many factors can be attributed to the lack of success on larger sites such as the short-term duration of this study. Unfortunately, the scope of this study did not enable the testing of these factors.

Aspen encroachment onto grassland areas not only reduces visibility, but reduces the diversity of prairie plant species (Wright and Bailey 1982). Aspen being an aggressive invader results in the loss of prairie plant species either through competition or shading effect (Bailey 1984). Sharp-tailed grouse association with prairie plant species on lek habitat is important. For example, insects that inhabit prairie plants may be lost with aspen invasion. Sharp-tailed grouse may require these insects as a food source. Evidently with the loss of prairie plant species due to aspen invasion, one may assume the loss of an entire ecosystem over time. This loss may not only show signs of sharp-tailed grouse population reductions, but population reductions of other wildlife species (ie. both plants and animals) that inhabit the prairie ecosystem.

This research fulfilled the study objectives set out in chapter one. Furthermore, this research and suggested recommendations will assist in conserving an important heritage species of the Province of Manitoba, the prairie sharp-tailed grouse.

5.3 RECOMMENDATIONS

The following recommendations are made to assist agencies in managing prairie sharp-tailed grouse habitat and set back habitat loss.

1. If lek site recreation in NWMA is a management objective, and personnel and financial resources are available, then bulldozing is a feasible initial habitat manipulation treatment to remove aspen cover at this time. Secondary management treatment by mowing to control aspen suckering and encroachment has proven to be successful in NWMA and should be continued.

2. Since lek site recreation apparently was unsuccessful at attracting displaying sharp-tailed grouse in the short-term, and lek site recreation occurred during a potential low in sharp-tailed grouse population; then management efforts to recreate lek sites should be targeted during a peak in the population cycle (ie. approximately 1997 to 1999). However, it must be noted that this recommendation should only be followed if lek site recreation is a management objective.

3. Maintaining existing active leks in NWMA should continue to be a management objective. Mowing has proven to be an effective maintenance treatment for aspen encroachment on NWMA lek sites and should be continued. However, prescribed burning can provide a cost efficient and effective treatment alternative for use in NWMA if regulations allow its use. Future research should consider the combined effect of mowing and prescribed burning, on a timely cycle, for sharp-tailed grouse habitat management.

4. Habitat management should follow Table 5.2 if the need to maintain active sharp-tailed grouse leks within NWMA is a management objective. This table will provide a useful tool for wildlife managers.

5. A habitat map of the entire NWMA should be developed. Dixon and Sexton (1978) developed a habitat map for part of the area over 13 years ago and the extent of habitat change should be verified. Mapping should utilize new techniques as well as methods established by Dixon and Sexton. In addition, recent aerial photographs and consultation with biologists would aid in habitat map development. This map would improve the area's habitat management, not only for sharp-tailed grouse but other wildlife species.

TABLE 5.2: Recommended habitat management prescriptions for sharp-tailed grouse lek sites in NWMA.

PRIORITY VALUE	LEK NO.	MANAGEMENT GUIDELINES PRESCRIBED
1	1	area maintained open by agricultural activities, ensure spring visibility.
1	7	guidelines #3,4,5.
1	13	guidelines #3,4,5.
1	18	guidelines #3,4,5.
1	19	guidelines #3,4,5.
1	22	guidelines #3,4,5.
2	10	guidelines #3,4,5.
2	11	guidelines #3,4,5.
2	17	guidelines #3,4,5.
2	20	guidelines #3,4,5.
3	21	guidelines #2,3,4,5.
3	5	guidelines #2,3,4,5.
3	6	guidelines #2,3,4,5.
3	8	guidelines #2,3,4,5.
3	9	guidelines #2,3,4,5.
3	12	guidelines #2,3,4,5.
3	16	guidelines #2,3,4,5.

LEGEND: PRIORITY LEVEL

1. HIGH PRIORITY, active leks, immediate maintenance of habitat required, ongoing management.

2. MEDIUM PRIORITY, recently abandoned leks, only implement habitat manipulation in time of a high in the population cycle.

3. LOW PRIORITY, abandoned leks since mid 1970's or earlier, heavy aspen encroachment, and costly. Target manipulation in time of a high in the population cycle and when finances are available.

6. Spring (mid April to the end of May) counts of lek attendance by sharp-tailed grouse should be continued by Manitoba Dept. of Natural Resources (MDNR). Other interested agencies should be involved in the hope to form important management partnerships. The lek counts will provide sharp-tailed grouse numbers per lek and assist in establishing breeding population trends and cycles in NWMA. The focus of spring counts should be towards active leks in the area. Consideration should also be given to research techniques that will improve the locating of active grouse leks.

7. Since WMA's are public resources, MDNR needs to strengthen its commitment to maintaining habitat as per the original objectives set for WMA's. A cooperative working relationship, such as an advisory committee, involving government and the various users of the resource should be established. This would aid in developing habitat management objectives considering the needs and interests of all parties involved, as well as assist in reducing conflicts over competing land/resource use. For example, agencies such as Sharp-tails Plus Foundation., Canadian Wildlife Service, the many Agriculture agencies along with MDNR could develop a co-management partnership benefiting

the NWMA sharp-tailed grouse, and the entire ecosysytem. Involvement could entail population surveys, habitat management, research and education. Thus, the co-management would be using WMA's to their fullest and supporting their established objectives.

8. An education program should be developed to conduct public workshops and seminars on the importance of sharp-tailed grouse and their management. This program could be developed and operated by private agencies in cooperation with the appropriate Government Department. Programs should reach and involve such parties as farmers, other landowners, general public, schools, private business and wildlife managers.

9. Suggett (1991) suggested the establishment of priorized sharp-tailed grouse management areas where intensive research would be performed to increase grouse habitat. With this in mind, consideration should be given to the excellent opportunity that exists in NWMA. The availability of data and research produced in NWMA presents an opportunity to target not only other research and management, but to promote education and recreation of sharp-tailed grouse.

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APPENDIX A

List of avian and mammalian species found and observed in NWMA (Sexton 1979, Berger 1989)

AVIAN SPECIES

Red-tailed Hawk (Buteo jamaicensis)
Merlin (Falco columbarius)
Great Horned Owl (Bubo virginianus)
Sharp-tailed Grouse (Tympanuchus phasianellus)
Ruffed Grouse (Bonasa umbellus)
Downy Woodpecker (Picoides pubescens)
Eastern Bluebird (Sialia sialis)
Northern Flicker (Colaptes auratus)
Western Meadowlark (Sturnella neglecta)
Dark-eyed Junco (Junco hyemalis)
Upland Sandpiper (Bartramia longicauda)
American Robin (Turdus migratorius)
House Sparrow (Passer domesticus)
European Starling (Sturnus vulgaris)
Blue Jay (Cyanocitta cristata)
Common Grackle (Quiscalus quiscula)
Eastern Kingbird (Tyrannus tyrannus)
Sandhill Crane (Grus canadensis)
Blackbird (Agelaius phoeniceus)
Tree Swallow (Iridoprocne bicolor)
Yellow Warbler (Dendroica petechia)
Killdeer (Charadrius vociferus)
Common Snipe (Capella gallinago)
American Crow (Corvus brachyrhynchos)
American Goldfinch (Carduelis tristis)
Goshawk (Accipiter gentilis)
Marsh Hawk (Circus hudsonius)
Black-billed Magpie (Pica pica)

MAMMALIAN SPECIES

White-tailed Deer (Odocoileus virginianus)
Snowshoe Hare (Lepus americanus)
Red Fox (Vulpes vulpes)
Coyote (Canis latrans)
Vole (Microtus spp.)
Badger (Taxidea taxus)
Striped Skunk (Mephitis mephitis)
Thirteen-lined Ground Squirrels (Spermophillis tridecemlineatus)
Elk (Cervus canadensis)
Black Bear (Ursus americanis)
Weasel (Mustela urminia)
Mink (Mustela vison)
Muskrat (Odatra zibethicus)
Beaver (Castor canadensis)
Woodchuck (Marmota monax)

APPENDIX B

List of plant species found in NWMA

MARSH SPECIES

cattails (_Typha_ spp.)
common reed grass (_Phragmites communis_)
sedges (_Carex_ spp.)
reed canary grass (_Phalaris arundinacea_)
bullrushes (_Scirpus acutus_)

GRASSES

needle grasses (_Stipa_ spp.)
june grass (_Koeleria cristata_)
wheatgrasses (_Agropyron_ spp.)
blue grasses (_Poa_ spp.)
big bluestem (_Andropogon gerardi_)
little bluestem (_Schizachyrium scoparium_)
wild rye (_Elymus canadensis_)
cord grass (_Spartina pectinata_)

FORBS

bearberry (_Arctostaphylos uva-ursi_)
three-flowered avens (_Geum triflorum_)
wild red raspberry (_Rubus idaeus_)
common bedstraw (_Galium boreale_)
lamb's-quarters (_Chenopodium album_)
asters (_Aster_ spp.)
bergamot (_Monarda fistulosa_)
seneca root (_Polygala senega_)
black-eyed susan (_Rudbeckia serotina_)
blazing stars (_Liatris_ spp.)
goldenrod (_Solidago_ spp.)
harebells (_Campanola rotundifolia_)
fleabane (_Erigeron_ spp.)
prairie lily (_Lilium philadelphicum_)
gaillardia (_Gaillardia aristata_)

SHRUBS

roses (_Rosa_ spp.)
saskatoon (_Amelanchier alnifolia_)
chokecherry (_Prunus virginiana_)
shrubby cinquefoil (_Potentilla fruticosa_)
prairie cinquefoil (_Potentilla pensylvanica_)
silverberry (_Elaeagnus commutata_)
Canada buffaloberry (_Shepherdia canadensis_)
western snowberry (_Symphoricarpos occidentalis_)
dwarf birch (_Betula glandulosa_)
red-osier dogwood (_Cornus stolonifera_)
ground cedar (_Calocedrus_ spp.)
ground juniper (_Juniperus_ spp.)
beaked hazel (_Corylus cornuta_)
cranberry (_Vibernum edule_)

APPENDIX B

List of plant species found in NWMA

TREES

trembling aspen (*Populus tremuloides*)
balsum poplar (*Populus balsamifera*)
white spruce (*Picea glauca*)
black spruce (*Picea mariana*)
bur oak (*Quercus macrocarpa*)
willow (*Salix* spp.)
jack pine (*Pinus banksiana*)
alder (*Alnus* spp.)

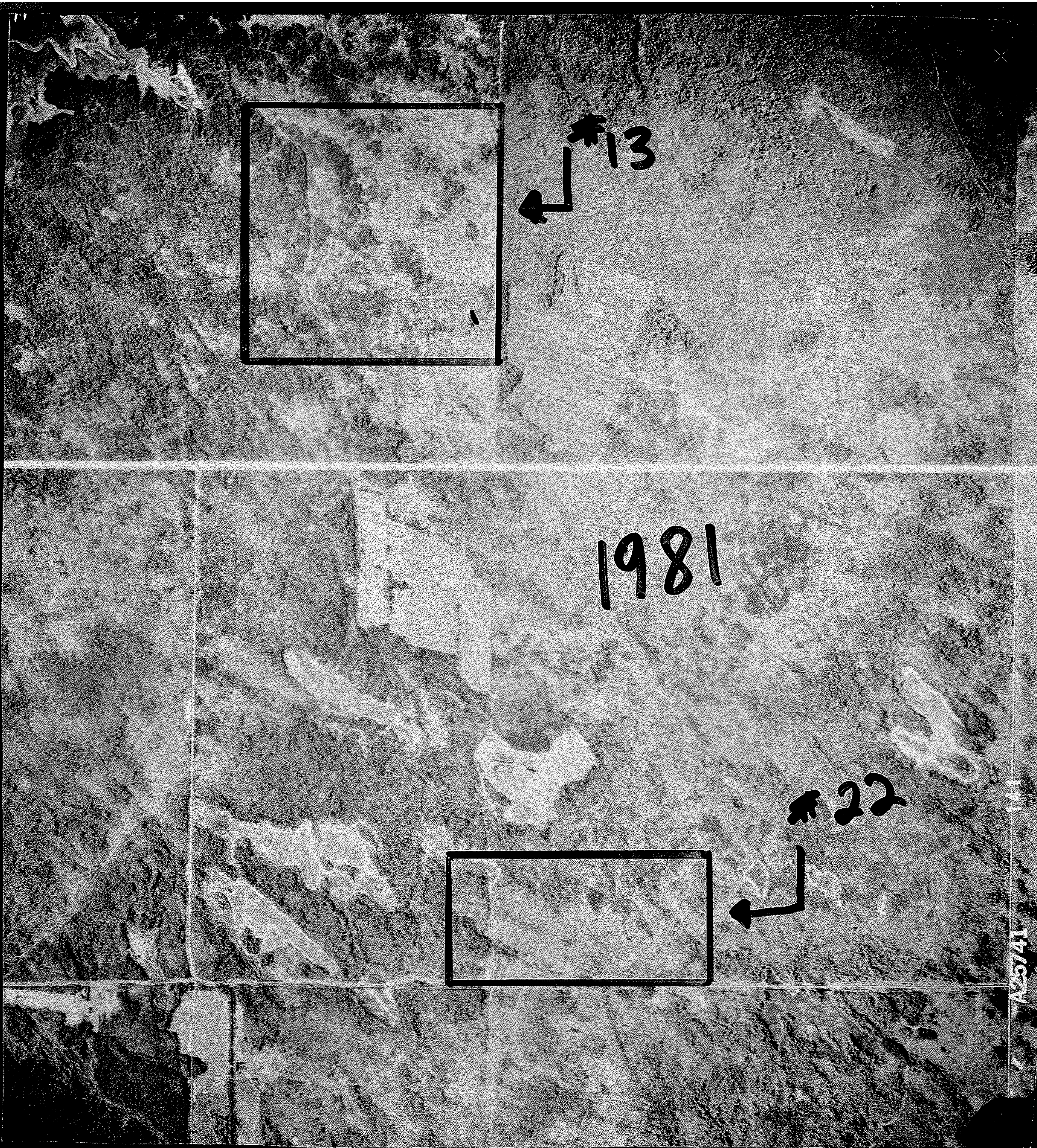
APPENDIX C

Distribution of habitat types in the NWMA, Manitoba, from 1965-1986 (Berger and Baydack 1992).

Cover type	Abandoned Leks	Leks Prior to Abandonment	Permanent Leks	Average Change on All Leks
Aspen Closed Forest	56%	43%	44%	36.2%
Aspen Open Forest	14%	12%	15%	2.5%
Prairie and Abandoned Fields	15%	28%	23%	(-) 37.5%
Shrub	12%	15%	17%	2.3%
Marsh	3%	2%	1%	(-) 1.1%

APPENDIX D

Air photos of manipulated sites #13 and #22 in 1961 and 1981.



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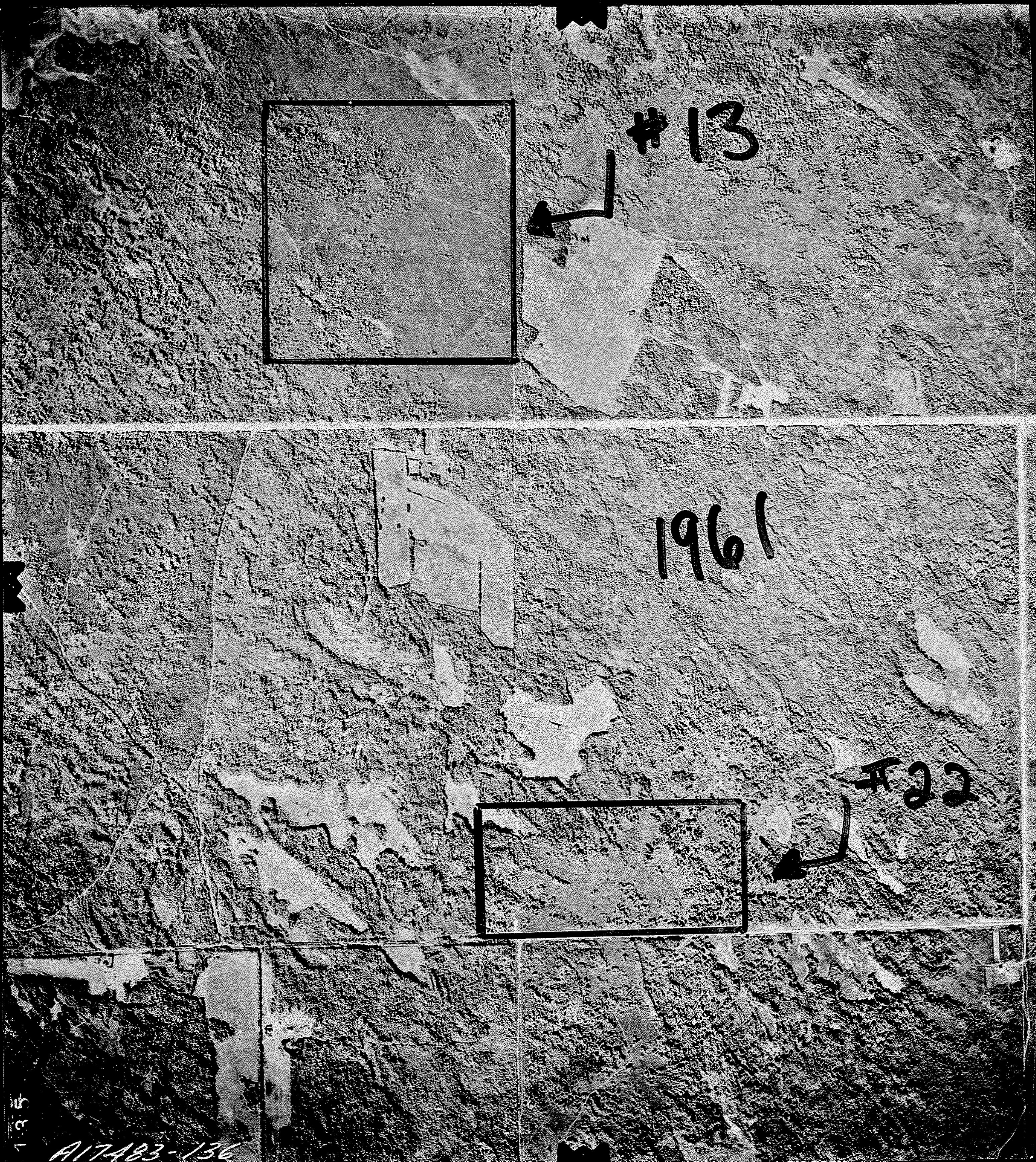
1981
#22
A25741



#13
1961
#22
A17483-136