FUNCTIONS OF FOOD PLOTS FOR WILDLIFE MANAGEMENT ON MINNESOTA'S WILDLIFE MANAGEMENT AREAS

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SUMMARY OF FINDINGS

The purpose of this document is to identify the primary functions of food plots managed by the Minnesota Department of Natural Resources (MNDNR), and determine whether they accomplish their intended purposes. This report identifies 7 major functions of food plots used by the Section of Wildlife. These functions included: (1) providing winter food; (2) providing food and loafing areas for migrants; (3) depredation abatement; (4) holding wildlife on public land for hunting or viewing; (5) grassland management; (6) reproductive habitat; and (7) public relations. For each function, we provide scientific or anecdotal evidence demonstrating that food plots are effective in accomplishing their intended purpose in some, but not all, circumstances.

INTRODUCTION

Food plot management is the second highest land management expenditure for the Minnesota Department of Natural Resources Section of Wildlife. As a result, the Section has initiated a review of the scope, functions, and effectiveness of managing food plots for wildlife on public Wildlife Management Areas (WMAs) and private lands. The purpose of this document is to identify the primary functions of food plots managed by the MNDNR, and determine whether they accomplish their intended purposes.

Food plots are often referred to in the literature as supplemental feeding, lure crops, or agronomic plantings. Supplemental feeding, however, can also include feeders or provision of grain piles for wildlife. Our use of the term 'food plot' does not include grain piles or feeders. For the purpose of this report, we define food plots as "small areas planted to annual or perennial agricultural crops to provide a supplemental food source for wildlife" (MNDNR 2007). We consider use of forest openings to be a separate issue warranting its own discussion, and therefore we do not discuss forest openings in this review.

Isley (1993) identified 4 purposes of food plots on WMAs administered by MNDNR: (1) provide nutrition; (2) keep wildlife near cover; (3) reduce depredations; and (4) provide recreation. This report expanded on Isley's (1993) purposes and identified 7 major functions of food plots used by the Section of Wildlife, discussed below. These functions were initially outlined by the MNDNR Farmland Wildlife Committee, and expanded upon by surveying MNDNR wildlife area managers for major units. We then reviewed the literature to find evidence supporting or disputing each function. For many of the functions, however, evidence was lacking or anecdotal. A brief summary of our findings is provided for each.

Function #1: Provide Winter Food for Resident Wildlife (especially pheasants, wild turkeys, and deer)

Ample evidence exists demonstrating use of winter food plots by a variety of game species. There are reports of food plot use by such wildlife as pheasants (*Phasianus colchicus*) (Larsen et al. 1994, Bogenschutz 1995, Gabbert et al. 1999, Evrard 2000, Gabbert et al. 2001), wild turkeys (*Meleagris gallopavo*) (Porter et al. 1980, Kane et al. 2007), bobwhite quail (*Colinus virginianus*) (Robel et al. 1974, Burt 1976), prairie grouse (*Tympanuchus cupido* and *T. phasianellus*) (Manske and Barker 1988), and white-tailed deer (*Odocoileus virginianus*) (Johnson et al. 1987, Smith et al. 2007). Larsen et al. (1994) documented food plot use by songbirds, lagomorphs, rodents, and squirrels. Donalty et al. (2003) concluded in a Texas study that the majority of winter food plot consumption was from nongame wildlife.

One purpose of food plots is to increase reproductive and survival rates of upland game birds by maintaining healthy body condition during winter and early spring. Bogenschutz (1995) found that female pheasants with access to corn and sorghum food plots had higher quality diets and more fat reserves than females without access to food plots during 1 year of a 2-year study. Ability to meet dietary requirements during late winter and early spring may affect onset of egg-laying, total egg production, and hen survival during the reproductive period (Breitenbach et al. 1963, Gates and Woehler 1968, Draycott et al. 1998). Furthermore, pheasant hens with food plots within their home range have shown higher winter survival than those lacking food plots (Gabbert 1997). Pheasants make greatest use of food plots when located within 300-600 m of heavy winter cover (Johnson 1973, Larsen et al. 1994). Food plots have also been found to increase population densities (Burt 1976, Ellis et al. 1969), body weights, and fat reserves in bobwhite quail (Robel 1969, Robel et al. 1974).

During a severe winter in southeastern Minnesota, survival was enhanced for wild turkey populations with access to corn food plots (Porter et al. 1980). North of historical wild turkey range in central Minnesota, food plots enhanced survival during 2 winters with below-average snow (Kane et al. 2007). The authors found that in a winter with above-average snow, however, survival was low even with corn food plots, suggesting that food plots have limited effectiveness in deep snow. Use of food plots by wild turkeys likely depends on multiple variables including turkey awareness of food plot location and mobility as affected by snow. Wright et al. (1996) reported starvation by Wisconsin turkeys within 0.7 km of standing corn when deep snow restricted movement.

Occasional severe winters in northern Minnesota exceed the physiological adaptations of white-tailed deer, resulting in over-winter mortality (Karns 1980). Supplemental deer feeding can reduce winter mortality (Doman and Rasmusssen 1944, Baker and Hobbs 1985) and may improve female reproductive success (Ozaga and Verme 1982). However, because the nutritional carrying capacity is very high in the farmland region of Minnesota, deer are in healthy condition at the onset of winter and the need for ancillary food sources is typically unwarranted (M. Grund, MNDNR, personal communication). Food plots provide a concentrated, palatable food source, which results in close interactions among individual deer, and may increase disease transmission (Palmer and Whipple 2006). Furthermore, in much of the forested and transition zones of Minnesota, the deer management goal is to reduce deer densities (Grund 2007, Lenarz 2007). Thus, employing management techniques designed to increase survival and reproduction in these areas is in direct conflict with population management goals (M. Grund, MNDNR, personal communication).

Food plots may be effective for enhancing body growth and antler characteristics of white-tailed deer. Vanderhoof and Jacobson (1989) found that 0.5% of an area in food plots year round increased body mass, number of antler points, beam circumferences, and beam lengths in Mississippi. Johnson et al. (1987) documented a 19% increase in live weights of yearling male white-tailed deer after establishing cool-season food plots in the mesic habitat of Louisiana. In a deer herd that was already biologically healthy, Johnson and Dancak (1993) found that diet quality was not significantly improved by the use of food plots in a southern pine-mixed hardwood forest. Because the deer population was managed below the biological carrying capacity, they concluded that food plot programs were not justified based on biological effects.

In some cases, supplemental feeding could decrease survival by attracting predators. In a study of spatial patterns of bobcats (*Lynx rufus*) in relation to supplemental food provided for northern bobwhite quail, Godbois et al. (2004) found that bobcats were observed to be about 10 times closer to supplemental food (both spread grain and food plots) than expected.

Function #2: Provide Spring and Fall Food Resources and Loafing Areas for Migratory Birds

Survival and reproduction of waterfowl are affected by body condition during migration, which is determined by food availability. Food plots can be an important source of energy and nutrients for migrating waterfowl if consideration is given to the type of food planted and the time of year it will be available for wildlife (Maxon et al. 2007). Gates et al. (2001) found that Canada geese (*Branta canadensis*) in the Mississippi Valley need an abundant source of high energy food (e.g., corn) during fall and winter, especially when foraging opportunities are limited by weather and hunting. Green forage and non-agricultural foods provide important sources of protein and other nutrients during all seasons (Gates et al. 2001), and high protein may be necessary to efficiently convert carbohydrates (e.g., corn) to the fat needed during spring migration (McLandress and Raveling 1981a,b). Additionally, food plots may become more important to migrants as waste grain becomes less available in agricultural lands due to more efficient farming methods (Krapu et al. 2004).

In Iowa, migrating mallards (*Anas platyrhynchos*) used moist-soil or corn-vegetated wetlands more than emergent wetlands or soybean-vegetated wetlands (LaGrange and Dinsmore 1989). Gruenhagen and Fredrickson (1990) found that mallards in Missouri ate moist-soil seeds and agricultural food to help meet their energy needs for migration. They suggested that both wetland and agricultural habitats might be important for meeting the energy requirements of migrants. While corn is a heavily used food source for migrants, soybeans are poorly suited for meeting nutrient needs of migrating wildlife requiring a high-energy diet (Krapu et al. 2004). Linz et al. (2004) encouraged land managers in Nebraska to consider sunflower fields as part of their crop rotation to provide late-season habitat for summer resident birds undergoing feather replacement and pre-migratory fattening, transients already migrating, and winter residents migrating from more northerly locations. They observed 49 species of birds using fall sunflower fields (blackbirds, sparrows, finches, and doves were most abundant).

Food plots are heavily used at the 22,000-acre Lac Qui Parle State Game Refuge in west-central Minnesota. Benson (1959) reported that after food plots and a sanctuary were established in 1958, “favorable response to the feeding strips and the safety of the sanctuary by geese and mallards was clearly evident.” The combination of food plots and sanctuary has continued at Lac Qui Parle. The number of waterfowl that used the sanctuary increased from 1,500 Canada geese and 10, 000 mallards in 1959 (Benson 1961) to 14,000 Canada geese and 40,000 mallards between 1964 and 1966 (Benson 1966). Food plots are still used at Lac Qui Parle, and the refuge peaks at over 100,000 geese each fall (D. Trauba, MNDNR, personal communication). Other large WMAs, including Thief Lake and Roseau River, also use food plots to provide food for a large number of migrants.

Food plot use by the Interlake-Rochester Population of giant Canada geese is particularly heavy during severe winters. When snow depth exceeds 8 inches, food plots are used until all corn is depleted (usually late December to mid-January), whereas geese make very little use of MNDNR food plots during mild winters (Maxon et al. 2007).

Function #3: Depredation Abatement (especially for deer and waterfowl)

In 1967, the MNDNR Depredation Control Committee recommended that feed crops remain unharvested on state leased lands surrounding refuges for consumption by waterfowl, and that plantings, especially small grains, on state land be increased through cooperative farming agreements (Minnesota Outdoor Recreation Resources Commission 1967). Food plots are still used by the State as a means of preventing or reducing depredation on private lands. Food plots planted to prevent damage to crops by wildlife are often referred to as “lure crops”. Lure crops can be established in areas with a history of wildlife damage and allowing animals to feed there, or by paying a landowner for the crop in a field already being fed on by wildlife

(Cleary 1994). The first method has been successful in North Dakota and Wyoming for depredating ducks and geese (Gustad 1979, Fairaizl and Pfeifer 1987). Stowell and Willging (1991) reported that lure crops were effective in reducing depredation by Canada geese and, in some cases white-tailed deer, and they speculated that lure crops could also prevent depredation by bears. Lure cropping has been used with mixed success to intercept or shortstop deer from entering busy highways (Woods and Wolfe 1988; Craven and Hygnstrom 1994) and airports (Seamans 2001), and to prevent damage to private croplands (Smith et al. 2007).

Smith et al. (2007) reported use of abundant food plots on a large WMA in North Dakota may have contributed to a population increase of white-tailed deer that exceeds the capacity to control by hunting. Similarly, Brown and Cooper (1996) believed that food plots and supplemental feeding may increase “nutritional carrying capacity”, resulting in damage to the natural vegetative community by concentrating more deer in less space. Matschke et al. (1984) recommended treating deer depredation on forest and agricultural crops through deer harvest regulations that keep the population in balance with its natural habitat. Because food plots may increase nutritional carrying capacity, many wildlife biologists recommend food plots be used as a temporary mitigation strategy and not a long-term solution to depredation management (Matschke et al. 1984, Woods and Wolfe 1988, Brown and Cooper 1996).

Function #4: Hold Wildlife on Public Lands for Improved Hunting/Viewing (wildlife watching, birding) Opportunities

While we did not find any scientific literature supporting the claim that food plots hold wildlife on public lands for improved hunting or viewing opportunities, this function is generally accepted among wildlife managers and the hunting public. Influencing harvest was cited as an important function of food plots in the northeastern U.S. in Krusac and Michael’s (1979) survey of 32 state wildlife agencies. Schultz et al. (2003) suggested establishing sunflower or wheat fields near urban areas to attract mourning doves (*Zenaida macroura*) to improve hunting opportunities for the urban public. They felt that food plots may provide a valuable food source for nongame wildlife, while also providing game for hunters.

Johnson and Dancak (1993) reported that hunters often request food plots be used on public lands, possibly as a result of food plot advertisements in hunting magazines. MNDNR wildlife managers reported that hunters often ask for locations of food plots on major units. Although use of food plots by wildlife is well documented (see Function 1 above), we found no studies that compared wildlife use of lands with food plots to those without. However, Johnson and Dancak (1993) found that deer hunter success was not affected by presence of food plots in a southern pine-mixed hardwood forest.

Attempts by Kopischke (1975) in south central Minnesota to use food plots to hold deer in secure winter habitat were not successful. He reported that “established" wintering areas were used instead of the food plots. In contrast, Smith et al. (2007) documented long distance movements by white-tailed deer in North Dakota to utilize food plots on a large WMA from November to April, followed by return movements in spring and early summer. Smith et al. (2007) suggested food plots were attracting and holding deer on the WMA during winter.

While food plots are popular among hunters for (at least the perception of) attracting game animals to an area, the ethics of such hunting practices have been questioned. If hunting over bait is generally considered unethical (and, in some cases, illegal), why is hunting near food plots accepted? Brown and Cooper (1996) explored the ethical issues involved with managing game through feeding programs (food plots, baiting, and crib feeding). Peyton (2000) referred to maintaining artificially high numbers of deer through feeding, in lieu of suitable winter habitat, as “open-range ranching” which provides a crop of game animals. He asked whether wildlife management efforts are encouraging stewardship or simply promoting a form of agriculture among hunters (e.g., “farming deer without fences”).

Function #5: Aid in Grassland Management

Harper (2003) described the use of cool-season food plots as a source of supplemental food for bobwhite quail, while also serving as a firebreak to contain prescribed burns. MNDNR wildlife managers commonly use food plots in conjunction with mowed lines as firebreaks on WMAs. In addition, wildlife managers use food plots to prepare sites for planting grasslands. Farming sites as food plots kills undesirable vegetation and uses up chemical residue in the soil, leaving a clean seedbed for planting sensitive prairie plants. Finally, managers use food plots as a physical (via annual tillage) and chemical barrier to contain woody vegetation from encroaching into grasslands.

Function #6: Hayfields and Small Grains Provide Reproductive Habitat

Hayfields can provide valuable habitat in landscapes where natural grasslands have been degraded and reduced. However, some important qualifications when assessing the breeding habitat value of hayfields are size and landscape context, and the timing and frequency of haying. Many grassland species exhibit minimum area requirements, and will not nest in grassland patches below a certain size (Winter and Faaborg 1999, Herkert et al. 2003). Hayfields can provide needed heterogeneity in a landscape matrix where row crops dominate. For example, a diversified landscape (e.g., hayfields and cropland) appeared to enhance pheasant nest survival (Clark and Bogenschutz 1999). Porter (1977) noted female wild turkeys increased use of hayfields and pastures through July and August in southeastern Minnesota. Similarly, Wright et al. (1989) reported that turkey hens with broods used pastures and idle fields more than expected. McMaster et al. (2005) found 26 species of birds nesting in haylands in Saskatchewan, including songbirds and waterfowl.

Mowing hay drastically alters the structure of the vegetation, which affects species differently depending on their habitat preferences (Frawley and Best 1991). In the Prairie Pothole Region, ducks have been found to nest in hayfields (Klett et al. 1988), but hayfields were less attractive than idle grasslands because the previous year's hay operation removes much of the residual vegetation that attracts nesting ducks early in the spring. Dale et al. (1997) found that various species of grassland songbirds nested in hayfields, but they were less attractive than native grasslands. Mowing hay also can cause nest losses as well as mortality of fledglings and adults (Frawley 1989, Rodenhouse et al. 1993). If mowing is frequent, many birds may not be able to complete their nesting cycles, and Dale et al. (1997) recommend that most hayfields be mowed only in alternate years with some hayfields left idle for 3 or more years to increase bird productivity.

In Wisconsin, Murphy et al. (1985) determined that white-tailed deer used hayfields during fawning season when other crops were being planted or were in early growth stages. It was suggested that preference for grassland and shrub habitat during the fawning season and in summer probably was due to the greater availability there of forbs and grasses (Murphy et al. 1985). In Minnesota, Brinkman et al. (2004) observed that high neonate survival was likely associated with a low predator density, quality vegetation structure at neonate bed sites, and high nutritional condition of dams. However, they suggest that any effects of fawning habitat on survival are speculative because fawning habitat quality has not been evaluated in the intensively farmed regions of Minnesota (Brinkman et al. 2004). Likewise Gould and Jenkins (1993) did not determine fawning site selection, but they found that Conservation Reserve Program (CRP) grasslands were important habitat to females during fawn rearing, both for resting and active periods, and particularly at night.

Function #7: Public Relations with County Commissioners, Farmers, and Sporting Clubs

In a survey of 32 state wildlife agencies, edge effect, supplemental food, and public relations were the main reasons for food plot management (Krusac and Michael 1979). In this survey, public reaction to food plots was favorable in all states that received public feedback. Our interviews with wildlife managers throughout Minnesota's farmland region found a consistent belief that food plots are good for public relations. Arranging for farmers to maintain food plots on WMAs establishes a landlord-renter relationship in which MNDNR wildlife managers offer a valuable commodity (cropland) to farmers. The farmer becomes invested in what happens with the WMA and watches over it as he would his own land. This relationship establishes lines of communication between MNDNR and the farming community. Although this relationship is valuable in itself, it can lead to additional work accomplished (e.g., barter for other services, such as mowing parking lots), future land acquisitions, and reduced complaints about noxious weeds. Also, county commissioners in the farmland region often like to see part of MNDNR acquisitions remain in cropland and local farmers remain connected to the property

In a plan to increase pheasant populations, South Dakota Department of Game, Fish, and Parks (1988) advocated food plots as "an excellent medium for involving local sportsmen groups." A, wildlife food plot contest was implemented in Minnesota to involve local youth organizations in wildlife management (Dornfeld 1989). Sporting clubs also actively promote and encourage planting food plots and seed mixes specifically designed for target game species (Pheasants Forever 2008). Woods et al. (1996) and Hayslette (2000) demonstrated that personal involvement with management had a strong effect on hunter satisfaction with habitat management. Involvement of sporting clubs through food plot plantings may lead to higher hunter satisfaction on WMAs.

DISCUSSION

We identified 7 primary functions of food plots managed by the MNDNR on WMAs and private lands. For each function, we found scientific or anecdotal evidence demonstrating that food plots were effective in accomplishing their intended purpose in some, but not all, circumstances. The effectiveness of food plots in serving their intended purpose depended partly on factors (such as weather and human attitudes) that are beyond the control of wildlife managers.

Additional research is needed to quantify the effectiveness of food plots in meeting their intended functions. For example, effectiveness of food plots in increasing survival and reproductive rates of resident game birds depends on winter severity. Managers provide food plots every year because they cannot predict when severe winters will occur and because they perceive a high, but unquantified, cost in public relations for not being prepared. Thus, information is needed to quantify both the magnitude of biological benefits to birds and societal benefits to the public. On the other hand, identifying certain food plot characteristics could increase the effectiveness of food plots in their desired function. For example, because food plots serve resident game birds best when located within 300-600 m of heavy winter cover, food plots further from winter cover should probably be questioned.

One food plot function for which we found little support was providing winter food for deer in Minnesota's farmland/transition region (M. Grund, MNDNR, personal communication). Because of the infrequency of killing winters and the current management emphasis on reducing deer population density in much of Minnesota (Grund 2007, Lenarz 2007), use of food plots may not be justifiable in these areas.

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