Nest Search Operations 1999 - 2001

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Executive Summary:

Waterfowl nest densities in Minnesota were 15 acres per nest, and about 40 acres per successful nest. We found nest densities were higher on federally managed Waterfowl Production Area's (WPA's) than on privately owned CRP fields. However, nesting success was slightly lower on WPA's.

Analysis of historical (1983-1990) nest site visual obstruction readings (VOR's) indicated that mallards required taller and denser vegetation than blue-winged teal. VOR's of successful nests are significantly higher than unsuccessful nests after early July for mallards and early June for blue-winged teal. VOR's taken in fields over the 3 years indicated annual variations in vegetation height and density between seeded warm season (WS) grasses and seeded cool season (CS) grasses depending on climatic conditions. The abundance of nests was similar in seeded warm season grasses and seeded cool season grasses. Mallard nest abundances were higher in seeded warm season grasses in 2000. There was no significant difference in nests success in seeded warm season grasses when compared to seeded cool season grasses. We found that the relationship between nest success and the amount of grass in the landscape was highly variable. Nest success showed a positive relationship with an increase of grass in the landscape. However, the amount of grass in the landscape only explained about 4% of the variability in nest success. It appears that the relationship between grass in the landscape and nest success is a complex relationship and the shape of that relationship is not static and changes spatially and temporally. Factors affecting duck nesting success are complex and intertwined.

Better information is needed on factors that directly influence nesting success such as the predator component in the landscape. Increased knowledge of predator interactions with ducks and duck nests as well as interactions with other nest predators may allow us to adopt management strategies that have a positive influence on duck production in Minnesota.

Background:

Over the last 3 years the US Fish and Wildlife Service HAPET office and the Minnesota Waterfowl Association have monitored duck nesting success in west central Minnesota. Available habitats to nesting ducks are constantly changing. Farm programs and management practices also continue to change over time. Predator populations fluctuate over time. Those fluctuations can have a direct effect on duck nesting success and production. Duck nesting success is affected by all of these changes. To accurately model duck populations and duck production, the affect of these changes in the landscape needs to be known. To evaluate the effects of these changes on nesting ducks, it is necessary to monitor their effects over time. This study was an attempt to monitor current nesting success rates and to evaluate a few variables in the landscape that may have some impact on duck nest success in western Minnesota.

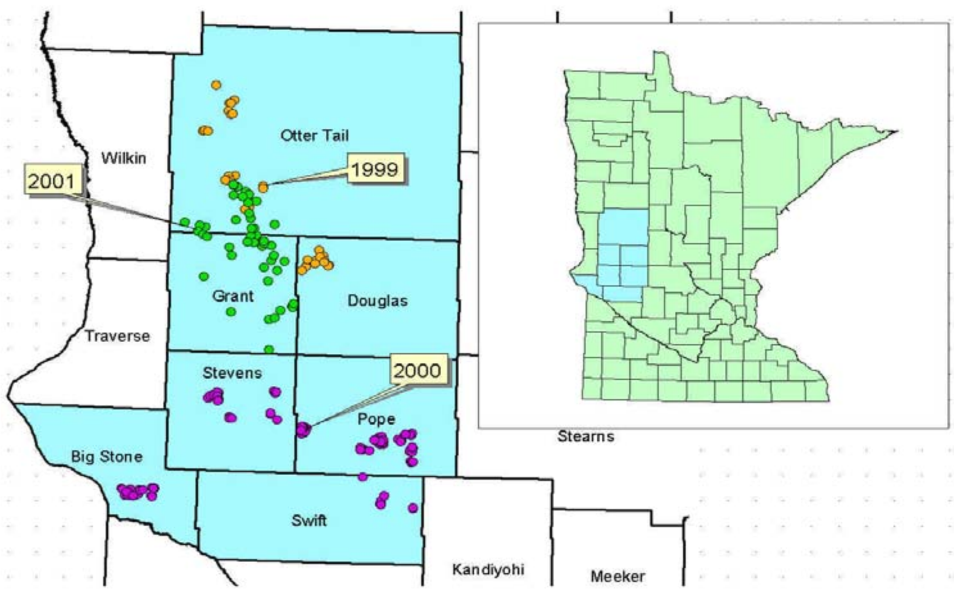
Objectives:

1) Provide baseline nesting success information to predict duck production across the landscape.

2) Provide biological data to develop decision support tools for management activities.

3) Monitor biological components that allow us to model duck populations and evaluate the adequacy of decision support tools.

Figure 1. Location of Study Areas (1999-2001).



From 1999 – 2001 work was conducted in 7 counties in west central Minnesota (Fig 1). Search operations were conducted with four-wheel drive Jeeps and ATV's using a chain drag similar to methods described by Higgins et. al. (1969). Approximately 12,000 acres were searched over the 3 year period and nearly 1000 duck nests were located (Table 1). Nest densities averaged approximately 15 acres per nest, and roughly 40 acres per successful nest (Table 2).

Table 1. The Number of Acres Searched and the Number of Nests Found.

Year	Estimated Acreage Searched	Duck Nests
1999	2770	143
2000	5052	512
2001	4043	262
Total	**11865**	**917**

Table 2. The Number of Acres Searched and the Number of Nests Found in Each Year.

Year	Acres Searched	Acres/ Nest	Acres/ Successful Nest	Ducklings Fledged/ 100 Ac.
1999	2770	19	49	9.5
2000	5052	10	43	11
2001	4043	15	35	13.4
Avg	9095	**13**	**39**	**12.2**

Nest density by land ownership analysis was not conducted in 1999 or 2001. However, in 2000, we found that nest densities were higher on Waterfowl Production Areas (WPA's) than on state or privately owned properties (Table 3). We also know from the four square mile survey information that there is more breeding pair water on WPA's. Some of the higher nest densities on WPA's may be explained by the somewhat opportunistic behavior of nest site selection of blue-winged teal using the pair water on WPA's. Nesting success however, was lower on WPA's than on state or privately owned properties in 2000 (Table3). In 2001 nesting success on WPA's and in CRP was 25% and 28% respectively. Klett et. al. (1988) and Sargeant et. al. (1995) documented low nest success on WPA's possibly due to isolation in landscapes dominated by cropland.

Table 3. Nest Densities and Nesting Success by Ownership.

		Private owned		State Owned	Federal owned
		CRP	WBP[1]	WMA's[2]	WPA's
Mallards	**Total nests**	27	7	33	149
	Nests/100 ac.	2.24	1.68	4.44	5.63
	Mayfield Est.	20	55.1	12.3	14
	80% C. L.	11.2-35.2	32.0-94.1	7.1-21.2	10.7-18.4
Blue-winged	**Total nests**	15	7	36	200
Teal	**Nests/100 ac.**	1.25	1.68	4.85	7.56
	Mayfield Est.	29.6	25	23.5	15.1
	80% C. L.	17.0-51.1	6.9-85.7	14.7-37.2	12.1-18.9
Other Species	**Total nests**	0	3	4	20
	Nests/100 ac.	NA	0.72	0.54	0.76
	Mayfield Est.	NA	0.1	58.8	7.3
	80% C. L.	NA	0.0-12.1	29.6->100	3.1-16.6
All Species	**Total nests**	42	17	73	369
	Nests/100 ac.	3.49	4.08	9.83	13.94
	Mayfield Est.	23.8	26.3	18.6	14.1
	80% C. L.	15.9-35.5	13.7-49.8	13.3-26.0	11.9-16.7

1) Waterbank Program
2) Wildlife Management Areas

Isolation compounded with limited foraging cover for predator species resulted in low nest success. Another factor influencing lower nesting success on WPA's is the more numerous wetlands on WPA's and therefore more numerous wet meadow zones that function as primary foraging areas for red fox and skunks (Greenwood and Sovada personal communication 2002).

The Attractiveness of Nesting Cover.

. We used two methods to analyze nesting cover in our study. Historical records (1983-1990) from the Center Nest File at Northern Prairie Wildlife Research Center were analyzed to define vegetation density at duck nest sites. Random visual obstruction readings (VOR's hereafter) were taken from selected fields to analyze the quality of nesting vegetation on our study sites. Analysis of the covariance was used to analyze the data and a value of $P < 0.05$ was used to test for significance.

Analysis of historical nest site VOR's showed that mallards nested in taller and denser vegetation than blue-winged teal through out the nesting season (Fig. 2). Both successful mallards and successful blue-winged teal nest sites had higher VOR's than depredated nest sites. Interestingly, nest site VOR's for depredated mallard and blue-winged teal nests were slightly higher than nest site VOR's for successful mallard and blue-winged teal nests prior to June 1st . A possible explanation for this phenomenon is that early nesting ducks may be selecting nest sites in taller grasses and forbs in wet meadow zones which are prime foraging areas for red fox and skunks.

VOR's taken from fields over the 3 year period showed that fields with a heavy switchgrass component had significantly higher VOR's than seeded cool season exotics (CS) and seeded warm season natives (WS) lacking the heavy switch grass component (Fig 3). In 1999 and 2000, fields seeded to warm season natives had slightly higher VOR's than seeded cool season exotics (significantly higher in 2000 prior to early June). In 2001, seeded CS exotics had significantly higher VOR's than seeded WS natives. The spring of 2001 was a cooler and wetter spring than the previous two springs. The wet cool conditions of the spring of 2001 may have favored the growth of CS grasses more than WS grasses.

Figure 2. Minnesota Nest Site VOR's for 3 Common Species of Ducks (1983-1990).

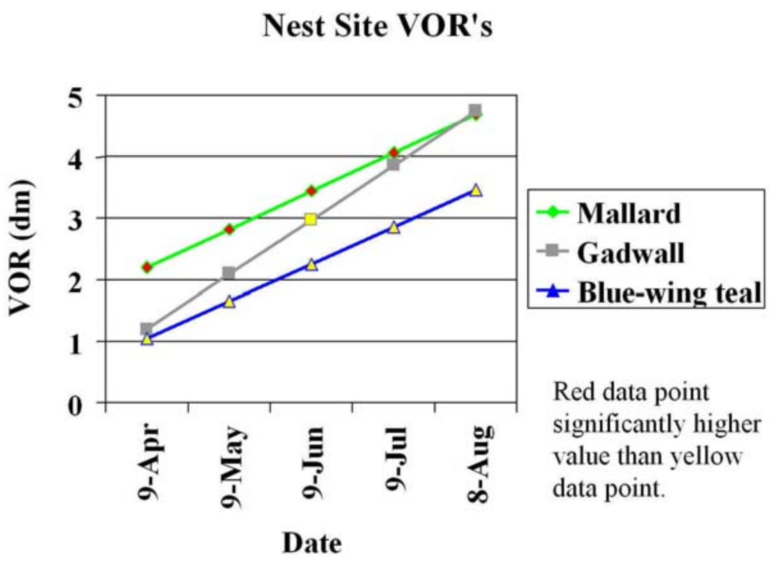
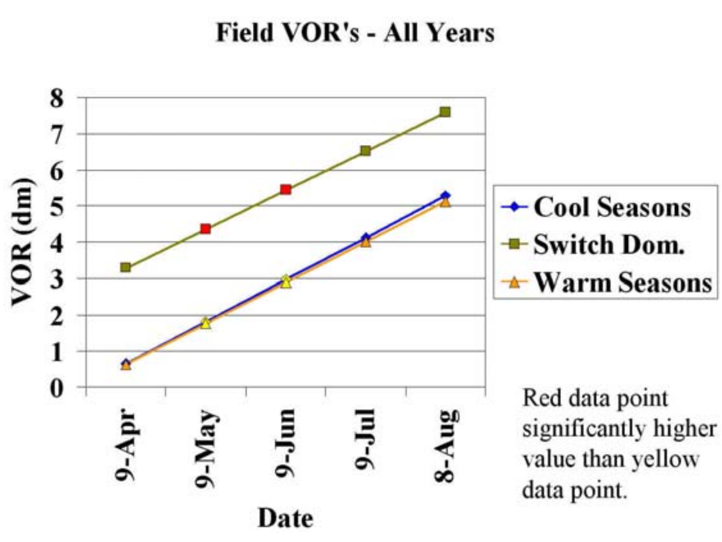


Figure 3. Field VOR's by Vegetation Class (1999-2001).



In 1999, field vegetation data was not collected in a manner to support analysis of nesting cover attractiveness. In 2000 and 2001, field vegetation data was collected and an attempt was made to analyze attractiveness of field vegetation to nesting ducks. In both years, relative abundance of nests (Mayfield corrected) was used to analyze attractiveness to nesting ducks. Field vegetation was categorized as WS grasses, CS grasses, and native prairie in 2000. In 2001, native prairie was not targeted for search operations. Relative abundance of duck nests was slightly higher in WS grasses than in CS grasses in both years. Analysis of combined mallard, blue-winged teal, and gadwall nest abundances was significantly higher in WS grasses only in 2001 (Table 4). In 2000, mallard nest abundance was significantly higher in WS grasses than in CS grasses, 15.1 ± 3.4 S.E. and 6.5 ± 1.7 in WS grasses and CS grasses respectively. The abundance of blue-winged teal nests in the two grass categories did not vary significantly in either year.

Table 4. Mayfield Estimated Nests for All Species of Ducks in the Two Seeded Grass Categories (2001).

	Acres Searched	Nests/100 Acres L80%CL	Nests/100 Acres	Nests/100 Acres U80%CL
CS Grasses	2000	7.5	9.3	11.5
WS Grasses	1810.8	11.7	14.6	18.3

Nesting Success in Various Cover Types.

Field data was collected to analyze nesting success in the various cover types in 2000 and 2001. Analysis of mallard and blue-winged teal nest success indicated no significant differences in nesting success in seeded CS grasses compared to seeded WS grasses (Table 5). Although consistent nest success trends in were observed in the data. Mallard nest success calculated was 2-3 percentage points higher in WS grasses than CS grasses in both years. On the other hand, blue-wing teal calculated nest success was consistently higher in CS grasses than it was in WS grasses (3-6%). If these observed trends are real, there is insufficient statistical evidence to support those trends. Interestingly, blue-winged teal nesting success in native prairie (2000 only) was significantly higher than blue-winged teal nest success in WS grasses (22.2% ± 6.17 S.E., 12.1% ± 3.88 respectively).

Table 5. Nesting Success of Mallards and Blue-winged Teal in the Two Seeded Grass Categories.

Mallard				
		Mayfield L80%CL	**Mayfield Success**	**Mayfield U80%CL**
CS Grasses	**2000**	12.8	16.3	20.7
	2001	18.5	26.3	37.2
	Combined	19.5	22.9	26.9
WS Grasses	**2000**	14.4	18.4	23.6
	2001	19.6	29.1	43.1
	Combined	19.2	23.0	27.4
Blue-winged Teal				
		Mayfield L80%CL	**Mayfield Success**	**Mayfield U80%CL**
CS Grasses	**2000**	14.4	18.2	23.0
	2001	18.2	24.9	33.9
	Combined	19.5	22.5	26.9
WS Grasses	**2000**	9.1	12.1	16.0
	2001	15.3	21.2	29.2
	Combined	19.2	19.0	27.4

Influence of Cover Age Since Treatment.

The age of the stand of cover since treatment did not seem to influence attractiveness to nesting ducks. Fields that have received treatment (usually prescribed burns) within 5 years had virtually the same nest abundances as fields that have been left idle for > 5 years (16.3, 16.4 acres/nest respectively).

Nest success and the influence of stand age were also analyzed in 2001. We wanted to compare nesting success in fields recently treated (≤ 5years) to fields that have received no treatment in > 5 years. However, due to an aggressive prescribed burning program it was not logistically possible to locate an adequate sample of fields with a stand age between 3 and 5 years. Consequently, our sample of fields in the recently treated category was weighted more heavily towards fields that had received treatment within 1 and 2 years and could have significantly biased our results. Although our data was biased towards fields receiving treatment within 2 years, nesting success was significantly higher in fields that did not receive treatment in 5 years (30.9% ± 4.8 S.E. compared to 16.6% ± 6.6). The implications of this are that duck productivity may be reduced in these fields for a period of 1 to 2 years after these fields receive treatment.

Landscape Factors and the Effects on Nesting Ducks

Greenwood et. al. (1995) found a negative correlation between duck nesting success and the proportion of land in cropland. Reynolds et. al. (2001) published similar information stating that the duck nesting success had a linear relationship with the percentage of grass in the landscape. Their research indicated that with an increase in grass in the landscape, duck nesting success also increased. Using this information, it was concluded that in order to obtain a stable mallard population, a landscape needed to contain 40% or more perennial cover. It was estimated in Minnesota and portions of northern Iowa that only 1.2% of the landscape has greater than 40 % grass in the landscape (Fig 4). Yet duck nesting success rates in the 3 years of our work were at maintenance levels and 2 of those years nesting success rates were well above maintenance levels (29%, 16%, 26% in 1999, 2000, 2001 respectively).

Our study was not designed to analyze the relationship of the amount of grass in the landscape and the affect on duck nesting success. However we did perform

Figure 4. Amount of Grass in the Landscape in the Prairie Regions of Minnesota and Northern Iowa.

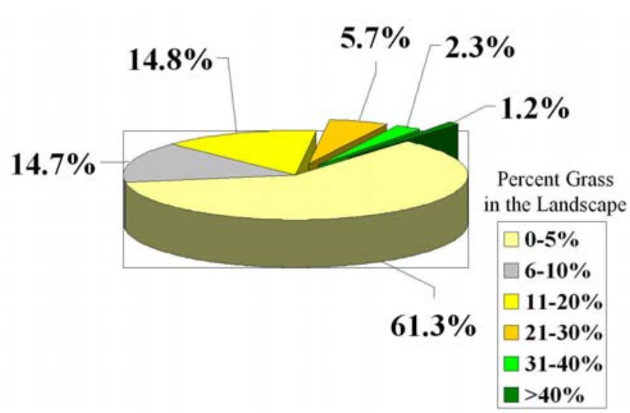
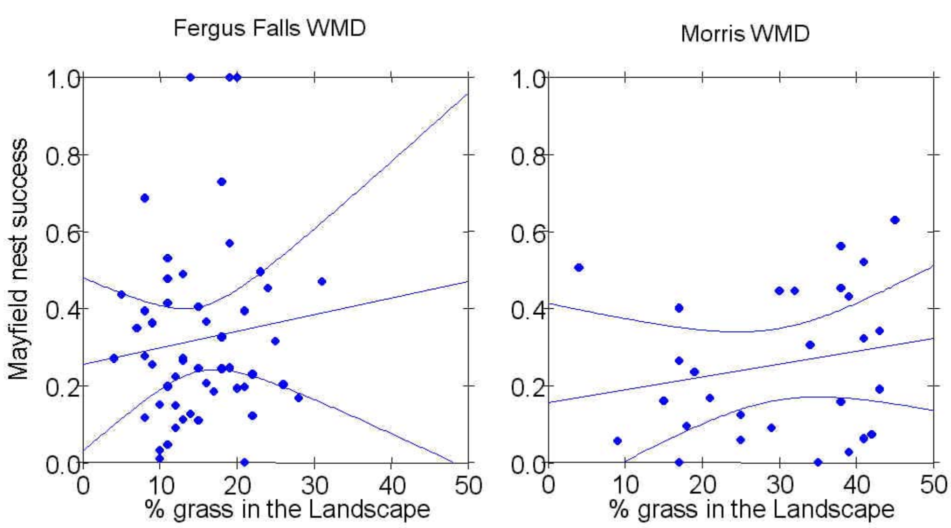
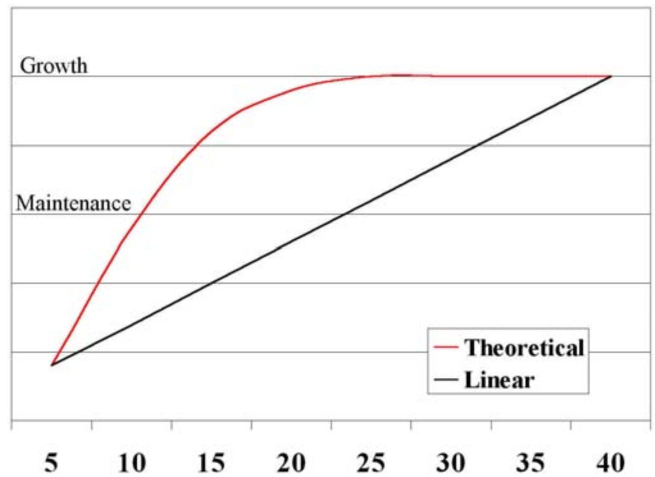


Figure 5. Linear Regression Plots Showing the Relationship Between Nesting Success and the Amount of Grass in the Landscape by Wetland Management District.



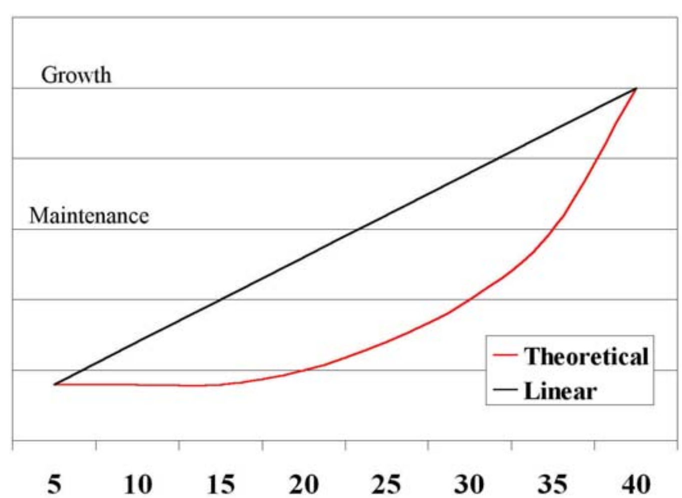
a post-analysis of the data in an attempt to examine this relationship. Classified Landsat imagery (2000-2001) was used to define landscape features surrounding each field. A 2000 meter (1.25 miles) radius from the center point of the field was used to define the landscape surrounding for each field. Grass in the landscapes surrounding our fields varied between 4 and 45%. The hypothesis that nest success is a function of the percentage of grass in the landscape was tested using a linear regression model. Test results indicated a slight positive relationship between nesting success and the percentage of grass in the landscape (Fig. 5). Meaning, generally that as grass increased in the landscape nest success also increased. However, the strength of that relationship was a weak relationship. Only 3.4% of the increase in nest success could be explained by an increase in the amount of grass in the landscape. Our data contains several small fields with low numbers of nests. Nesting success in these fields ranged from 0 to 100%. There were also several large fields, both with high and low numbers of nests. This certainly increased the variability in the results of our data. Because our data was highly variable we showed a weak relationship between the amount of grass in the landscape and nesting success. We were unable to support or refute Reynolds (2001) findings of a linear relationship between duck nesting success and the amount of grass in the landscape. On the other hand, we recorded much higher nesting success rates than would be expected using Reynold's linear regression. Understanding the shape of this relationship could have huge implications on management strategies. Theoretically, a curvilinear relationship could exist. If the shape of the relationship was similar to figure 6, there would be higher benefits to duck populations if management practices added 5% more grass to a landscape that currently had 10%-15% grass than in landscapes with higher percentages of grass.

Figure 6. Theoretical Curvilinear Relationship Between Nest Success and the Amount of Grass in the Landscape.



Ball et. al. (1995) found high duck production rates on study blocks where large areas of grass remained intact. This information suggests that the relationship of grass in the landscape and duck nesting success may be similar to figure 7. In this scenario, duck populations would achieve maximum benefits if management would concentrate their efforts on creating and restoring very large blocks of grass cover.

Figure 7. Theoretical Curvilinear Relationship Between Nest Success and the Amount of Grass in the Landscape Similar to Ball's Findings (1995).



Our conclusion that there are a number of variables that affect duck nesting success. The amount of grass in the landscape is only one piece of the puzzle. It is highly probable that the shape of this relationship changes over time and locality. The shape of the relationship between the amount of grass in the landscape and duck nest success is probably not a static relationship spatially or temporally. Local occurrences of factors affecting nest success either positively or negatively could exist annually or within a few miles of each other.

Another factor that has a direct influence on nesting success is the predator component in the landscape. In 2000 and 2001 we attempted to identify the species of predator that depredated each duck nest using methods described by Sargeant et. al. (1998). Striped skunks were found to be the most common predator of duck nests, accounting for approximately 25% of all depredations of duck nests (Table 6).

Table 6. Identified Predators of Depredated Nests (2000-2001).

Predator Species	Percentage of Depredation
Striped Skunk	25.2%
Red Fox	13.4%
Raccoon	11.8%
American Badger	10.3%
Coyote	5.5%
Franklin Ground Squirrels	3.8%
Mink	3.5%
Weasels	0.5%
American Crow	0.5%
Rapter	0.3%

Implications to Management.

The variety of grassland cover seedings in the landscape is diverse. Due to annual variation in precipitation and temperature and the resulting response of grass species, this diversity can be beneficial to upland nesting duck species. Species respond differently to the various cover types. Reproductive success in a given cover type may vary greatly between species. A landscape that has ample nesting cover in the form of both warm season natives and cool season exotics should have benefits to nesting ducks in most years. However, maximum production of duck species' may not be experienced in any one year in a diverse landscape. Mallards may be selecting nesting sites in one type of cover and have good reproductive success in those sites. On the other hand, blue-winged teal may experience reproductive failure in the same cover type. Theoretically, it is possible that pockets or patches within seeded warm season grasses where seeded grasses fail to out compete invasive species may provide similar benefits. Areas within a field where grass cover seedings are established could provide nesting cover for one species and pockets where the seeding fails and invasive plant species dominate may provide nesting cover for other duck species that key on those vegetative characteristics. Grassland cover seedings that have a combination of warm and cool season grasses and forbs may provide similar benefits. Seeding to provide duck nesting cover should be set to a maximum level to a point of diminishing returns where additional seed densities do not result in increased stand density. Seeding rates should be targeted to provide the tallest and densest cover during the spring nesting season (approx. April 15 through June 30).

Periodic treatment, such as prescribed burns, of grassland cover is an accepted practice. However, our information suggests that productivity of nesting ducks in grassland cover recently treated may be reduced. Management should realize the possibility of localized reduction in duck production on treated units and devise burn plans that spatially and temporally disperse burn units across the landscape. Clustering multiple burns in a small localized area could have negative effects on duck production within that area. By spatially and temporally dispersing burn units across a larger landscape management ensures that some quality habitat remains within managed landscapes and that population sinks are not created within the landscape.

The location of grassland blocks in a landscape has an impact on the value of that grass to nesting ducks. Research has indicated that an increase in the amount of grass in a landscape has a positive affect on duck production. Landscapes may differ in components such as 1) predator populations, buffer prey species, predator travel corridors, 2) habitat type, size, and shape, 3) edge effects, tree effects, and 4) the amount, type, and dispersal of wetlands. Therefore, adding equal amounts of cover to differing landscapes may not have equal benefits. Efforts need to be directed to target management practices towards areas where maximum benefits can be achieved.

In order to better manage our public properties for duck production and to maximize the benefits from our acquisition dollars more information is needed on the predator component in the landscape. Predators have a direct influence on duck nesting success. Simple knowledge of where certain predator species occur annually within managed landscapes may allow management to target practices that are beneficial to nesting ducks. Increased knowledge of predator interactions with the components of the landscapes in which they survive may allow management to adopt strategies that have a positive influence on duck production in the Prairie Pothole Region of Minnesota and Iowa.

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