The Importance of Maintaining Structure to Ring-necked Pheasant and Waterfowl Production in the Upper Great Plains

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Introduction

Privately owned lands serve a crucial role in maintaining wildlife populations. Perhaps that is because approximately 60 percent of the land in the United States is privately owned (Lubowski et al. 2006). While many private landowners are aware that how they use their lands will impact wildlife, some private landowners are looking for ways to maintain wildlife populations at increased levels for both aesthetic and economical purposes. In recent years, expenditures associated with hunting have boosted many local economies as well as benefiting private landowners (Benson, 1989; Das and Rainey, 2009). As such, landowners who are concerned with both agriculture and wildlife on their lands continue to search for land uses that will remain profitable with respect to agriculture, but will also benefit wildlife species of interest. For an agricultural land use to be acceptable to wildlife it must result in land that provides at least one requirement for a given wildlife species. The following paper will focus on the ability of various land uses to provide "structure" for ring-necked pheasant (*Phasianus colchicus*) and a variety of upland nesting waterfowl species during the nesting season in the Upper Great Plains.

Defining Structure

Managing wildlife populations often requires managers and landowners to be concerned with meeting all requirements of a given wildlife species throughout the entire year. For example, ring-necked pheasant generally occupy a relatively small home range (Hill, 1985; Whiteside and Guthery, 1983), so it is not difficult to imagine that one landowner may own all of the land that an individual pheasant will occupy throughout its entire life cycle. As such, the land base will need to provide suitable habitat throughout all four seasons. In contrast, upland nesting waterfowl may return to the Northern Great Plains to raise young and then return south for the winter months. Thus it is important to provide suitable nesting and brood rearing habitat for waterfowl in the Upper Great Plains, but not necessarily habitat for the rest of the year. The production period for ring-necked pheasant and waterfowl, similar to livestock, is a very critical time for maintaining or growing populations and poor production can often result in significant reductions in population levels. While landowners and managers can provide habitat crucial for production, weather can also play a role in how successful a nesting season will be with respect to ring-necked pheasant and waterfowl production (Snyder 1984). However, since managers generally have little control over the weather, it is beneficial for landowner managers to provide high quality habitat that will facilitate high production rates under ideal climatic conditions.

Numerous wildlife studies have evaluated the characteristics that occur around nests of upland nesting bird species (Camp and Best, 1994; Duebbert and Kantrud, 1974; Fondell and Ball 2004). While structure can include species composition, for the purpose of this paper we will define structure as the height and density (visual obstruction) of the vegetation that occurs immediately at the nest bowl. Ring-necked pheasant and most species of upland nesting waterfowl initiate nesting prior to the on-set of heavy new growth, therefore, residual structure maintained from previous years growth is often thought to be an important attribute of nesting cover (Snyder 1984). Management agencies and scientist often employ the Robel pole (Robel et al. 1970) to gain visual obstruction readings (VOR) as a means to measure structure or residual cover. While the Robel pole was initially constructed to correlate the weight of vegetation to vegetation height and density (Robel et al. 1970), it has been used extensively by wildlife managers and researchers in rangeland management and studies of numerous wildlife species (Fondell and Ball, 2004; Snyder 1984).

Land Use, Structure, and Ring-necked Pheasant and Waterfowl Production

Fondell and Ball (2004) reported higher densities of mallard (*Anus platyrhynchos*), northern shoveler (*A. clypeata*), cinnamon teal (*A. cyanoptera*), gadwall (*A. strepera*), and ring-necked pheasant in ungrazed plots versus those grazed in Montana. Grazing tended to reduce available structure and in return reduced the number of acceptable nesting sites. However, within grazed and ungrazed plots waterfowl and ring-necked pheasant generally selected sites for nesting that were similar to one another from within a wide range of structure which could be found in each plot. This may suggest that ring-necked pheasant and waterfowl have a threshold level of structure required for nesting; when structure values dip below this unknown level at a particular micro-site, is no longer suitable as nesting cover. However, this also implies that it is not a requirement for 100% of the landscape to be at the threshold level, as a patchwork of suitable habitat intermixed with below threshold VOR's may still provide the needed structure to initiate nesting. VOR at ring-necked pheasant nests averaged 9.45 inches, while VOR at mallard, northern shoveler, cinnamon teal, and gadwall nests averaged 10.23, 9.05, 8.66, and 11.81 inches; respectively (Fondell and Ball 2004).

Ring-necked pheasant and waterfowl generally select areas of permanent cover as nest sites, however, in some regions of the United States winter wheat has been found to provide the majority of available nesting cover for ring-necked pheasants (Snyder 1984). In northeastern Colorado, Snyder (1984) reported higher VOR's for winter wheat stubble and new growth (3.25 inches) compared to perennial grass stands (1.85 inches) over a three year period. Ring-necked pheasant initiated a total of 88 nests in green wheat, old stubble, and new stubble, with 14 nests initiated in undisturbed cover. While wheat stubble and new growth was attractive to ring-necked pheasant, perhaps due to the increased availability of structure, farming practices associated with winter wheat production and predation lowered the success rate (49%) of nests below that which occurred for nests found in undisturbed cover (64%).

Beginning in 1986 and continuing today, Conservation Reserve Program (CRP) grasslands have provided a secure source of nesting cover for many grassland birds (Reynolds et al., 1994). CRP enrollment peaked in 2007 at approximately 36.7 million acres and has declined since (United States Department of Agriculture, 2011). CRP participation has been substantial in the Upper Great Plains, but with increasing returns on crop production as well as limited federal budgets, CRP enrollment in the Great Plains has declined across the Upper

Great Plains since 2007 (United States Department of Agriculture, 2011), and the trend is expected to continue.

The North Dakota State University Hettinger Research Extension Center evaluated the ability of a multiple land use management system to produce both agricultural and wildlife outputs on lands previously enrolled in CRP. Two, 640 acre blocks of land formally enrolled in CRP were used for the research sites. We randomly applied a 320 acres season long grazing pasture to each block which was grazed from approximately 1 June until 1 January by 32 to 38 cow calf pairs. We randomly assigned 80 acres of each block to a one-cutting hay production system with forage generally being harvested in late June or early July. Eighty acres of no-till barley was planted on each block annually and was baled in mid-July with another 80 acres planted to corn which was left standing and grazed from 1 January until 15 April. Our final land use consisted of leaving 80 acres within each block idle in an attempt to maintain wildlife habitat in the form of continued CRP enrollment.

We located and monitored nests of upland nesting waterfowl and ring-necked pheasant from 2007 to 2010 on the post-CRP lands. Upon locating a nest, we collected a Robel pole reading (VOR) immediately north of the nest bowl to determine vegetation structure being selected for by nesting ring-necked pheasant and waterfowl. We collected Robel pole readings (VOR) at random sites to access differences within each land use between nest sites and random locations. For the purpose of this paper, the VOR gathered at each nest bowl was considered a “used” site versus those VORs collected at random points which were considered “available” sites.

From 2007 to 2010, we monitored 142 ring-necked pheasant nests and 229 nests belonging to waterfowl. Common waterfowl species nesting on the research blocks include mallard, gadwall, northern shoveler, and northern pintail (*A. acuta*). Ring-necked pheasant and waterfowl primarily selected areas of permanent cover as nest sites with densities of pheasant nests ranging from a high of 16 nests/250 acres in idle land to a low of 0 nests/250 acres in no-till corn (Table 1). Similarly, densities of waterfowl nests were highest in idle land (24 nests/250 acres) and lowest in no-till barley (0 nests/250 acres; Table 2).

Table 1. Ring-necked pheasant nest density and success on Post-Conservation Reserve Program lands

Treatments	**Nest Density (Nests/250 Acres)** ***P = 0.009****	**Nest Success (Mayfield)** ***P = 0.21***
No-till Barley	0[b]	NA
No-till Corn	0[b]	NA
Hay	4[ab]	NA
Season Long Pasture	8[a]	33
Idle	16[a]	46

[*] values with different superscripts are significantly different

Approximately 32 percent of all ring-necked pheasant nests were abandoned throughout the time of our research trial and were not included for calculating nest success. We did not have enough active nests to allow us to calculate Mayfield (1969) nest success for ring-necked pheasant in hay, no-till corn, and no-till barley treatments. We were unable to calculate Mayfield nest success for waterfowl in the no-till corn and no-till barley land uses due to lack of nesting attempts. Although not significant, ring-necked pheasant nests experienced a higher Mayfield success rate in idle land use over those that were initiated in season long pastures (Table 1). In contrast, nest success was slightly greater, although not significant, in season long pastures over idle lands for waterfowl nests (Table 2).

Table 2. Waterfowl nest density and success on Post-Conservation Reserve Program lands

Treatments	**Nest Density (Nests/250 Acres)** ***P = 0.001****	**Nest Success (Mayfield)** ***P = 0.42***
No-till Barley	0^{c}	NA
No-till Corn	0.7^{c}	NA
Hay	7^{b}	30
Season Long Pasture	13^{ab}	56
Idle	24^{a}	51

[*] values with different superscripts are significantly different

Due to the presence of few nests in the no-till barley, no-till corn, and hay, we were only able to compare nest sites to available sites with respect to VOR in the season long pastures and idle lands for both ring-necked pheasant and ducks. Unit odds ratios indicated that nest sites of ring-necked pheasant within the season long pastures had greater structure than available sites (odds ratio ≥3.50; Table 3). Visual obstruction readings or structure averaged 7.8 inches at nest sites and 4.2 inches at available sites. Unit odds ratios indicate that nest sites of ring-necked pheasant within idle lands had greater structure (8.7 inches) than available sites (7.1 inches; odds ratio ≥2.10; Table 3).

Waterfowl tended to select nest sites with greater structure than was found at random available sites within the season long pastures (odds ratio ≥4.45; Table 4). Similarly, waterfowl nest sites had greater structure within idle lands than occurred at available sites (odds ratio ≥ 1.95). Structure at waterfowl nest sites averaged 9.1 inches and 10.0 inches in season long pastures and idle lands, respectively. In contrast, structure at available sites averaged 4.5 inches in season long pastures and 7.9 inches in idle lands.

Table 3. Univariate tests, unit odds ratios (UOR) and 95% confidence intervals (95% CI) from logistic regressions comparing structure at nest sites versus random points for ring-necked pheasant				
Treatment	X^2	*P* value	UOR[a]	95% CI
Season Long	46.93	<.0001	3.49	2.44-5.00
Idle	7.35	0.0067	2.099	1.23-3.59
[a] UOR ≥ 1 indicates a positive relationship				

Table 4. Univariate tests, unit odds ratios (UOR) and 95% confidence intervals (95% CI) from logistic regressions comparing structure at nest sites versus random points for waterfowl				
Treatment	X^2	*P* value	UOR[a]	95% CI
Season Long	70.33	<.0001	4.45	3.14-6.31
Idle	8.65	0.0033	1.95	1.25-3.03
[a] UOR ≥ 1 indicates a positive relationship				

Management to Provide Structure for Nesting Ring-necked Pheasants and Waterfowl

Based on our findings, regardless of land use, managers and landowners must be aware of retaining structure on their lands during the initiation of nesting by ring-necked pheasant and waterfowl. Our data further support previous findings that when available, pheasants and ducks prefer to nest in areas of permanent cover. However, based on findings by Snyder (1984), where permanent cover is not an option ring-necked pheasant will nest in winter wheat providing structure is available. In contrast to winter wheat stubble, based on our findings, barley stubble generally does not provide the required structure during nest initiation to facilitate nesting by ring-necked pheasant. Our findings suggest the importance of leaving some areas of increased structure following the completion of grazing by livestock. While the density of ring-necked pheasant and waterfowl nests was greater in idle lands over those grazed in a season long system, birds did continue to search out areas of higher structure as nest sites suggesting the importance of maintaining areas of higher structure for production of ring-necked pheasant and upland nesting waterfowl.

Implications

Private landowners are increasingly concerned with wildlife populations that occur on their lands. As such, landowners must be aware of a species needs throughout its time on their lands. The nesting season is a critical time for populations of ring-necked pheasant and waterfowl throughout the Upper Great Plains. Maintaining areas of higher structure appears to influence the density of ring-necked pheasant and waterfowl nests which may occur on the various land uses that tend to occur on private lands. With respect to livestock production, the goal for a landowner that is concerned with livestock production and ring-necked pheasant and waterfowl production should be to maintain a patchwork of areas within pastures that contain high structure. It is important to maintain some structure at the end of the grazing season as those areas of higher structure are likely the ones that will be selected as nest sites by birds in the spring. Our data demonstrates that ring-necked pheasant and waterfowl production is compatible with a proper grazing program, albeit at reduced rates, provided residual vegetation is maintained as structure following the completion of the grazing system. However, tradeoffs may exist between maximizing livestock or wildlife production.

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