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The Shepherd Project: A Case Study of Private Management for Ring-necked Pheasants (Phasianus colchicus) in Montana

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The Shepherd research farm is headquarters for Floating Island International, a company that produces floating wetlands for water quality and wildlife enhancement. It is also a demonstration site for managing ring-necked pheasants (*Phasianus colchicus*) on Montana landscapes. Primary goals for the 100-ha farm include an exploration of how agriculture can better integrate with wildlife to achieve a more sustainable landscape. One of the measures of this transition is ring-necked pheasant abundance. During 1998 to 2006, 3 management programs have been implemented: 1) changes in farming methods, 2) targeted habitat development, and 3) predation management. The main change in farming has been a reduction of irrigated annual cropland and pasture from 73% of the land area to 13%. The major crops planted on the site are more diversified and include corn, sorghum-sudan grass, barley, Maximillian sunflower, asparagus, and alfalfa. Other habitat management changes include delayed mowing and incomplete harvest of planted crops. During 7 years, the main predators removed by trapping were raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), feral house cat (*Felis domesticus*), red fox (*Vulpes vulpes*), and coyote (*Canis latrans*). Estimates of pheasant abundance were made during the hunting season using change-in-ratio of observed pheasants during male-only harvest. Each year harvest was halted when $>$75% birds observed were hens. Harvest using this method increased from 14 in 1998 to 207 in 2005. We believe this integrated approach, with its use of less intense agricultural methods, creates a diversified landscape that is beneficial to pheasants and enhances wildlife habitat for a variety of other species.

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Introduction

As managers of property which traditionally held populations of the ring-necked pheasants, but where harvest was generally much lower than we believe possible, we were interested in understanding what the level of sustainable wild pheasant harvest is on a farm managed intensively for wild pheasant. We hoped to gain an understanding of which variables were most important, relative to increasing levels of legal pheasant harvest on the study area. Similar measurement has taken place on larger study areas in Europe. For example, annual wild hen and rooster harvest at Seefeld Estate in Lower Austria demonstrated value of habitat management (Anderson 2002, Draycott et al. 2002, Bliss 2004). However, there are a number of key differences between these settings. Our goal was to track levels of sustainable wild bird harvest in a conventional farm ground setting in which certain potential variables could only be influenced within the relatively small study area.

Study Area

Our study area is located in Yellowstone County, about 30 km northeast of Billings, Montana. It is situated between 900 and 960 msl. The study area consisted of about 97 ha (240 acres) of farmland and associated habitats. During the 7 year study period, land use was transformed from mainly flood

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Table 1: Land Use at Shepherd Farm, Yellowstone County, Montana, before and after initiation of pheasant management program.

Description of Land Use	Land Use Prior to Study ha (acres)	Land Use Changes During Study ha (acres)
Flood irrigated annual crops	40 (100)	10 (25)
Flood irrigated pasture	30 (75)	12 (30)
Brushy draws and river bottom	25 (63)	26 (65)
Perennial crops (asparagus, Maximillian sunflower)	0 (0)	7 (18)
Ponds and wetlands	0 (0)	3 (8)
Fallow ground	0.4 (1)	34 (84)
Hedgerows	0.4 (1)	3 (8)
Orchard	0 (0)	1 (2)
Total	97 (240)	97 (240)

irrigated farm and pasture ground, to some native habitat, perennial crops and a mix of other habitats beneficial to pheasants (Table 1). Main annual crops are maize, sorghum-sudan grass and barley. Perennials include Maximillian sunflower, asparagus and alfalfa. Orchards are made up of cherry, plum and apple trees. An additional 7 acres of irrigated ground has been developed into weakly defined wind breaks and hedgerows during the study period. About 2.5 acres of the farm has also been transitioned into additional waterways that include ponds and ditches that flow consistently through spring and summer months.

Methods

Pheasant Harvest

During all 7 years of the project, pheasant hunting methods conventional to North America were utilized. Most hunts involved groups of hunters, typically 2 to 6, walking through cover with dogs, with some of the hunters strategically positioned in blocking positions that anticipated pheasant escape routes. Particular focus was placed on identification and recovery of any bird that showed signs of being hit by shot. This included loss of feathers, apparent flinching, or collapse of the bird to the ground.

Montana's hunting season ran for 10 weeks during the first 5 years of the study, then was lengthened to 12 weeks during the last 2 years. After the first month of hunting, hunters were consistently asked to report on the number of pheasants seen, and the ratio of hens to roosters. To ensure sufficient numbers of males relative to available spring breeding territories (Hill and Robertson 1988), hunting pressure was reduced once female to male ratio reached or exceeded 3 to 1 during the first 4 years of the study. After the first 4 years, pheasant numbers were estimated to be sufficiently high to ensure adequate roosters for available territories; therefore, hunting pressure was not reduced for the final 3 years of the study.

A pheasant survey was taken in late winter/early spring of each year of the study. A specific acreage of the study area would be pushed. Counters would tally roosters, hens and total pheasants seen. These results would be extrapolated over the rest of the study area to provide a generalised population count as well as hen to rooster ratios. We obtained harvest data for the rest of Yellowstone County, Montana for the first five years of the study. The percentage change in harvest was compared to the Shepherd project study area for all years data

was available We then identified presence or absence of general foods found in each crop.

Habitat Management

In each study year but the first, a portion of annual farm crop was left standing, in some cases for the balance of the study. This took place with corn (maize), sorghum-sudan, annual and perennial sunflower, millet and barley. Up to 10 ha (25 acres) in a year were left unharvested and therefore available to pheasants and other wildlife on the property. At 2 times during the study 200-pound increments of medicated poultry grit were spread within high pheasant usage zones. Other than this, no other supplementary feeding was carried out in the study area.

The owner integrated a blended strategy to enhance for nest security. This involved coordinating land and water features so that security cover, food, (especially insect habitat associated with broadleaf plants) water and grit were present across the study area. "Edge" habitat was expanded by reduction in field size. Land disturbance was minimized during nesting season.

Except in one instance involving an aphid outbreak within a 0.6 ha (1 acre) orchard, pesticides or herbicides were not used within the study area. Fertilizer was applied sparingly, and at a rate approximately 2/3 lower than levels recommended for optimal agricultural production. Vinegar concentrate was utilized as an organic herbicide during the last 2 years of the study. Manure from a local feedlot was also spread through approximately 8 ha (20 acres) of the study area twice during the study period.

Alfalfa and grass hay were harvested from the study area intermittently through the study period, but never before July 15 in any year. Correspondingly, flood irrigation was also phased back. Currently, flood irrigation is initiated no earlier than the beginning of July. During nesting season and throughout summer months irrigation ditches provided a low volume source of water that presumably pheasant chicks could access and cross safely. Low water flow was maintained through these ditches that spread across the farm, providing a widely dispersed source of drinking water.

Predation Management

Several strategies were employed to manage small mammalian predators. Box traps armed with connibears were broadcast around the property and pre-baited, typically starting in November - December each year. At first, bait would be positioned in the box without the trap being set to condition predators to focus on the traps as food sources, then at the conclusion of the pheasant hunting season, the traps would be set. This was the primary trapping and predator control method utilized during the first three years of the study, and was effective at harvesting racoon, skunk and feral housecats.

As of year four a snare system was integrated into the predator management protocol, which was significantly effective in the harvesting of red fox, coyote and racoon.

As of year two, bait stations were also introduced into the predator control strategy. Carcasses and other odiferous materials were deployed in a brushy area, to attract predators. These locations, typically 2 on opposing sides of the research area, were then densely set with snares and box traps. Snares and box traps would otherwise be strategically positioned in funnel areas, and on or adjacent to deer trails within the property.

Hunting Method

During the first four years of the study hunters used shotguns with loads of their choice. During the 5th and 6th years, in most instances hunters were provided with shotgun loads of #4 or 6 Hevi-Shot. In year seven hunters were allowed again to shoot the load of their choice. In all instances, the study investigator accompanied hunters, unless it was determined that hunters were appropriately familiar with study protocols.

Crippled birds were verified on the following basis: as soon as possible after a shot sequence, hunters were queried about the disposition of the bird. In cases where the hunters indicated they hit a bird, but it was not recovered, hunters near the scene were

Table 2: Pheasant harvest at the Shepherd Project, Yellowstone County, Montana, during 1999-2005. This includes all legally harvested or wounded and lost males.

Year	Number Shot	Wounded and Lost	Recovered (%)
1999	14	3	11 (79)
2000	24	6	18 (75)
2001	41	11	30 (73)
2002	57	14	43 (75)
2003	92	21	71 (77)
2004	121	23	98 (81)
2005	207	21	186 (90)

asked for verification. If every hunter witnessing the episode confirmed that the bird had been significantly hit and was either going down or had gone down but had not been recovered, it was classified as a downed bird, in the "not recovered" category. A single hunter disputing this status would negate the entry. In cases without corroborating witnesses, hit birds that were not recovered were not tallied.

Results

Pheasant Harvest

Pheasant harvest has steadily increased from a low of 14 shot in 1999 to 207 shot in 2005 (Table 2). The percentage of shot birds that were recovered ranged from 73% to 90% with the highest recovery during the last 2 years (Table 2). Compared to slightly declining trend in harvest for Yellowstone County, there was a 1,400% increase in pheasant on the Shepherd study area (Figure 1).

Pheasant harvest increased 15-fold over the seven year study.

Pheasant Abundance

Post-hunting season pheasant population surveys were conducted for Year 2 and Year 7. The one-day surveys were conducted by flushing and counting pheasants from the areas of the property where most of the pheasant population was believed to reside. During February of the second year, 49 pheasants were counted, comprising 24 roosters and 25 hens. During the prior season 24 roosters had been shot. Despite this, hens to roosters were still 1:1, indicating that hens were experiencing similar mortality levels that year.

During March of the seventh year, 260 pheasants were counted, comprising 205 hens and 55 roosters. A territory count taken later that spring found 30 territories occurring in the study area, indicating 1.8 roosters available per territory, with 6.8 hens per territory, assuming no dispersal. Since dispersal is likely due to proximity of additional appropriate habitat adjacent to the study area, the hens-per-territory ratio is likely to lower somewhat. With a 205 hen count a further increase in next year's pheasant population seems probable.

We found a diversity of plant and animal materials in the crops of harvests birds (Table 3). The main animal food was grasshopper (Orthoptera). Most of the plant materials were seeds of corn, Russian olive, sorghum-sudan, and rose hips (Table 3).

Predation Management

We estimate that predator control activities consumed an average of 100 hours per year. Use of bait stations and funnel zones, quickset snares and pre-baited box traps on a small farm made the predator work significantly more effective, especially in relation to travel time between trap sets.

The most common predators trapped during predator removal were raccoons and striped skunks

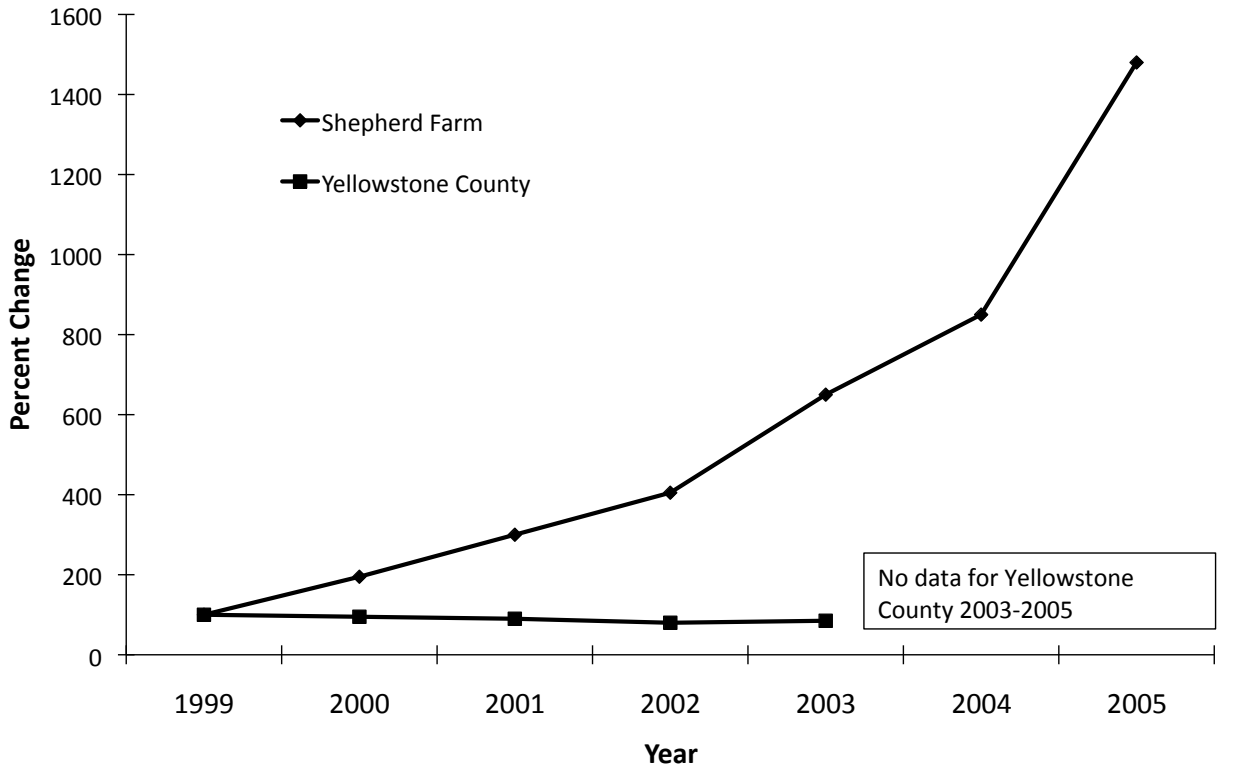

Figure 1: Change (%) in pheasant harvest on the Shepherd Project study area compared to the harvest from Yellowstone County, Montana during 1999 to 2005.

(Table 4). Large numbers of feral cats were also trapped on the study area. During the last year of trapping, mean weight of racoons harvested on the study area was 4.1 kg (9 lbs) compared to the 6.4 kg (14 lbs) average observed by a local fur buyer. For red fox we observed a mean weight of 4.3 kg (9.5 lbs) compared to the fur buyers reported 5.0 kg (11 lbs) average.

Discussion

The Shepherd research farm is headquarters for Floating Island International, a company that produces floating wetlands for water quality and wildlife enhancement. The company's production headquarters are located on a property adjacent to the research farm. Primary goals for the research farm include an exploration of how agriculture can be synchronized with wildlife to achieve an optimal and sustainable balance. The owner has determined that increasing organics in the soil and increasing the amount of land area planted in perennials compared to annual crops will contribute to the long-term goal. Because of the well-established research protocols and methods associated with pheasant, the owner chose to use them as one of the "flagships" tracking progress towards these goals.

The project modified 3 major variables that would positively impact pheasant abundance, farming methods, habitat, and predator demographics to achieve a 15-fold increase in pheasant harvest. Achieving this on a relatively small area was challenging. Pheasants could readily avoid the significant hunting pressure by moving to adjacent properties (the farm was hunted on average twice per week during the last two years of the study). On the other hand the 100 ha (234 acre) size presented a much more focussed opportunity to concentrate predators.

Increases in habitat dovetailed with the farm's

Table 3: Crop contents of harvested male pheasants on the Shepherd project study area, Yellowstone County, Montana during 1999-2005

Year	Contents of Crops
1	grasshoppers (Orthoptera), Russian olive (*Elaeagnus angustifolia*), Rose Hip (*Rosa* spp.)
2	corn (maize), Russian olive, sorghum-sudan
3	Russian olives, sorghum-sudan, corn (maize)
4-7	corn (maize), Russian olive, sorghum-sudan

goal of expanded perennial cover. The owner estimates that between 6,000-7,000 trees and bushes were planted during the study period. It is also noteworthy, however, that these plantings are not likely to have had much bearing on study results for 2 reasons: drought conditions, and unwillingness on the owner's part to utilize chemicals for weed control. As a result tree and bush survival and growth have been low to moderate. What has contributed to enhanced brood survival, the owner believes, is the strategy of not harvesting up to 10 ha (25 acres) of crop per year, and leaving these crops, primarily sorghum-sudan grass and corn, standing or lodged over for up to 5 years, with corresponding broadleafed weeds like koshia (*Koshia scoparia*), Russian pigweed (*Axyris amaranthoides*), white or yellow-blossom sweet clover (*Melilotus officinalis*) and mustard (*Sinapis arvensis*) filling in and providing dense security cover and thermal mass. Integrating low water volume ditching with these weedy patches, as well as some manure strips, akin to the European beetle bank strategy, provided for added pheasant chick survival enhancement (MacLeod et al. 2004).

We have refrained from burning on the property, but we have used cattle to graze off major areas of the farm twice during the study period, both times during winter months. Some fields have also been mowed in late winter/early spring, then tilled into the ground. After testing for mycorrhizial presence, selected sites around the farm have been inoculated with a commercial blend of micorrhizia. The farm has also incorporated approved insect vectors into its weed control strategy in order to meet mandated weed control guidelines.

As explanation for the significant improvement in the recovered birds ratio in the last year of the study, the owner proposes the following theory. Montana had been in a long-term drought throughout the study period. Higher than normal precipitation occurred during the last year of the study: fall precipitation was double the previous year. Added moisture seemed to enhance the dogs' ability to find downed birds. In addition, the ample moisture seemed to result in many high quality shot opportunities as birds would hold tighter in the more dense cover. We propose that these 2 considerations combined to provide a setting that compared to more typical Midwestern cover and moisture conditions, and to recovery ratios that have been reported from that region. It is also noteworthy that Hevi-shot, while not mandated for the last year of the study, was the predominant load selected by hunters and is also the year with the highest recovery rate of shot birds.

Over the next several years we intend to expand wetland habitat on the property. Expansion of optimal habitat in concert with conscientious farming methods and predator control could result in further expansion of the pheasant harvest.

Of the 3 variables - habitat improvement, predator management or adjusted farm practices we believe that all 3 are important and actually become syngernistic in their value. Additional research into various factors would certainly be of value, for

Table 4: Predator removal from the Shepherd project study area, Yellowstone County, Montana, during 1999-2006.

Species	Number Harvested
Raccoon	279
Red fox	78
Coyote	40
Striped skunk	117
Feral cat	111
American mink	4
Long-tailed weasel	2

example, into the impact on pheasants and other ground nesting birds of pesticide and herbicide use; into variations in predator effectiveness relative to predator age and experience and into tracking effectiveness of weed-infested standing crops as a pheasant enhancement strategy.

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