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Home range size and habitat preference of pen-raised ring-neck pheasants *(Phasianus colchicus)* released at Lancaster County Central Park.

Report for Lancaster County Central Park

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ABSTRACT Six pen-raised ring-necked pheasants (*Phasianus colchicus)* were radio collared and released into Lancaster County Central Park (LCCP), Pennsylvania in September 2015. These pheasants were radio-tracked in LCCP during multiple times of the day over a 40-day period to obtain a greater understanding of how pen-raised ring-necked pheasants use available habitat. Their movements were recorded and analyzed for trends in habitat preference and overall home range extent. The pheasant's two-week survival was 50%, with the remaining pheasants surviving the duration of the tracking period. The average home range size was 6.04 hectares (ha) with an average usage rate of 0.27 ha per day. As a whole, the pheasants showed significant preference for grass/shrub habitat ($p < 0.05$). The 50% survival rate and the availability of ideal habitat suggest that LCCP could successfully maintain a reintroduced ring-necked pheasant population. However, pheasant carrying capacity of LCCP still needs to be estimated and unknown regional factors that may affect home range size (e.g., food availability, competition from other species, predator counts) need more exploration.

INDEX DESCRIPTORS Ring-necked pheasant, *Phasianus colchicus*, diurnal movement, radio-tracking, grass shrub habitat, Lancaster County Central Park

INTRODUCTION

Understanding habitat needs, preference, and usage patterns of wildlife is a critical component for effective management and conservation of a wildlife species, particularly for ring-necked pheasants (*Phasianus colchicus)* which survive on the fringes of highly-developed human landscapes. Mid-Atlantic pheasant populations have decreased dramatically since the early 1970s, primarily due to habitat loss driven by the forces of urbanization and the expansion of 'clean' agricultural (Smith et al. 1999). In Pennsylvania, recent efforts such as the Conservation Reserve Enhancement Program (CREP) have helped to increase ring-necked pheasant numbers

overall, but is not enough to reverse the declining population trend without additional effort (Pabian et al. 2015).

Prior research indicates that farm raised ring-necked pheasants use habitat with ample cover in all seasons. Fall habitat use varies among regions, however, farm-raised birds generally favor idle, untilled cropland (Smith et al. 1999, Gatti et al. 1989; Leif 2005), shrub lands and wetlands (Klinger and Riegner 2008, Marco et al. 2010). In its ring-necked pheasant management plan, the Pennsylvania Game Commission also cites plantings of cool season grasses and forbs as a preferred fall environment (Klinger and Riegner 2008). In addition, from research studies done by Neilson et al. (2008), they found that ring-necked pheasant population size was a good indicator of conservation reserve success along agricultural areas in the United States.

The purpose of this project was to determine both the habitat usage preference and the home range extent of male and female pen-raised pheasants upon reintroduction to a wild landscape using radio-telemetry and GIS data analysis. As demonstrated by Marcstrom et al. (1989) and Matthews et al. (2012), fitting pheasants with necklace transmitters and tracking via radio telemetry provides an innocuous, and efficient method to generate the necessary data for spatial analysis. Our null hypothesis was that both male and female pheasants would exhibit similar landscape usage preferences and range extents during the project period.

MATERIALS AND METHODS

This project involved 6 adult, pen-raised pheasants – 4 female and 2 male –purchased from Red Fox Farm Gamebirds in Mohrsville, PA. The birds were transported to Millersville University where they were fitted with necklace-style radio transmitters manufactured by Advanced Telemetry Solutions (https://atstrack.com/) (Figure 1). The pheasants were released

into Lancaster County Central Park (LCCP), mid-afternoon on September 18th, and were equally spaced along a 750 m transect (Figure 2). The pheasant release transect traveled the margin of an open, contiguous, shrubby, 13-hectare early successional field. The field was mostly surrounded on all sides by tree canopy. Following release, the pheasants were tracked using a hand-held antenna and radio-receiver manufactured by Telonics Inc. (http://telonics.com/). Once pheasant locations were confirmed in the field, their positions were marked using hand-held Garmin eTrex Venture GPS units (www.garmin.com). Pheasant positions were marked at least twice daily, Morning (6:30 – 9:30 am), Noon (11:00 am – 2:00 pm), Evening (2:00 – 5:00 pm) and/or Dusk (5:00 – 7:00 pm).

Data was collected from September through October 2015, or until pheasant mortality. Spatial data was analyzed using the Biotas® software program (http://www.ecostats.com/web/Biotas). Home range estimations were made using the 95% fixed-kernel home range estimator with least squares cross validation. Land cover raster satellite data was obtained from the Pennsylvania Geospatial Data Clearinghouse (www.pasda.psu.edu) for Lancaster County. Land cover data was divided into four categories: grass/shrub, paved, tree canopy and water. The field defined as "grass/shrub", comprised 51% of the project area. The deciduous forest was defined as "tree canopy", and comprised 43% of the project area. "Paved" surface area covered 3% of the project area. The final category "water" accounted for a nearby river (Conestoga River) and occupied 3% of the project area (Figure 2). Land cover selection (i.e., habitat selection) analysis was conducted for pen-raised ring-necked pheasants using Goodness-of-fit comparisons of expected number of pheasant locations in each habitat or land cover type based on habitat availability. This was compared to observed pheasant locations in each habitat type represented by 95% confidence intervals (Neu et al. 1974). This analysis was

conducted using the Biotas® software program to calculate the X^2 value with 95% confidence intervals for each habitat type.

This project was carried out with approval from the Millersville Institutional Animal Care and Use Committee, Lancaster County Department of Parks and Recreation, Millersville University and the Pennsylvania Game Commission.

RESULTS

The average home range size of the pheasants was 6.04 ha (Table 1). One pheasant, Female 65, was an outlier with a home range size of 17.41 ha. The average home range size of female pheasants was 7.0 ha, while males used an average of 4.16 ha. All pheasants used an average 0.27 ha per day.

Two of the birds (Female 65, Female 15) survived through the duration of the project period, with two other birds slipping the collar with no remains found. Females 65 and 15 were recaptured at the end of the project period, relieved of the radio collars, and released back into the park. The average survival time for the 3 pheasants that died was 9.6 days; all three failed to survive beyond two weeks (Table 1). The home range sizes for the three surviving pheasants were larger than the range sizes for the three deceased pheasants, with larger home range sizes being associated with longer tracking periods.

The pheasants showed a significant preference for grass/shrub habitat and against tree canopy habitat (Figure 3). The habitat preference of the female pheasants mimicked the overall results, significantly favoring grass/shrub over tree canopy (Figure 4). In contrast, the male pheasants failed to show a significant difference in habitat preference, with observations across all habitat not falling outside the 95% confidence interval (Figure 5). In all cases, the pheasants avoided water, while using paved habitats based on the proportion available (Figures 3, 4, 5).

DISCUSSION

The average range extent of pheasants in this project (6.04 ha) was markedly lower than demonstrated in other similar studies. Ramey et al. (2006) found that pen-raised birds averaged a home range size of 117.2 ha, while Smith et al. (1999) showed that home range size can range from 35 – 150 ha. Considerations such as population density, regional climate, land usage and/or sampling method contribute to the variability in range size (Smith et al. 1999). Since home range size increased with survival duration during this project (Table 1), it is reasonable to infer that the surviving birds' home range would continue to expand and ultimately fall within a similar range given a longer project period. However, in the Ramey et al. (2006) study, pen-raised pheasants experienced a 72% mortality rate two weeks after release; the LCCP pheasants showed a 50% mortality rate after two weeks. With a larger percentage of birds surviving longer, one might expect larger range sizes in the Lancaster birds compared to the Ramey et al. (2006); the link between range extent and survival duration may need further study with a larger sample size.

The overall preference for grass/shrub habitat demonstrated by the LCCP pheasants was consistent with findings by Matthews et al. (2012) and Smith et al. (1999). The presence of thick, shrubby, heterogeneous vegetative cover is consistently found to be beneficial for pheasant populations. This habitat provides solid cover for the birds, while also providing ample foraging opportunities and more secure nesting sites (Smith et al. 1999). Additionally, Smith et al. (1999) found that pheasants also avoided open grassland in favor of shrubby cover. While this project found an overall preference for shrubby cover, it did not show a significant preference among males (Figure 4). Neither Smith et al. (1999) or Matthews et al. (2012) demonstrated habitat preference differences between male and female pheasants. Since the data showing no significant

habitat preference among males narrowly fell outside the necessary 95% confidence interval (Figure 5), one must consider the potential effects of small sample size (only 2 male pheasants tracked). Seasons may also play a role in a pheasant's choice of habitat. Trautman (1963) found that woody cover provided roosting places for pheasants in the winter when snow covered the ground; when snow was minimal, pheasants preferred herbaceous cover. In the fall, snow did not play a role in the pheasant's roosting preference. Given the consistent trend throughout the literature, it is fair to dismiss the insignificant habitat preference of male pheasants in this project as an artifact of small sample size. Further efforts are necessary to confirm or refute this hypothesis.

MANAGEMENT IMPLICATIONS

Land use managers interested in preserving ring-necked pheasant habitat have a relatively clear picture of what the birds require. The presence of mid-successional, shrubby vegetation is a clear and consistent prerequisite for a stable pheasant population (Figure 6). Because this habitat type is fundamentally one of ecological transition – from open field to wooded forest – it requires periodic maintenance. Controlled burns or mechanical clearance (i.e. heavy-duty mowing) of saplings and brush to prevent the transition to forest are possible strategies for maintenance of the necessary habitat. However, managers should take care to not overuse such methods, as pheasants preferentially avoid early successional habitats (i.e. open grassland). Applying these methods in a segmented, rotational basis is recommended to maintain a vegetation height of 100 to 200 cm, which provides ideal cover for pheasants (Neutel and Bealey, 1993).

The amount of land necessary for a stable pheasant population is less clear. There are many regional variables that can affect home range size for pheasants (Smith et al. 1999). The LCCP (220 ha) appears to offer ample space for a pheasant population. The survival of half the

pheasants in this project suggests that this area is a quality habitat with room for growth. However, the exact carrying capacity remains unknown. Further monitoring, perhaps with a more long range perspective, would provide key data in this regard.

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Table 1. Home range size estimates based on a fixed kernel estimator with least squares cross validation and survival duration of six pen-raised ring-necked pheasants released and radio-monitored in Lancaster County Park from September through October, 2015.

Pheasant ID	Sex	Home Range (hectares)	Survival (days)	Usage Rate (hectares/day)
15	Female	5.48	40**	0.137
25	Female	1.65	12	0.138
35	Female	3.37	10	0.337
45	Male	5.58	40	0.140
55	Male	2.74	7	0.391
65	Female	17.41	40**	0.435

**survived beyond the duration of the radio-tracking period

FIGURES

Figure 1. Male ring-necked pheasant fitted with a 12-gram Advanced Telemetry Solutions (https://atstrack.com/) necklace radio transmitter.

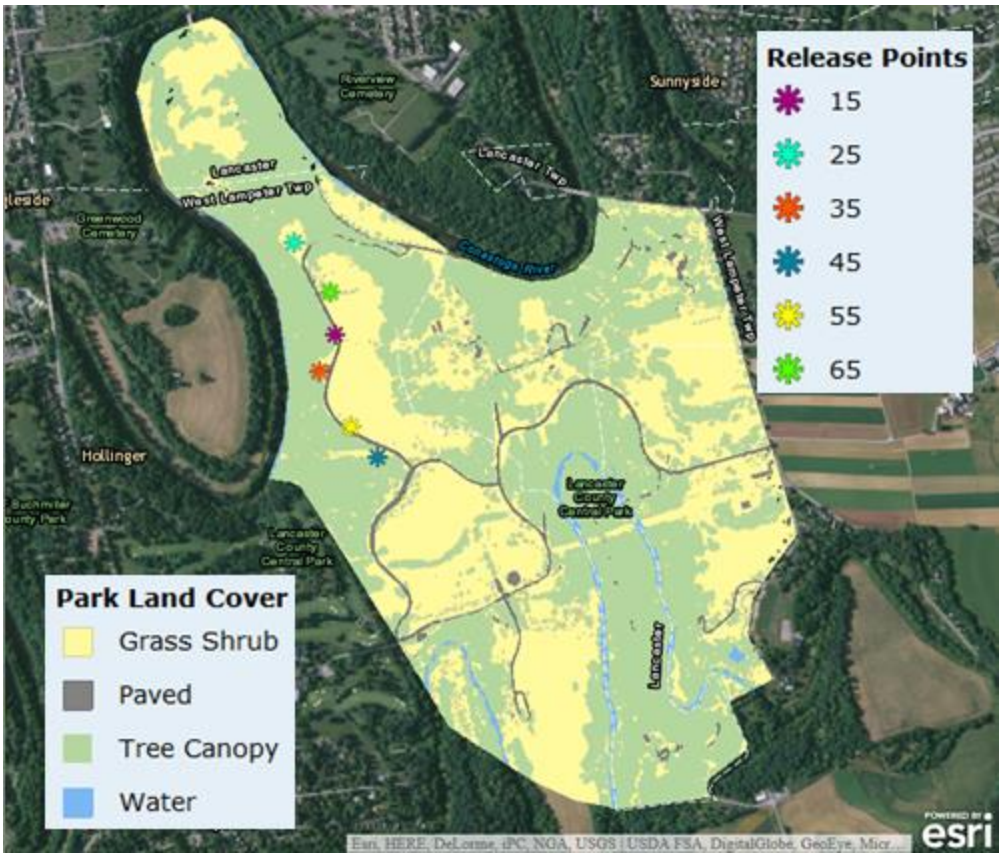

Figure 2. Lancaster County Central Park project site, located in Lancaster, Pennsylvania. The park is open to the public and offers mixed use recreation opportunities. Release points indicate areas where pen-raised ring-necked pheasants were released and Park Land Cover indicates the different land cover/habitat types within the project area. Refer to the website http://mapmaker2.millersville.edu/pamaps/LanCo_Pheasants2015/ for pheasant home range analysis with land cover data.

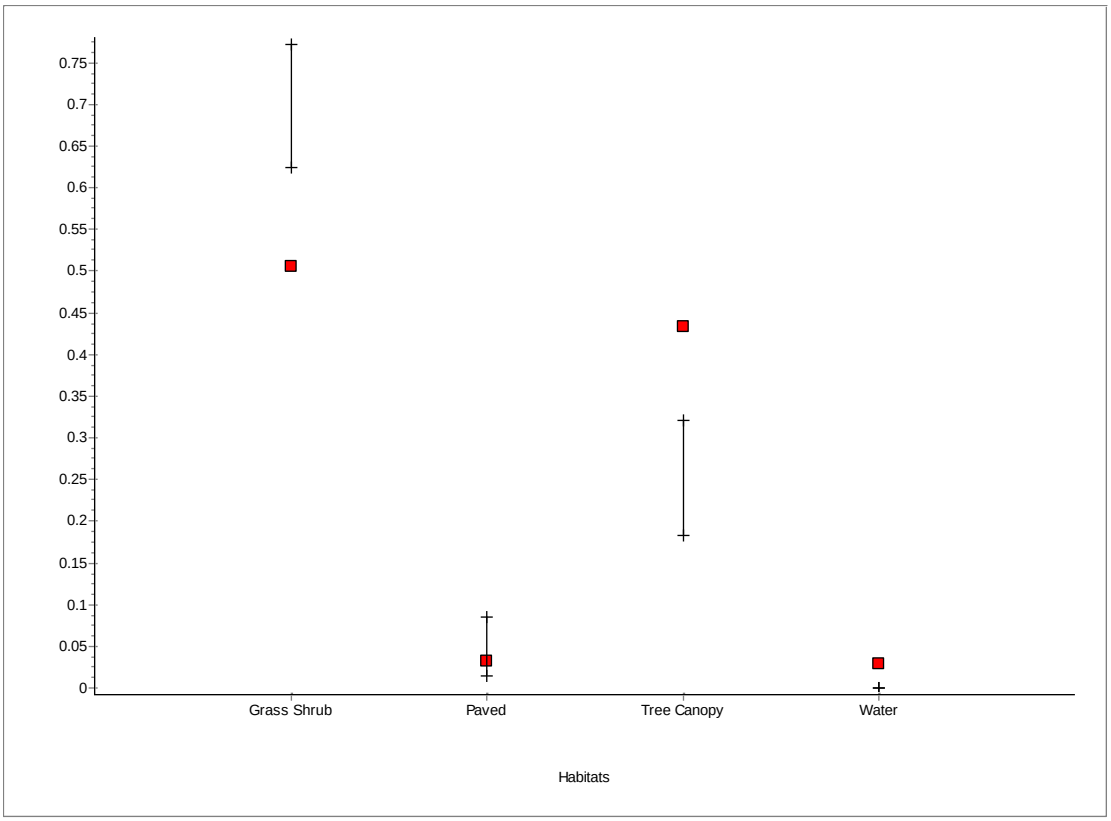

Figure 3. Analysis of habitat usage preference (Grass/Shrub, Paved, Tree Canopy, Water) of six pen-raised ring-necked pheasants (two male, four female) released into Lancaster County Central Park in September 2015. Squares indicate the proportion of habitat available on the project area and the 95% confidence intervals indicate the proportion of habitat used by pheasants.

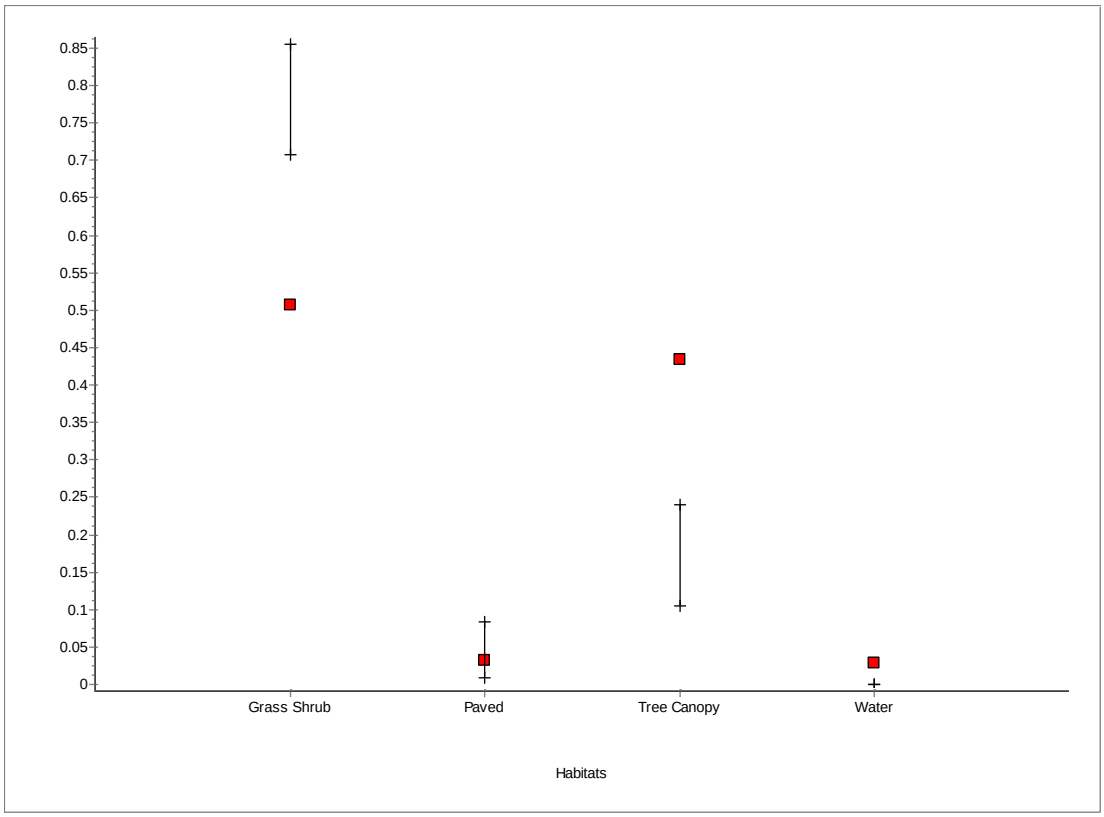

Figure 4. Analysis of habitat usage preference (Grass/Shrub, Paved, Tree Canopy, Water) of four female pen-raised ring-necked pheasants released into Lancaster County Central Park in September 2015. Squares indicate the proportion of habitat available on the project area and the 95% confidence intervals indicate the proportion of habitat used by pheasants.

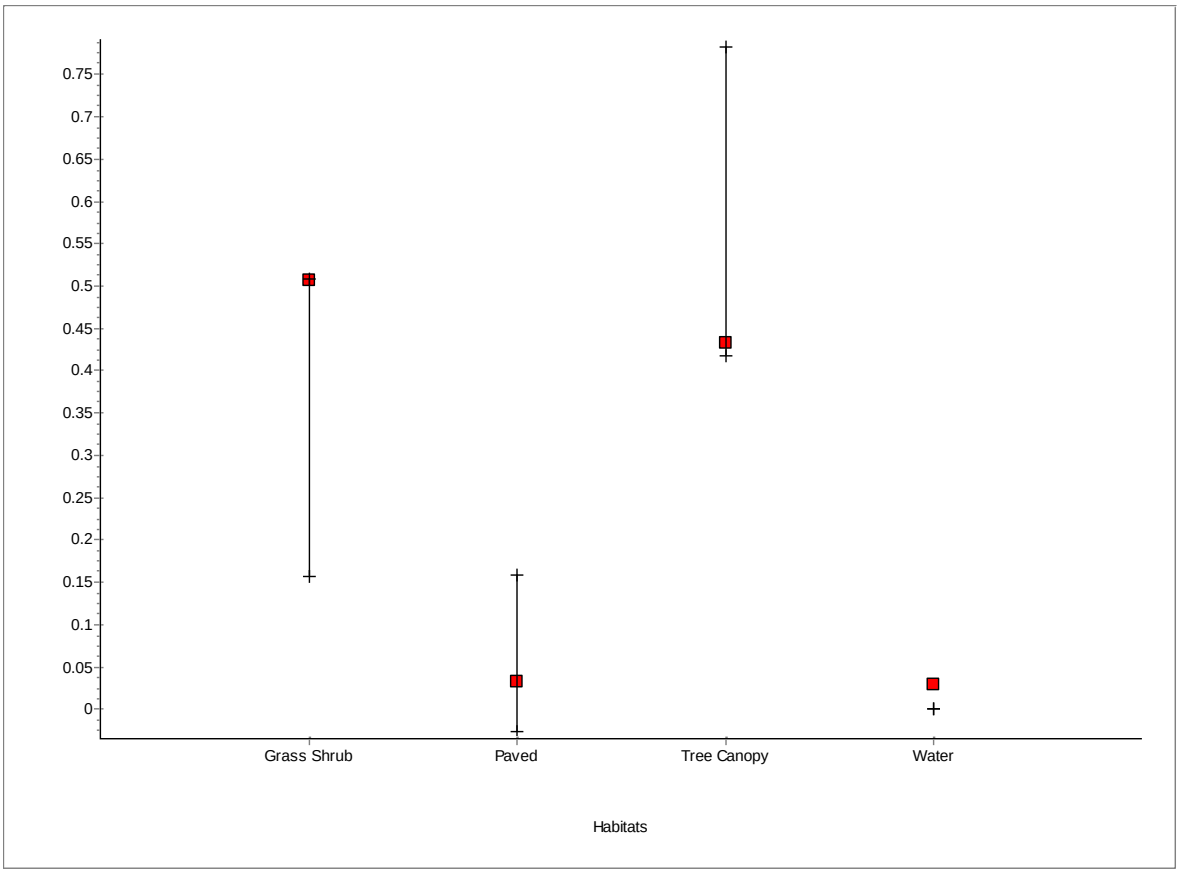

Figure 5. Analysis of habitat usage preference (Grass/Shrub, Paved, Tree Canopy, Water) of two male pen-raised ring-necked pheasants released into Lancaster County Central Park in September 2015. Squares indicate the proportion of habitat available on the project area and the 95% confidence intervals indicate the proportion of habitat used by pheasants.

Figure 6. Grass/shrub habitat used by ring-necked pheasant tracked via radio-telemetry at Lancaster County Central Park in Lancaster, Pennsylvania.