White-tailed Deer Fawn Survival Study[a]

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Justin Vreeland prepared a thesis titled *Survival rates, cause-specific mortality, and habitat characteristics of white-tailed deer fawns in central Pennsylvania,* as partial fulfillment of the requirements for the degree of Master of Science from The Pennsylvania State University (Vreeland 2002). His document represents the final report for this research project. A copy of this thesis will be placed in the Pennsylvania Game Commission (PGC) Bureau of Wildlife Management's final research report file. The following abstract was published in his thesis.

Abstract: Estimates of survival and cause-specific mortality of white-tailed deer (*Odocoileus virginianus*) fawns are important to population management, but are unknown for Pennsylvania. Sources of fawn mortality likely include predation, other natural causes excluding predation, legal harvest, poaching, collisions with vehicles and farm machinery, and accidents. However, in what proportions fawns die from these causes is unknown in Pennsylvania. Habitat type, extent, and arrangement can influence predator and prey communities and their interactions, and therefore also might influence fawn survival. However, influence of habitat characteristics on fawn survival has not been investigated. Therefore, I quantified cause-specific mortality, survival rates, and habitat characteristics related to survival of white-tailed deer fawns in a forested landscape (QWA) in northern central Pennsylvania with presumed poor habitat condition and greater predator density, and a separate, agricultural landscape (PV) in central Pennsylvania with presumed better habitat condition and lesser predator density. Using foot searches in PV and vehicles searches in QWA, I captured neonatal fawns in May and June 2000 and 2001. Fawns were fitted with expandable, releasable radiocollars designed to transmit for ≥9 months. I monitored fawns at least weekly from capture until death, transmitter or collar failure, or the end of the study. I developed 13 models of fawn survival and used Akaike's Information Criteria (AIC) and the known fates procedure in computer program MARK to model survival through 9 weeks. I created circular buffer areas corresponding to the median areas of study-site- and year-specific 95% fixed-kernel home ranges for fawns at 9 weeks after capture and centered these buffer areas on the median location for each fawn. Using a geographic information system, I calculated edge density, road density, proportion of buffer area in annual and perennial herbaceous land cover, and habitat patch diversity within fawn buffer areas. I used logistic regression models and AIC to evaluate the relation between these 4 habitat characteristics and fawn survival. I captured 110 fawns in PV and 108 fawns in QWA. In the best (ΔAIC = 0) logistic regression model, only study site and fawn mass at capture were related to fawn survival, with fawns in PV and heavier fawns more likely to survive. None of the 4 metrics of habitat composition and configuration was related to fawn survival. Of known-fate models, the best (ΔAIC_c = 0, AIC_c weight = 95.0%) model suggested fawn survival differed between QWA and PV through time. Survival at one week post-capture was 83% in PV (82.7%, 95% CI = 74.5–88.7%) and in QWA (83.3%, 95% CI = 75.1–89.2%). Survival at 9 weeks after capture was 72.4% (95% CI =

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63.3–80.0%) in PV and 57.2% (95% CI = 47.5–66.3%) in QWA. Survival at 26 weeks after capture was 58.6% (95% CI = 48.8–67.7%) in PV and 45.6% (95% CI = 36.0–55.6%) in QWA. Thirty-four-week survival was 52.9% (95% CI = 42.7–62.8%) in PV and 37.9% (95% CI = 27.7%–49.3%) in QWA. Within 34 weeks of capture, 106 of 218 monitored fawns died and 21 were censored. Of 98 fawns radio-tagged in 2000, 51 died within 34 weeks of capture and 7 were censored. Of 120 fawns radio-tagged in 2001, 55 died within 34 weeks of capture and 14 were censored. For both study sites combined, predation was the greatest source of mortality, accounting for deaths of 22.5% (95% CI = 17.6–28.8) of captured fawns and 46.2% (95% CI = 37.6–56.7) of mortalities through 34 weeks. Natural causes, excluding predation, were the second leading cause of death, accounting for deaths of 13.3% (95% CI = 9.5–18.6) of captured fawns and 27.4% (95% CI = 20.1–37.3) of mortalities. Vehicle accidents accounted for deaths of 9 fawns. Hunting accounted for deaths of 7 monitored fawns. Predation rates were greater in QWA, where 83.7% of predation events occurred. Mortality rates from other sources of mortality did not differ between QWA and PV, but 62.1% of deaths by natural causes, excluding predation, occurred in PV. I attributed 32.7% and 36.7% of predation events to black bears (*Ursus americanus*) and coyotes (*Canis latrans*), respectively. Bobcats (*Lynx rufus*) and unidentified predators accounted for 6.1% and 24.5% of predation events, respectively. White-tailed deer fawn survival in a forested and an agricultural landscape in central Pennsylvania is comparable to fawn survival in other forested and agricultural regions in northern portions of the white-tailed deer's range. Fawn survival may be greater in agricultural landscapes where habitat quality is presumed greater and predator densities may be less than in forested landscapes where habitat condition may be poorer and predators may be more abundant. However, the influence of landscape condition on fawn survival requires further study with replicate landscapes over larger geographic scales. Mortality from predation and other natural causes, excluding predation, are the dominant sources of mortality to fawns in Pennsylvania. In heavily forested regions in Pennsylvania where black bear densities are great, black bears may be at least as efficient predators of fawns as are coyotes. Collisions with vehicles and farm machinery, hunting and other legal means of take, poaching, and accidents play a comparatively minor role in fawn survival in Pennsylvania. I detected no relation between fawn survival and habitat characteristics at home-range scales. However, landscape ecology likely plays an important role in fawn survival both directly through habitat type and arrangement, and indirectly by influencing predator distribution and activity. Future studies of fawn survival should consider the landscape context through replicated studies of the effect of landscape composition and configuration on fawn survival.

OBJECTIVES

1. To quantify proportions of white-tailed deer fawns dying from specific causes and to estimate survival rates.

PROCEDURES

Procedures including a description of the study areas, capture and handling of fawns, marking fawns (radiocollars and ear tags), telemetry monitoring, and data analyses were described by Vreeland (2002).

FINDINGS

A detailed account of the results was published by Vreeland (2002).

RECOMMENDATIONS

1. This research documents the survival and cause-specific mortality of white-tailed deer fawns from birth through their first hunting season. Additional research will be needed to measure survival of yearling and older bucks with respect to harvest strategies used for management of white-tailed deer in Pennsylvania.

LITERATURE CITED

Vreeland, J. K. 2002. Survival rates, cause-specific mortality, and habitat characteristics of white-tailed deer fawns in central Pennsylvania. Thesis, The Pennsylvania State University, University Park, Pennsylvania, USA.