Can Passive Camera Grids Effectively Monitor Activity Patterns of White-tailed Deer?

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Temporal activity patterns of white-tailed deer (*Odocoileus virginianus*) have historically been evaluated using visual observations of deer or by monitoring a subsample of a population via VHF or GPS collars. However, inferring activity patterns through the use of VHF telemetry can be problematic due to infrequent sampling regimes and the inaccuracy of activity sensors. Higher location acquisition rates and greater location accuracy of GPS collars have improved identification patterns of collared animals. However, high costs often limit sample sizes and collared animals may not be representative of the population because variation in activity patterns has been reported among individual deer [1,2]. Additionally, due to behavioral differences among age groups, it is difficult to obtain a random sample of individuals that are representative of the population. High density trail camera grids may allow non-invasive monitoring of population-level activity patterns, and have been used to determine environmental effects on sika deer scientific name activity [3].

To evaluate temporal patterns of activity of white-tailed deer, and to investigate the influence of seasonal and environmental factors, we deployed cameras (1 camera/20 ha) on a 1,000 ha tract at the Joseph W. Jones Ecological Research Center at Ichauway in Georgia, USA. Between September 2014 and February 2017, we collected 13,036 observations of deer while simultaneously collecting weather data. During the study period, a record setting drought occurred in southwestern Georgia. Between 1 September 2016 and 1 December 2016, rainfall on our study site was 44% of normal. Therefore we investigated how the drought affected deer activity. We used ANOVA to determine differences in activity rates between a year with normal rainfall (2015) and a drought year (2016). Activity rates of does (p<0.01) and adult bucks (p<0.01) were substantially higher during the drought period than the same months of the previous year (Fig. 1). We used linear mixed effects models to assess the effects of seasonal and diel factors on activity rates during the year with normal rainfall. Diel periods were considered dawn, day, dusk, and night, and biological seasons were considered rut, post-rut, gestation, fawning, rearing, and pre-rut. Diel period was the best year-round predictor of doe activity patterns, with dawn and dusk activity rates being greater than day or night. The best predictor of adult buck activity was biological season, with 61% of all detections occurring during the rut. We used linear mixed effects models to determine the effects of temperature, wind speed, and precipitation, along with changes in each factor from the last diel period and the previous 24 hours on activity rates within each biological season. Change in wind speed from the previous diel period had a negative effect on doe activity during the post-rut, and the average temperature value had a negative effect on doe activity during gestation. No weather
variables accurately predicted activity for does or adult bucks during the other seasons. Because buck detection rates were low outside of the rut, small sample size prevented identification of environmental influences on activity. Although passive camera grids can be used to monitor white-tailed deer activity at a broad temporal scale (i.e. season, diel period), they are likely not appropriate to monitor fine scale influences on activity (i.e. weather factors) due to the low number of detections during certain biological seasons and diel periods.

**Figure 1.** Activity rates (photos/camera-day) of adult female and adult male white-tailed deer during 2015 (normal rainfall) and 2016 (drought) southwestern GA, USA. Period of drought indicated by grey shading.

![Graphs showing doe and buck activity in 2015 and 2016](image)

**References**

