Relationships Among White-tailed Deer Thermal Environment Measurements

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INTRODUCTION

Thermal environment may strongly influence behavior of white- tailed deer (*Odocoileus virginianus*) in subtropical climates with hot summers. Operative temperature integrates thermal environment characteristics experienced by an animal including ambient temperature, solar radiation, and thermal radiation (O'Conner and Spotila 1992, Beaver et al. 1996, Dzialowski 2005). Operative temperature, therefore, should be more closely related to the body surface temperature of a deer than is ambient temperature (Senft and Rittenhouse 1985). Telemetry transmitters with GPS (Global Positioning Systems) are often equipped with thermometers, but the relationship between deer body surface temperature and GPS collar temperature, operative temperature, and ambient temperature are unclear. Understanding these relationships will help researchers to select the best thermal modeling approach to examine white-tailed deer behavior in response to temperature.

OBJECTIVES

Determine whether GPS collar temperature, operative temperature, or ambient temperature is more strongly related to body surface temperature of white-tailed deer.

METHODS

- Four male captive white-tailed deer (≥ 2.5 years old) were outfitted with Lotek 3300L GPS collars.
- Four blackglobes were constructed using 15-cm diameter copper balls to estimate operative temperatures.
- Blackglobes were placed in each of two treatments consisting of either shade provided by woody plants or full sunlight and mounted on metal t-posts at a height of 0.5 meters.
- Each blackglobe contained a datalogger that was suspended to the center of the blackglobe.
- Deer were alternated between two treatments (shade vs. sunlight) every hour.
- Deer body surface temperatures were measured with a hand-held infra red gun at mid rib cage height at a distance of < 10 meters every 15 minutes.
- Operative and ambient temperatures were recorded every 15 minutes using a HOBO pendant datalogger.
- GPS collar temperatures were recorded every 15 minutes.

Statistical Analyses:

- Strength of the linear relationship between the dependent variable deer body surface temperature and the independent variables GPS collar temperature, operative temperature, and ambient temperature was determined using linear regression (SAS Institute, Inc. 2004).

RESULTS

Blackglobe temperature was more closely related to body surface temperature ($P < 0.001$, $R^2 = 0.507$) than was GPS collar temperature ($P < 0.001$, $R^2 = 0.175$). Ambient temperature was a poor reflection of body surface temperature ($P < 0.001$, $R^2 = 0.097$), but was closely related to GPS collar temperature ($P < 0.001$, $R2 = 0.813$).

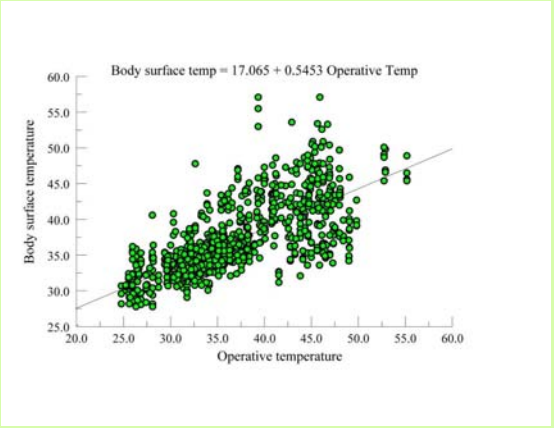

Figure 1. Relationship between the dependent variable deer body surface temperature and the independent variable operative temperature

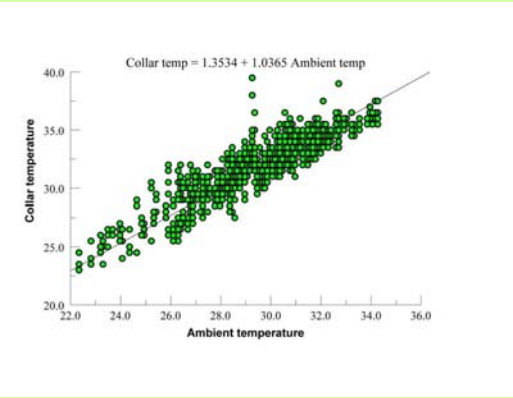

Figure 2. Relationship between the dependent variable GPS collar temperature and the independent variable ambient temperature.

CONCLUSION

GPS collar temperatures more strongly reflect ambient temperatures than the actual heat load experienced by deer. Blackglobes should be used to model the thermal environment of deer in the field rather than GPS collar temperatures.

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