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Modeling Pregnant Elk Presence in Alberta, Canada

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INTRODUCTION

Gastrocentric Model proposes that sexual segregation is a result of physiology and sex specific demands such as reproduction rather than previous supported predation and competitive exclusion principle (Long et al. 2009).

Cervus elaphus is a significant species important to ecosystems, culture, and economics of the Pacific northwest (Sevigny et al. 2018).

Understanding the dynamic of Gastrocentric Model is critical as it can clarify sexual dimorphic Cervids habitat use and specific forage.

The aim of this research is to better understand pregnant *Cervus elaphus* relationship to climatic and topographic elements.

METHODS

GSP collar data was obtained by contacting Dr. Mark Boyce, a professor of ecology at the University of Alberta using MoveBank.org (Boyce and Ciuti 2020).

I gathered layers from worldclim.org for the predicting climate variables and found the annual average using raster calculator (Arcmap). A digital elevation model (DEM) was used to determine all other topographic layers (ESRI 2020).

I tested GLM's to determine the best fit model based on lowest AIC (Burnham et al. 2011). Pregnancy was the response variable and climate and topographic as explanatory variables. A chi-square was completed to determine if mortality was sex specific first to gain a better understanding of how the gastrocentric model can affect populations.

GLM	AIC	▲AIC
Pregnancy~ BIO1+ DEM+ Slope+ Aspect+ Hillshade+ BIO12	557,996	0
Pregnancy~ BIO1 +BIO12	562,093	4097
Pregnancy~ DEM+ Slope+ Aspect+ Hillshade	561,515	3519
Pregnancy~DEM+BIO1+ BIO12	562090	4094

Table 1. Generalized Linear Model (GLM) comparison based off Akaike Information Criterion (AIC), BIO1 (annual mean temp), BIO12 (annual mean precipitation).

Variable	Estimates	STD. Error	P
BIO1	-0.1688	0.006125	P < 0.0001
BIO12	-0.03087	0.0005443	P < 0.0001
DEM	-0.0002862	0.00003653	P < 0.0001
Slope	0.1268	0.002912	P < 0.0001
Aspect	0.001654	0.00003724	P < 0.0001
Hillshade	-0.002578	0.0004473	P < 0.0001

Table 2. Predictor variables estimates, standard error, and p-value.

Collect Data Layers
1=Pregnant
0= Not pregnant
→ Filter data & extract values to points
→ Model selection & Chi-square
→ Results

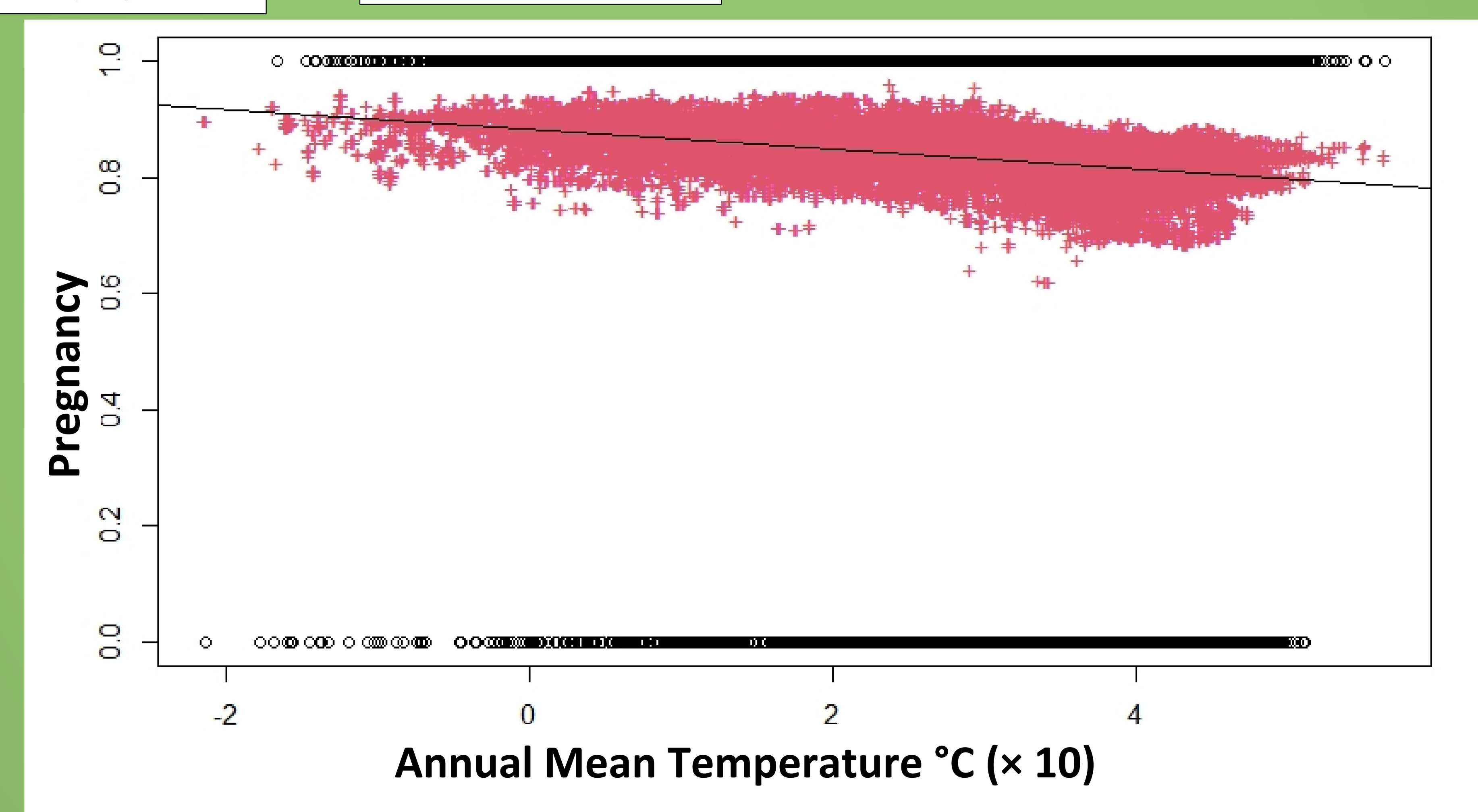

Figure 1. Pregnant *Cervus elaphus* selected cooler areas (β=-0.1688, P<0.0001).

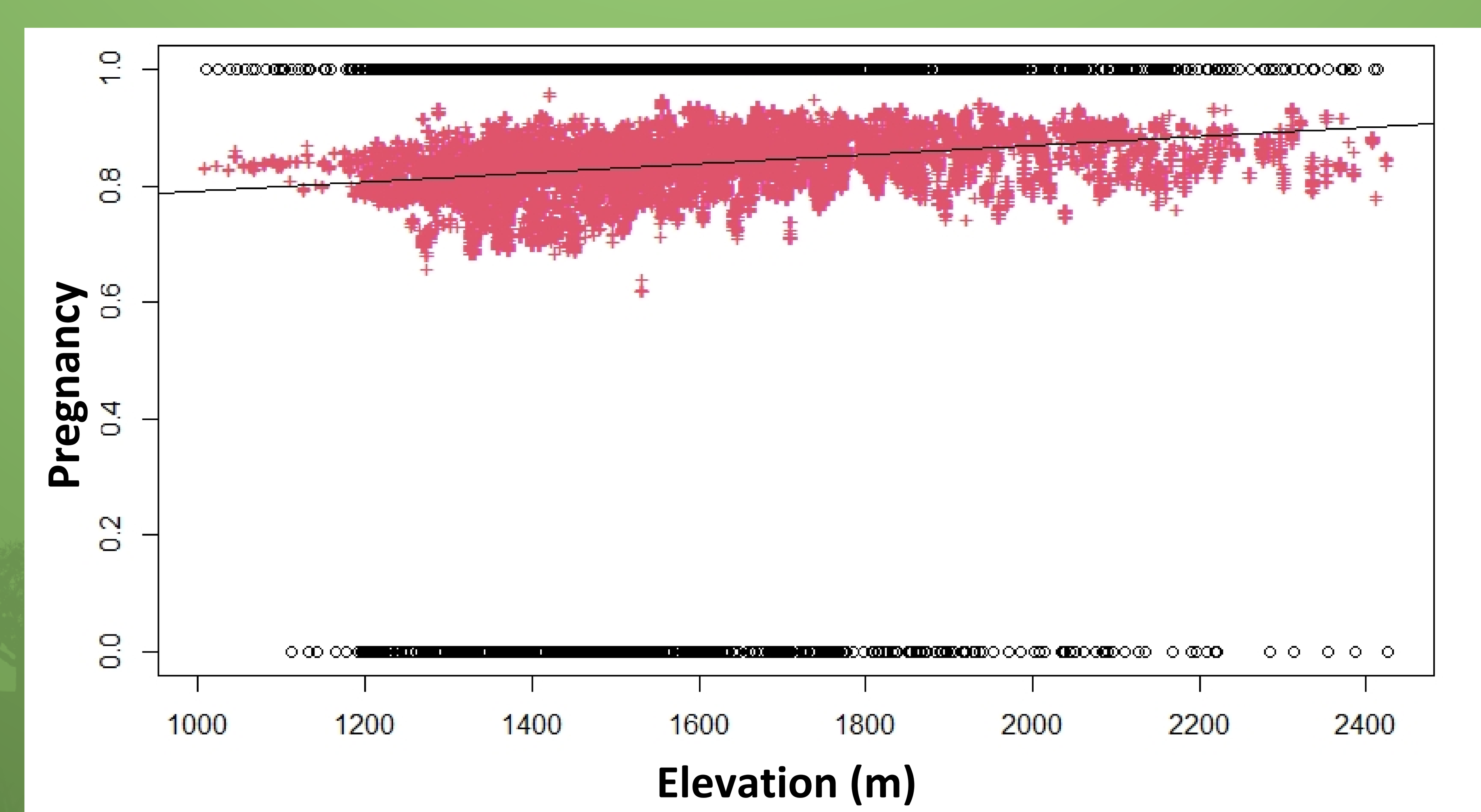

Figure 2. Pregnant *Cervus elaphus* selected higher elevation areas (β=-0.00028, P<0.0001).

RESULTS

The top model included annual average temperature, annual average precipitation, elevation, slope, aspect, and hillshade which were all significant explanatory variables for pregnant *Cervus elaphus* (Table 1). All model variables significantly predicted elk presence (Table 2). The models suggest that pregnant elk prefer colder habitats (Fig. 1, β=-0.1688, P<0.0001) that are higher in elevation (Fig 2, β=-0.00028, P<0.0001). Based on the X^2 analysis, mortality was not sex specific ($X^2 = 1.0667$, df = 1, P = 0.3017).

DISCUSSION

Elk prefer higher elevations during the summer due to the diversity of available forage (Sawyer et al. 2007) which may hold higher levels of nutrients. Avoidance of predators by seeking areas of increased visibility (Gingery et al. 2017) can result in higher elevations as well that are colder in temperatures.

The minimal adequate model for pregnant *Cervus elaphus* is vulnerable to overfitting, leading to the reduction of generality of the GLM (Gelfand and Schliep 2018). Flaws of multicollinearity may play a role in the analysis since all topographic layers were extracted from DEM (Tonidandel and LeBreton 2011).

Fewer, more significant explanatory variables across multiple scales can help establish the framework for analyzing population dynamics leading to informed management decisions. Future research conducted can save time and expenses of tracking and tagging pregnant *Cervus elaphus.*

Works Cited:

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