Do landscape features affect the number of Spotted Hyena(Crocuta crocuta) attacks on livestock settlements in eastern Africa?

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Background

Spotted hyenas (*Crotus crotus*) are a top predator in the savanna biome of Eastern Africa that, due to being opportunistic feeders, are highly adaptive to urbanization(Kolowski, J., & Holekamp, K., 2006). They have been documented to move in and out of settlements during times of food scarcity(Patterson, B., Kasiki, S., Selempo, E., & Kays, R., 2004). Hyenas are drawn to the abundance of human waste (e.g. food scraps, livestock carcasses) produced by settlements and attack the livestock being raised there(Yirga, G., et al., 2015).

Spotted hyenas have home ranges up to 40 square miles(Abay, G.Y., et al., 2010). They are more likely to form home ranges where they can find the most resources with the least amount of interspecific competition.

Figure 1. A female Spotted Hyena in the savanna brush. Photo from Wikipedia, by Charles J. Sharp.

Motivation

People living in these settlements have been known to perform preemptive and retaliation killings, where they hunt down the predators they believe are responsible for livestock deaths. Animosity for hyenas has led to people discrediting conservation efforts of large African carnivores(Green, D., Johnson-Ulrich, L., Couraud, H., & Holekamp, K., 2017).

While the spotted hyena is currently listed as a species of least concern, it is estimated that without a conservation program put in place, they will be considered threatened within five years (Crocuta crocuta (spotted hyena), 2020). Reducing the number of human-hyena conflicts will help improve the negative image people have of spotted hyenas. A way to do this is investigating the landscape where these conflicts happen.

Study Design

To test my hypothesis, an observational study will be conducted where settlements in Eastern Africa will be picked at random using simple random selection from a list of settlements within Ethiopia, Kenya, and Tanzania. A total of 10 settlements will be chosen. The distance from three different landscape features(freshwater source, roads, protected natural area) will be measured using GIS software, and averaged if multiple of the same feature is present at the site. The number of attacks at the sites will be monitored over the course of three years and will be averaged to find the annual average.

Intended Analysis

The independent variable, or predictor variable, is the distance a landscape feature is from a settlement. This type of variable is continuous. The dependent variable, or response variable, is the number of hyena attacks on the settlement. This type of variable is also continuous. A regression test will be used to measure the statistical significance, using a p-value of 0.05, for each of the three landscape features because the independent and dependent variables are continuous. Due to the experimental unit (the settlement chosen for study) being randomly selected, the scope of inference is only limited by the study area of eastern Africa.

Hypothesis

I hypothesize that there is a correlation between the number of hyena attacks on livestock settlements and the proximity of surrounding landscape features.

Predictions

I predict that the closer to protected nature areas and freshwater sources a settlement is, the higher the number of hyena attacks they will face. I also predict that the closer to roads a settlement is, the lower the number of hyena attacks they will face until the distance surpasses the average home range.

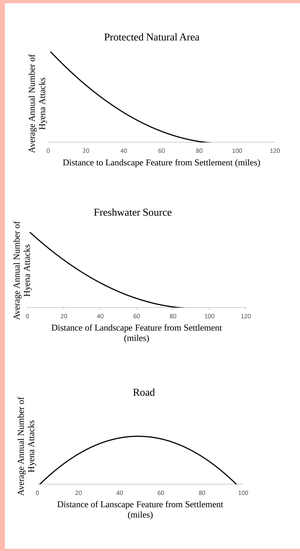

Figure 2. These graphs represent the data predicted to be collected from the settlements. The first graph shows that as settlements are closer to a protected natural area, the more average annual number of hyena attacks. The number of attacks decreases steadily until the distance surpasses the average home range, which is when it starts to decrease exponentially. The same can be seen for the second graph, depicting the affect of distance from a freshwater source. The third graph shows a parabola that, at first, depicts an increase in attacks with an increase of distance from roads. The number of attacks then decreases as the distance surpasses the average home range of a spotted hyena.

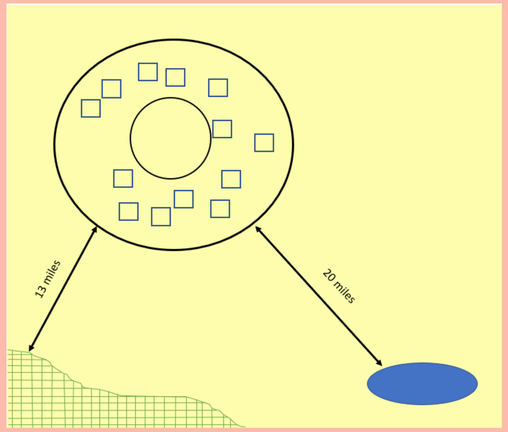

Figure 3. An example of how a settlement's distance from landscape features will be measured. The central circle within the settlement is the livestock corral and the squares around it are the settlement's houses. The outer circle is the settlement's fence or barrier. All measurements will be taken from the fence/barrier. If a settlement has no fence/barrier, an outer ring will be drawn to symbolize the farthest reaches of the settlement. The blue oval is a lake. The green crosshatched area is a protected natural area. Distances are not to scale.

Figure 4. An aerial view of a village in Kenya's Masai Mara National Reserve (National Geographic). The central corral can be seen surrounded by the villager's houses. An outer wall made of wood and foliage can also be seen. The outer wall would be used to measure all landscape features from.

Literature Cited: Abay, G.Y., Bauer, H., Gebrihiwot, K. et al. (2010). Peri-urban spotted hyena (Crocuta crocuta) in Northern Ethiopia: diet, economic impact, and abundance. *European Journal of Wildlife Research*, *57*, 759–765 (2011). https://doi.org/10.1007/s10344-010-0484-8; Crocuta crocuta (spotted hyena). (2020). Retrieved 10 November 2020, from https://animaldiversity.org/accounts/Crocuta_crocuta/#1d126634e00e7b5b1a060ca3812c6cda; Green, D., Johnson-Ulrich, L., Couraud, H., & Holekamp, K. (2017). Anthropogenic disturbance induces opposing population trends in spotted hyenas and African lions. *Biodiversity And Conservation*, *27*(4), 871-889. https://doi.org/10.1007/s10531-017-1469-7; Kolowski, J., & Holekamp, K. (2006). Spatial, temporal, and physical characteristics of livestock depredations by large carnivores along a Kenyan reserve border. *Biological Conservation*, *128*(4), 529-541. https://doi.org/10.1016/j.Biocon; Patterson, B., Kasiki, S., Selempo, E., & Kays, R. (2004). Livestock predation by lions (Panthera leo) and other carnivores on ranches neighboring Tsavo National ParkS, Kenya. *Biological Conservation*, *119*(4), 507-516. https://doi.org/10.1016/j.Biocon; Yirga, G.,et al (2015). Spotted hyena (Crocuta crocuta) concentrate around urban waste dumps across Tigray, northern Ethiopia. *Wildlife Research*, *42*(7), 563-569. https://doi.org/10.1071/WR14228.