Introduction

Human influence has caused cheetah and elephant populations to become endangered, resulting in an essential demand to help conserve these African species. Scientific research has suggested that elephants favor savanna woodland and sand forest vegetation, and adjust their movement in order to avoid human interactions or unexplored areas (Druce, 2008). Elephants are threatened by habitat loss, hunting by farmers, and overexploitation through the ivory trade (Bagheera, 2012). Elephants are keystone species in their ecosystems, making them important targets for conservation efforts. Cheetahs are threatened by habitat loss, hunting by farmers, and prey decline (CCF, 2012). Cheetahs are predators in their ecosystems, also making them important species to protect (Bagheera, 2012). In order to maintain these species’ populations, scientists are promoting education of the problem, habitat protection, and scientific data collection to fully understand their behavior (CCF, 2012).

The goal of this study was to better understand the location of cheetah and elephant populations on the Hlambanyathi Game Reserve, South Africa. Experts from the reserve have monitored two cheetah groups called “SC and Cubs” and “Kal,” along with the total population of elephants present. Once spotted, the scientists record the GPS coordinates of the animals.

Methods

I imported the GPS data, re-projected the area, and imported it as “x,y” coordinates. I completed this process for the elephants, Kal, and SC and Cubs groups; the data for these three groups therefore became vector layers, displaying the exact points where these animals were found on the reserve.

I added global satellite imagery of the world and extracted the country of KwaZulu-Natal by mask. I downloaded an aerial map of the reserve which contained dams and river systems and used geo-referencing to match this with the satellite imagery, which placed the reserve in accurate coordinates.

To analyze the three vector layers, I calculated the mean center of each distribution. I had to adjust my data to obtain accurate results because there were outliers present in the original data. The first outlier was placed in the middle of the South Atlantic, so it was clear that these “x,y” coordinates were not correct. I eliminated the other two points that were farther than 2000 meters away from the reserve in order to have accurate results. I then found the mean center for each layer and determined the compactness, orientation, and direction, which gave a visual of relative distributions of the cheetah and elephant locations.

I clipped and reclassified the land cover raster for the area of the reserve. I categorized each land cover type as 0 or 1, representing “bad” and “good” habitat type, respectively. I labeled riparian zones, bare areas, sparse vegetation, closed to open grassland, closed to open shrubland, mosaic grassland and forest shrubland, mosaic croplands and vegetation, and mosaic vegetation and croplands as “good” habitat, and the rest of the land cover “bad” habitat. The “bad” habitats mostly consisted of broadleaf, evergreen, and deciduous forests land types. I clipped this new raster so I could determine the proportions of the values to create an expected number of cheetahs. I used a chi-squared test to compare the expected number in each habitat and the observed cheetahs in each habitat. This process was repeated for the elephants.

My initial elephant results did not show any significant difference between the observed and expected values, so I readjusted my “good” and “bad” vegetation classifications to model elephant preferences. There was a significant difference of where they were located, so I created a new shapfile which included the two lakes found in the reserve. I created three buffers, which were 100, 200, and 300 meters, and used the measurement tool to find out the proportion of lakes with their buffers compared to the rest of the area in the reserve. I used a chi-squared test to compare the expected number of elephants to the observed number contained within each buffer.

Results

I modeled an area comparable to a home-range in Figure 1, by showing the mean center, compactness, orientation, and direction of each animal population. When converting the land cover layer to a binary raster, 27% of the land was labeled as “bad” and 73% of the land was labeled as “good.” When analyzing the cheetah populations based off of the vegetation layer I found that SC and Cubs and Kal were significantly found on classified “good” habitat rather than “bad” habitat with p-values of 0.027 and 0.010, respectively (Figures 2 & 3, Tables 1 & 2). Elephants were significantly found within the 10 meter, 100 meter, and 200 meter buffers with p-values <0.05 (Figure 4, Tables 3, 4, & 5).

Discussion

I was able to evaluate land cover factors that significantly predicted cheetah presence. When the “good” and “bad” habitat was altered to fit the criteria more suitable for elephants by changing broadleaf forest types and water to suitable areas, the population was not significantly on the “good” classified land cover compared to the “bad” land cover. On the other hand, elephant location seemed to be influenced by distance from watering holes. The elephants were significantly found within 10 meters, 100 meters, and 200 meters from the watering holes within the reserves. These findings are interesting because they indicate that cheetah location is influenced by land cover type, while elephant location is dependent by distance from watering holes.

Errors that may have affected the accuracy of the results include sample size, removal of data points, and the pixel accuracy. The sample sizes for both cheetah and elephant populations are small, which may be affecting the accuracy of the statistical analysis. In order for results to be presented with more confidence, future studies should obtain a data set with a larger sample size. Another factor that may be affecting the results is the two data points that were removed from the data set at the beginning of the study. I removed these points because they were located so far away that the results would not have accurately shown analysis within the Hlambanyathi Game Reserve. A third possible factor that may be manipulating the statistical analysis is that the land cover data I used is on a global scale, so the information within the pixels are not as exact as they could be. However, taking into account these possible errors, I believe the study is as accurate as it could be with the data present.

Conclusion

The purpose of this study was to analyze the movement and locations of the elephant and cheetah populations in the Hlambanyathi Game Reserve in South Africa. I obtained data from scientists at the reserve, and although the sample sizes were small, I was able to find significant results. The findings illustrate that cheetah location is mostly based off of the land cover type, while the elephant location was dependent on distance from watering holes rather than land cover. These conclusions can help in making elephant and cheetah conservation decisions, since they explain the location of the animals and suggest their most suitable habitats.

References


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