Giant Kangaroo Rat Dispersion Analysis

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The giant kangaroo rat (*Dipodomys ingens*) is an endangered species endemic to southern California. Originally found throughout most of the southern central valley, the population is now fragmented and found in less than five percent of its historical range (USFWS 2010). Adapted to desert conditions, the giant kangaroo rat lives in colonies of burrows known as precincts. Typically, each burrow is occupied by a single kangaroo rat, thus areal counts of burrows yield an excellent estimation of population size (Bean et al. 2014). We conducted our analysis on the population located in the Carrizo Plain National Monument. After digitizing burrows from National Agriculture Imagery Program (NAIP) imagery, we used a Ripley's K multi-distance cluster analysis to determine the dispersion of the giant kangaroo rat across different spatial scales.

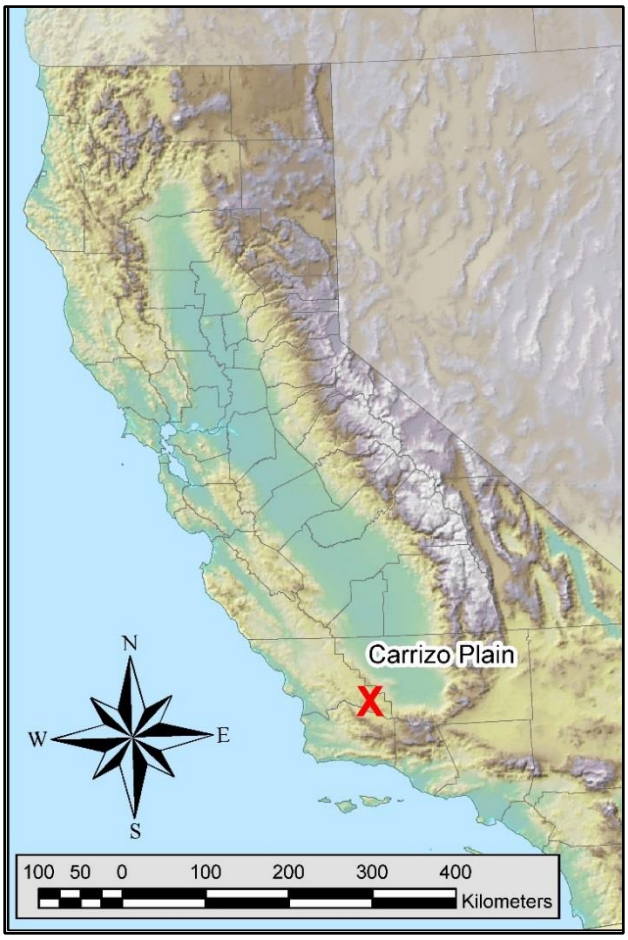

Figure 1. A locator map showing the Carrizo Plain within the state of California. (Source: US Census Bureau, United States Geological Survey (USGS). Spatial reference: North American Datum (NAD) 83, Universal Transverse Mercator (UTM) Zone 10 North).

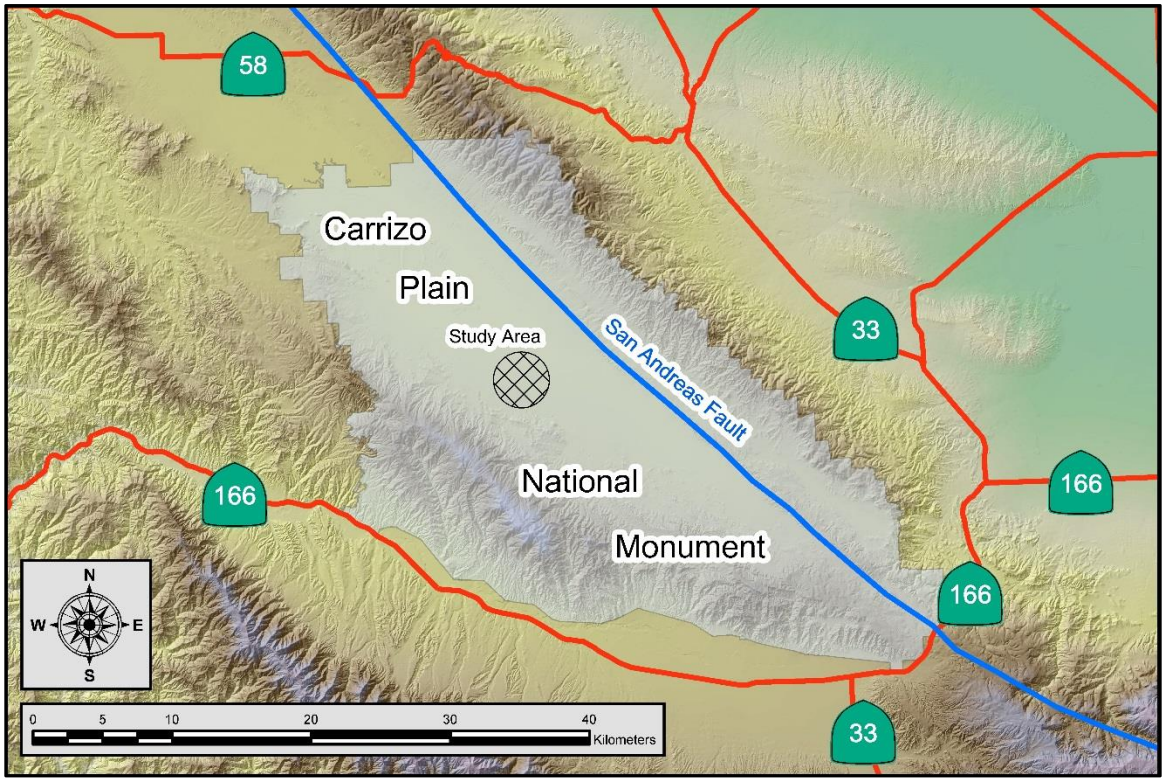

Figure 2. A locator map showing the Carrizo Plain National Monument and the study area. (Source: USGS, Caltrans. Spatial reference: NAD 83 Datum, UTM Zone 10 North).

METHODS

We used Esri's ArcGIS to digitize giant kangaroo rat burrows from a 2012 1 meter NAIP image. Points were used to indicate burrows, while polygons were created around areas where burrows could not be accurately digitized. Analysis was performed on 25,764 points spread across an area of approximately 700 hectares within the Carrizo Plain National Monument (N35° 8.26′ W119°46.41′). Author order was determined by taking the mean of 1,000,000 random numbers generated in R between 0 and 1. The lead author was selected based on whether the mean was above or below 0.5, which author was assigned above or below 0.5 was determined by the toss of a 1994 nickel.

Nearest Neighbor

The near function was used run a nearest neighbor analysis in ArcMap. This analysis calculated the distance from every one of our points to its nearest neighboring point, and generated a table of those distances. We then loaded this table into the program R to generate a histogram.

Ripley's K

In ArcMap, we exported the UTM coordinates of each point to a table which we converted to Comma-separated values (CSV) format and loaded into R. Once in R we used the spatstat

package to perform a Ripley's K analysis of the dispersion of burrows across different spatial scales.

RESULTS

We found the burrows to have a mean nearest neighbor distance of 11.77 ± 0.02 meters (Figure 3). The Ripley's K function found that at distances closer than 11 meters there were fewer burrows than would be randomly expected but at distances greater than 11 meters there were more burrows than random (Figure 4). This suggests that giant kangaroo rats exhibit uniform dispersion which is consistent previous work that found they defend exclusive summer territories (Cooper and Randall 2007).

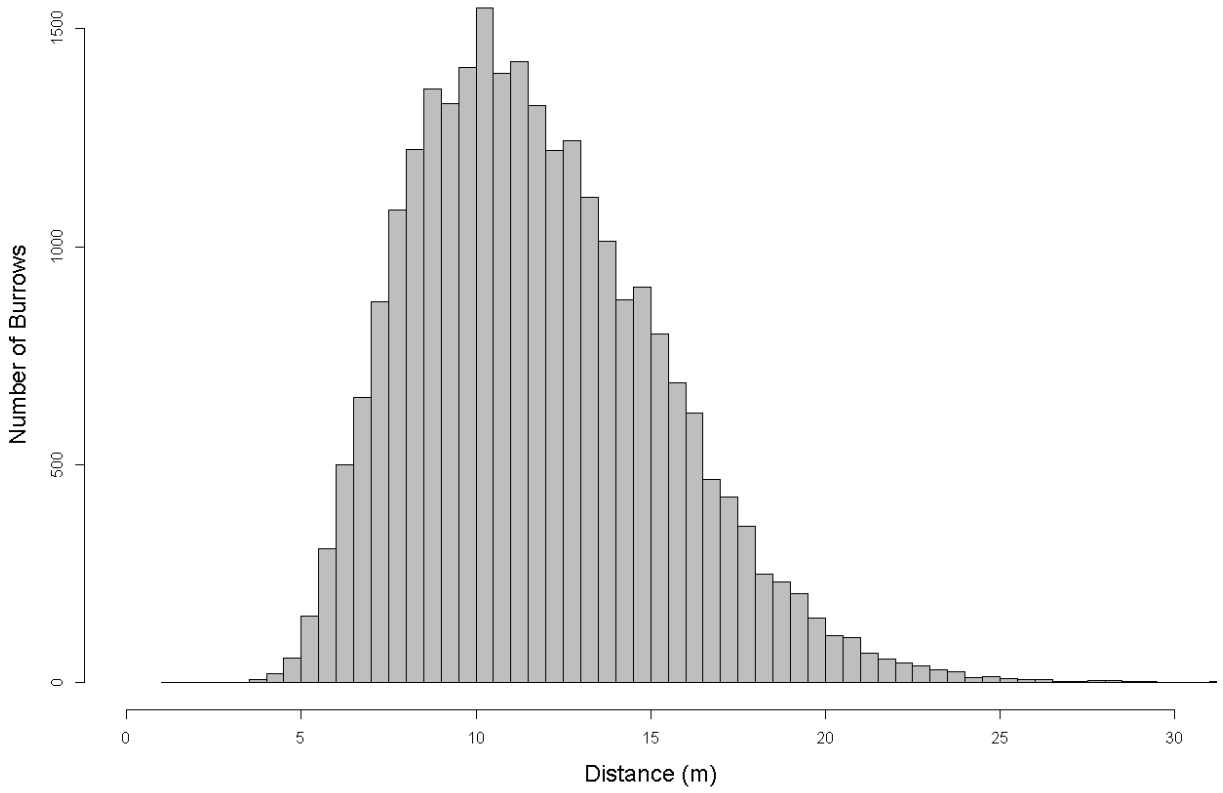

Figure 3. A histogram showing the distance to the nearest neighboring burrow.

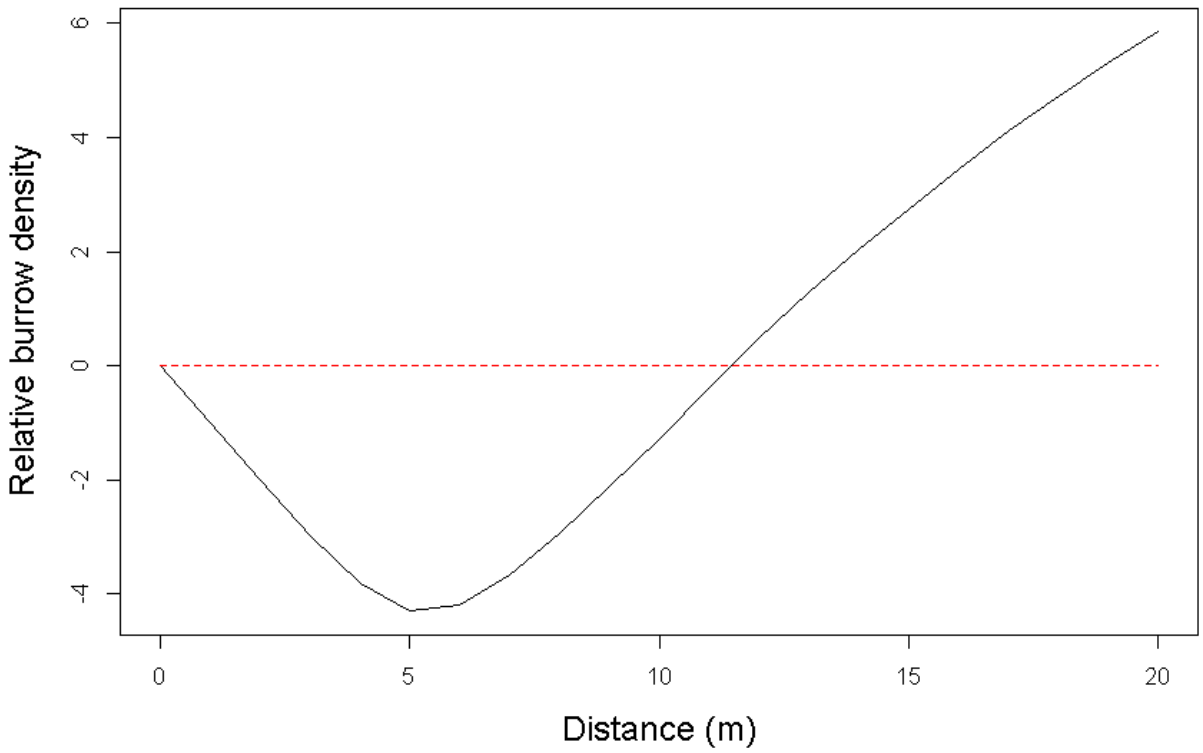

Figure 4. The observed burrow density at different distances from each burrow compared to the density expected at each distance from a random dispersion (dashed line). The solid line represents the difference between the observed and random densities at each distance. The observed density of burrows is less expected by a random dispersion for distances less than 11 meters and greater than expected above 11 meters.

CONCLUSION

Our mean nearest neighbor distance (11.77 ± 0.02 meters) is similar to the nearest neighbor analysis of work conducted Cooper and Randall (2007) which yielded a mean of 9.9 ± 1.3 meters. Though our analysis quantified giant kangaroo rat dispersion on a local level, the analysis would need to be expanded before any solid inferences could be drawn. Due to the relatively small number of digitized points, our analysis was only able to look at giant kangaroo rat dispersion across 6 of 129 pastures in the Carrizo Plain study site. However, due to differences in soil type and historical land use, dispersion may very between, or even within, pastures. Future work should look for these potential differences in dispersion and nearest neighbor distances between pastures, with a specific emphasis on identifying the factors that influence giant kangaroo rat burrow density.

ACKNOWLEDGEMENTS

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WORKS CITED

Bean, W. T., L. R. Prugh, R. Stafford, H. S. Butterfield, M. Westphal, and J. S. Brashares. 2014. Species distribution models of an endangered rodent offer conflicting measures of habitat quality at multiple scales. Journal of Applied Ecology 51:1116-1125.

Cooper, L. D., and J. A. Randall. 2007. Seasonal changes in home ranges of the giant kangaroo rat (*Dipodomys ingens*): a study of flexible social structure. Journal of Mammalogy 88:1000-1008.

ESRI 2012. ArcGIS Desktop: Release 10.1. Redlands, CA: Environmental Systems Research Institute.

R Core Team. 2014. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

U.S. Fish and Wildlife Service [USFWS]. 2010. Giant kangaroo rat (*Dipodomys ingens*) 5-year review: summary and evaluation. Sacrament Fish and Wildlife Office, Sacramento C.A., USA.