A DESCRIPTIVE STUDY OF STRUCTURE DEVELOPMENT DATA AND UTILITY OF THE GOOSENECK CORRIDOR TO DESERT MULE DEER (*ODOCOILEUS HEMIONUS*) IN THE MCDOWELL SONORAN PRESERVE

Michele V. Moreno[1*], Monica Chacon[2], Jessica Jones[1], Glenn Geisheker[1], Melanie Tluczek[3], Helen Rowe [4], Scott Sprague[5], John D. Nagy[1,6]

[1]Department of Life Sciences, Scottsdale Community College, Scottsdale, AZ 85256-2626, [2]School of Life Sciences, Arizona State University, Tempe, AZ 85287-4501, [3]Gila Watershed Partnership of Arizona, P.O. Box 1614, Thatcher, AZ 85552, [4]McDowell Sonoran Conservancy Field Institute, 7729 E. Greenway Road, Suite 100, Scottsdale AZ 85260, [5]Arizona Game and Fish Department, 5000 W. Carefree Highway, Phoenix, AZ 85086, [6]School of Mathematical and Statistical Sciences, Arizona State University, Tempe, AZ 85287-1804. *mic2165929@maricopa.edu

INTRODUCTION

- A *wildland urban interface* (WUI), where an urbanized area intermingles with undeveloped lands, can provide resources and land for migration for wildlife displaced by urbanization.

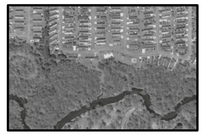


Figure 1: Interface WUI (left)
Figure 2: Intermix WUI (right)

- *Wildlife corridors*, expanses of land, manmade or natural, can provide connectivity across extensive areas; combat habitat loss and fragmentation due to urbanization; and provide a path for animals to maintain typical behavior (dispersal, migration, search for food) and allow movement across dangerous roads.


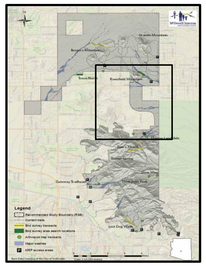

Figure 3: Example manmade corridor (above)
Figure 4: The Gooseneck Corridor (narrow S-shaped region in box) is a natural corridor in the McDowell Sonoran Preserve (right)

- The Gooseneck Corridor in McDowell Sonoran Preserve (Figure 4) is a WUI surrounded by developed (built) and undeveloped land. The corridor may also serve as a natural wildlife corridor.
- A keystone species of the Preserve is the desert mule deer (*Odocoileus hemionus*). Deer play a critical role in ecosystem function and are an indicator of the ecosystem's health.
- Previous studies have shown that location and movement of mule deer is influenced primarily by water sources, vegetation, elevation and slope of land and human disturbances, but little is known about how mule deer use the corridor and the built areas adjacent to it.

Figure 5: Desert Mule Deer. Credit: M. Jensen

- Our objective was to compare mule deer distribution with developed and undeveloped lands in and adjacent to the Gooseneck Corridor.

METHODS

- **Phase I: Survey Data** Using ArcGIS, Google Earth and information from the City of Scottsdale, we counted the number of houses (potential source of food) and pools (potential source of water) in a nonrandom sample of subdivisions to the west of the corridor. We estimated the area of each subdivision and calculated the density of houses and pools. To determine the landscape type(s) (potential source of food) of each subdivision, we used Google Earth and the four landscape types defined by Martin (2008): native, xeric, oasis and mesic.
- **Phase II: Housing and Structure Locations/Density** Using ArcGIS and information from the City of Scottsdale, one yellow marker was placed on individual existing structures, including homes, apartment buildings, resorts/hotels, guard houses, guest houses, club houses, stables/barns and several unidentifiable small buildings. Parking lots, tennis and shuffleboard courts, transmission towers, empty lots in residential areas and pools were not included. An orange marker was placed on subdivisions not yet built but with plans for development.

METHODS, cont.

- **Mule Deer Use** In 2016, Arizona Game and Fish Department (AGFD) deployed radio telemetry collars on 38 mule deer within or immediately adjacent to the Preserve. The collars were programmed to record six to 12 locations per day for two years before releasing from the deer in February 2018. Data from the collars were collected and are currently being analyzed.

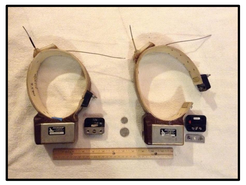

Figure 6: GPS telemetry collars

Figure 7: Searching for deer

Figure 8: Collar deployment

Figure 9: Collar recovery

RESULTS

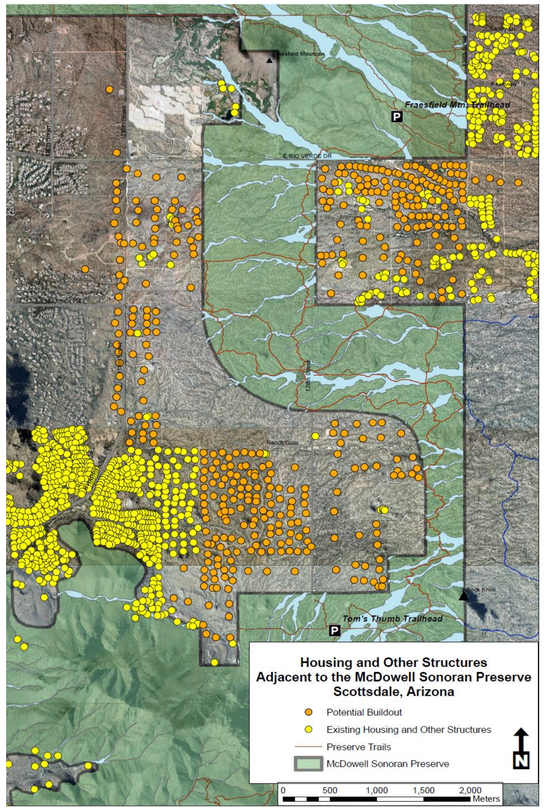

Figure 10: From Phase II, map displays locations and density of existing structures (yellow markers) and areas of future structures (orange markers) around the corridor (S-shaped area outlined in black) in 2014. Note: Aerial shots with existing structures on west side of the map were not available when markers were added. Undeveloped area to the east is McDowell Mountain Regional Park.

RESULTS, cont.

- **Phase I: Survey Data** Density of houses and pools in subdivisions along the west side of the Gooseneck is less than 0.100 house and 0.100 pool per acre. Landscaping is primarily native species in xeric settings (desert adapted trees and shrubs).
- **Phase II: Housing and Structure Locations/Density** With the exception of the area northeast of the corridor (Figure 10), the majority of *existing* structures (yellow markers) are *not* immediately adjacent to the corridor. Dense housing occurs west of the Gooseneck, immediately adjacent to the Preserve but not to the corridor. Many of the areas adjacent to the Gooseneck are slated for *future development* (Figure 10, orange markers). Some of the area east of the Gooseneck is protected as McDowell Mountain Regional Park.
- **AGFD Mule Deer Study** Deer locations appear to correlate with primarily undeveloped areas in and adjacent to the Preserve and McDowell Mountain Regional Park. Most locations are clustered north or south of the corridor with few locations in the northern section of the corridor. Some locations occur in low-density built areas, but few locations occur in high-density housing.

CONCLUSION AND IMPLICATIONS

- Although mule deer occasionally used developed areas outside of the Preserve, the bulk of their locations occurred on undeveloped lands in and adjacent to the Preserve. Further analyses might indicate what density of development precludes deer movement, as well as what built resources are conducive to or prohibit deer use.

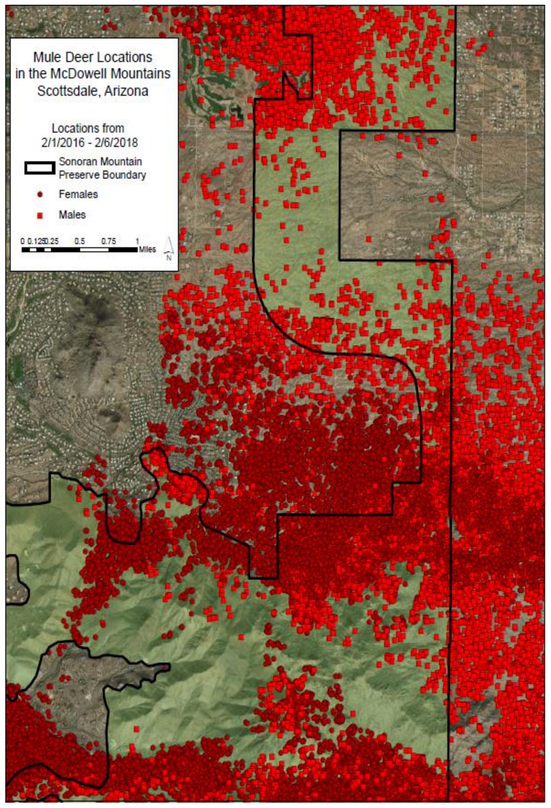

Figure 11: From the AGFD study, the map displays locations and density of male mule deer (red squares) and female mule deer (dark red circles) within and around the corridor (S-shaped area outlined in black).

CONCLUSION AND IMPLICATIONS, cont.

- As development continues, the Gooseneck Corridor could cease to be a viable movement corridor unless suitable resources are maintained in adjacent areas. Understanding what these resources are is vital to maintaining a healthy deer population in the Preserve.
- Water and forage are the most important resources for mule deer and dictate mule deer use, movements, and distribution within areas (Marshal et al. 2006, Lendrum et al. 2013). Whether or not vegetation and water resources in built areas adjacent to the Gooseneck can provide the necessary resources to maintain the mule deer population is a question for future study.
- Another question for study is the impact of human disturbance on mule deer in the Preserve. Distance to roads can affect deer distribution (Marshal et al. 2006) and can limit movements, including migration (Lendrum et al. 2013). Preserve managers should determine if measures are needed to mitigate negative effects of human disturbance.

Figure 12: Mule deer moving near a paved road. Credit: L. Russell

REFERENCES

1. Bar-Massada, A., Radeloff, V.C., Stewart, S.I. 2014. Biotic and abiotic effects of human settlements in the wildland-urban interface. *BioScience.* 64(5): 429-437.
2. Lendrum, P.E., Anderson Jr., C.R., Monteith, K.L., Jenks, J.A., Bowyer, R.T. 2013. Migrating Mule Deer: effects of anthropogenically altered landscapes. *PLOS ONE.* 8(5): 1-10.
3. Marshal, J.P., Bleich, V.C., Krausman, P.R., Reed, M.L., Andrew, N.G. 2006. Factors affecting habitat use and distribution of Desert Mule Deer in an arid environment. *Wildlife Soc B.* 34(3): 609-619.
4. Marshal, J.P., Bleich, V.C., Andrew, N.G., Krausman, P.R. 2004. Seasonal forage use by Desert Mule Deer in Southeastern California. *Southwest Nat.* 49(4): 501-505.
5. Martin, C.A. 2008. Landscape sustainability in a Sonoran desert city. *Cities and the Environment.* 1(2): 1-16.
6. Nolan, M. 2014. A Proposal to the Globe Foundation: Mule Deer corridor and habitat use in the McDowell Sonoran Preserve.
7. Radeloff, V.C., Hammer, R.B., Stewart, S.I., Fried, J.S., Holcomb, S.S., McKeefry, J.F. 2005. The Wildland-Urban Interface in the United States. *Ecol Appl.* 15(3): 799-805.
8. Relyea, R.A., Lawrence, R.K., Demarais, S. 2000. Home range of Desert Mule Deer: Testing the body-size and habitat-productivity hypotheses. *J Wildlife Manage.* 64(1): 146-153.

ACKNOWLEDGMENTS

This research was supported by Scottsdale Community College, the Center for Native and Urban Wildlife, the McDowell Sonoran Conservancy Field Institute, the City of Scottsdale and Arizona State University. We thank Daniel Gruber, Tiffany Sprague, Debbie Langenfeld, John Weser and the Spring 2016 Scottsdale Community College BIO 298 research class teaching assistants (Perry Olliver and Sabrina Jones) for valuable comments and insights.