BY ANDREA MONTALVO

MEASURING RATES OF CHANGE

Monitoring programs designed to measure rates of change and assess management decisions on wildlife populations and habitat are essential to wildlife research. Rather than testing a hypothesis (a specific question or prediction), these studies are designed to take inventory (count) and monitor (track over time) changes in species abundance. Studies like this often assess planned activities like harvest regulations, wind farm development, or highway construction; or unplanned disturbances such as weather events, drought, or wildfire. A prime example of a long-term monitoring project is the Breeding Bird Survey (BBS) initiated in 1966 to track trends in North American bird populations. This study has shown that while continental populations of most species have remained relatively stable since 1966, many have experienced significant regional and species-specific declines. Faced with the challenge of surveying 217,000 acres of diverse rangeland, we had to answer a fundamental question: How and where do you begin?

In 2014, Texas A&M University and East Foundation implemented a large-scale inventory and monitoring program focused on birds (songbirds, raptors, night jars), small mammals (mice, rats), bats, amphibians and reptiles, and vegetation. Due to their large size and geographic diversity, East Foundation's San Antonio Viejo and El Sauz ranches showcase a wide range of wildlife and wildlife habitat, with the additional benefit of sampling across a region with widely variable annual precipitation.

The first stage of this program focused on how to effectively and efficiently track the abundance of species over large acreages. Researchers produced several publications on designing and implementing bird (including raptors), small mammal, bat, and amphibian and reptile monitoring programs on East Foundation lands. Having initially developed an inventory across multiple species, we scaled down monitoring in the second stage to focus on songbirds and small mammals. This stage allowed insight into

how we can use data from the monitoring study to assess changes in small mammal and bird abundance due to prescribed fire and grazing.

Since we monitor at a large scale, this program requires a labor intensive on-the-ground data collection effort from 10 to 14 field technicians working from late January to mid-July. Over the 10-year program, East Foundation and Texas A&M have hired close to 100 technicians (all with at least a BS degree) and eight graduate students (MS and PhD candidates) to make the project work. As funding allowed, we also provided hands-on opportunities for undergraduate students to participate. Graduate students were given flexibility in data use and project design, resulting in several publications using the monitoring data (referenced below). This program served as an excellent training ground for young scientists to learn valuable animal handling skills, bird identification by sight and sound, and practical field knowledge. This included a notable publication documenting a rare case of albinism in white-footed mice, discovered by our technician crew in 2021.

The third stage of our monitoring program begins this coming year, once again in conjunction with our partners at Texas A&M University. We aim to evaluate new methods that integrate technology and utilize fewer field technicians to monitor key bird and small mammal species across broader landscapes more accurately. These data will help to identify emerging research needs and guide hypothesis-driven projects in those areas.

In a world where ecosystems are continually reshaped by climate and human activity, long-term monitoring remains a cornerstone of our science program — to generate long-term knowledge to inform conservation and management.

Graduate Student and Partner Publications

Baumgardt, J.A., M.L. Morrison, L.A. Brennan, T.A. Campbell. 2019a. Developing rigorous monitoring programs: power and sample size evaluations of a robust method for monitoring bird assemblages. *Journal of Fish and Wildlife Management* (10)2: 480-491.

Baumgardt, J.A., M.L. Morrison, L.A. Brennan, and T.A. Campbell. 2019b. Effects of broadcasting calls on detection probability in occupancy analyses of multiple raptor species. *Western North American Naturalist* 79(2): 185-194.

Baumgardt, J.A., M.L. Morrison, L.A. Brennan, B.L. Pierce, and T.A. Campbell. 2019c. Development of multispecies, long-term monitoring programs for resource management. *Rangeland Ecology & Management* 42(2): 31-42.

Baumgardt, J.A., M.L. Morrison, L.A. Brennan, M. Thornley, and T.A. Campbell. 2021. Variation in herpetofauna detection probabilities: implications for study design. *Environmental Monitoring and Assessment* 193(658): https://doi.org/10.3390/ani11061565

Baumgardt, J. A., M. L. Morrison, L. A. Brennan, H. T. Davis, R. R. Fern, J. M. Szewczak, and T. A. Campbell. 2022. Monitoring occupancy of bats with acoustic data: power and sample size recommendations. *Western North American Naturalist*, 82:1.

Fern, R.R., E.A. Foxley, A. Bruno, and M.L. Morrison. 2018a. Suitability of NDVI and OSAVI as estimators of green biomass and coverage in a semi-arid rangeland. *Ecological Indicators* 94(1): 16-21.

Davis, H.T., A.M. Long, T.A. Campbell, and M.L. Morrison. 2018. Nest defense behavior of Greater Roadrunners (Geococcyx californianus) in south Texas. *The Wilson Journal of Ornithology* 130(3):788-792.

Davis, H.T., A.M. Long, J.A. Baumgardt, T.A. Campbell, and M.L. Morrison. 2019. Factors affecting nest success and predator assemblage of breeding birds in semiarid grasslands. *Rangeland Ecology & Management* 72(2): 385-395.

Fern, R.R., H.T. Davis, J.A. Baumgardt, M.L. Morrison, and T.A. Campbell. 2018b. Summer activity patterns of four resident south Texas bat species. *Global Ecology and Conservation* 16: DOI 10.1016/j.gecco.2018.e00500.

Fern, R.R., M.L. Morrison, H.H. Wang, W.E. Grant, and T.A. Campbell. 2019. Incorporating biotic relationships improves species distribution models: Modeling the temporal influence of competition in conspecific nesting birds. *Ecological Modelling* 408(15): DOI 10.1016/108743.

Fern, R. R., M. L. Morrison, W. E. Grant, H. Wang, and T. A. Campbell. 2020. Modeling the influence of livestock grazing pressure on grassland bird distributions. *Ecological Processes* 9(42): DOI 10.1186/s13717-020-00244-7.

Hardin, F.O., S. Leivers, J. K. Grace, Z. Hancock, T. Campbell, B. Pierce, and M.L. Morrison. 2021. Secondhand homes: The multilayered influence of woodpeckers as ecosystem engineers. *Ecology and Evolution* 11(11425-11439): https://doi.org/10.1002/ece3.7932

Pence, A.R., C.M. Kiel, A. Montalvo, B.L. Pierce, L.A. Brennan, and M.L. Morrison. 2024. Food niche responses in southern Texas small mammal communities. *Southwestern Naturalist* 67:216–223. (East Foundation Manuscript 084)

Ziolkowski Jr., D.J., Lutmerding, M., English, W.B., Aponte, V.I., and Hudson, M-A.R., 2023, North American Breeding Bird Survey Dataset 1966 - 2022: *U.S. Geological Survey data release*, https://doi.org/10.5066/P9GS9K64.