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East FOUNDATION

Management Bulletin No. 4

We promote the advancement of land stewardship through ranching, science, and education.

Coyote Conundrums

Shedding Light on Coyote Behavior to Inform More Effective Management

JUSTIN T. FRENCH, HSIAO-HSUAN "ROSE" WANG, WILLIAM E. GRANT, NOVA J. SILVY, JOHN M. TOMEČEK, AND LANDON R. SCHOFIELD

Coyotes (*Canis latrans*) are well known for their intelligence and remarkable adaptability. This is manifested by the simple fact that coyotes are found over most of North America and have colonized major metropolitan areas throughout the country. So why should we study a species that seems to be everywhere and are commonly observed? As land stewards we are interested in the long-term sustainability of our rangelands and it is important to understand the interaction of all species that depend on them. This is particularly important when a species presents a potential conflict with management goals, as coyotes often do. By studying them, we are better able to improve sustainability of livestock production, wildlife management, and native rangelands.

EVEN THOUGH COYOTES SEEM TO EXIST EVERYWHERE, VERY LITTLE IS KNOWN ABOUT HOW COYOTE BEHAVIOR AFFECTS THEIR LONG-TERM PERSISTENCE ON THE LANDSCAPE.

Coyotes exhibit true territorial behavior, which means that small social groups defend an established area (a territory) from other groups of coyotes. These territories are arranged like a sheet of bubble wrap across the landscape, as they are nearly circular, do not overlap, and feature thin neutral areas between them (Figure 1). Their boundaries are stable over several decades despite the fact that the occupants experience turnover over time. Coyote populations structure themselves across an area in a way where the resulting territories represent distinct populations. These populations are connected by transient individuals that move through neutral areas in hopes of gaining access to a territory. These transient individuals are thought to allow coyote populations to persist over time because they are able to fill vacancies due to individual turnover. All of this suggests that the dispersal of individual coyotes is a key process affecting their populations but has not been accounted for in coyote management because it is perhaps the least understood aspect of their ecology.

COYOTE MANAGEMENT, LIKE THAT OF MANY CARNIVORES, HAS FOCUSED ON REDUCING POPULATION SIZES IN ORDER TO REDUCE THEIR IMPACT ON BOTH WILDLIFE AND LIVESTOCK.

However, these measures are largely unsuccessful. They rarely produce the desired management outcome, such as reduced livestock depredation or increased game species survival. Despite decades of lethal management, coyote populations have persisted, grown, and even expanded into new habitats.

To understand how coyote territoriality and dispersal affects population persistence we conducted research on the East Foundation's San Antonio Viejo Ranch in Jim Hogg and Starr counties. We equipped 44 coyotes with satellite GPS collars to monitor movements. These data

allowed us to examine coyote territorial behavior within the population and better understand its relationship to population persistence.

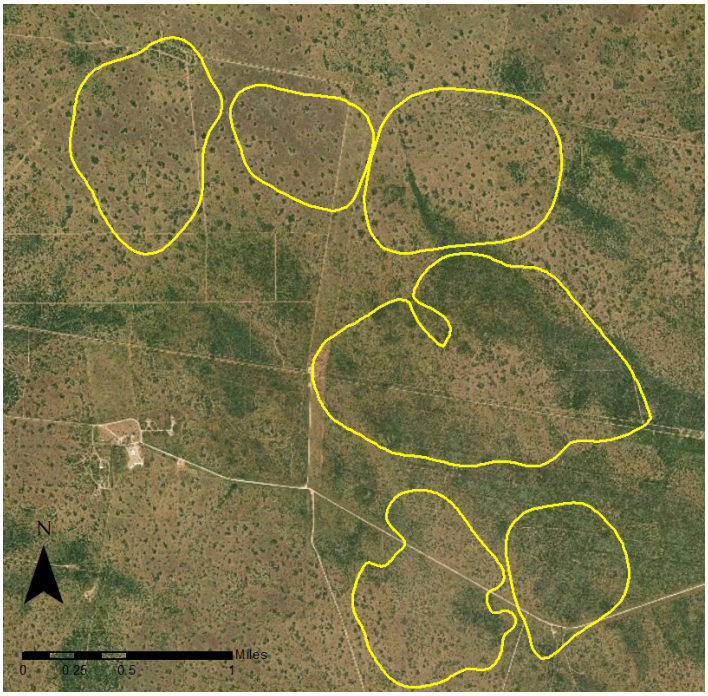

Figure 1. Map showing a cluster of coyote territories. Resident coyotes defend these territories from transient and biding individuals.
Image Credit: Justin French.

Researchers recording the weight of a coyote during a capture.
Image Credit: Alfonso "Poncho" Ortega, Jr.

We found a staggering 88% of adult, territorial coyotes dispersed within a given year. This runs contrary to earlier thinking that dispersal mostly occurs in juveniles. As we begin to look a little more closely, this behavior does make biological sense. Coyote packs are characterized by a dominance hierarchy, where a dominant male and female breed, and subordinate individuals assist with raising pups. If a subordinate is unlikely to gain a dominant position within in the group, it would make sense for them to seek other opportunities in a different territory. We observed high individual survival, suggesting that subordinates were justified in seeking greener pastures for lack of opportunity at home.

Once coyotes dispersed, they alternated between two distinct behavioral strategies. The first was consistent with the idea of a transient coyote. In this behavior strategy, coyotes traveled through large, rapidly changing ranges. We measured the size of these ranges on a weekly basis and found that range sizes were largest in the winter and smallest in the summer, averaging 8,048 and 3,615 acres, respectively. The largest observed weekly range size was 126,000 acres, when a transient male roamed 25 miles east of his previous range to the eastern edge of Zapata, Texas. This ability to cover vast areas on short timescales allows transient coyotes to find opportunities in other territories relatively quickly, but it may come at a cost. We observed only six mortalities over our two-year study period, but four of those coyotes were transients at the time of their demise.

While it is difficult to generalize such a small sample, this observation is consistent with other findings, which suggests that transient behavior is risky for coyotes.

TRAPPING EFFORTS LARGELY CATCH TRANSIENTS MOVING THROUGH AN AREA, RATHER THAN ESTABLISHED INDIVIDUALS, ULTIMATELY UNDERMINING MANAGEMENT EFFORTS.

Dispersing coyotes likely use the second behavior mode we found, called biding (Figure 2), to manage the risks of transience. Biding simply means to remain or stay somewhere; for coyotes this occurs when a dispersing coyote uses the neutral area between one or more territories, rather than roaming over broad areas. Interestingly, coyotes almost never switched directly between residency and transience, but instead transitioned to biding behavior first. This strategy would allow the coyote to gain familiarity with an area and wait for an anticipated opportunity to absorb into a new territory. The increased familiarity likely reduces mortality risk, as none of the six mortalities we

observed, occurred while an animal was biding. Thus, this strategy likely serves to balance risk with potential opportunities.

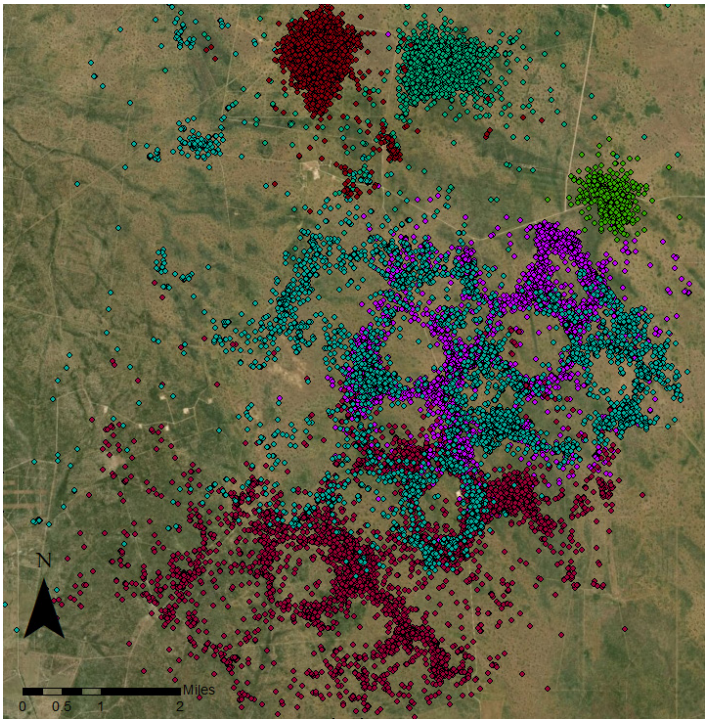

Figure 2. Map showing contrasting resident and biding behaviors of several coyotes. Biding coyotes use the gaps between territory boundaries to seek opportunities.
Image Credit: John Tomecek.

This project has produced the most detailed picture of coyote dispersal to date and shows several important aspects of coyote behavior to consider in management. It is challenging to implement a successful management effort due to the fact that coyotes move across large areas of land over short timeframes. Thus, any vacancies created are likely to be filled quickly, making any effect of removal efforts short-lived. Creating these vacancies is difficult as well, as most trapping or shooting is most likely removing naïve transients. The cost required to achieve lasting results from lethal management, may ultimately prove to not be worth the price. Such an effort would require collaboration across many properties, and significant financial and time investments.

What we are learning about coyote behavior in South Texas is consistent with behavioral processes researchers suspect undermine the effectiveness of broad lethal control in generalist canines (such as jackals, dingoes, and coyotes) world-wide. Frustratingly, few alternatives have fared any better. While other research has demonstrated that across generalist canids, indiscriminate control doesn't accomplish management goals, none have been able to tell us "why." Our results show a population process that is consistent with the mechanism that other work has hypothesized is why broad-scale reduction is not effective. While we are not yet able to make specific recommendations, the results of this study suggest some general guidelines for the development of new approaches moving forward.

1. Managers must remember their motivating goal in coyote management. This may be increased fawn survival, or reduced livestock loses, but is unlikely to be reducing coyote density in itself. It is generally easier to work with nature than against it, and the coyote's adaptable behavior may be the key.

2. Rather than reducing abundance, management actions may be more effective by instilling a behavioral response in the coyote population. On short timescales, such as while livestock are calving or rounded up, using other methods, such as fladry (Image 2) or guardian dogs, to deter coyotes from handling areas has given promising results.

Fladry set up around a pasture. Fladry is a line of rope mounted along a fence, from which strips of fabric or colored flags that will move in the breeze are suspended with the goal of deterring coyotes from entering an area.
Image Credit: NRDC

3. In wildlife management, increasing the numbers of game species often prompts coyote removal, however recent work suggests that coyote predation of fawns may be a symptom of marginal

fawning habitat, rather than coyote density. Thus, habitat management may play a key role in managing predation, rather than managing the predator.

While these alternatives are nonlethal, lethal management will still play a valuable role in coyote management. Recent research suggests that animals respond to a "Landscape of Fear", meaning they adjust their behaviors to areas and times at which they perceive greater mortality risk. Lethal management, when applied in key areas, key times, or to key individuals, may produce a behavioral response in coyotes that is more effective at achieving desired management outcomes than population reduction. While untested, this hypothesis suggests that management efforts that are targeted, in space and time, are more likely to be effective than broad-scale, nonselective "control" efforts.

In conclusion, it is important to remember that coyote management is not as simple as lethal removal and producing dead coyotes-the system is much more complex. Being adaptable and keeping the motivating goal in mind are the keys to success, for coyotes and managers alike. While the "wiley" coyote will remain a figure of the South Texas landscape, East Foundation, Texas A&M and other research partners will continue to apply scientific principles to produce needed information and solutions to coyote problems. For us, this is just a part of promoting the advancement of land stewardship through ranching, science, and education.

SUGGESTED CITATION

French, et al. 2020. *Coyote Conundrums: Shedding Light on Coyote Behavior to Inform More Effective Managements*. East Foundation Management Bulletin No. 4, 4p.

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CONTACT INFORMATION

JUSTIN T. FRENCH, Ph.D.
Research Scientist
Borderlands Research Institute
Sul Ross State University
justin.french@sulross.edu

CONTRIBUTORS

JUSTIN T. FRENCH, Ph.D. is a Research Scientist at Borderlands Research Institute at Sul Ross State University in Alpine, Texas.

HSIAO-HSUAN *ROSE* WANG, Ph.D. is a Research Scientist in the Department of Wildlife & Fisheries Sciences at Texas A&M University, in College Station, Texas.

WILLIAM E. GRANT, Ph.D. is a Professor in the Department of Wildlife & Fisheries Sciences at Texas A&M University in College Station, Texas.

NOVY J. SILVY, Ph.D. is a Professor in the Department of Wildlife & Fisheries Sciences at Texas A&M University in College Station, Texas.

JOHN M. TOMEČEK, Ph.D. an Assistant Professor and Extension Wildlife Specialist in the Department of Wildlife & Fisheries Sciences at Texas A&M University in College Station, Texas.

LANDON SCHOFIELD, M.S. is the Range & Wildlife Biologist at the East Foundation in Kingsville, Texas.

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