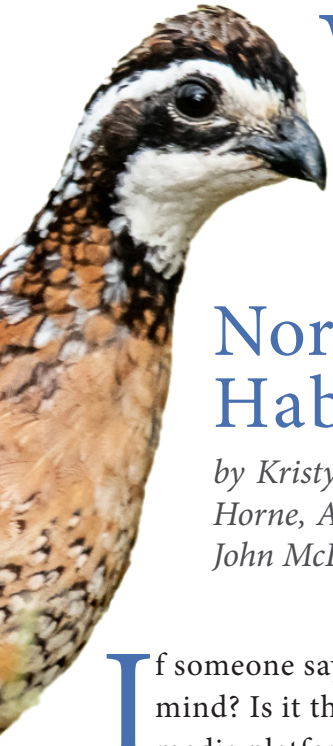

WHAT IS THE COST?

Northern Bobwhites and Habitat Fragmentation

by Kristyn Stewart, Fidel Hernández, Sabrina Szeto, Jon Horne, Alejandra Olivera-Mendez, Angela Guerrero, and John McLaughlin

If someone says the word "network", what pops into your mind? Is it the phone in your hand? The various social media platforms? Or maybe the social circle of friends you keep? The truth is, we are surrounded by all different kinds of networks in daily life.

A network is a structure that is comprised of two things: nodes and links. A node can be any object, and a link is a connection between the objects. For example, in a banking network, the banks are the nodes and the financial exchanges occurring among them are the links. In a social network, the people represent the nodes, and relationships among them are the links. Given this structure, networks can be viewed as highly connected if many links exist among the nodes, or as disconnected if only a few links exist among the nodes. Such a "network" perspective has been very useful in better understanding phenomenon occurring in a diversity of disciplines such as engineering, economics, biology, and more recently, ecology, where researchers have begun to view habitat as a network.

When habitat is lost due to urbanization, agriculture, or other factors, the landscape is transformed from a single, contiguous patch of habitat into many, isolated habitat patches. In this scenario, the habitat patches are viewed as nodes and if the patches are close enough to permit animal movement among them, then wildlife travel can occur between habitat patches thereby establishing a link. If the distance is too great to permit travel, then the habitat patches are not connected. Thus, habitat on a landscape can be viewed as a network, and such a habitat network can experience high connectivity or low connectivity depending on the distance between patches and the dispersal ability of the species in question.

Bobwhite quail habitat

Northern bobwhite have been declining across their geographic range for many decades, and habitat loss and habitat fragmentation are considered the ultimate cause of the bobwhite decline. Although bobwhites in Texas are doing relatively better than in other parts of the species' range, bobwhite populations in the northern part of the state appear to be performing worse than in the southern portion, and habitat loss and fragmentation have been proposed as a possible explanation. However, to date, no one has quantified or compared the amount of bobwhite habitat between these regions. Thus, we wanted to apply a network perspective to bobwhite habitat and compare habitat characteristics (amount and connectivity) between northern and southern Texas and relate those metrics to bobwhite abundance.

To do this, we first created a map of bobwhite habitat to identify individual patches of habitat within our study regions. We used National Land Cover Database (NLCD) and CropScape landcover data to produce a map of bobwhite habitat. These databases consist of many landcover classes, such as urban, water, grassland, crop, etc. Thus, we reclassified and reduced the original NLCD and CropScape landcover classes into just two classes (bobwhite habitat or not-habitat) based on our knowledge of the species' ecology. To estimate bobwhite abundance, we used the roadside surveys conducted by Texas Parks and Wildlife Department (TPWD) every August. For the routes that occurred within northern (Rolling Plains and Cross Timbers ecoregions) and southern (Rio Grande Plains and Gulf Prairies) Texas, we identified the centroid of each route and buffered it to a radius of about 16 miles (Figure 1). We utilized these circular areas as our focal landscapes and quantified the amount of bobwhite habitat existing within each landscape. We then used a method called least cost path analysis to produce the paths of least resistance (or cost) to a bobwhite from habitat patch to patch in each focal landscape. This analysis allowed us to produce the possible routes that a bobwhite could take, given the different types of landcover (farm fields, urban

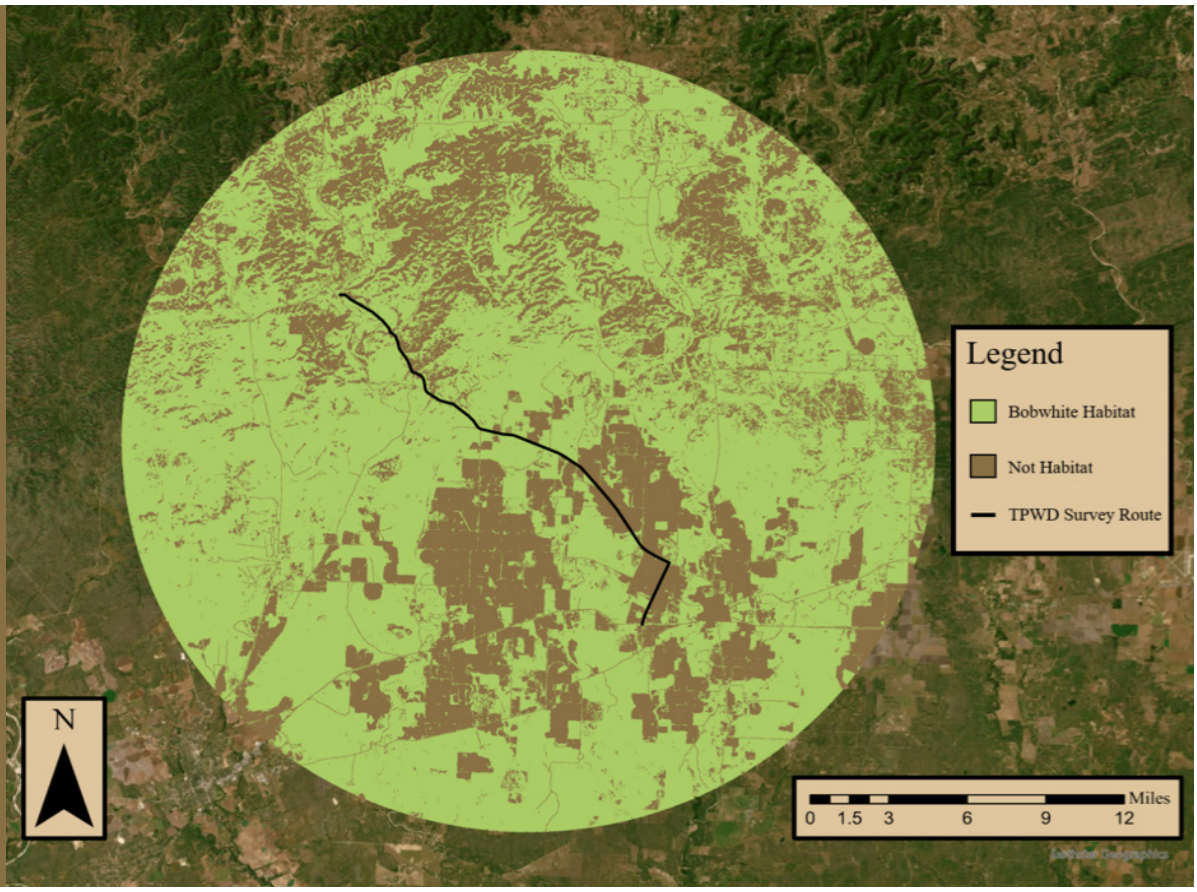

Figure 1. Example of a focal landscape displaying bobwhite habitat (light green) and not habitat (brown) occurring within a 16-mile buffer around a Texas Parks and Wildlife quail survey route in South Texas.

Variable	Southern Texas	Northern Texas
No. of routes	36	71
Habitat amount (%)	85	73
Mean patch area (ac)	5,410	391
Mean path distance (yds)	234	265

Table 1. Summary of habitat characteristics between southern and northern Texas.

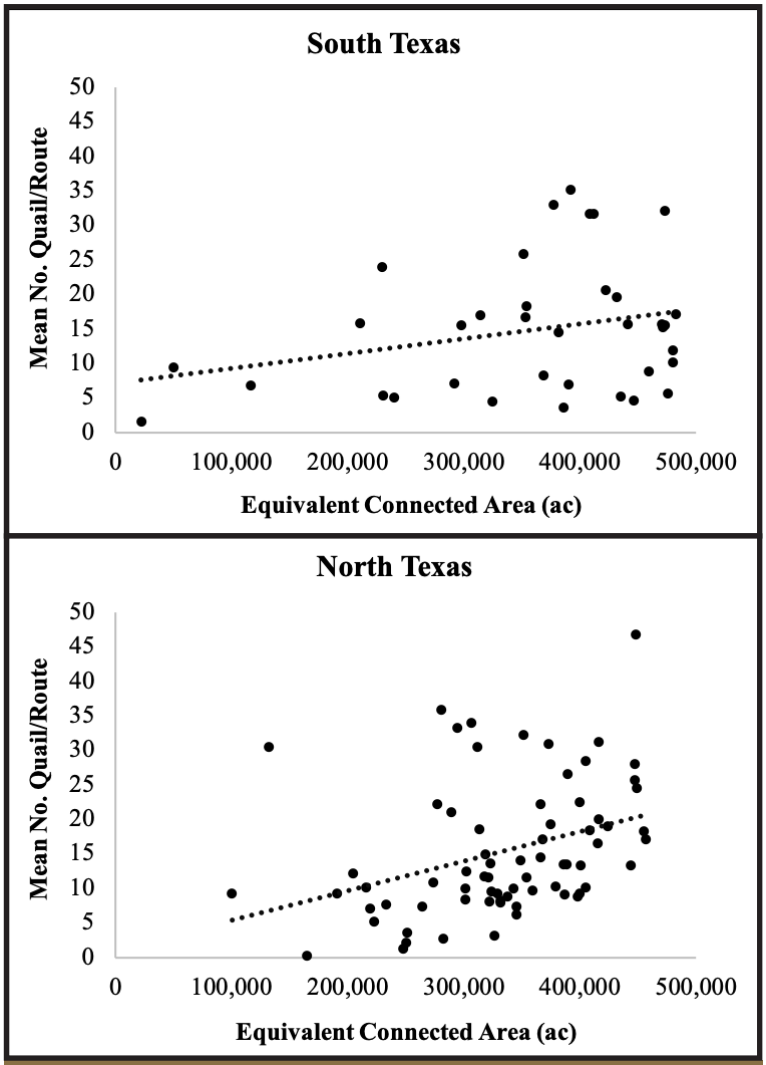

Figure 2. Relationship between a measure of habitat connectivity (Equivalent Connected Area; ac) and mean quail abundance in northern and southern Texas. The larger the ECA value, the higher the habitat connectivity.

areas, rangeland, etc.) and the different types of roadways (highway, county road, caliche path, etc.) which could help or hinder quail movement. We then quantified the degree of habitat connectivity within each buffered route and related this to the mean number of quail counted on these routes.

We collected habitat data (amount and connectivity) from 71 routes in northern Texas and 36 routes in southern Texas. We documented that the area surrounding routes in southern Texas had more habitat (80%) than routes in northern Texas (72%). In addition, our habitat-network analysis indicated that southern Texas had larger habitat patches, shorter distances between patches, and higher habitat connectivity than northern Texas (Table 1). Moreover, we documented a positive relationship between mean bobwhite abundance and habitat connectivity (Figure 2).

Our preliminary analysis provides supporting evidence that habitat connectivity could be a possible factor explaining population differences between northern and southern Texas. In the future, we will relate other metrics of population performance (e.g., population growth) to habitat connectivity to assess whether the same patterns are documented. We also plan to quantify the social network of quail stakeholders' perspectives, and use information from all three components (habitat, quail populations, and people) to link them into a larger, social-ecological network. This project is a first approximation analysis of the bobwhite decline as a social-ecological system and will provide a framework for management conservation that can be used with other species.

Just maybe the next time you hear the word "network", hopefully, you will think "bobwhites!". ↓