



Caltrans Division of Research,  
Innovation and System Information

# Research



# Results



Environmental

## FEBRUARY 2016

**Project Title:**

Do California Highways Act as Barriers to Gene Flow for Ground-Dwelling Mammals?

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## Do California Highways Act as Barriers to Gene Flow for Ground-Dwelling Mammals?

Analyze genetic samples in the east bay area and the Sierra Nevada foothills to determine if highways are a barrier to coyote gene flow.

### WHAT WAS THE NEED?

Transportation agencies are mandated to reduce the negative effects of roads on wildlife populations, including disruption of gene flow. Overpasses or under-crossings may be installed to restore natural gene flow patterns. However, to effectively plan these and other mitigation activities, transportation agencies must know which roads to target and which species are most affected. This was a pilot study using genetic analysis to help understand genetic fragmentation caused by highways.

### WHAT WAS OUR GOAL?

The aim of this study was to determine whether highways disrupt wildlife gene flow in the Bay Area and the Sierra Nevada foothills, using coyote as a model species.

### WHAT DID WE DO?

The research team studied coyote separated by Interstates 680 and 580 in the inland valleys of the East Bay; and coyotes separated by Interstate 80 and U.S. 50 in the lower Sierra Nevada Foothills. Fecal sampling was conducted in open space and parklands in regions adjacent to these highways. All samples were collected ≤ 10 km from the highways. After sample collection, DNA extraction, and genetic analysis, the results were analyzed for genetic diversity and genetic connectivity.



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## WHAT WAS THE OUTCOME?

High quality genetic information was obtained for 59 individual coyotes from 128 coyote samples. Despite the small sample size, the researchers still discovered some evidence of genetic divergence among sampling locations related to highway presence. However, it is unclear from the current dataset whether highways form significant barriers to coyote movements in the Bay Area and Sierra Nevada foothills.

The results contrast with the findings of Riley, who studied coyote movements and gene flow across Highway 101 in Southern California. In Riley's study, he detected two populations, corresponding to the north and south sides of Highway 101. In our study areas, there is no distinct break between populations that can be attributed to highways alone.

Both Riley 's and this study identified migrants across highways although the levels of population structure in Riley's suggested that little gene flow occurred. The lack of population structure in our study areas suggests there is gene flow across highways, which may be facilitated by crossing points such as culverts and underpasses.

The research team will continue to analyze coyote DNA from the study area and update the results at no cost to Caltrans. Future research in the Sierra Nevada foothills will compare the impacts of highways on the genetic structure of disturbance resistant coyotes and disturbance resistant gray foxes.

## WHAT IS THE BENEFIT?

This research helps Caltrans, other transportation agencies, and the California Department of Fish and Wildlife understand better how highways and their associated features (such as under crossings and culverts) impact the ability of wildlife to thrive in modified landscapes. This study, along with others, will help Caltrans plan and construct cost effective wildlife population mitigation.

## LEARN MORE

The final report is available from Harold Hunt of Caltrans Division of Research, Innovation, and System Information: [harold\\_hunt@dot.ca.gov](mailto:harold_hunt@dot.ca.gov).