



Caltrans Division of Research,  
Innovation and System Information

Research

Notes

Environmental

OCTOBER 2015

Project Title:  
Using noninvasive genetics to compare  
how California highways affect gene flow  
in a disturbance averse versus a  
disturbance-tolerant species

Task Number: 2978

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Task Manager:  
Harold G. Hunt  
Senior Environmental Planner  
harold\_hunt@dot.ca.gov

## Comparing how highways affect gene flow in a disturbance-averse and a disturbance-tolerant species

Examining whether highways are greater barriers for the disturbance-averse gray fox than for the disturbance-tolerant coyote

### WHAT IS THE NEED?

One of Caltrans goals is to develop and maintain a sustainable transportation system in California. An important part of sustainability is maintaining ecological integrity. According to the Federal Highway Administration, American highways extend for over 4 million miles and have ecological effects on about 20% of the US land area. Highways can act as barriers to wildlife movement, either through direct mortality or through modification of natural behavior patterns. Roadway barriers can fragment and isolate wildlife populations, increasing their risk of extinction due to such things as genetic diversity loss, and inbreeding depression. The degree to which highways affect species can depend on species' ecological characteristics and features of highways themselves.

As roads have ecological effects on approximately 20% of the land area of the lower 48 US states and an increasing number of studies have documented negative effects of roads on wildlife, it is becoming increasingly apparent that mitigation for transportation infrastructure is required to protect wildlife populations. The "Moving Ahead for Progress in the 21st Century Act" passed by the US Congress in 2012 identifies the need for state and metropolitan agencies to reduce wildlife-related automobile hazards, reduce wildlife mortality, and improve habitat connectivity. Knowledge of how California highways impact wildlife with differing behavioral responses to disturbance will help Caltrans and other transportation agencies plan mitigation activities that will benefit multiple species.



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## WHAT ARE WE DOING?

The objective is to determine the degree to which a species' tolerance to disturbance and highway characteristics influence a highway's impacts on gene flow of northern California wildlife. Specifically, the research team will:

1. Use landscape genetics tools to compare the impact of State Route 49 in Placer, Nevada, and Yuba Counties on movements of coyote and gray fox, two closely related sympatric species with differing affinity for disturbance.
2. Compare the degree to which traffic volume in three study sections of State Route 49 influence coyote and gray fox gene flow.

## WHAT IS OUR GOAL?

This research will develop increased knowledge of how State Route 49 influences the genetic structure of the populations of two closely related sympatric species; the disturbance-tolerant coyote and the disturbance-averse gray fox. The results will improve our understanding of how California highways affect different wildlife species and provide preliminary data on how traffic volumes are related to wildlife movements across highways.

The research team will collaborate on a 2 page policy brief and on a final research report to be submitted by the end of the project. The research report will contain the detailed methods used in the landscape genetics analysis as well as the detailed results of the analysis. The team will engage with National Center for Sustainable Transportation staff to disseminate the results of the study to policy makers involved in transportation planning. The research team will also disseminate the results to the scientific community through a conference presentation and in a peer reviewed journal article.

## WHAT IS THE BENEFIT?

The results of this study will improve our understanding of how California highways affect different wildlife species and provide preliminary data on how traffic volumes are related to wildlife movements across highways. Knowledge of how California highways impact wildlife with differing responses to human disturbance will help transportation agencies plan mitigation activities that will benefit multiple species.

Future studies will target additional highways to increase the number of high, moderate, and low volume sections considered. The knowledge arising from this work will help transportation agencies target mitigation activities to stretches of highways predicted to provide the greatest barrier to wildlife movements. For example, crossing structures might be preferentially installed in highway stretches with high traffic volume to have the greatest impact on restoring population connectivity.

## WHAT IS THE PROGRESS TO DATE?

This project is just beginning and no milestones have been completed.