Special Report 4: Impact of COVID-19 Mitigation on Wildlife-Vehicle Conflict

ROAD ECOLOGY CENTER
Roadecology.ucdavis.edu
UCDAVIS

Tricia Nguyen, Malak Saleh, Min-Khant Kyaw, Gabrielle Trujillo, Mireya Bejarano, & Karla Tapia (Road Ecology Center Interns)
David Waetjen, Ph.D. (Analyst)
Fraser Shilling, Ph.D. (Co-Director)

6/24/2020

Impact of COVID-19 Mitigation on Wildlife-Vehicle Conflict

"Temporary respite for wildlife with reduced traffic"

Using traffic and collision data from California, Idaho, and Maine, **we found that wildlife-vehicle conflict (WVC), including for mountain lions in CA, has declined by ~21-58% following the various government stay-at-home orders.** From early March to mid-April, these orders have resulted in up to 71%, 63% and 73% reduction in driving, as measured by vehicle miles traveled (VMT), in CA, ID, and ME respectively. We used carcass and crash reports to calculate the change in daily collision rates from the 4 weeks prior to stay-at-home orders going into effect, to the 4 weeks after. Although rates of WVC naturally vary by season, the change from 1 month pre-stay-at-home orders to 1 month post-order only occurred in 2020 and not 2015, 2016, 2017, 2018, or 2019, suggesting that the reduction was associated with the reduction in traffic. In the three states, this could amount to 5,700 to 13,000 fewer large mammals killed on roads per year and in CA 50 fewer mountain lion mortalities on roads per year. **This represents the first evidence of reduced rates of WVC in response to the reduced travel by many Americans in response to COVID-19 related mitigation efforts.**

This report and other tools are available on the Road Ecology Center website: https://roadecology.ucdavis.edu. For more information, contact Fraser Shilling (fmshilling@ucdavis.edu).

We would like to **acknowledge** the hard work and data collection efforts of the California Highway Patrol officers; Caltrans Districts, MaineDOT (especially Eric Ham), and IDT Maintenance and Environmental staff (especially Alissa Salmore); volunteers in the California Roadkill Observation System and Idaho Fish and Wildlife Information System; the Idaho Department of Fish and Game (especially Matt Pieron); the California Department of Fish and Wildlife (especially Justin Dellinger); and Winston Vickers. We recognize the trauma, pain, and losses that the Covid-19 pandemic has brought to the US and other countries and by pointing out the benefits from reduced traffic, we are not making light of Covid-19 impacts.

Cover photo credit. Coyote, California Roadkill Observation System

Contents

Top 4 Talking Points 3
Introduction to Study 4
Findings 5
1) Reduction in Travel 5
2) Reduction in Impacts to Wildlife 6
3) Reduction in Impacts to Mountain Lions 7
4) No Change in Distribution of WVC 8
Conclusions 9
Citations 9

Special Report on Impact of COVID19 Mitigation on Wildlife-Vehicle Conflict

Top 4 Talking Points

1) **Nationwide traffic data suggests that most residents in all states significantly reduced their travel in response to "stay-at-home" orders.** We used data from Caltrans' Performance Monitoring System (PeMS) for CA state highways and from Streetlightdata.com to estimate changes in travel in CA, ID and ME. State highway travel in CA and ME declined 20-60% between early March and mid-April and travel on all roads in CA , ID, and ME declined by up to 71%, 63%, and 73%, respectively, suggesting that the majority of people were taking guidance about staying at home seriously.

2) **Traffic reduction in US states was accompanied by statistically-significant reductions in the number of WVC.** We found that for CA, ID, and ME, the number of WVC recorded as crashes or carcasses in statewide WVC-reporting systems declined statistically between the 4 weeks prior to the stay-at-home order and the 4 weeks after the order. This is contrast to previous years, where WVC rates in this time period usually either stays constant or increases, due to transition from winter to spring.

3) **Mountain lions in CA experienced a 58% reduction in mortality on roads at a time when the state is considering legal protection for the species, in part because of lion-vehicle collisions.** Mountain lions are reported hit on California roads and highways up to twice per week. In a typical year, this rate either stays constant or increases slightly in the transition from winter to summer. We found that the rate of mountain lion mortality declined 58% between the 10 weeks prior to the state order and the 10 weeks after.

4) **The distribution of WVC generally did not change between the period before and after the order.** The density of WVC per unit area was calculated for the pre- and post-order periods for each state. Generally, there was no obvious difference between patterns and distribution of WVC density before and after state stay-at-home orders, suggesting an evenly-distributed benefit to wildlife across the states.

Introduction to Study

Mitigation of the spread of COVID-19 has been implemented by cities, counties, and governors' offices through "shelter-in-place" and "stay-at-home" orders and related actions (e.g., closure of non-essential businesses). In previous reports, we have pointed to the potential unintended impact of reduced traffic: 1) reduced traffic crashes and thus injuries and fatalities for people involved in the incidents; 2) reduced costs associated with crashes for society (e.g., emergency response, medical costs, vehicle repair/replacement, lost time at work); 3) reduced fuel use and corresponding fuel tax revenue for state and local government; and 4) reduced greenhouse gas emissions due to reduced driving and fuel use. This mixture of silver linings (e.g., reduced crashes) and potential impacts (e.g., reduced tax revenue) are an ongoing and dynamic consequence of stay-at-home orders and these reports represent a type of "real-time" policy analysis. The reports are available on the Road Ecology Center website: https://roadecology.ucdavis.edu).

In the current report, we investigated potential changes in impacts to wild and domestic animals from reduced traffic in 3 US states with advanced systems for tracking wildlife-vehicle conflict (WVC): California, Idaho and Maine. There are several important caveats to keep in mind with this report: a) WVC can be under-reported by 5 to 9-fold (Donaldson, 2017; Olson et al., 2014); b) despite the massive impact that transportation has on wildlife, there is no systematic monitoring of WVC involving large, medium and small animals (mammals, reptiles, amphibians, and birds) in any US state; and c) animal responses to roadways and changes in traffic volumes is likely to vary substantially among species. Traffic volumes are tied to rates of WVC, though not in a linear way. In other words, intermediate traffic volumes may result in higher rates of WVC than large traffic volumes because wildlife may be more willing to attempt to cross roads/highways with moderate traffic than highways with frequent vehicles (Seiler, 2003). For any given highway, it is possible that if traffic volumes are radically reduced, say by 75% for weeks, as has been the case for many US roads and highways, then rates of WVC may be proportionally reduced. Given that it is possible that 100s of millions of vertebrates (birds, reptiles, amphibians, and mammals) are killed per year on US roadways, then such a reduction could be equivalent to millions of animals <u>not being killed</u> during periods of low traffic volumes.

In past reports, we have examined the impact of reduced traffic on traffic crashes affecting people. We continue that thread here by examining the possibility that reduced traffic has resulted in reduced rates of wildlife mortality on US state highways and roadways. For CA, we used data collected by the Road Ecology Center's California Highway Incident Processing System (CHIPS) from California Highway Patrol reports. For ID, we downloaded data from the Idaho Fish and Wildlife Information System (IFWIS) and communicated the use of the data to Idaho Department of Fish and Game. For ME, we requested and received data from the Maine Department of Transportation. We compared total numbers and rates of WVC before and after the respective stay at home orders for each state. For mountain lion mortalities, we used a "consensus" dataset developed by the Road Ecology Center, Winston Vickers (UC Davis) and California Department of Fish and Wildlife.

Findings

1) Reduction in Travel

Using daily travel data from Streetlightdata.com, we calculated the change in daily "vehicle miles traveled" for every county in the US from early March to mid-April. Streetlightdata uses custom algorithms with cell-phone tracking data to estimate how many miles people drive per day. The total miles traveled in the first week of March in the US was 103 billion miles, whereas the total miles traveled in the second week of April was 29 billion miles. This 71% reduction in total miles traveled was reflected in the range of reductions seen across each state. The date of the stay-at-home order, or similar guidance, varied among states. For California, it was March 20th, for Idaho March 26th and for Maine March 31st. We calculated the drop in average weekly travel from the first week of March to the second week of April as reasonable pre- and post- order timeframes. Travel on all roads decreased by 75%, 63% and 73% for CA, ID and ME between early March and mid-April (Figure 1). The decrease in VMT for all travel on all roads for CA, 75%, is greater than the estimated change in traffic volumes on 12 state highways, 37%, suggesting that driving patterns may be quite different on local roads and state highways. A caveat to the finding for ME is that traffic engineers in

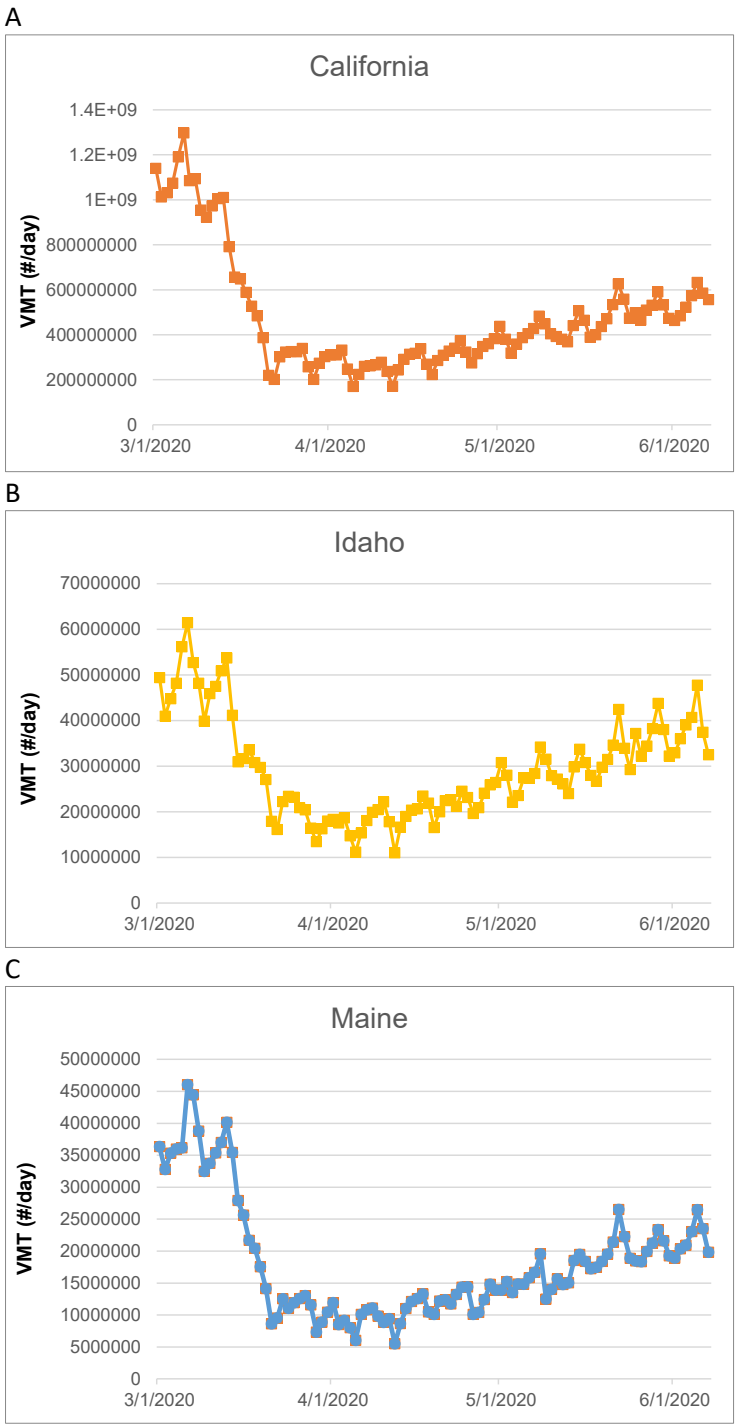

Figure 1. Vehicle miles traveled (VMT) for CA, ID, and ME between March 1, 2020 and June 10, 2020 for (A) CA, (B) ID, and (C) ME.

MaineDOT have reported only a 20% reduction in traffic on state roads following the stay-at-home guidance. This suggests that resolution is needed of the true reduction in traffic volumes has been and whether there are differences in reductions between state and minor roads.

States have seen a return of traffic similar to before the stay-at-home guidance, but it is not clear that this is consistent among states or that it has stabilized at some new rate. In CA, there has been a 3-fold increase in traffic, to a level about 50% of pre-order (Figure 1A). In ID, a similar 2-3 fold increase in traffic has resulted in traffic level about 75% of pre-order (Figure 1B). In ME, traffic has increased 3-fold and is now about 50% of pre-order traffic (Figure 1C).

2) Reduction in Impacts to Wildlife

Co-occurring with and possibly because of the reduction in VMT were statistically-significant reductions in collisions with wild animals of 21%, 38% and 44% for CA, ID and ME (Table 1). We compared the number of animals found dead on state highways, or involved in a collision reported to emergency response, in the 4 week period prior to each state's stay at home order with the number killed in the 4 week period after each state's order. In the case of California's order, we used 28 days prior to the San Francisco Bay region's order on 3/16/2020 because this region represents a large portion of California's WVC. There were similar statistically-significant ($p<0.05$) reductions in impacts to domestic animals, including cows, horses, sheep, goats, dogs, and cats for CA. For all 3 states, we also analyzed rates of WVC in previous years (2015, 2016, 2017, 2018, & 2019) and for the same time periods, there were either significant increases or no change in numbers of WVC before and after the date of each state's order in any of these previous years. An important point is that these numbers represent the numbers of large wildlife reported killed in collisions (e.g., mule deer, white-tailed deer, moose, elk, black bear, coyote, mountain lion) and does not represent all collisions with large wild animals, or with all wild animals of any size. However, in every case, we confirmed that the effort of reporting carcasses or crashes had not changed before and after the order suggesting the reductions are not due to less people reporting carcasses or crashes with wild animals.

Table 1. Number of large wildlife killed per day on California, Idaho and Maine state highways and significance of the change. P-values less than 0.05 indicate statistical significance.

State	Number/day Pre-Order	Number/day Post-Order	Decrease/Statistical Significance
CA	8.4	6.6	21%/P=0.04
ID	8.7	5.4	38%/P=0.01
ME	15.2	8.4	45%/P<0.001

Previous research has shown that collisions with deer and other large wildlife can be under-reported to police and others by 5 to 9 fold (Donaldson, 2017; Olson et al., 2014). In 2019, CA, ID, and ME recorded at least 5,443 (mule deer only), 4,530, and 5,808 collisions with large mammals per year, respectively. This suggests that 27,000 – 49,000 large mammals are killed per year on CA roads and highways, as well as an unknown number of other species. This is supported by the State Farm Insurance Co estimate of >23,000 claims/year for collisions with deer resulting claims in California (https://newsroom.statefarm.com/download/234883/allstates2015-16deerstats-finalpdf.pdf).

It is likely that there are also collisions that do not result in insurance claims. If we used a conservative under-reporting rate of 5-fold, then it is possible that the reported collisions represent 27,200, 22,650, and 29,040 deer and other large mammals killed on roads and highways per year in CA, ID, and ME, respectively. The reduction we observed would represent 5,712, 8,607, and 13,068 fewer deer and other large mammals killed per year in CA, ID and ME, respectively. Obviously, as traffic increases again, these reductions may be reversed.

3) Reduction in Impacts to Mountain Lions

Mountain lions are proposed for legal listing in CA as state-threatened. There are three primary threats to the species: 1) state-permitted killing of mountain lions that may have attacked domestic animals, 2) mortality from road and highway traffic, and 3) population fragmentation by busy highways. We found that the rate of mountain lion mortality declined 58% (P=0.030) from the 10-week period pre-order to the 10 week period post-order. A longer period was used than for all wildlife because the number of mountain lions killed per day is low in comparison to all large wildlife. The rate of mortality during the post-order period in 2020 was also significantly lower than rates for the same period during the preceding two years (P<0.04).

Table 2. Rate of mountain lion mortality on CA roads and highways in 2020, 2019, 2018, 2017, and 2016, before and after the dates of the Bay Area and state stay-at home orders. P-values of <0.05 are considered statistically-significant, P-values >0.05 are not significant. "n.s." refers to non-significant differences.

Year	Mortality/day pre-order	Mortality/day post-order	% Change	P-value/ significance
2020	0.27	0.11	- 58%	0.030/significant
2019	0.19	0.26	--	0.40/n.s.
2018	0.21	0.23	--	0.88/n.s.
2017	0.17	0.21	--	0.57/n.s.
2016	0.11	0.1	--	0.79/n.s.

One significant impact of this finding is the clear link between traffic and rates of mountain lion death. This means that to reduce mountain lion mortality, populations must be protected from traffic, especially in the Bay Area and Southern California where isolated and small populations of mountain lions are at risk of extinction. Protection from traffic has been accomplished in CA and other places by building wildlife crossings associated with fencing. For example, SR 241, a state highway operated by the Transportation Corridor Agencies of Orange County as a toll-road, is punctuated with large bridge under-crossings and is protected along much of its length with 10'-high fencing. This combination of large crossings and 10'-high fencing has eliminated wildlife entry onto the highway, including by the endangered mountain lion population of the Santa Ana Mountains. A proposed wildlife over-crossing on US 101 in the San Fernando Valley would become California's second wildlife over-crossing and the largest in the world. Its primary goal is to reduce the isolation of the mountain lion population of the Santa Monica Mountains.

4) No Change in Distribution of WVC

In general, there were no major changes in the distribution of WVC across the states. In other words, the number of animals killed by vehicles seemed to decrease uniformly across all highways. In California, areas around the San Francisco Bay, Sacramento region, and Southern California that usually have higher densities of WVC than surrounding areas continued to have higher densities (Figure 1 A,B). Similarly in Maine, areas along the I-95 corridor around Portland, Augusta, Bangor and Houlton continued to have higher densities of WVC than surrounding areas, but with lower overall numbers (Figure C,D). These results are consistent with the idea that there was proportionally less driving among areas between the pre and post-order periods.

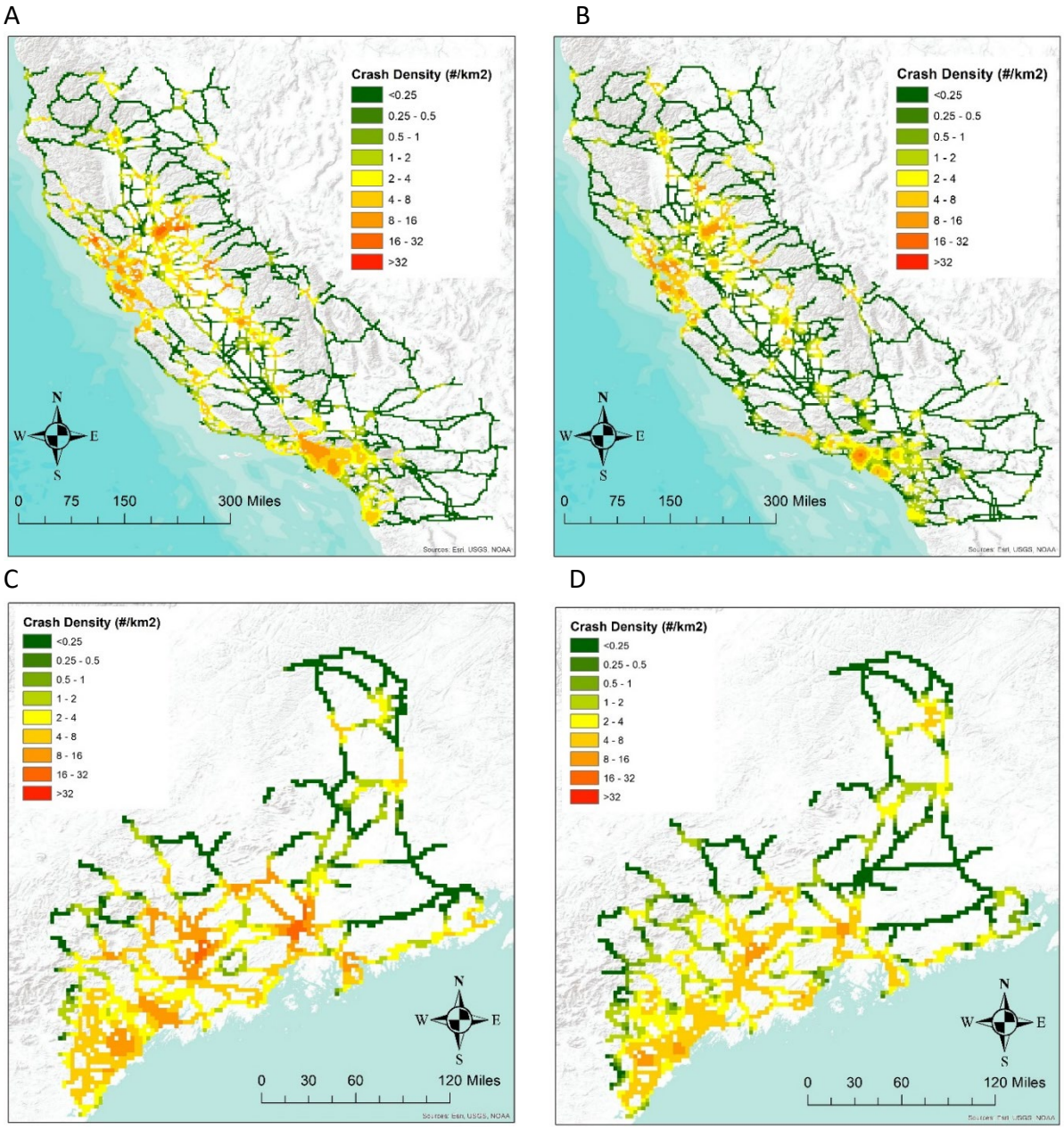

Figure 1. Distribution of AVC density before and after stay-at-home orders in California, A and B, respectively, and in Maine, C and D, respectively.

Conclusions

Our previous reports have highlighted the various unintended consequences of COVID-19 mitigation through state and regional stay-at-home and shelter-in-place guidance (available here: https://roadecology.ucdavis.edu). We show here that there was a statistically-significant reduction in the number of large wild animals killed per day on CA, ID, and ME state highways that coincided with the reduced traffic following state stay-at-home guidance. It seems likely that the reduction was due to reduced driving and further that this positive impact occurred in other states and for other animals besides large mammals. Given the five to 9-fold under-reporting of large animals involved in collisions with vehicles and the lack of systematic reporting of smaller animals killed on roads, the positive impacts we report are likely to be just the tip of the iceberg of reduced deaths of wildlife on U.S. roads and highways. This unintended positive consequence of COVID-19 mitigation on wildlife joins the growing group of "silver", "gold" and "green" linings: reduced injury/fatal crashes for drivers/passengers, reduced costs associated with crashes, and reduced greenhouse gas emissions.

Citations

Donaldson, B. 2017. Improving Animal-Vehicle Collision Data for the Strategic Application of Mitigation. Virginia Transportation Research Council. Report FHWA/VTRC 18-R16. URL: http://www.virginiadot.org/vtrc/main/online_reports/pdf/18-r16.pdf

Olson, D. D., J. A. Bissonette, P. C. Cramer, A. D. Green, S. T. Davis, P. J. Jackson, and D. C. Coster. 2014a. Monitoring wildlife-vehicle collisions in the information age: how smartphones can improve data collection. PLoS ONE, 9(6): e98613. DOI:10.1371/journal.pone.0098613

Seiler, A. 2003. Effects of infrastructure on nature. In: Trocme M et al. (eds) COST 341 – Habitat fragmentation due to transportation infrastructure; The European review. Office for Official Publications of the European Communities, Luxembourg, pp. 31-50.

Contact: Fraser Shilling, Co-Director, Road Ecology Center, UC Davis; fmshilling@ucdavis.edu.