

UC Berkeley

Recent Work

Title

The Patron Saint of Roadkill

Permalink

<https://escholarship.org/uc/item/31p1w8pt>

Author

Schiewe, Jessie

Publication Date

2013-05-12

The Patron Saint of Roadkill

Jessie Schiewe

One man's quest to make California's roads safer for wildlife

It started with a dead raccoon.

Fraser Shilling, a tall, longhaired biologist at UC Davis, was driving along the Russian River one spring day in 2009 in his beat-up tan Mercedes, when he saw the flattened, partially corroded body on the side of the highway. On a whim, he decided to pull over and take a look at it.

Since the early 1990s, Shilling has had a penchant for stopping to examine roadkill. "It's an interesting way to see animals," he says. "They're lying there, unmoving, and you can check them out." Over the years, he's collected feathers and bones. Once he even brought home an injured gopher snake, which he nursed back to health.

But for reasons Shilling still can't explain, the raccoon on the side of the road that day was different. "It struck a chord," he says—a chord that inspired him to take a photograph of the dead animal, write down its location, and a few months later, create a website dedicated to roadkill.

The California Roadkill Observation System (CROS, for short) is an unassuming, minimalist website that is easy to understand and even easier to use. It is an online record of roadkill specimens found throughout California, replete with tables, a GPS map, and a surprisingly gory photo gallery¹. Other than the species, location, and estimated time since the animal's death, there are virtually no limitations to the website. And, because anyone can contribute to CROS, it's also what academics refer to as a citizen science project².

To date, more than 21,000 dead animals have been reported by more than 800 people on the website³, which also has a newsletter and a Facebook page⁴. CROS is also the largest roadkill database in the country⁵ and its success has inspired other states, such as Maine, Massachusetts, and Idaho, to create roadkill observation websites of their own⁶.

Shilling estimates that throughout the country, hundreds of animals die each day while trying

1 <http://www.wildlifecrossing.net/california/>.

2 Shilling interview, 2/15/13, pg 2.

3 Email from Shilling, 5/6/13, both statistics.

4 <http://www.facebook.com/pages/California-Roadkill-Observation-System/160965163923153>.

5 Interview with Shilling, 2/13/13; *San Francisco Chronicle* article, 10/6/10,

<http://www.sfgate.com/bayarea/article/Roadkill-warriors-track-carnage-to-save-lives-3250764.php>.

6 Interview with Shilling, 3/14/13 ~~FOR PUBLICATION, THESE ARE ASSERTIONS THAT YOU WOULD WANT TO BACK UP WITH FOLLOWUP CALLS TO THE STATE IN QUESTION.~~

to get across roads. But too few people, he argues, seem to care. “We seem to have a fairly deep lapse in collective concern,” he says. “People don’t notice roadkill, and don’t think about it. It has become part of the landscape and roadway background.”

Since before there were cars, animals have been dying under the wheels of vehicles. Covered wagons ran over critters and Roman chariots surely smashed hapless animals back in the day. But, with our larger population, faster cars and urban sprawl, the likelihood of animals getting killed on the road is far greater today, and what worries Shilling is that nobody seems to be keeping tabs on the death toll⁷. A 2008 report from the Federal Highway Administration estimates that between one million and two million large animals are killed by vehicles each year⁸, while an oft-cited, un-sourced, and highly unreliable figure from the Humane Society of the United States estimates that one million animals are killed by vehicles each day⁹, week¹⁰, or year¹¹, depending on who the quote is coming from.

Roadkill is hard to count. Animals aren’t necessarily killed on impact; some crawl off the road and die in the brush. Some get eaten in private—more than a dozen states have passed “roadkill bills,” allowing the collection and consumption of dead wildlife. In California it is illegal to collect roadkill¹², but before CROS was created, Shilling says, there was a complete dearth of information¹³. “We have laws to protect California wildlife,” he says, “but we didn’t have this kind of system.” This is especially worrisome, he argues, because California, the most populated state, not only has more species than any other state, but is also home to more endemic species (species not found anywhere else in the world) than any other state in the country¹⁴.

There are both obvious and not-so-obvious consequences of animal carnage on the road, Shilling says. Wildlife could become less varied. The environment as a whole could be thrown off. Even the most common species today, such as raccoon and deer, might not be common in the future¹⁵. “You hit enough [animals of the same species] and they’re not going to be common anymore,” Shilling says. “It works that way for everything.”

But though animals are never going to be completely safe from cars, Shilling says, there are ways to cut down on the number that are killed every year. “It’s a predictable outcome of how we do things,” he says. Fences can be installed to keep wildlife off highways. Underground tunnels and bridges can be built so that animals can cross roads safely. Motion-sensor

7 This was confirmed not only by Shilling, but in interviews with Melim, Cleckler, and Ostrum.

8 “Wildlife Vehicle Collision Reduction Study—Report To Congress,” August 2008, US Department of Transportation, Federal Highway Administration, pg 1.

<http://www.fhwa.dot.gov/publications/research/safety/08034/>.

9 New York Times article: <http://www.nytimes.com/2010/09/13/technology/13roadkill.html>

10 National Geographic article: <http://newswatch.nationalgeographic.com/2011/04/25/roadkill-threat-to-wildlife/>.

11 Petersen, Thomas Reed. *A Road Runs Through It: Reviving Wild Places*, pg. 37.

12 “Roadkill Road trip Map,” <http://www.marketplace.org/content/roadkill-roadtrip>.

13 Shilling interview, 3/14/13, pg 5.

14 “Wildlife and Habitat Management in California,” California Conservation Center.

<http://www.stateconservation.org/california/?q=7>.

15 List of consequences of roadkill from Shilling interview, 3/14/13, pg 6.

warning lights and wildlife crossing signs can be erected along roadways. “You could still have conventional transportation, but in a way that you didn’t kill so many animals,” Shilling says. “So in other words, it’s not inevitable.”

Road kill is often the stuff of jokes. There are roadkill cookbooks¹⁶, roadkill bingo cards¹⁷, roadkill Halloween costumes¹⁸ and roadkill T-shirts¹⁹. In at least 18 states throughout the country, there are restaurants called “The Roadkill Café,” not to mention dozens of restaurants, grills, BBQs, saloons and markets with “roadkill” also in the title²⁰. There’s a Facebook group called “Roadkill is Fun,²¹” replete with pictures of dead animals that have “Get Well Soon” balloons tied onto their legs, as well as quite a few Tumblr blogs dedicated to roadkill photography. Shilling himself has received mail from PR agents advertising roadkill cookbooks, and somebody once mailed him gummy candies from China in the shape of roadkilled frogs²².

“They probably think there are enough animals out there that will survive,” says Dave Waetjen, the former graduate student turned research assistant who developed CROS. “They don’t really think too much about it.”

Others say this kind of black humor cynicism about dead animals is a reflection of modern society. “In America we have this abundant resource mentality that it’s always going to be there,” says Denise Boehler who founded Wildsight, a Colorado-based company that promotes awareness for wildlife through slogan-based cycling apparel. “That’s obviously not the case, but that’s why we conduct ourselves the way we do.”²³

Roadkill is usually seen from a moving car, and it’s easier to forget the sight of a smashed animal when it is 100 yards behind you within a few seconds. It’s also easy to miss in the first place. “We’re essentially disconnected from the life beyond our windshields,” says Boehler, who wrote her master’s thesis, entitled “Raising Social Awareness to Decrease Wildlife Road Mortality,” on this issue²⁴. “We run around in these metal boxes enclosed in glass and we don’t even think about the lives beyond it.”

If Boehler had her way, she says she’d find a name other than “roadkill,” which she says “takes away from it being about sentient beings.” She suggests “wildlife road mortality” as

16 <http://www.amazon.com/Roadkill-Cookbooks/lm/TKOJCLY2PJF1>.

17 <http://www.netads.com/tccc/play.html>.

18 <http://www.halloweencostumes.com/kids-road-kill-costume.html>.

19 http://www.roadkilltshirts.com/?gclid=CK--_tz7mLcCFS9dQgod4gwAbw.

20 <http://www.road-kill-cafe.com/address.html>.

21 <http://www.facebook.com/RoadkillIsFun>.

22 Shilling interview, 3/14/13, pg 2.

23 Boehler interview, 3/19/13, pg 5.

24 Boehler interview, 3/19/13 (pg 1) and the “About” page on her website: <http://wildsight.co/about/>.

one alternative. “I know it’s longer, but that doesn’t matter to me,” she says. “They were creatures, too. In terms of value, they had lives of their own.”

Before Shilling’s dead raccoon epiphany, there was no such thing as a statewide, multi-species roadkill reporting website. A few websites related to animal road deaths had existed in the previous decade, but they were private projects, accessible only to the scientists and conservationists involved with the whatever organizations was sponsoring the studies²⁵. Most of the websites were also small-scale efforts, Shilling says, confined to a specific geographic area (for instance, a particular mountain range or in some cases, a specific stretch of highway) and focusing only on one or two species.

Shilling’s idea was different. “It’s not novel,” he says. “But I knew there was no extensive system like this.” Because death by vehicle can happen to any species of animal on any road within the state, Shilling didn’t see the point of confining his website to a particular species or geographic area. Why focus on one species or one area, he reasoned, when you can focus on them all?

To ensure that he would collect as much data possible, Shilling made the unorthodox decision of allowing access to the website to the general public. Even the photo gallery of squashed animals serves a particular function, Shilling says. The photos are grisly, but he says they “tell the story in a different way,” especially in comparison to the website’s more data-oriented tables and maps. Shilling’s other goal for CROS is to teach people how they can avoid hitting wildlife while driving—although he himself uses his bicycle and public transportation to get around. But road fatalities can be reduced through simple behavioral tweaks, he says, like driving slower and being aware of the sides of the road, or any low-flying birds nearby. Birds, don’t have to be hit by cars to be hurt or killed, he says. Sometimes the wind generated by passing cars is strong enough to cause low-flying birds to hit the ground or pull nearby animals onto the road itself.²⁶.

The website is a volunteer effort on Shilling’s part, as well, as it is unaffiliated with his university work. He guesses that he and other volunteers have put as much as \$30,000 worth of time and resources into it²⁷. Last year, the website also received a small grant from the Maine Audubon Society in exchange for Shilling’s help in building their own roadkill reporting website²⁸.

Douglas Long, an Oakland Museum of California curator who has contributed information to CROS since 2010, sees the website as a way of getting people to explore nature and learn more about science²⁹. “It’s not really designed for professionals,” he says. “It’s designed for very interested lay people, and it’s an opportunity for them to learn even more.”

Biologists, researchers, government agencies and wildlife organizations regularly comb the website for data, animal sightings, or reference for a study. In 2012, maps and statistics from

25 Shilling interview, 2/15/13 and “*Flattened Fauna*” by Roger Knutson.

26 Shilling interview, 3/14/13, pg 12.

27 Shilling interview, 2/13/13, pg. 4.

28 Dave Waetjen interview, 3/14/13, pg. 3.

29 Douglas Long interview, 3/19/13, pg 1.

website were even used by a lawyer who was arguing a personal injury case³⁰. John Cleckler, an endangered species specialist at the U.S. Fish and Wildlife Services, says he uses data from the website to get a better idea of the effect that various project proposals by the California Department of Transportation (known as Caltrans) might have on the local wildlife³¹. Even his own agency can use the informational help on roadkill statistics, he says. "We just don't have a lot of data," he says. The website also helps him track the status of endangered animals in the state. "I go to CROS daily to look through what's been reported," Clecker says, "to find out if there's any listed species."

Engineers and biologists at Caltrans have also used CROS data when they lack roadkill statistics of their own³². "I don't know if we'll ever have a database that is one hundred percent," says Suzy Melim, a senior Caltrans environmental planner. "It's very inconsistent." And though she has her doubts about the accuracy of CROS's data because "it's not scientifically collected," she still considers the website "a valuable piece of information."

But for some people, the benefits of CROS are less obvious. Online comments in response to a 2010 *San Francisco Chronicle* article about CROS drew some cranky responses from the public³³. Some people called roadkill "natural selection." One writer said the website had backwards priorities. "Yes, spend all your money saving animals while the homeless live in the streets," he wrote. "Save the animals, let the humans die. Makes total sense."

Shilling, of course, is not the first person to worry about roadkill. As far back as the early 1900's, the Berkeley-based field biologist Joseph Grinnell voiced his concern for the hapless victims of vehicles³⁴. Steinbeck wrote about the impact of transportation on wildlife in *The Grapes of Wrath*, and the canon of modern poetry is rife with allusions to roadkill (William Stafford's "Traveling Through The Dark," Elizabeth Bishop's "The Moose," Richard Eberhart's "On A Squirrel Crossing the Road in Autumn in New England," George Szirtes' "Inuit," Bruce Snyder's "The Afterlife of Roadkill," and Gary Snyder's "The Dead By The Side of the Road.")

Grassroots organizations and communities have also rallied around the issue of dead animals on the roadside for a while, Melim says. "The issue goes back a long ways," she says. For example, she's seen records from the California Department of Fish and Game, dating back to the 60s and 70s, asking various agencies to collect information on roadkill³⁵.

But roadkill is tricky cause to take on. Shilling describes it as a frustrating, protracted process, which is made all the more complicated by the fact that every agency he must contend with has different priorities and agendas. "We don't agree about the processes of how something should be resolved," he says. "So you've got this conflict, this gulf, all the time."

30 Dean Mermell interview, 3/23/13.

31 John Cleckler interview, 3/19/13, pg 2.

32 Suzy Melim interview, 4/18/13, pg 2.

33 "Saving Deer from 1-280 Slaughter," *The San Francisco Chronicle*, <http://www.sfgate.com/bayarea/article/Saving-deer-from-I-280-slaughter-3745285.php>.

34 <http://www.wildlifecrossing.net/california/>.

35 Melim interview, 4/18/13, pg 1.

Shilling grew up in New Providence, the most populated island in the Bahamas, in a conventional and unreligious household³⁶. His parents, both teachers at the local high school, left the U.S. and moved to the island before Shilling and his younger brother were born. The Shillings lived outside Nassau, the country's capital city, in a bucolic neighborhood less than a mile from the beach. Their cinderblock house was surrounded by a low scrub forest of oak and casuarinas trees and was bordered by an inlet that led to the ocean.

Shilling and his brother spent most of their time outdoors in shorts and flip-flops. They hiked and swam and climbed rocks, but Shilling's favorite activity was spear fishing. He would often drag his family's boat over to the inlet, sail out to sea, and spend hours hunting and observing the marine life. His vocabulary was smattered with local words and phrases that he'd picked up from other students at school, such as the West African "oke" for "okay" and the popular insult, "You must be smell yourself," which meant, "You're arrogant."³⁷ His hair, naturally brown, was sun-streaked blonde and he let it grow long even then.

Both Shilling boys hated tending to the family's vegetable garden, which was one of their chores. Because both his father and brother cooked terrible meals, the cooking chore fell to Shilling and his mother. By the time he was 14, Shilling was cooking half of the family's meals, oftentimes using the fish he caught from spear fishing.

In the early 80s, Shilling and his family moved to Los Angeles when his parents were offered teaching positions at the University of Southern California. Since tuition was free for the children of faculty, Shilling attended USC for college. He was only 16.

Acclimating to the mainland was hard for Shilling. "I didn't know real basic stuff," he says. "It was quite hilarious." He didn't know how to drive or how to date. The warmest items of clothing he owned were two pairs of long pants.

After a while Shilling got the hang of things, though, and he eventually moved from downtown Los Angeles to Venice, closer to the beach. He finished his undergraduate studies in marine biology and by 25 had earned a PhD from USC in the same field. For his post-doctoral work, he relocated to Connecticut and then Oregon, where he studied the molecular basis of egg fertilization in sea urchins, starfish and frogs.

Though he had conducted tests on invertebrates back at USC, he had never before done such research on vertebrates. Unlike the former, which had to be killed in order to retrieve their eggs, the frogs were kept alive. But that provided little comfort to Shilling, who began to grapple with the morality of his work on the frogs. It pained him to think that the frogs would never experience life in the wild, but would instead spend the entirety of their short lives in glass tanks. "It was affecting me," he recalls, "and I didn't want to do that anymore."

So he quit. But he ran out of money, and when he was offered a research position at UC

36 Shilling interview, 3/7/13 (pg 2) and 3/14/13 (pg 7-8), for all of his biographical information.

37 "Diverse Language to the World," Letter to the Editor, *The San Francisco Chronicle*, December 27, 19967. <http://www.sfgate.com/default/article/LETTERS-TO-THE-EDITOR-2955104.php#page-2>.

Davis, he took it, even though it meant a return to “the frog stuff” he had escaped from in the first place. He muscled through it for a few more years, until the mid-90s, when he was offered a job in another department conducting research on how people use scientific information to make decisions.

To this day, the thought of animal testing still repulses Shilling, who says he avoids the part of campus where the testing laboratories are located. He’s been a vegetarian for two decades, and says he does not visit zoos or any other places where animals are in enclosures. As he puts it: “When I want to go to the food store, I don’t want to hang out in the meat section.”

After his stint in animal testing, Shilling’s research became more environmentally focused. He studied environmental policy, water sustainability, fish contamination, and watershed management, and did research for the United States Environmental Protection Agency, the California State Water Resources Control Board, the United States Forest Service, and the California Department of Water Resources.

By the early 2000’s, Shilling’s research had shifted to an emerging field in science called road ecology. Road ecology focuses on roads and transportation’s interactions with the environment, which can include everything from water and air to plants and wildlife³⁸. Because of his fascination with roadkill, Shilling’s started looking into the ways in which wild animals successfully, and unsuccessfully, cross roads—and the areas where this problem is greatest. Shilling has also taught undergraduate classes on road ecology and for the last year and a half has been working on a Caltrans-funded study on deer migration along Interstate 280 in San Mateo.

Shilling’s colleagues, and those that he’s worked with through CROS, say he’s fiercely passionate and staunchly loyal. He’s been described as someone who doesn’t mince words and someone who ruffles feathers, as well as someone who sticks to his principles and doesn’t kowtow to others.

“He’s important because he’s that link between the research that is going on with road ecology and the general public,” said Long. “In many ways, he’s almost a spokesmodel for road ecology and roadkill.”

In 1895, during his first year in office, James Budd, the 19th Governor of California, signed a bill creating the Bureau of Highways³⁹. Three commissioners were appointed and charged with the gargantuan task of assessing the state’s unevaluated hodgepodge of dirt and paved roads. With an Irish setter named Maje in tow, the commissioners clamored aboard a horse-drawn buckboard and traveled more than 16,500 miles throughout the state, taking notes on panoply of details in each county⁴⁰.

38 <http://roadecology.ucdavis.edu>.

39 “One Hundred Years of Progress” by Raymond Forsyth and Joseph Hagwood.

40 Ibid.

A little over a year later, they turned in their first annual report to the governor. “The condition of highways in California today is the result of generations of neglect and apathy,” they wrote. Their recommendation was to start anew and replace the existing roads with a statewide system of highways that also included separate routes⁴¹.

Throughout the 20th century, a number of transportation agencies were created, merged, spliced and dissolved. During their reigns, construction prospered. By the time Caltrans was created in 1972, most of the state’s landmark freeways and bridges had already been built⁴².

But though this was a boon for travelers, it was a hazard for the animals that lost homes and habitats to the construction of the roads and now had to cross perilous territory to follow familiar routes or access resources. It wasn’t until the early 70s that new laws began establishing that transportation projects include provisions for wildlife. The most notable of these were the National Environmental Policy Act (NEPA), the law that created Environmental Impact Reports, and the California Environmental Quality Act (CEQA). As a result, every proposed construction project needs to address the environmental impacts that it might create, especially with regard to the interference it may have on the movement of any native or migratory species in the area⁴³.

New roads are rarely built these days, so most construction involves repairing, reinforcing, expanding or otherwise modifying pre-existing structures⁴⁴. These older roads are still subject to NEPA and CEQA, though, and coming up with roadkill mitigation solutions can be tricky, Cleckler says. Since the road itself will likely remain unchanged, he tries to find solutions that work around the structure. If there is a culvert, a drainage pipe, or a railroad-crossing tunnel under a road, Cleckler might propose widening the passage so larger species can also use it as a safer alternative to crossing the road. Fencing is another option, to keep animals off the highway or as a funnel to direct them to culverts or other under crossings.

Because roadkill mitigation projects involve modifying, adding to, or otherwise changing the roads, permission to actually implement them must come from the state’s Department of Transportation, which will then takeover the project.⁴⁵ Comparable agencies in other states, like the Arizona Department of Transportation, are known for their progressive, innovative roadkill mitigation projects, while others, such as Caltrans, are lambasted by biologists and wildlife activists for not doing more⁴⁶. “There’s just not a lot of precedents for dealing with road effects by Caltrans,” Cleckler said. “There are some things that have been done in the state, but it’s really slow to come about, and it’s just not part of the mindset.”

Conflicting priorities are to blame for this: biologists and ecologists, like Cleckler and Shilling, versus you have an engineer-staffed transportation agency, like Caltrans. Though individual Caltrans employees might worry about the safety of wildlife, the agency as a whole has different concerns. “Our purpose is to maintain movement of goods and services and people

41 Ibid.

42 Ibid.

43 Ibid.

44 Cleckler interview, pg 1, and Melim interview, pg 2.

45 Melim and Ostrum interviews.

46 Long, Cleckler, and Shilling interviews.

through the state of California,” Melim says. “I mean, that is why we exist.”

Shilling and Caltrans do, however, agree about one priority: safety. “Safety is our absolute number one responsibility,” Melim says. “I think you can ask anyone at Caltrans and they’ll tell you that.”

What Shilling has realized is that when animals try to cross the road, they are not only risking their safety, but the safety of drivers, as well. “If you have a bunch of wildlife and no way for them to get across, they’ll go over the top, they’ll get hit, the car is damaged and the person is potentially injured,” he says. “It is legitimately a drivers’ safety issue.”

There’s a special name for this type of traffic mishap: wildlife vehicle collisions, or WVC’s for short. According to a 2008 report from the US Department of Transportation, anywhere from 725,000 to 1.5 million collisions between wildlife and vehicles occur in the U.S. each year⁴⁷. Today, about five percent of all reported motor vehicle collisions are caused by wildlife, the report says, and over 26,000 drivers are injured this way each year⁴⁸. In California alone, more than 1,800 wildlife-vehicle collisions and \$1 billion in related property damage were reported in 2010, according to the California Highway Patrol⁴⁹.

WVCs can be costly—there’s medical treatment, damage to vehicles, assistance from emergency services or law enforcement, and road repairs⁵⁰— and drivers injured in such accidents have started suing their state transportation departments for damages. Figures from the 2008 US Department of Transportation report estimate the total annual cost of wildlife vehicle collisions at \$8,388,000,000⁵¹. There is still debate over whether the agencies should be held accountable for these collisions, and not every court has decided in favor of the drivers, but since the early 2000s, suing for damages has become increasingly common. In the fall of 2012 alone, both Caltrans⁵² and the Florida Department of Transportation⁵³ were involved in suits from drivers who had been injured by animals (a deer and an endangered Florida panther, respectively) in the road.

These cases also have the potential of costing state transportation agencies millions of dollars in litigation. In a 2003 lawsuit against the Arizona Department of Transportation, injured members of one family were awarded \$3 million in damages because the ADOT, the court decided, had been negligent by not maintaining the fence along Interstate-40 where their collision with an elk had occurred⁵⁴. In 2009, Caltrans also lost an \$8.6 million case that involved a collision between a motorcyclist and a wild boar on Highway 1 near Carmel. The jury accepted the argument that Caltrans was responsible for the accident because department officials had prior knowledge of wild boar crossings on that stretch of highway, but

47 Ibid.

48 Ibid

49 Caltrans news release, 9/19/12, <http://www.dot.ca.gov/hq/paffairs/news/pressrel/12pr119.htm>.

50 “Wildlife Vehicle Collision Reduction Study—Report To Congress.”

51 Ibid.

52 Mermell interview and Shilling interview, 3/14/13 (pg 1).

53 Huffington Post, 9/17/12, http://www.huffingtonpost.com/2012/09/17/kenneth-nolan-sues-fdot-hits-panther_n_1890093.html.

54 Booth v State of Arizona, http://www.ecoinst.org/files/Booth_v_State_of_Arizona_appeal.pdf/.

did nothing to make the roads safer⁵⁵.

“It’s this huge issue,” Shilling says. “And I think there’s a distinct possibility of a [personal injury] class action lawsuit.” If Caltrans wants to prevent such a lawsuit, as well as future wildlife-vehicle collisions, then all officials have to do is keep animals off the roads, he says. And keeping animals off the road is essentially the same thing as preventing roadkill. In other words, the very solutions that Shilling and Cleckler propose to keep animals safe when crossing the highway (such as fencing, under crossings, and bridges) can be used to keep drivers safe, as well.

“It’s an investment,” Shilling says. “There are a lot of social and economic benefits to what’s often thought of as a wildlife concern project.”

But, of course, there is no such thing as a foolproof solution. Even if Caltrans were to invest hundreds of millions of dollars on roadkill mitigation projects by installing miles of wildlife fencing along a highway or radar activated warning systems that flash lights when animals are near a road, problems would persist. Fencing might keep animals safe from vehicles, but it certainly won’t help them get across the road. Wildlife bridges and under crossings might be a safer alternative to crossing the road, but who’s to say the animals will actually use the structures?

In other words, there are still no easy solutions for keeping animals off the road. “If it was easy, it would be done already,” Melim says. “That would have just been a no-brainer.”

Shilling’s office, on the eastside of the UC Davis campus, is on the top floor of a squat Pepto-Bismol pink building called Wickson Hall. It’s a small, narrow space with high ceilings and a skylight and very little free space. There are three desks and a filing cabinet, a small couch and bookshelf, and dozens of cardboard tubes containing posters of maps from Shilling’s past studies. The hallway walls outside his office are decorated with maps, and on the wall behind his desk, next to this year’s Shilling family calendar, there’s a map, too. The maps differ in resemblance and focus on a range of highways and roads throughout California, but they have at least one thing in common: they’re pockmarked with tiny dots.

Each dot marks the location of one roadkilled animal, Shilling says. And the more dots there are in an area, the more likely it is to be chosen as the site of a roadkill mitigation project. Perhaps Caltrans will put in a few miles of fence along that stretch of highway or maybe they’ll lower the speed limit and put up wildlife crossing signs.

Either way, Shilling feels that the approach is limiting. “If you’ve got a thousand cuts, you want to figure out where the cuts are coming from,” he says, “not try to find a thousand band-aids.” Because roadkill is a systemic problem, a handful of mitigation projects on a

⁵⁵ Larry Biegel phone interview notes, 4/1/13; *San Francisco Chronicle*, 2/23/04; *The Carmel Pine Cone*, 4/3/09.

few dozen stretches of state road are not enough, he says. Rather than wait for roadkill or wildlife vehicle collisions to become a problem, why not put in fences or wildlife crossings to prevent them in the first place?

In 2006, a report written by representatives from eight Federal agencies referenced this same trend. "Positive opportunities can be permanently lost," they wrote, "when the traditional, project-specific approach to avoiding, minimizing, reducing or compensating impacts is used.⁵⁶" Their solution to this problem, which they call an "ecosystem approach," is for state transportation agencies to think more about the environmental benefits of their projects, collaborate with others, care less about their transportation goals and not skimp on money.

Unfortunately, neither Shilling, nor the report, has any power to actually enforce these ideas. All they can do is encourage state transportation agencies to approach mitigation projects from this new angle. But since broader solutions, like additional fencing on highways or more bridges for wildlife, can cost millions of dollars, this is not easy to do. After all, transportation, not nature, is still these agencies' first priorities.

"It comes down to money," Shilling says. "If you say the problem is here and it costs this much and it's affordable, it's very attractive. If you say the problem could be anywhere and it's expensive and unpredictable, that's not attractive at all."

Now, whenever Shilling works on a mitigation project, he tries to think of ways to reduce costs so that the project can be built over larger distances. For instance, in his current Interstate 280 project, he will recommend that Caltrans repair and refurbish the already existing fences that line the highway by patching up holes or adding a few more feet of height. Ideally, the money saved from putting in new fences would go towards extending the length of the project, which only spans about 15 miles of the highway.

Other cost-saving solutions that he proposes include widening, cleaning and blocking off human access to culverts, drainage pipes, and railroad crossing tunnels underneath highways. "There are a lot of existing structures out there that are being used to varying degrees," Shilling said. "So we have a lot of those structures already." More frequent roadkill clean up by Caltrans maintenance crews would also help, he says, because the freshly-killed animals attract scavengers, like possums and predatory birds, which end up getting run over while feasting on their predecessors.

Solutions run the gamut from those designed for a specific species to those designed with a more general purpose. There are gaps in the median barrier on a highway in San Diego to prevent animals from getting trapped while crossing the road⁵⁷. There are break-the-

56 "Eco-Logical: An Ecosystem Approach To Developing Infrastructure Projects," April 2006, <http://www.environment.fhwa.dot.gov/ecological/ecological.pdf>.

57 "Critter Crossings," Federal Highway Administration, Office of Planning, Environment, and Realty. http://www.fhwa.dot.gov/environment/critter_crossings/main.cfm.

beam sensors that trigger warning lights in Yellowstone National Park⁵⁸. Agencies in Massachusetts, Montana, Connecticut, Oregon, California and Arizona have built tortoise underpasses and fish ladders, as well as salamander tunnels and amphibian walls⁵⁹. Wyoming recently constructed six under crossings and two bridges for local mule deer, moose, elk and pronghorn antelope⁶⁰, and the Washington State Department of Transportation is building a \$2.9 million underpass for deer, elk, cougars and black bears near Mount Rainier⁶¹. In a handful of states, including California, local roads are also closed for a few weeks every year to ensure safe passage for the species who cross them during their mating seasons⁶².

But progress, for the most part, is slow. Many solutions are still being researched and data on roadkill is still greatly lacking. Shilling describes it as a “long slog through data and engineers and resistance,” and yet, for all his frustrations, he knows that he will never give up his crusade to end roadkill. “Once you realize what’s going on, you can *never* give up,” he says. “As a person with any kind of moral fiber, it’s not possible.”

58 “Advances in Wildlife Crossings” by Mary Gray, Sept/Oct 2009, Vol. 73 No. 2, *Public Roads*.
<http://www.fhwa.dot.gov/publications/publicroads/09septoct/03.cfm>.

59 “Critter Crossings”

60 “Fastest US Land Animal Gets Help Crossing Wyoming Highway,” US News, 10/16/12,
<http://usnews.nbcnews.com/news/2012/10/16/14486484-fastest-us-land-animal-the-pronghorn-gets-help-crossing-wyoming-highway>.

61 “Wildlife Crossing On Highway 97,” *The Register Guard*, 4/14/13,
<http://projects.registerguard.com/apf/wash/wa-wildlife-crossings/>.

62 “Critter Crossings.”