PUBLIC COMMENT (Agenda Item 8c)

UNIVERSITY OF CALIFORNIA, DAVIS

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DEPARTMENT OF ENVIRONMENTAL SCIENCE AND POLICY
ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616-8576

June 23, 2020

MTC Commissioners
Metropolitan Transportation Committee
375 Beale Street
San Francisco, CA 94105

Dear Commissioners:

Subject: Agenda Item 8c– Allocation for Valley Link Project Advancement and Environmental Review and Mitigation for Transportation Wildlife Crossings and Contiguous Land Corridors

I am writing on behalf of myself to oppose the approval of the allocation of the $46.8 million in AB 1171 Bridge Toll funds for the Tri-Valley – San Joaquin Valley Regional Rail Authority (Authority) for further advancement of the Valley Link project. This action would allow for the completion of 30% design, federal environmental review documents, required Caltrans' documentation and other critical reports and environmental review studies needed to expeditiously advance rail connectivity to the Tri-Valley and Northern San Joaquin County. In my professional opinion, it would also cement a combination of alignment and station location that would irreparably harm the ecosystems and wildlife of the Diablo Range and East Bay.

I am co-director of the Road Ecology Center at UC Davis and have ~20 years' experience in field and geographic information system analysis and modeling related to wildlife connectivity and impacts of human actions on connectivity. I have attached my curriculum vitae (Appendix B) which provides more detail about my expertise. My research center is the oldest and one of the largest research centers specializing in studies of how transportation systems impact ecosystems, including wildlife, aquatic systems, shorelines, and human communities. I am also Lead Organizer of the International Conference on Ecology and Transportation, the last conference of which was in Sacramento (2019) and featured HSR Chief Executive Officer Brian Kelly as one of our plenary speakers. I am co-chair of the Animal-Vehicle Conflict Sub-Committee of the Transportation Research Board (National Academies of Science Engineering and Medicine), a national body that provides guidance on how to study and resolve animal-vehicle conflicts, such as between wildlife and trains. I am therefore expert in the areas I comment on below, including carrying out field and computational research on noise and light impacts, impacts of infrastructure on wildlife connectivity, and mitigation of these impacts.

This light rail project could theoretically support greenhouse gas reduction, enhance public safety, and reduce highway travel by commuters. It could also theoretically alleviate the fragmentation impacts from I-580 through funding development of transportation wildlife under or over-crossings through mitigation actions. However, it is important to recognize that the current proposed alignment and Greenville Road rail station location will negatively impact wildlife movement and increase the barrier to wildlife movement along the I-580 corridor and add a whole new barrier. If the current preliminary environmental analysis sets the locations of station and alignment in concrete in the design phase, I am concerned that it will be difficult if not impossible to achieve design changes later. I would like to work with the MTC regarding the rail alignment and station location to ensure it does not cut off wildlife movement through the southern portion of the Diablo Range. Although this would delay the project, it would ensure that the benefits of the light rail project would not be offset by the harm caused to regional wildlife.

I have included details about possible impacts of the project below and welcome your questions and feedback.

Sincerely,

Fraser Shilling, Ph.D.
Department of Environmental Science & Policy
University of California, Davis
fmshilling@ucdavis.edu; 530-752-7859
(for identification purposes)

Summary of Comments

There are a variety of mammal, amphibian, reptile, and bird species that are sensitive to key aspects of anthropogenic noise and vibration, including loudness, sound frequency, loudness at certain frequencies, stochastic vs. chronic noise, and ground vibration. Train noise originates from: "propulsion or machinery noise; mechanical noise resulting from wheel-rail interactions; and/or guideway vibrations aerodynamic noise resulting from airflow moving past the train, including the pantograph" (FRA 2012). Because of the speed of high-speed rail, the speed at which loud noise appears can be considered a sudden, or stochastic noise, while regular occurrence of the noise could contribute to a chronic noise condition. Stochastic and chronic noise from anthropogenic sources can cause stress, habitat avoidance, nest abandonment, reduced foraging, infrastructure avoidance, and fear responses (e.g., flight). This means that if there is natural habitat near an area with train noise disturbance, wildlife (e.g., mammals and birds) will avoid inhabiting, avoid moving through an area, or fail to flourish in these areas, decreasing the ecosystem value of the area. The degree of impact depends on noise level entering the habitat area, propagation of noise through the area, and sensitivity of the particular species.

Background and Literature Review

The proximate impacts of anthropogenic noise on wildlife and birds are disturbance of normal activity, masking of communication (i.e., for territoriality, breeding and predation-avoidance), and very high levels, harm to hearing (Francis and Barber, 2013). Impacts from trains, including infrastructure and operation impacts, are reviewed in Barrientos et al. (2019) and include habitat and population fragmentation, stochastic and chronic noise and light disturbance.

Vehicle (including train) noise is measured as sound pressure levels using a logarithmic decibel scale. The range of sound frequencies that wildlife is sensitive to is similar to the range of human audibility (FHWA, 2004), which is usually measured as dB(A), a weighting scheme based on human audibility, or Leq, the equivalent continuous sound level. Anthropogenic and vehicle noise can affect wildlife communication (Parris and Schneider 2009; Owens 2013), habitat occupancy (Goodwin and Chriver 2010), vigilance (Shannon et al. 2014; Li et al. 2009), predation efficiency (Siemers and Schaub 2011), predator avoidance behavior (Meillere et al. 2015) and various other types of behavior and likelihood of occupancy (reviews: Barber et al., 2011; Francis and Barber 2013). These effects vary among wildlife species, leading to differential responses within wildlife communities (Francis and Barber 2013), which could affect trophic and other interactions. Recently, McClure et al. (2015) and Ware et al. (2015) experimentally introduced vehicle noise into roadless areas to generate what is known as a "phantom road", and demonstrated behavioral and other effects on migrating birds. This was the first direct evidence of vehicle noise by itself being the cause of disturbance for birds. Herpetofauna (amphibians and reptiles) are also vulnerable to anthropogenic noise, primarily low-frequency vibrations, which can cause harmful behaviors, such as emerging from burrows during dry conditions. These effects may be experienced at noise level of ~40 dBA and higher (Barber et al., 2011).

Traffic related light (at night) disturbance has been shown to affect animal behavior and occupancy (Davies et al., 2013) and have cascading ecological and biodiversity impacts (Longcore and Rich, 2004; Newport et al., 2014). For example, elk use wildlife underpass structures where traffic is absent and at higher-continuous traffic volumes, but less frequently at intermediate-occasional traffic volumes (Gagnon et al., 2007). Transportation-sourced artificial light is likely to vary across many orders of magnitude across different vehicle types and volumes, and attenuate differently within natural landscapes depending on the surrounding habitat. Light dissipation with distance is superficially similar to sound decay, but in real environments may result in different outcomes. Light intensity decreases with the inverse square of distance, just as sound does. Light intensity is measured as either radiance or irradiance with associated spectral properties. Similar to the case with noise, the expected transmission and decay of light with distance is usually not the actual distance as light can be absorbed and reflected by environmental elements (ground, vegetation, structures). The actual distance of light propagation to particular levels defines the light impacts on species. This zone can be mapped using either light propagation models or field light measurements, or both.

Thresholds

There have been proposed thresholds for significant noise impacts on wildlife, with 55 dBA being the most commonly-cited (Dooling and Popper, 2007). This is consistent and more conservative that Barber et al. (2011) and Shannon et al. (2016), who showed that wildlife disturbance by anthropogenic noise started at sound levels of 40-50 dBA. For diverse wildlife approach and crossing any infrastructure, noise and light intensities must be below thresholds of sensitivity for wildlife species, or they will refuse to approach and cross. This will absolutely result in fragmentation of wildlife populations, imperiling species in isolated areas.

Methods for Determining Impacts

Sensitive Receptors

There are at least 69 species of bird, 24 species of ground-dwelling and aerial (bat) mammal species, 15 species of herpetofauna, previously observed in the Diablo Range near the rail project. Recorded species occurrences from 5 databases are shown in Figures 3 and 4 and listed in Appendix A. The data were from the California Roadkill Observation System (https://wildlifecrossing.net/california), the California Highway Incident Processing System (https://roadecology.ucdavis.edu/chips), the California Natural Diversity Database (https://wildlife.ca.gov/data/cnddb), HerpMapper (https://www.herpmapper.org/), and the federal Biodiversity in Service of Our Nation (https://bison.usgs.gov/#home) database. Habitat types include: riparian, blue oak woodland, grassland, and coastal sage scrub. Sound levels above 45 dBA may impact presence and habitat value for herpetofauna, songbirds, and various mammals (Francis and Barber, 2013; Barber et al., 2011).

Noise Impact

Rate of noise decay was estimated using an online calculator (http://hyperphysics.phy-astr.gsu.edu/hbase/Acoustic/isprob2.html; Georgia State University, Department of Physics and Astronomy). The calculated change in sound level is based on the inverse square method. Calculated sound levels at different distances from the sound source (rail-line) were based on a starting noise level of 93 dBA at 25 m (DEIR). The speed of the train, acceleration/deceleration, number of cars, track condition, surrounding habitat, distance from the train, and climate conditions will all contribute to actual noise levels. The level and importance of impact was determined using the guidance from FRA (2012, Figure 2) and the scientific literature.

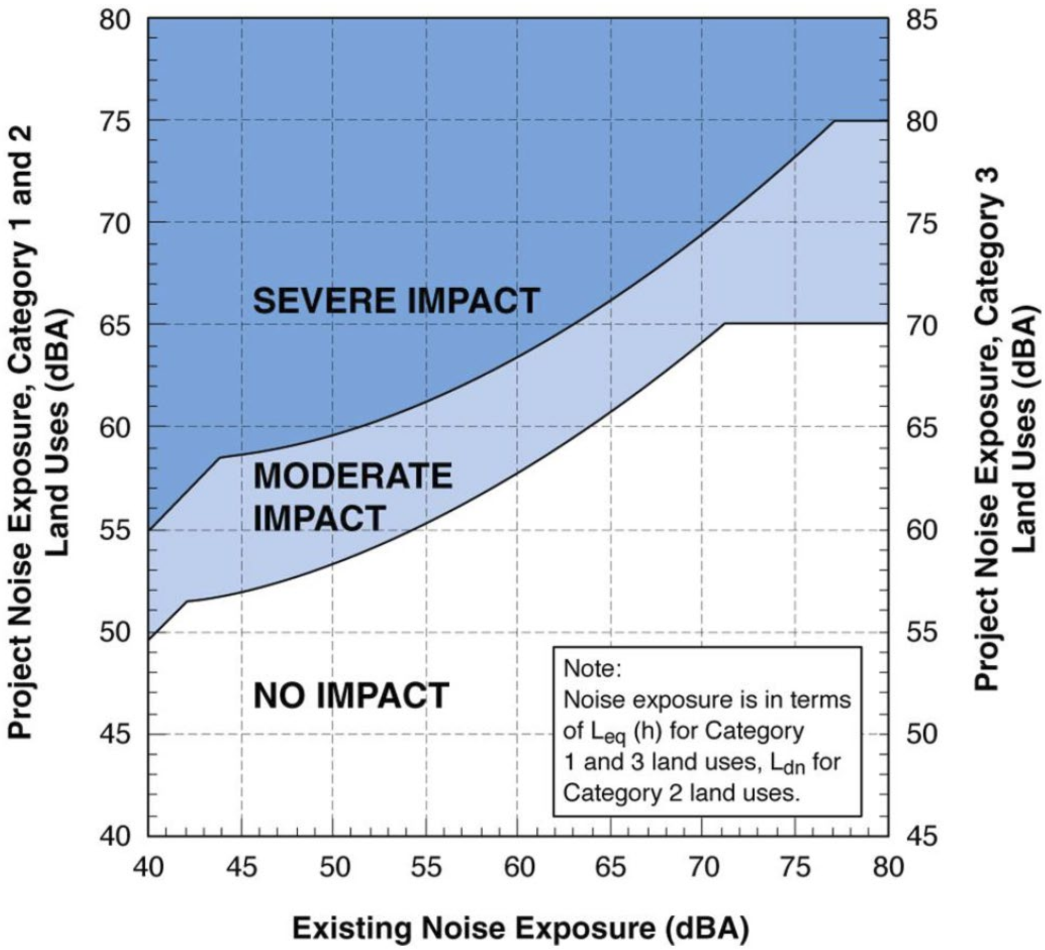

Figure 1. Potential train noise impact relative to existing noise levels (Figure 3.1, "Noise Impact Criteria for High-Speed Rail Projects", FRA, 2012)

<u>Results</u>

Sensitive Receptors

The area around the proposed Valley Link alignment through the Diablo Range where train noise impacts are of concern includes habitat (oak woodland and grassland,) appropriate for 15 amphibian/reptile species, and 24 mammal species, including 5 bat species. Other than low-intensity grazing and wind-power generation, there is very little anthropogenic disturbance of this area and it is likely that the natural habitat areas support, or could support, most or all of these species.

Wildlife are likely to be responding to absolute the noise/light intensity, relative (to ambient) noise/light intensity and the rate of change in intensity. The literature (e.g., Barrientos et al. (2019) has many examples of wildlife sensitivity to anthropogenic noise and light. The relative impact is displayed well in Figure 1 (FRA, 2012), which shows how impact of train noise on different land-uses varies with the existing condition, where the quieter the existing condition (e.g., native habitat) the lower noise level is needed to cause impacts.

Estimate of Theoretical Train Noise Propagation

Assuming a starting noise level of 93 dBA at 25 m (FRA 2012), a sound level of 65 dBA could be expected at ~600 m from the sound source (red arrow, Figure 2), a sound level of 55 dBA at 2000 m from the sound source (orange arrow, Figure 2), and a sound level of 45 dBA at 6200 m from the sound source (green arrow, Figure 2).

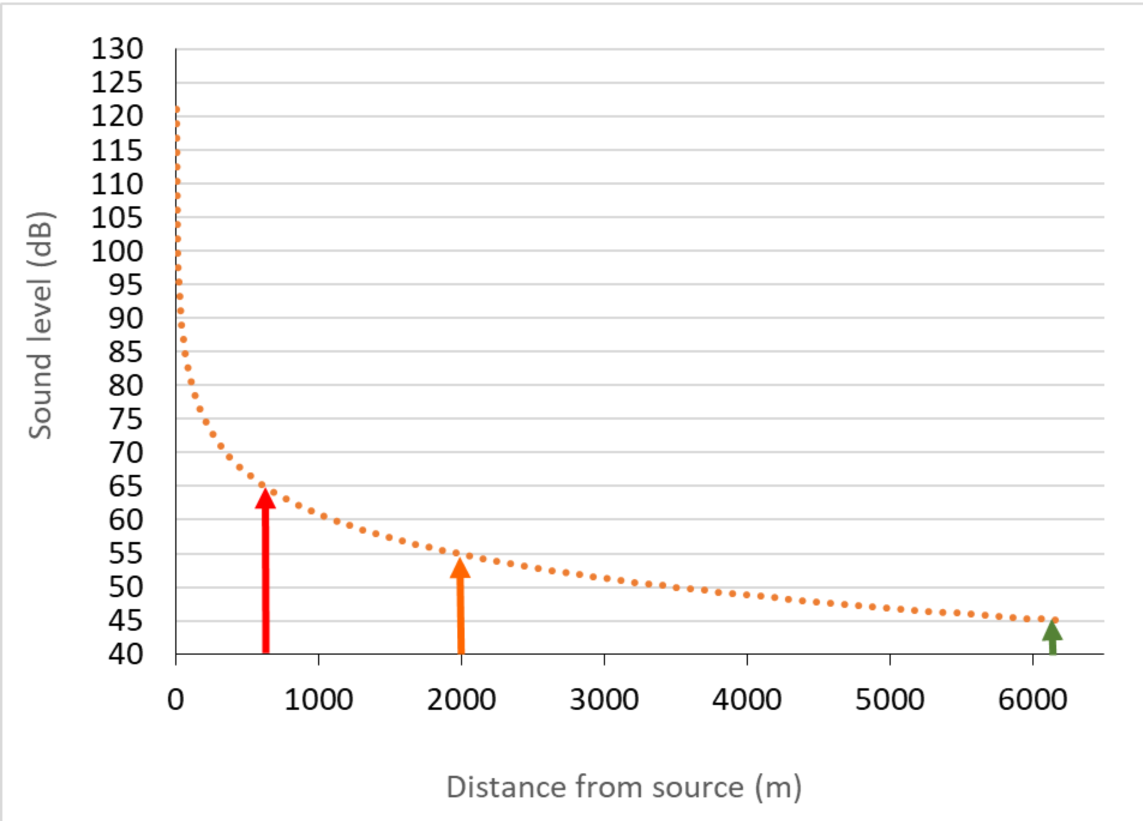

Figure 2. Rate of decay of vehicle noise with distance, starting at the suggested noise level at 25 m (93 dBA, FRA 2012). The red arrow indicates the distance (~600 m) where a sound level of 65 dBA would be expected. The orange arrow indicates the distance (~2000 m) where a sound level of 55 dBA would be expected. The green arrow indicates the distance (~6200 m) where a sound level of 45 dBA would be expected.

Noise Impacted Areas

Actual noise and light levels and rate of change in levels from train travel will depend on topography, habitat type, climate conditions, train acceleration or deceleration, number of cars, and train speed. Similarly, impacts of train noise and light will depend on the intensity, rate of change, and chronic exposure. No meaningful noise analysis or model was used in the existing environmental analysis. Assessing potential impacts to wildlife from noise should be based upon readily-available models in GIS that take into account topography, climate, vegetation, starting noise level and other characteristics (e.g., Barber et al., 2011).

It is clear that for the distances of possible (<6,200 m) and likely (<2,000 m) noise impacts, a large are of habitat over the Altamont Pass will be affected by the train corridor. For small mammals and herpetofauna, these distances – several kilometers, are beyond normal or even exceptional movement distances. This means that even occasional train-related aversion impacts will keep individuals of species of small mammals and herpetofauna from approaching the alignment and enjoying available crossings. For medium and large sized mammals, the periodic high intensity noise and light from trains several times per day or night will have two types of impacts –wildlife aversion to occupying an area within one kilometer of the rail alignment and flight responses from wildlife that approach the alignment if a train is running. It is possible that sensitive species, which includes most of those listed in this letter, will never approach the alignment and use the grade, or crossing structures to cross the alignment. This would isolate wildlife populations in the Diablo Range north of the alignment, resulting in possibility of local extinctions of various species and loss of healthy ecosystem function.

Ground vibration is disturbing to amphibians and other ground-dwelling vertebrates. It can cause animals to leave burrows, exposing them to cold, predation and other harm. Ground vibration has been cited by Washington State Department of Transportation as a primary reason that amphibians in mitigation wetlands fail to use wildlife crossing structures under Interstate-90. This is because they won't approach or live in areas near the infrastructure. The consequences for amphibians and other ground-dwelling organisms could be that they become genetically and otherwise isolated from other populations of the species. Just as train noise would spread across surrounding landscapes, light from the train at night would similarly propagate across surrounding habitat areas and disturb resident and moving wildlife (Longcore and Rich, 2004).

Mitigation

Evaluating and proposing noise abatement strategies to benefit residential areas and wildlife is not new in transportation (e.g., Barrett 1996; Zimmer and Buffington, 1997; Baaj et al., 2001). There is a wide variety of structures intending to mitigate traffic noise and light disturbance of sensitive receptors (e.g., residential areas) near roadways. The most commonly used are walls adjacent to the right-of-way, varying in their materials (e.g., plastic, concrete) and effectiveness. Although these may effectively shield adjacent areas from light (absent stray reflections), noise is notoriously harder to control because of noise reflection, refraction, and vibration of the noise wall itself.

It is unlikely that most wildlife species will approach the rail alignment because of the noise, light and ground vibration. Constructed wildlife crossings are often seen as suitable and adequate mitigation for impacts to wildlife movement. However, due to train noise and light intensities being greatest at the approaches and opening of these structures, it is possible that sensitive species will not approach or use these crossing structures at a frequency sufficient to reduce genetic, population and ecosystem impacts from this barrier effect. My previous research demonstrated that at the lower noise and light intensities associated with crossings under highways, ~40% of wildlife species avoided the structures, an effect that was related to traffic volumes (Shilling et al., 2020).

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Appendix A1. Herpetofauna and mammal species in vicinity of HSR alignment and potentially isolated by alignment.

Group	Species Name
Reptiles	Blunt-nosed leopard lizard
	Coast horned lizard
	Gopher snake
	Ringneck snake
	San Joaquin coahcwhip
	Western pond turtle
	Western racer
	Western skink
Amphibians	California chorus frog
	California red-legged frog
	California tiger salamander
	Common kingsnake
	Foothill yellow-legged frog
	Western spadefoot toad
	Western toad
Mammals (ground)	American badger
	Black-tailed jackrabbit
	Black bear
	Bobcat
	Brush rabbit
	California ground squirrel
	Coyote
	Desert cottontail
	Elk
	Gray fox
	Mountain lion
	Mule deer
	Raccoon
	Red fox
	San Francisco dusky-footed woodrat
	San Joaquin kit fox
	San Joaquin pocket mouse
	Santa Cruz kangaroo rat
	Striped skunk
Mammals (bats)	Hoary bat
	Pallid bat

	Townsend's big-eared bat
	Western mastiff bat
	Yuma myotis

Appendix A2. Native bird species, including species of special concern or listing (in **bold**), observed in the inner coast range.

Acorn Woodpecker
American Goldfinch
American Kestrel
Anna’s Hummingbird
Ash-throated Flycatcher
Bewick’s Wren
Black Phoebe
Black-headed Grosbeak
Brewer’s Blackbird
Brown-headed Cowbird
Bullock's Oriole
Bushtit
California Quail
California Thrasher
California Towhee
Cassin's Kingbird
Chipping Sparrow
Cliff Swallow
Common Raven
Cooper’s Hawk
Dark-eyed Junco
Golden Eagle
Golden-crowned Sparrow
Grasshopper Sparrow
House Finch
Killdeer
Lark Sparrow
Lazuli Bunting
Lesser Goldfinch
Lewis’ Woodpecker
Loggerhead Shrike
Mourning Dove
Northern Flicker
Northern Harrier
Northern Mockingbird
Nuttall's Woodpecker
Oak Titmouse
Orange-crowned Warbler
Pacific-slope Flycatcher
Phainopepla
Prairie Falcon
Red-tailed Hawk
Red-winged Blackbird
Rock Wren
Ruby-crowned Kinglet
Rufous Hummingbird
Savannah Sparrow
Say's Phoebe
Sharp-shinned Hawk
Spotted Towhee
Steller’s Jay
Turkey Vulture
Violet-green Swallow
Warbling Vireo
Western Bluebird
Western Kingbird
Western Meadowlark
Western Scrub-Jay
Western Tanager
Western Wood-Pewee
White-breasted Nuthatch
White-crowned Sparrow
White-tailed Kite
Willow Flycatcher
Wilson’s Warbler
Wrentit
Yellow Warbler
Yellow-billed Magpie
Yellow-rumped Warbler

FRASER M. SHILLING, Ph.D.

CONTACT

Department of Environmental Science and Policy, University of California, Davis, CA 95616

Phone: (530) 752-7859; fax: (530) 752-3350; fmshilling@ucdavis.edu

RESEARCH INTERESTS

Mr. Shilling's current work focuses on three research areas: landscape and transportation ecology, indicators of ecosystem performance, and wildlife ecology. He collaborates with social scientists, natural scientists, and humanities professors in inter-disciplinary investigations of land-use, water policy, and transportation policy implications. Mr. Shilling is co-Director of the UC Davis Road Ecology Center and the China-US Land Ecology Center and a research scientist in the Department of Environmental Science and Policy. He practices at the interface between science and policy, requiring that he collaborate and interact with regulatory agencies, resource management agencies, community organizations, and academics of many disciplines

EDUCATION

Ph.D. in Biological Sciences, University of Southern California, 1991
B.Sc. in Biological Sciences, University of Southern California, 1986

PROFESSIONAL RESEARCH EXPERIENCE

2017-present	Co-Director, China-US Land Ecology Center, UC Davis
2015-present	Academic Coordinator II, Department of Environmental Science and Policy
2004-present	Co-Director, UC Davis Road Ecology Center
2000-2014	Staff Researcher, Department of Environmental Science and Policy
1998-2000	Research Coordinator, Sierra Nevada Network for Education and Research, UC Center for Water and Wildlands Resources
1995-1998	Postdoctoral Fellow, Division of Biological Sciences and the Institute of Theoretical Dynamics, University of California, Davis (NIH and ITD-funded)
1991-1994	Postdoctoral Fellow, University of Connecticut (NIH-funded)

SUPERVISORY AND TEACHING EXPERIENCE

Course Director	"General Ecology" (4-unit undergraduate class) at the Thai Nguyen University for Agriculture and Forestry, Vietnam, Fall, 2013. "Social Surveying Methods" (2 & 4-unit graduate course), for CRD and GGG methods credit, UC Davis, Spring, 2011. "Improving Community and Landscape Connectivity" (2-unit graduate seminar), Transportation Studies Program, UC Davis, Fall, 2009. "Road Ecology: Road Effect Zone" (2-unit graduate seminar), Transportation Studies Program, UC Davis, Winter, 2008. "Road Ecology" (4-unit graduate course), Transportation

	Studies Program, UC Davis, Spring, 2007. "Modeling Reserve Design" (2-unit graduate seminar) Department of Environmental Science and Policy, UC Davis, 1995-96.
Guest Lecturer	"California Indian Environmental Policy II" (NAS 162), UC Davis, 2014; "Water Policy", UC Davis, 2005, 2006, 2007, 2008, 2010.
Scientific Leadership	Lead Organizer for the International Conference on Ecology and transportation, (September, 2019). Coordinated the 3rd California Connectivity Forum (2012). Designed and co-coordinated the California Sustainability Indicators Symposium (2011) in Sacramento and Los Angeles. Designed and coordinated the 2nd California Connectivity Forum (2010). Co-designed and coordinated the Best Science in Connectivity Workshop sponsored by the Wildlife Conservation Society (2009). Co-designed and coordinated the California Connectivity Forum (2008). Designed and directed 3 Road Ecology Center workshops on road effects; integrated land-use, conservation, and transportation planning; and habitat connectivity. Designed and conducted a 2-day workshop for Washington Department of Natural Resources on Developing Decision-Support Systems for Forested Landscapes. Designed and directed 5 regional workshops on watershed assessment throughout California (2004-2006). Organized California's first Road Ecology Conference (1999).

ACADEMIC COMMUNITY AND PUBLIC SERVICE

Journal Editor: Korean Journal of Civil Engineering (former Associate Editor)

Journal Reviewer: Ecological Indicators, Landscape Ecology, Conservation Biology, Biological Conservation, Environmental Management, Landscape and Urban Planning, Transportation Research Record, Ecoscience, Environmental Modeling and Software, Ecological Engineering, Land Degradation and Development, Environmental Science and Pollution Research, Open Urban Studies and Demography Journal, Biological Bulletin (past reviewer), Developmental Biology (past reviewer)

Transportation Research Board: Co-chair TRB Animal Vehicle Collision Subcommittee (ANB20-2, current); member TRB Ecology and Transportation Committee (ADC30, current); Strategic Highway Research Program 2: Expert Task Group (2007-2009); member TRB Sustainable Transportation Indicators Subcommittee (current).

Federal Highways Administration: Eco-Logical Champion, providing on-call technical assistance to state DOTs and MPOs (2014-present)

IENE 2016: Member of Programme Committee

Review Panelist: Water Research Foundation (2015-16)

CALFED: Member of Watershed Program Sub-Committee (2002-2006)

City of Davis Open Space Commission: Member (2000-2003) and Chair (2000-2002)

University of California, Davis: Diversity Award (1996)

American Society of Zoologists/Society for Integrative & Comparative Biology: Conservation Chair (1992-1997)

RECENT ENVIRONMENTAL SCIENCE & POLICY PUBLICATIONS

Tiedeman, K., R.J. Hijmans, A. Mandel, D.P. Waetjen, F. Shilling (2019) The quality and contribution of volunteer collected animal vehicle collision data in ecological research. Ecological Indicators. https://doi.org/10.1016/j.ecolind.2019.05.062

Creley, C.M., F.M. Shilling and A.E. Muchlinski (2019) Using ecological niche models to predict the potential future range expansion of the eastern gray squirrel in California. Bulletin Southern California Academy Sciences 118(1): 58-70; https://scholar.oxy.edu/scas/vol118/iss1/4/

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Mr. Shilling has prepared and delivered presentations at conferences of the: American Planning Association, American Society of Limnology and Oceanography, American Society of Zoologists/Society for Integrative and Comparative Biology, American Society for Cell Biology, Gordon Conferences, Ecological Society of America, International Conference on Ecology and Transportation, Transportation Research Board, Infra Eco-Network Europe, Life Strade Project (Italy), National Congress of American Indians, National Water Quality Monitoring Council, Bay-Delta Science Conference, Marine Biological Laboratory, The Wildlife Society, Sierra Nevada Alliance, California Aquatic Bioassessment Workgroup, Great Valley Center, California Rangeland Coalition, Salmon Restoration Federation, California Association of Resource Conservation Districts, Korea Institute for Construction Technology, and other regional symposia, conferences, and workshops.