

## EXECUTIVE SUMMARY

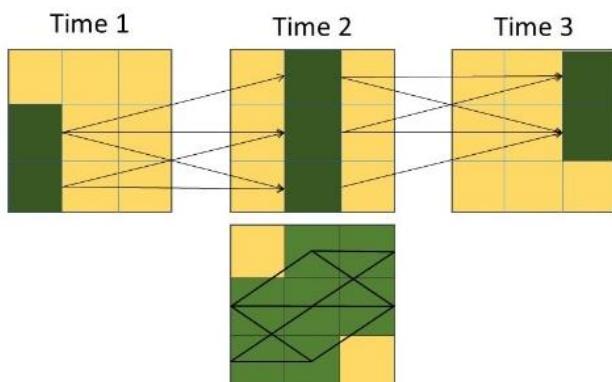
Corridors for Climate Adaptation: Science and Practice Workshop • November 9-10, 2016



*"Where are today's species going? Where are tomorrow's species coming from and who are they?" David Ackerly, UC Berkeley*

Scientists and conservation professionals from California's resource agencies and non-profit organizations met at the National Center for Ecological Analysis and Synthesis (NCEAS) in November, 2016 to brainstorm ways to best plan and implement climate-wise connectivity to help species adapt to climate change. Findings from the workshop will be included in a review of connectivity science and practice for California's Fourth Climate Change Assessment. Differences between wildlife corridors intended to facilitate animal movement and habitat connectivity that will allow species to shift their ranges with climate change were captured during the workshop. Given how the climate will change over the next 100 years or so, it's clear that we need to plan for connectivity at the landscape level, provide many movement options for a broader range of species including linkages and permeable working landscapes, and focus on minimizing the rate of climate change species will experience as they undergo range shifts.

Projects already underway to improve habitat connectivity in California along with research on the topic were presented, including the following highlights. A green print presented by Caltrans guides placement of wildlife highway crossing projects between San Jose and Santa Barbara. Fine-scale connectivity mapping presented by California Department of Fish and Wildlife based on focal species needs, land facets, and river corridors in the Sierra Nevada foothills provides detailed information for habitat connectivity projects. Protection of a vital pinch point across Sonoma Valley is part of the Sonoma Valley Wildlife Corridor Project presented by the Sonoma Land Trust. This project also includes habitat management actions such as fence removal and trail management which are being conducted on public and private lands that make up a larger Bay Area linkage.



To address the climate challenge, new analytical models are needed to plan for climate connectivity. Three cutting-edge approaches were presented, two of which are based on predicted species range shifts, while one aims to delineate intact landscape corridors between similar current and future climate types. At the same time, much can be learned from field studies such as those



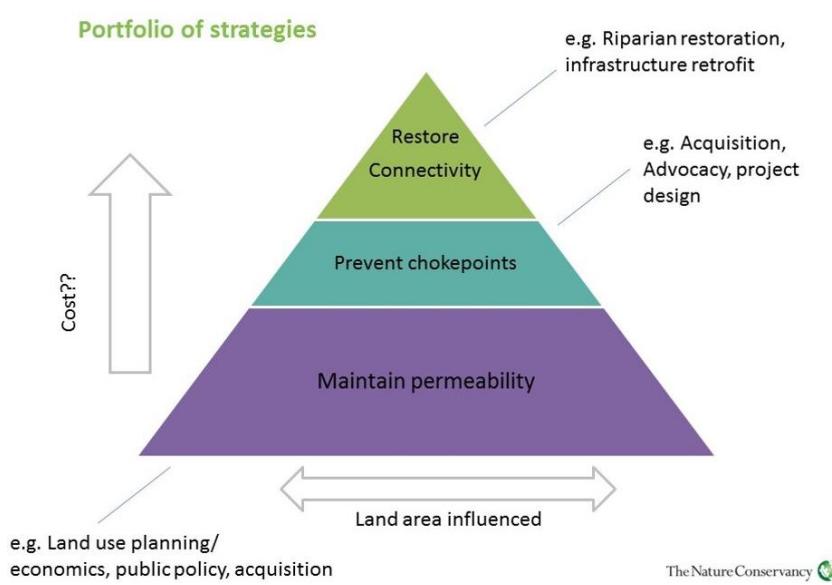
Planned transportation projects (marked red and yellow) in Caltrans District 5. Map courtesy of Nancy Siepel and Amy Golden, Caltrans.

*Network Flow Analysis delineates corridors connecting current suitable habitat with habitat predicted to be suitable at three different times in the future to enable species to shift their distributional ranges with climate change (green: suitable habitat, yellow: unsuitable habitat, black lines in bottom panel: corridors that connect the suitable habitat through time). Figure courtesy of Lee Hannah, Conservation International.*

presented for bobcat and golden eagle movements that re-affirmed human dominated landscapes can be a barrier for species and underscored the importance of maintaining and restoring habitat connectivity.

A myriad of challenges and opportunities specific to improving habitat connectivity on the ground were explored to learn about and improve upon connectivity project implementation. A few challenges that stood out were lack of funding, lack of data for locating the best sites for corridors, and the need to balance human needs with wildlife needs. Keys for success include close collaboration with scientists, political incentives, information sharing with land managers and the broader community, and enthusiastic and informed local communities.

In a productive discussion, participants clarified that many of the land management and conservation tools necessary to implement climate connectivity are essentially the same as those for implementing habitat connectivity, but some may need to be adapted to facilitate long-term species range shifts. Wildlife friendly fencing, under-and overpass construction, culvert maintenance, habitat restoration, and conservation easements are just a few of these tools.



*Connectivity implementation strategies vary in cost and affected land area. Figure courtesy of Dick Cameron, The Nature Conservancy.*

While several existing laws in California motivate wildlife connectivity and climate change adaption, the need to better couple policy, practice, and research to achieve climate-wise connectivity became evident at the workshop.

This productive workshop culminated in the development of a climate-wise connectivity implementation framework that reveals context and interactions among conservation objectives (e.g. species, habitat), implementation strategies (e.g. corridor, matrix permeability), barriers (e.g. data availability), opportunities (e.g. T&E species recovery), implementation tools (e.g. overpass, land acquisition), and modeling approaches (e.g. species distribution modeling). This framework along with scientific principles for climate connectivity science is intended to foster climate resilient landscape conservation efforts.

Workshop participants included: Jim Weigand (Bureau of Land Management); Whitney Albright, Melanie Gogol-Prokurat (California Department of Fish & Wildlife); Amy Golden, Nancy Siepel (California Department of Transportation); Lee Hannah (Conservation International); Nicole Heller (Peninsula Open Space Trust); Galli Basson (Santa Clara Valley Open Space Authority); Bob Neale (Sonoma Land Trust), Dick Cameron, Brad McRae, Carrie Schloss (The Nature Conservancy), David Ackerly, Morgan Gray, Annika Keeley, Adina Merenlender, Tristan Nuñez (UC Berkeley), Patrick Huber, Jim Thorne (UC Davis), Cat Darst (US Fish & Wildlife Service), Robert Fisher (US Geological Survey).



The workshop was made possible thanks to these valued sponsoring organizations: California Landscape Conservation Cooperative; Berkeley Energy and Climate Institute; California Department of Water Resources; Santa Clara Valley Open Space Authority.