Zachary L. Steel

zachary.steel@usda.gov zacksteel zack-steel.com | *Updated:* August 14, 2024

EDUCATION

University of California, Davis, Ph.D. Ecology 2014–2018

University of California, Davis, M.S. Ecology 2008–2011

Whitman College, B.A. Biology 2002–2006

EMPLOYMENT

USDA Forest Service Rocky Mountain Research Station:

Research Biological Scientist 2022–Present

University of California, Berkeley:

Post-doctoral Researcher 2019–2022

University of California, Davis:

Graduate Student Researcher 2014–2018

Jr. Specialist Researcher 2012–2014

Fire Science Consortium Coordinator 2012–2013

US Fulbright Program, Santiago, Chile:

Research Fellow 2011

University of California, Davis:

Graduate Student Researcher 2008–2011

University of California, Santa Cruz:

Assistant Biologist 2007–2008

PRBO Conservation Sciences:

Biology Technician 2007–2008

ACADEMIC AFFILIATIONS

Colorado State University - Affiliate Faculty, Dept. of Forest and Rangeland Stewardship 2024–Present

Boise State University - Adjunct Graduate Faculty 2024–Present

PUBLICATIONS

Journal Articles

2024 – **Steel, Z. L.**, J. E. D. Miller, L. C. Ponisio, M. W. Tingley, K. Wilkin, R. Blakey, K. M. Hoffman, and G. Jones. "A roadmap for pyrodiversity science". *Journal of Biogeography* 51(2):280-293.

2023 – Francis, E. J., S. Pourmohammadi, **Z. Steel**, B. M. Collins, and M. D. Hurteau. "Proportion of forest area burned at high-severity increases with increasing forest cover and connectivity in western US watersheds". *Landscape Ecology*.

2023 – Stephens, S.[1], **Z. Steel**[1], B. Collins, D. Fry, S. J. Gill, H. Rivera-Huerta, and C. N. Skinner. "Climate and fire removal impacts on tree recruitment in mixed conifer forests in Northwestern Mexico and California". *Ecological Applications* 33(4):e2844.

[1]*Authors contributed equally to this work*

2023 – **Steel, Z. L.**, G. M. Jones, B. M. Collins, R. Green, A. Koltunov, K. L. Purcell, S. C. Sawyer, M. R. Slaton, S. L. Stephens, P. Stine, and C. Thompson. "Mega-disturbances cause rapid decline of mature conifer forest habitat in California", *Ecological Applications 33(2):e2763*.

2023 – Weeks, J. M., H. Safford, J. Miller, **Z. Steel**, and E. Batzer. "High Severity Fire Drives Floristic Homogenization in Human-Altered Forests", *Ecosphere* 14(2):e4409.

2023 – Williams, J., H. Safford, N. Enstice, J. Tangenberg, **Z. Steel**, and A. Paulson. "High severity burn area and proportion exceed historic conditions in forests of Sierra Nevada and adjacent ranges (USA)". *Ecosphere* e4397.

2022 – Viljur, M. and 46 others including **Steel, Z. L.**. "The effect of natural disturbances on forest biodiversity: An ecological synthesis", *Biological Reviews* 97(5):1930-1947.

2022 – Levine, J., B. Collins, **Z. L. Steel**, P. de Valpine, and S. Stephens. "High-severity fire risk heightened both on and near industrially managed forests". *Frontiers in Ecology and the Environment* 20(7):397-404.

2022 – Safford, H., A. Paulson, **Z. Steel**, D. Young, and R. Wayman. "The 2020 California fire season: A year like no other, a return to the past, or a harbinger of the future?". *Global Ecology and Biogeography 31(10):2005-2025*.

2022 – **Steel, Z. L.**, A. Fogg, R. Burnett, L. J. Roberts, H. D. Safford. 2022. "When bigger isn't better – implications of large high-severity wildfire patches for avian diversity and community composition". *Diversity and Distributions* 23(3):439-453.

2021 – **Steel, Z. L.**, B. M. Collins, D. B. Sapsis, and S. L. Stephens. "Quantifying pyrodiversity and its drivers". *Proc. R. Soc. B* 288(1948).

2021 – **Steel, Z. L.**, M.J. Goodwin, M.D. Meyer, G.A. Fricker, H.S.J. Zald, M.D. Hurteau, and M.P. North. Do forest fuel reduction treatments confer resistance to beetle infestation and drought mortality? *Ecosphere* 12(1):e03344.

2021 – Jager, H., J. Long, R. Malison, B. Murphy, A. Rust, L. Silva, R. Sollman, **Z. Steel**, M. Bowen, J. Dunham, J. Ebersole, and R. Flitcroft. "Resilience of terrestrial and aquatic fauna to historical and future wildfire regimes in western North America". *Ecology and Evolution* 11(18):12259-12284.

2021 – Stephens, S., S. Thompson, G. Boisrame, B. Collins, L. Ponisio, K. Rakhmatulina, **Z. Steel**, J. Stevens, K. Wilken, and J. van Wagtendonk. "Fire, water, and biodiversity in the Sierra Nevada: A possible triple win". *Environmental Research Communications* 3(08):1004.

2021 – **Steel, Z. L.**, D. Foster, M. Coppoletta, J. M. Lydersen, B. Wing, S. L. Stephens, and B. M. Collins. "Ecological resilience and vegetation transition in the face of multiple large wildfires". *Journal of Ecology* 109(9):3340-3355.

2019 – **Steel, Z. L.**, B. Campos, W. Frick, R. Burnett, and H. D. Safford. "The effects of wildfire severity and pyrodiversity on bat occupancy and diversity in fire-suppressed forests". *Scientific Reports 9, 16300*.

2019 – Wilkins, L. G. E., K. R. Matthew, **Z. L. Steel**, S. C. Nussle, and S. M. Carlson. "Population dynamics of *Rana sierrae* at Dusy Basin: Influence of non-native predators, drought, and restoration potential". *Ecosphere* 10(11):e02951.

2018 – **Steel, Z. L.**, M. Koontz, and H. Safford. "The changing landscape of wildfire: Burn pattern trends and implications for California's yellow pine and mixed conifer forests". *Landscape Ecology* 33(7): 1159-1176.

2017 – **Steel, Z. L.**, A. E. Steel, J. Williams, J. H. Viers, P. Marquet, and O. Barbosa. "Patterns of bird diversity and habitat use in mixed vineyard-matorral landscapes of Central Chile". *Ecological Indicators* 73:345-357.

2017 – Grof-Tisza, P., **Z. L. Steel**, E. Cole, M. Holyoak, and R. Karban. "Testing predictions of movement behavior in a hilltopping moth". *Animal Behavioral* 133:161-168.

2017 – Grof-Tisza, P., **Z. L. Steel**, and R. Karban. "The spatial distribution and oviposition preference of the Ranchman's tiger moth, Platyprepia virginalis (Lepidoptera: Arctiidae)". *Journal of the Lepidopterists' Society* 71(1):16-19.

2015 – **Steel, Z. L.**, H. D. Safford, and J. H. Viers. "The fire frequency-severity relationship and the legacy of fire suppression in California forests". *Ecosphere* 6(1):1-23.

2013 – Schwartz, M.W., L. B. Smith, and **Z. L. Steel**. "Conservation investment for rare plants in urban environments". *PLOS ONE* 8(12):e83809.

2012 – **Steel, Z. L.**, M. L. Bond, R. B. Siegel, and P. Pyle. "Avifauna of Sierra Nevada Network parks: Assessing distribution, abundance, stressors, and conservation opportunities for 145 bird species". National Park Service, Fort Collins, Colorado. Natural Resource Report NPS/SIEN/NRR—2012/506.

2011 – Siegel, R. B, R. L. Wilkerson, J. F. Saracco, and **Z. L. Steel**. "Elevational distribution of common bird species on the Sierra Nevada's west slope". *Western Birds* 42:2-26.

In Review or Revision

van den Bosch, M., J. Costanza, R. Peek, J. Mola, and **Z. L. Steel**. "Climate change scenarios forecast increased drought exposure for terrestrial vertebrates". *Communications Earth & Environment*.

Calhoun, K., P. Parker-Shames, Z. Steel, H. Oyler, and J. Brashares. "Severity and pyrodiversity shape avian and bat species distributions following an Oak Woodland Megafire". *Ecosphere*.

Ramírez Sánchez, D., G. Seingier, G. De León Girón, M. Villada Canela, **Z. L. Steel**, and H. Rivera Huerta. "Systematic review of the trends and methodologies in research on the effects of forest fires on avifauna in temperate forests". *Ardeola*.

Miller-ter Kuile, A., J. Sanderlin, J. Ayars, H. Chmura, M. Dressen, J. Golding, G. Jones, R. Kirby, K. Norman, **Z. L. Steel**, and V. Stein Foster. "Functionalizing ecological integrity: using functional ecology to monitor animal communities". *Frontiers in Ecology and the Environment*.

Mills, K., M. Leclerc, M. Ditmer, **Z. L. Steel**, D. Stoner, J. Sexton, P. Wang, K. Hersey, D. DeBloois, C. Schroeder, J. Young, A. Andreasen, K. Longshore, P. Jackson, D. Hall, K. Engebretsen, and N. Carter. "Dynamic impacts of fire on large mammal habitat quality and selection in the American West". *Global Change Biology*.

Technical Reports & Software

2024 – Eisenburg, C., S. Prichard, M. Nelson, P. Hessburg (lead authors) and 33 others including **Z. L. Steel**. "Braiding Indigenous and Western Knowledge for Climate-Adapted Forests: An Ecocultural State of Science Report". University of Washington. Available online

2021 – Meyer, M., Long, J., Safford, H. (editors) and 22 contributors including **Z. Steel**. "Postfire restoration framework for national forests in California". USDA Forest Service Pacific Southwest Research Station. PSW-GTR-270.

2021 – **Steel, Z. L.**, M. D. Meyer, M. P. North, A. Wuenschel, and S. M. Ostoja. "Reforestation tool for tree mortality landscapes." In: Meyer, M.D.; Long, J.W.; Safford, H.D., eds. Postfire restoration framework for national forests in California. Gen. Tech. Rep. PSW-GTR-270. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station: 191-192. Appendix 7.

2021 – USFS Region 5 Climate Change Trend Assessments (8 reports). E.g.:

Wuenschel, A., S. Gross, B. Estes, K. Merriam, H. Safford, S. Sawyer, **Z. Steel**, L. Wolf. Sierra National Forest Climate Change Trend Summary. Unpublished report. USFS Pacific Southwest Region, Vallejo CA.

2020 – **Steel, Z. L.**, M. Meyer, A. Wuenschel, S. Ostoja, and M. North. "Climate-wise reforestation toolkit". Rshiny web application prepared for the US Forest Service, and the California Climate Hub. Available online

2018 – **Steel, Z. L.**, B. R. Campos, and H. D. Safford. "Bat occupancy in Sierra Nevada wildfire areas and implications for post-fire management". Prepared for US Forest Service, Region 5. PDF

2018 – Campos, B. R., **Z. L. Steel**. FIRE-BAT spatial predictive tool. ArcGIS toolbox prepared for US Forest Service, Region 5. Users Manual

2017 – Campos, B. R., R. D. Burnett, and **Z. L. Steel**. "Bird and bat inventories in the Storrie and Chips fire areas 2015-2016: Final report to the Lassen National Forest". Point Blue Conservation Science, Petaluma, CA. Point Blue Contribution No. 2142. PDF

2017 – Fogg, A. M, **Z. L. Steel** and R. D. Burnett. "Avian Monitoring in Freds and Power fires: Final Report". Point Blue Conservation Science, Petaluma, CA. Point Blue Contribution No. 2138. PDF

2013 – Schwartz, M. W., et al. "Sensitive Animals - Appendix 15 to SEKI Natural Resources Condition Assessment". Natural Resource Report NPS/SEKI/NRCA—2013/665. National Park Service. Fort Collins, Colorado. Assessments within:

Steel, Z. L., E. Reddy and R. Green. The American Pika - *Ochotona princeps*

Steel, Z. L., J. Shields. Sierra Nevada Bighorn Sheep - *Ovis canadensis sierrae*

Copeland, S., K. Dybala, **Z. L. Steel**. California Condor - *Gymnogyps californianus*

Steel, Z. L., Sierra Nevada Chipmunks - *Tamais spp.*

2012 – **Steel, Z. L.**, O. Barbosa, and P. Marquet. "Biodiversidad de Aves y Carbono en el Paisaje Vinedo". Three reports prepared for landowner partners in the Colchagua Valley, Chile.

2011 – **Steel, Z. L.**, M. Wilderson, P. Grof-Tisza, and K. Sulzner. "Assessing species and area vulnerability to climate change for the Oregon Conservation Strategy: Willamette Valley Ecoregion". Prepared for the Oregon Department of Fish and Wildlife and the Defenders of Wildlife.

TEACHING

Graduate & Post-graduate Teaching:

Fire Effects on Wildlife – CA State Parks Fire Ecology training	April 2022
Guest Lecturer – UCD, Fire Ecology	Winter 2020-2022
Guest Lecturer – UCB, Fire Ecology Seminar	Spring 2020
Co-Instructor – UCD, Fire Ecology	Winter 2018
Guest Lecturer – UCD, Ecogeomorphology	Springs 2014–2018
Certificate of Completion – UCD Foundations of Teaching workshop series	Fall 2017
Guest Lecturer – American River College, Experimental Design	Spring 2017
Teaching Assistant – UCD, Trees and Forests; PLS 144	Fall 2015
Teaching Assistant – UCD, Trees and Forests; PLS 144	Fall 2014

Mentoring:

Undergraduate Mentor – Student research experience	Spring 2019-2020

Undergraduate Mentor – Association for Women in Science Mentoring program 2019

High School Mentor – Student & Landowner Education Stewardship program 2015–2016

Undergraduate Mentor – Student research experience Summer 2009

Outdoor Education:

Naturalist/Raft Guide – UCD, Outdoor & Watershed Sciences programs 2013-2018

Teacher/Scientist – Earthwatch citizen science programs 2013

Naturalist/Kayak Guide – San Juan Islands, WA Summers 2006-2007

Undergraduate Teaching:

Teaching Assistant – Whitman College, Genetics; BIO 205 Fall 2005

Teaching Assistant – Whitman College, Ecology; BIO 277 Spring 2005

AWARDS

Grants written & funded:

2024-2026 – *Assessing fuels treatment impacts for wildfire risk, forest carbon, and wildlife habitat*. Funder: USDA Forest Service R&D. PIs: **Steel, Z. L.**, Ditmer, M. $1,000,000

2023-2028 – *Assessing wildlife trends and the impacts of ecological disturbance*. Funder: USFS Rocky Mountain Research Station. PI: **Steel, Z. L.**. $341,000

2023-2026 – *Past and future drought exposure to sensitive terrestrial wildlife*. Funder: California Department of Fish and Wildlife. PI: **Steel, Z. L.**, Co-PI: Costanza, J. $249,000

2022-2023 – *Integrating legacy and emerging biodiversity datasets for improving future RPA assessments and the 2020 update*. Funder: USDA Forest Service RPA Assessment. PI: **Steel, Z. L.** $92,000

2022-2023 – *Linking pyrodiversity and biodiversity with terrestrial LiDAR*. Funder: Yosemite Conservancy. Co-PIs: **Steel, Z. L.**, Anderson, C. (NPS), Collins, B. (UC Berkeley). $40,000

2020-2023 – *Implications of increasing the scale of managed wildfire on forest carbon stocks and pyrodiversity*. Funder: California Department of Forestry and Fire Protection (CALFIRE). PI: Stephens, S. (UC Berkeley), Co-PIs: **Steel, Z. L.**, Collins, B. & Battles, J. (UCB). $422,000

2017-2018 – *Ecological implications of wildfire and forest restoration on birds and bats (phase II)*. Funder: USDA Forest Service, Region 5. PI: Schwartz, M. Co-PI: **Steel, Z. L.** & Safford, H. (USFS). $122,000

2014-2017 – *Ecological implications of wildfire and forest restoration on birds and bats (phase I)*. Funder US Forest Service, Region 5. PI: Schwartz, M. Co-PI: **Steel, Z. L.** & Safford, H. (USFS). $127,000

2011 – *Quantifying avian habitat use and carbon stocks in Chilean vineyards*. Funder: US Fulbright Program. $17,000

Fellowships received:

2014-2018 (7 quarters) – *Graduate Group of Ecology Fellowship*. Funded by UC Davis. $79,000

2017 – *Ecology Student Endowment*. Funded by UC Davis. $1500

2010 – *Graduate Group of Ecology Fellowship*. Funded by UC Davis. $11,000

SELECT PRESENTATIONS

Invited talks

2023 – University of Wisconsin Madison, Forest and Wildlife Ecology Seminar, *Wildlife in the Pyrocene: Understanding impacts of shifting fire regimes on wildlife communities*

2023 – California Forest Pest Council, *Mega-disturbances cause rapid decline of mature conifer forest habitat in California*

2023 – Journal of Fire Ecology, *Effects of wildfire and prescribed fire on wildlife panel*

2023 – European Geophysical Union Congress, *Mega-Disturbances and forest decline in the Sierra Nevada of California, USA: Insights for managing disturbance dynamics*

2022 – California Native Plant Society Conference, *Declining southern Sierra Nevada conifer forests in an age of mega-disturbances: applying remote sensing tools to inform mature forest conservation*

2021 – International Fire Ecology and Management Congress, *Forest resilience and transition in the face of successive large wildfires in California's Sierra Nevada Mountains*

2021 – Berkeley EcoLunch Seminar, *Wildlife and wildfire: a love-hate relationship*

2021 – Yosemite National Park Forum, *Restoring pyrodiversity to benefit Sierra Nevada wildlife communities*

2021 – Western Section of the Wildlife Society Annual Meeting **(Plenary)**, *Implications of changing fire patterns on habitats and wildlife*

2020 – Natural Areas Association Annual Meeting, *Implications of changing fire regimes for Sierra Nevada bat and bird communities*

2017 – Instituto Politécnico Nacional, CIIDIR-Unidad Oaxaca, Mexico, *Murcielagos en un paisaje caracterizado por incendios: Impactos en diversidad y uso de habitat*

2017 – Northwest Science Conference, *The influence of burn severity on bat species occurrence in post-fire landscapes*

2011 – Universidad Mayor, Santiago, Chile, *Mercados de carbono: una oportunidad potencial para biodiversidad en agroecosistemas*

Contributed talks

2023 – International Association of Landscape Ecology, *Burning for biodiversity: Finding pyrodiversity optimums for multiple taxa in a managed wildfire area*

2022 – Yosemite National Park Hydroclimate Meeting, *The chiropteran fire pulse: vegetation and hydro-climate mediate changes in bat activity in Sierra Nevada wilderness*

2022 – International Association of Landscape Ecology, *Megadisturbances Cause Rapid Decline of Mature Forest Habitat in California*

2021 – International Association of Landscape Ecology, *Quantifying pyrodiversity and its drivers*

2020 – Ecological Society of America Annual Meeting, *What doesn't kill you makes you stronger - or not: Conifer mortality following forest treatments and drought*

2019 – The Wildlife Society Annual Conference, *The Influence of Burn Severity and Pyrodiversity on Bat Communities in Sierra Nevada Forests*

2018 – Mediterranean Forest Ecosystems International Conference (MedPine6), *Changing patterns of severe wildfire lead to bird diversity declines & community transitions in conifer forests of California, USA*

2018 – Ecological Society of America Annual Meeting, *Bat species occupancy varies across a disturbance gradient; implications for a future of extreme wildfire events*

2017 – Ecological Society of America Annual Meeting, *The influence of spatial context and successional pathways on bird communities following high-severity wildfire*

2017 – Mediterranean Ecosystems Conference (MEDECOS), *Shifting patterns of California fire and forest landscapes in an era of global change*

2016 – Natural Areas Conference, *The Changing Landscape of California Fire: Trends in Burn Patterns and Post-Fire Forest Heterogeneity*

2011 – Buenos Aires Fulbright Regional Enhancement Seminar, *Carbon Sequestration: Risk or tool for biodiversity?*

2011 – Bay Area Conservation Biology Symposium, *Assessing species vulnerability to climate change in the Willamette Valley Ecoregion*

SERVICE

Professional Society Memberships (past or current): Ecological Society of America, The Wildlife Society, Natural Areas Association, International Association of Landscape Ecology - North America Chapter, Association for Fire Ecology, European Geosciences Union

**University

Journal Referee: *Global Change Biology, Environmental Research Letters, Landscape Ecology, Current Landscape Ecology Reports, PLOS One, Ecosphere, Ecography, Diversity and Distributions, Ecology and Society, Forest Ecology and Management, Biological Conservation, Fire Ecology, Ecological Applications, Conservation Science and Practice*

Grant Referee: *Joint Fire Science Program (2023).*

Special Symposium co-organizer: "Toward a comprehensive understanding of pyrodiversity: How landscape- scale heterogeneity in fire history influences biodiversity across taxa, fire regimes, and spatial scales." International Association of Landscape Ecology 2021 meeting, Reno, NV

Student Committee Member:

2022-Present – Dissertation committee; Autonomous University of Baja California

2024-Present – Masters thesis committee: Boise State University