

EMMA C. UNDERWOOD

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EDUCATION

Ph.D. Ecology. University of California, Davis. USA.

M.A. Geography. Ohio University, Athens. USA.

B.Sc. Geography and American Studies. University of Wales, Swansea, UK.

RESEARCH INTERESTS

Conservation assessments of biodiversity, mapping and predicting the distribution of invasive plant species, evaluating ecosystem services, estimating conservation return on investment, remote sensing and GIS.

PROFESSIONAL EXPERIENCE

Dept. of Environmental Science & Policy, University of California, Davis, USA

Research Scientist (2008-present);

- Managing USDA Forest Service funded project to spatially quantify and estimate the economic value of ecosystem services in southern California. Components include development of online mapping tool for resource managers, public outreach video to communicate scientific findings, and reports for USGS (collaborating with USFS and University of Michigan) (PI);
- Research on international conservation issues, such as global distribution of tropical-everwet forests under current and future climates;
- Developed spatial predictive models of the potential distribution of four invasive plant species in the Mojave desert (collaborated with USGS, Pacific Northwest National Laboratory) (PI);
- Evaluated ecosystem services in the Central Valley of California and quantified the tradeoffs of different management scenarios (collaborated with TNC, Audubon California) (co-PI);
- Developed science-based recommendations and spatial tools for addressing multiple management objectives in the Sierra Nevada forests (collaborated with USFS).

The Nature Conservancy, California Science Program, USA

Postdoctoral Researcher (Feb 2005-Dec 2007)

- Evaluated the protection and conversion status of the world's five Mediterranean-climate regions and assessed current and future threats to biodiversity;
- Applied return on investment concepts to prioritizing work in Mediterranean climate ecoregions.

California Space Institute Center of Excellence, University of California, Davis, USA

Postdoctoral Researcher (May 2004-Jan 2005)

- Investigated the use of hyperspectral and multispectral remote sensing to identify and map invasive plant species in California coastal ecosystems;
- Detected and mapped aquatic weeds in the river systems of the Central Valley of California using hyperspectral imagery for the California Department of Boating and Waterways.

National Park Service, Yosemite National Park, California, USA

Consultant (Oct 2001-Nov 2002)

- Analyzed plant community data from Yosemite National Park and developed predictive models of plant invasions using biophysical and anthropogenic disturbance data to assist resource managers.

Department of Environmental Science & Policy, University of California, Davis, USA

Doctoral Researcher in Landscape & Conservation Ecology (Oct 1999-Apr 2004)

- Designed and conducted experiments to investigate the effects of prescribed fire and cattle grazing on invertebrates in a blue oak ecosystem in Northern California;
- Developed a landscape scale monitoring framework for The Nature Conservancy's Lassen Foothills Project;

World Wildlife Fund - US, Conservation Science Program, Washington DC, USA

Conservation Analyst (Oct 1995-Aug 1999)

- Coordinated and conducted an assessment of the terrestrial ecoregions of continental Africa which informed WWF's Global 200 ecoregions project;

- Developed and tested predictive models for identifying patterns of biodiversity in the Congo Basin rainforests and undertook regional scale conservation assessments of central Africa (CARPE);
- Organised and taught GIS workshops at field sites across Africa and assisted field projects with GIS;
- Conducted GIS analysis of impediments to grizzly bear movement and identified potential linkage zones in southwestern Montana.

PUBLICATIONS

Journal papers

- Underwood, E.C.**, R.C. Klinger, and M. Brooks. Overlapping invasive plant distributions reveal extensive cumulative effects on fire regimes and post-fire vegetation diversity. *Journal of Applied Ecology* (in second review).
- Underwood, E.C.**, A.D. Hollander, and L.E. Flint. Climate change impacts on water provision ecosystem services in southern California's National Forests. To be submitted to *Global Environmental Change* (final revisions).
- Underwood, E.C.**, A.D. Hollander, J.B Kim, R. Drapek, H.D. Safford, L. Srivastava. Climate driven changes affect provision of ecosystem services in southern California. To be submitted to *Nature Climate Change* (final revisions).
- Flint, L.E., **E.C. Underwood**, A.L. Flint, and A.D. Hollander. Characterizing the influence of fire on hydrology in southern California. *Natural Areas Journal* (in review).
- Brauneder, K., C. Montes, S. Blyth, L. Bennun, S.H.M. Butchart, M. Hoffmann, N.D. Burgess, A. Cuttelod, M.I. Jones, V. Kapos, J. Pilgrim, M.J. Tolley, **E.C. Underwood**, L.V. Weatherdon, S.E. Brooks: Global screening for Critical Habitat in the terrestrial realm. 2018. *PLoS ONE* 13(3): e0193102.
- Bohlman, G.N., **E.C. Underwood**, and H.D. Safford. 2017. Estimating biomass in California's chaparral and coastal sage shrublands. *Madroño* 65(1): 28-46.
- Underwood, E.C.**, J.H. Viers, R.A. Hutchinson, T. Distler, T.R. Kelsey, and J. Marty. 2017. Quantifying ecosystem services in an agricultural-dominated landscape under future land management scenarios. *San Francisco Estuary and Watershed Science* 15(2): <http://doi.org/10.15447/sfews.2017v15iss2art4>
- Underwood, E.C.**, Olson, D., Hollander, A.D., and J.F. Quinn. 2014. Ever-wet tropical forests as biodiversity refuges. *Nature Climate Change* 4:740-741.
- Cox, R.L. and **E.C. Underwood**. 2011. The importance of conserving biodiversity outside of protected areas in mediterranean systems. *PLoS ONE* 6(1): e14508.
- Underwood, E.C.**, J.H. Viers, J.F. Quinn, and M. North. 2010. Using topography to meet wildlife and fuels treatment objectives in fire-suppressed landscapes. *Environmental Management* 46: 809-819.
- Underwood, E.C.** and J.F. Quinn. 2010. Response of ants and spiders to prescribed fire in oak woodlands of California. *Journal of Insect Conservation* 14: 359-366.
- Underwood, E.C.**, K.R. Klausmeyer, R.L. Cox, S.M. Busby, S.A. Morrison, and M.R. Shaw. 2009. Expanding the global protected areas network to save the imperiled mediterranean biome. *Conservation Biology* 23(1):43-52.
- Underwood, E.C.**, J.H. Viers, K. R.Klausmeyer, R.L. Cox, and M.R. Shaw. 2009. Threats and biodiversity in the mediterranean biome. *Diversity and Distributions* 15:188-197.
- Underwood, E.C.**, K.R. Klausmeyer, S.A. Morrison, M. Bode, and M.R. Shaw. 2009. Evaluating conservation spending for biodiversity return: A retrospective analysis in California. *Conservation Letters* 2:130-137.
- Underwood, E.C.** and C.E. Christian. 2009. Consequences of prescribed fire and grazing on grassland ant communities. *Environmental Entomology* 38(2): 325-32.
- Underwood, E.C.**, M.R. Shaw, K.A. Wilson, P. Kareiva, K.R. Klausmeyer, M.F. McBride, M. Bode, S.A. Morrison, J.M. Hoekstra, H.P. Possingham 2008. Protecting biodiversity when money matters: Maximizing return on investment. *PLoS ONE* 3(1): e1515. doi:10.1371/journal.pone.0001515.
- Bode, M., K.A. Wilson, T.M. Brooks, R.A. Mittermeier, W.R. Turner, F. McBride, **E.C. Underwood**, H.P. Possingham. 2008. Robustness of resource allocation among biodiversity hotspots. *Proceedings of the National Academy of Sciences* 105(17):6498-6501.

- Wilson, K.A., **E.C. Underwood**, S.A. Morrison, K.R. Klausmeyer, W.W. Murdoch, B. Reyers, G. Wardell-Johnson, P.A. Marquet, P.W. Rundel, M.F. McBride, R.L. Pressey, M. Bode, J.M. Hoekstra, S.J. Andelman, M. Looker, C. Rondinini, P. Kareiva, M.R. Shaw, and H.P. Possingham. 2007. Maximising the conservation of the world's biodiversity: What to do, where and when. *PLoS Biology* 5(9):e223.
- Underwood, E.C.**, S.L. Ustin, and C.M. Ramirez. 2007. A comparison of spatial and spectral image resolution for mapping invasive plants in coastal California. *Journal of Environmental Management* 39(1):63-83.
- Underwood, E.C.** and B.L. Fisher. 2006. The role of ants in conservation monitoring: If, when and how. *Biological Conservation* 132:166-182.
- Underwood, E.C.**, M.J. Mulitsch, J.A. Greenberg, M.L. Whiting, S.L. Ustin, S.C. Kefauver. 2006. Mapping invasive aquatic vegetation in the Sacramento-San Joaquin Delta using hyperspectral imagery. *Environmental Monitoring and Assessment* 121(1-3): 47-64.
- Chan, K.M.A., M.R. Shaw, D.R. Cameron, **E.C. Underwood**, G.C. Daily. 2006. Conservation planning for ecosystem services. *PLoS Biology* 4(11):e379.
- Klinger, R.C., **E.C. Underwood**, and P.E. Moore. 2006. The role of environmental gradients in non-native plant invasion into burned areas in Yosemite National Park, California. *Diversity and Distributions* 12:139-156.
- Underwood, E.C.**, R.C. Klinger, and P.E. Moore. 2004. Predicting patterns of non-native plant invasions in Yosemite National Park, California. *Diversity and Distributions* 10:447-459.
- Underwood, E.C.**, S.L. Ustin, and D. DiPietro. 2003. Mapping non-native plants using hyperspectral imagery. *Remote Sensing of Environment* 86:150-161.
- Reiner, R., **Underwood, E.C.**, Niles, J. 2002. Monitoring conservation success in a large oak woodland landscape. In Proceedings of the Fifth Symposium on Oak Woodlands: Oaks in California's Changing Landscape USDA Forest Service General Technical Report PSW-GTR-184.
- Olson, D.M., E. Dinerstein, E. Wikramanayake, N. Burgess, G. Powell, **E.C. Underwood**, J. D'Amico, I. Itoua, H. Strand, J. Morrison, C. Loucks, T. Allnutt, T.H. Ricketts, Y. Kura, W. Wettengel, and K. Kassem. 2001. Terrestrial ecoregions of the world: A new map of life on earth. *Bioscience* 51(11):933-938.

Books and book contributions

- Underwood, E.C.**, H.D. Safford, N.A. Molinari, and J.E. Keeley (editors). 2018. Valuing chaparral: ecological, socio-economic, and management perspectives. Springer Series on Environmental Management. Springer, Cham, Switzerland.
- Underwood, E.C.**, A.D. Hollander, P.R. Huber, and C. Schrader-Patton. Mapping the value of national forest landscapes for ecosystem service provision. 2018. Pages 245-270 in Underwood, E.C., H.D. Safford, N.A. Molinari, and J.E. Keeley, editors. Valuing chaparral: ecological, socio-economic, and management perspectives. Springer Series on Environmental Management. Springer, Cham, Switzerland.
- Safford, H.D., **E.C. Underwood**, and N.A. Molinari. Managing chaparral resources on public lands. 2018. Pages 411-448 in Underwood, E.C., H.D. Safford, N.A. Molinari, and J.E. Keeley, editors. Valuing chaparral: ecological, socio-economic, and management perspectives. Springer Series on Environmental Management. Springer, Cham, Switzerland.
- Molinari, N.A., **E.C. Underwood**, J.B. Kim, and H.D. Safford. Climate Change Trends for Chaparral. 2018. Pages 385-409 in Underwood, E.C., H.D. Safford, N.A. Molinari, and J.E. Keeley, editors. Valuing chaparral: ecological, socio-economic, and management perspectives. Springer Series on Environmental Management. Springer, Cham, Switzerland.
- Underwood, E.C.**, A.D. Hollander, and J.F. Quinn. 2013. Geospatial Tools for Identifying and Managing Invasive Plant Species. Pages 133-151 in S. Jose, H.P. Singh, R.K. Kohli and D.R. Batish, editors. *Invasive Plant Ecology*. CRC Press, Boca Raton, FL. (302 pages)
- M. North, R.M. Boynton, P.A. Stine, K.F. Shipley, **E.C. Underwood**, N.E. Roth, J.H. Viers, and J.F. Quinn. 2012. Chapter 10. Geographic Information System Landscape Analysis Using GTR 220 Concepts. In Managing Sierra Nevada Forests, USDA Forest Service Pacific Southwest Research Station General Technical Report PSW-GTR-237.

- Underwood, E.C.** and S.L. Ustin. 2007. Trends in Invasive Alien Species. Pages 161-177 in H. Strand, R. Höft, J. Stritholt, L. Miles, N. Horning, E. Fosnight, editors. *Sourcebook on Remote Sensing and Biodiversity Indicators*. Secretariat of the Convention on Biological Diversity, Montreal, Technical Series no. 32.
- Burgess, N.D., J. D'Amico, **E.C. Underwood**, E. Dinerstein, D.M. Olson, I. Itoua, J. Schipper, T.H. Ricketts, and K. Newman. 2004. *Terrestrial ecoregions of Africa and Madagascar: A conservation assessment*. Island Press, Washington, D.C. pp 501.
- Dinerstein, E., G. Powell, D.M. Olson, E. Wikramanayake, R. Abell, C.J. Loucks, **E.C. Underwood**, T. Allnutt, W. Wettengel, T.H. Ricketts, H. Strand, S. O'Connor, and N. Burgess. 2000. *A workbook for conducting biological assessments and developing biodiversity visions for ecoregion-based conservation: Part I, Terrestrial Ecoregions*. World Wildlife Fund. Washington, D.C.
- Primm, S.P. and **E.C. Underwood**. 1996. Reconnecting grizzly bear populations in fragmented landscapes. Pages 40-42 in T.H. Ricketts, E. Dinerstein, D.M. Olson, C.J. Loucks, W. Eichbaum, D. DellaSala, K. Kavanagh, P. Hedao, P.T. Hurley, K.M. Carney, R. Abell, and S. Walters, editors. *Terrestrial ecoregions of North America: A conservation assessment*. Island Press. Washington D.C.

RESEARCH GRANTS AND AWARDS

- National Fish and Wildlife Foundation: 'Developing a Decision Support Tool for Post-fire Restoration', E. Underwood (PI). \$169,021 (with \$84,550 in matching contributions) (active);
- USDA Forest Service technical assistance grant from USFS Geospatial Technology and Applications Center (GTAC) for developing on-line mapping tool. Equivalent to \$70,000 (active);
- California Landscape Conservation Cooperative. May 2015. 'Assessing the impacts of future climates and fire on hydrologic regimes in the Mediterranean-type ecosystems of southern California', E. Underwood (PI), L. Flint, A. Flint, H. Safford. \$124,880 (active);
- USDA Forest Service Regional Office and WWETAC: 'Ecosystem services assessment of the Santa Clara River Watershed'. June 2014. E. Underwood (PI), J. Quinn, H. Safford, and in collaboration with F. Lupi, C. Garnache, L. Srivastava. \$370,000 (active);
- US Geological Survey. July 2011. 'Detecting and mapping fuels and fire hazard in the Mojave Desert'. E. Underwood (co-PI), R. Klinger, J. Quinn. \$150,000 (complete);
- The Nature Conservancy, California. Feb 2005. Postdoctoral research funding 'A conservation assessment of Global Mediterranean Habitat Types'. E. Underwood (co-PI), J. Quinn, R. Shaw. \$115,000 (complete);
- National Park Service Inventory and Monitoring Program-Yosemite National Park. Oct 2001. 'Assessing Invasive Plants in Yosemite National Park'. E. Underwood (co-PI), R. Klinger. \$11,000 (complete);
- The Nature Conservancy, California; Schlinger Grant. April 2001. 'Evaluating the impacts of fire on invertebrates in oak savanna grasslands of Northern California' PhD research funding. \$7,590 (complete);
- National Science Foundation Biological Invasions IGERT Fellowship (Integrative Graduate Education and Research Traineeship Program). Spring 2002. \$4,038;
- University of California, Davis; Jastro Shields Award. Spring 2002. \$1,000;
- University of California, Davis; Out-of-State Tuition Fellowship. Fall 1999. \$3,000
- University of California, Davis; Graduate Group in Ecology Travel Grant. 2002. \$1,500.

ACADEMIC SERVICE

- Organizing committee member for 3rd Chaparral Symposium 'Global Change and the Vulnerability of Chaparral Ecosystems'. To be held at USFS Angeles National Forest training center, Arcadia, California.
- Organizing and facilitating special session at Riparian Summit, UC Davis (October 2017), 'Valuing Riparian and Hydrological Ecosystem Services on Federal Lands in Southern California';
- Voting committee member for a Project Scientist promotion with Agricultural Sustainability Institute at UC Davis (October 2017);

- Organizing and facilitating special session at Natural Areas Association conference, UC Davis (October 2016) ‘Understanding the Impact of Climate Change on Ecosystem Services’;
- Panel member for reviewing proposals to National Science Foundation grant call ‘Dimensions in Biodiversity’ (June 2012);
- Panel member for reviewing proposals to NASA ROSES (Research Opportunities in Space and Earth Sciences) grant call ‘Climate and Biological Response’ (January 2011);
- Member of IUCN SSC Invasive Species Specialist Group;
- Steering committee member for 2nd International Biodiversity and Vines Workshop, UC Davis;
- Reviewer for Conservation Biology, Remote Sensing of the Environment, Biological Invasions, Photogrammetric Engineering and Remote Sensing, Professional Geographer and Perspectives in Plant Ecology, Evolution and Systematics journals, Community Ecology, Environmental Management, and Frontiers in Ecology and the Environment;
- Invited speaker at selected classes at University of California, Davis including Principles of Ecology, Remote Sensing and the Environment (graduate level), and Insects in the Environment (undergraduate), and for US Forest Service funded International Seminar on Climate Change and Natural Resource Management. Presentations at numerous national and international conferences including the Society for Conservation Biology (san jose), Ecological Society of America, the Southwest Fire Ecology conference, and MEDECOS;
- Mentor for incoming National Science Foundation Biological Invasions IGERT Fellows (Integrative Graduate Education and Research Traineeship Program) at UC Davis (2003).