Christopher L. Crawford

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Key Skills and Accomplishments

- PhD conservation scientist currently serving as an American Association for the Advancement of Science (AAAS) Science & Technology Policy Fellow in the USDA Office of the Chief Scientist, applying my **interdisciplinary expertise** in biodiversity metrics, nature-based climate solutions, and agricultural land-use change, **quantitative and technical skills** in spatial and temporal (time series) analysis and data visualization, and **practical experience communicating across disciplines** and collaborating with the business, agricultural, and environmental communities to make durable progress on environmental and sustainability challenges.
- Practical and academic experience designing and conducting **quantitative research projects that draw on multiple disciplines** (including ecology, environmental science, economics, agricultural science, behavioral science, and statistics) to address the **complex set of factors affecting contemporary conservation** of species and their populations, tackling issues such as agricultural land-use change, habitat restoration, agricultural and land management decisions, and land-use prioritization.
- **Expertise in wrangling diverse and large datasets** (including biodiversity, environmental, socioeconomic, and agricultural data) and **applying approaches from data science and statistics** to extract simple conclusions and actionable recommendations **to address interdisciplinary problems**.
- Proven track record of **communicating complex scientific results to diverse audiences**, including in academic, policy, and public settings, through **accessible writing** (through articles in high-impact scientific journals like *Nature Sustainability* and *Science Advances*, technical reports and policy memos), **compelling presentations and talks** (at conferences, workshops, classes, and panels), and **clear data visualization**.

Education

Princeton University, Princeton School of Public & International Affairs (SPIA) — Princeton, NJ

PhD, Public and International Affairs (concentration: Science, Technology, and Environmental Policy) — 2022

MA, Public and International Affairs — 2018

- Dissertation: "Agriculture in flux, biodiversity in the balance: conservation implications of agricultural expansion & abandonment."
- Adviser: Dr. David S. Wilcove, Vice Dean (SPIA), Professor of Ecology and Evolutionary Biology and Public Affairs, Princeton University
- GPA: 3.95/4.00; Princeton Energy & Climate Scholar 2019-2021; Awarded Dean's Completion Fellowship 2022

University of Michigan — Ann Arbor, MI

BS (with distinction), Ecology & Evolutionary Biology (minor: Physics) — 2012

- GPA: 3.82/4.00; Phi Beta Kappa Society; University Honors for Academic Excellence 2008-2012; James B. Angell Scholar 2012

Publications

Peer-reviewed (see Google Scholar)

1. **Crawford CL,** Wiebe RA, Yin H, Radeloff VC, Wilcove DS. (2024). Biodiversity consequences of cropland abandonment. *Nature Sustainability* 7, 1596–1607. https://doi.org/10.1038/s41893-024-01452-1 (**Issue Cover Article**).
2. Zeng Y, Senior RA, **Crawford CL**, & Wilcove DS. (2023). Gaps and weaknesses in the global protected area network for safeguarding at-risk species. *Science Advances* 9, eadg0288. https://doi.org/10.1126/sciadv.adg0288
3. Ma L, Conradie SR, **Crawford CL**, Gardner AS, Kearney MR, Maclean IMD, McKechnie AE, Mi CR, Senior RA, & Wilcove DS. (2023). Global Patterns of Climate Change Impacts to Desert Bird Communities. *Nature Communications,* 14, 211. https://doi.org/10.1038/s41467-023-35814-8

4. **Crawford CL**, Yin H, Radeloff VC, & Wilcove DS. (2022). Rural land abandonment is too ephemeral to provide major benefits for biodiversity and climate. *Science Advances*, 8(21). https://doi.org/10.1126/sciadv.abm8999
5. **Crawford CL,** Estes LD, Searchinger TD, & Wilcove DS. (2021). Consequences of under-explored variation in biodiversity indices used for land-use prioritization. *Ecological Applications*, 31(7): e02396. https://doi.org/10.1002/eap.2396
6. **Crawford CL*,** Volenec ZM*, Sisanya M, Kibet R, & Rubenstein DI. (2018). Behavioral and Ecological Implications of Bunched, Rotational Cattle Grazing in East African Savanna Ecosystem. *Rangeland Ecology & Management*, 72(1):204-209. https://doi.org/10.1016/j.rama.2018.07.016 (*Co-lead author.)
7. Price JJ, & **Crawford CL**. (2013). Use and characteristics of two singing modes in Pine Warblers. *The Wilson Journal of Ornithology*, 125(3):552-561. https://doi.org/10.1676/13-006.1

Reports

1. Sustainable Conservation. (2015). Lower Mokelumne River Restoration Assessment. http://suscon.org/mokelumne-river-restoration-assessment/ **(Lead author of report.)**

Research and Professional Experience

AAAS Science & Technology Policy Fellow — **09/2023 – present**

American Association for the Advancement of Science (AAAS) — Full time (40 hours/week)
1200 New York Ave NW, Washington, DC 20005 — Salary: $102,506/year (GS-12, Step 2 equivalent)

Fellowship hosted by:
U.S. Department of Agriculture, Office of the Chief Scientist
1400 Independence Ave SW, Washington, DC 20250

- Earned a prestigious and competitive AAAS Science & Technology Policy Fellowship and was listed by USDA's Office of the Chief Scientist (and 4 other federal agencies) as their top-choice fellow for the cycle.
- Leveraged my background in ecology, biodiversity, and conservation science to support pollinator research and conservation efforts at USDA, particularly around innovations for data science, management, and transparency.
- Wrote custom code to create data links between USDA PLANTS, a widely-used and foundational plant database, and diverse external databases containing data on soils, taxonomic information, species status assessments, land cover and habitat information, and more. This project contributed to a broader effort to incorporate plant-pollinator interaction data to PLANTS for the first time, making the database more valuable for users and directly improving data sharing, public engagement, and transparency for pollinator and plant conservation and research.
- Provided technical and data guidance to the development of a knowledge graph focused on plant-pollinator interactions in collaboration with USDA agencies (ARS, NRCS), technical consultants (Esri) and university researchers. This pilot project demonstrated the value of a new way of structuring and visualizing data and drawing connections, leading the office director to encourage the development of similar efforts within USDA.
- Co-organized a "Workshop on Indigenous Co-Stewardship of Pollinators in the Western US" with Tribal, Federal, and NGO partners to increase tribal capacity, expand existing tribal stewardship efforts, and create more equitable and effective partnerships for pollinator conservation. This workshop catalyzed new and enhanced collaborations between tribal, governmental, and non-governmental stakeholders, and increased information sharing between these entities. This workshop was so successful that plans for follow-up workshops in other regions are underway.
- Contributed expertise to interagency discussions between USFWS, EPA, and USDA to foster proactive conservation actions for the monarch butterfly (*Danaus plexippus*) prior to its endangered species listing determination. This included compiling information on Federal, State, and private pollinator habitat conservation programs, which was directly incorporated into USDA's public comments on EPA's draft strategy to protect endangered species from insecticides. These collaborative discussions helped inform how natural resource conservation activities in agricultural settings are factored into endangered species mitigations and requirements, and will directly inform the USDA communication strategy for informing agricultural stakeholders of this listing determination.

- Served as a USDA representative to the National Science and Technology Council (NSTC) Subcommittee on Advanced Manufacturing (SAM), an interagency group coordinating federal advanced manufacturing activities. After only 1 month as a representative, initiated a survey of all relevant projects at USDA and subsequently presented an annual program review of USDA advanced manufacturing activities to the full Subcommittee. This work directly increased collaboration and coordination between USDA and other federal agencies and informed updates to the congressionally mandated National Strategy for Advanced Manufacturing.
- Served as co-lead for the Accelerating Innovative Technologies and Practices Team tasked with implementing the 2023-2026 USDA Science & Research Strategy, a strategic plan coordinating scientific and research priorities for the department. This involved leading a diverse team of 30 scientists from across the department to track progress towards plan goals and embed priorities into the current and future work across USDA.
- Coordinated USDA responses to two Governmental Accountability Office (GAO) audits on the use of immersive technology (including augmented and virtual reality) and unmanned aerial systems (UAS, or drones) at USDA. This involved coordinating data calls across 9 agencies and offices, collecting high-quality data, and managing a coherent response to satisfy these congressionally mandated requests.

Supervisor: Dr. Rich Derksen (202) 701-9510

Okay to contact this supervisor: Yes

Postdoctoral Research Associate 01/2023 – 08/2023
Postgraduate Research Associate (University Fellowship) 06/2022 – 12/2022

Center for Policy Research on Energy and the Environment — Full time (40 hours/week)
Princeton School of Public and International Affairs — Salary: $63,000/year (2023)
Princeton University, Princeton, NJ 08540 — Salary: $54,760/year (2022)

- Awarded selective fellowship (Dean's Completion Fellowship / Postgraduate Research Associate) for outstanding graduate students in the humanities and social sciences to provide financial support and a post-graduate research assistantship. Reappointed as a Postdoctoral Research Associate upon completion of the award period.
- Combined high-resolution land cover data with distribution and habitat data for over 2,000 terrestrial vertebrate species to produce the first detailed analysis of how cropland abandonment, secondary succession, and recultivation affect the amount of habitat available for individual bird and mammal species through time. Built linear models for each species to extract simple trends and understand individual habitat changes while accounting for temporal autocorrelation. Built additional linear models to explore the relative impact of various species traits on responses to cropland abandonment. This project resulted in the December 2024 cover article in the high-impact journal *Nature Sustainability*.
- Used simple linear models to explore the environmental, agricultural, socioeconomic, and biophysical drivers of cropland abandonment and recultivation, to inform investments and make restoration more durable.
- Communicated research at prominent academic conferences hosted by the North American Congress for Conservation Biology (NACCB) and the Ecological Society of America (ESA).

Supervisor: Dr. David S. Wilcove (609) 258-7118
Okay to contact this supervisor: Yes

Graduate Researcher and PhD Candidate 09/2016 – 05/2022

Princeton School of Public and International Affairs — Full time (40 hours/week)
Princeton University, Princeton, NJ 08540 — Salary: $34,000/year

- Developed expertise in biodiversity metrics by showing that commonly-used methods for quantifying biodiversity in land-use prioritization algorithms produce radically different land use recommendations for both biodiversity protection and agricultural conversion. This research resulted in a peer-reviewed article with concrete and practical recommendations for how to incorporate biodiversity data into spatial land-use planning decisions.
- Initiated a multi-university collaboration with leading remote sensing researchers and ecologists to evaluate the environmental impacts of the emerging agricultural land use trend of cropland abandonment. Combined cutting-edge high-resolution land cover time series with spatially-explicit data on biodiversity and carbon accumulation to

producing quantitative assessments of the impact of abandonment and recultivation on carbon storage and biodiversity.

- Developed R and shell scripts to process hundreds of millions of pixels of spatial time series data on computing clusters and quantify the persistence of cropland abandonment through time. Developed innovative linear models to handle messy time-series data and predict abandonment duration as a function of time (modeling recultivation as a decay process). This research resulted in a high-impact peer-reviewed article in *Science Advances* illuminating the potential for abandonment to help meet carbon and biodiversity goals.
- Conducted ecological field research to investigate methods to increase the sustainability of livestock grazing in Kenya's savanna ecosystems, producing one of the first quantifications of the behavioral and environmental consequences of rotational grazing.
- Communicated interdisciplinary research conclusions from my dissertation in four first-authored peer-reviewed publications in leading journals in ecology, conservation, and environmental science.
- Served as an Assistant in Instruction (TA) for two semesters of SPI/ENV 350 – The Environment: Science and Policy (2019, 2020), an advanced undergraduate course at Princeton University, leading three weekly discussion sections on environmental policy issues including natural resource management, biodiversity, wildlife trade, climate change, and ecosystem services, contributing to lesson planning, and grading student papers and exams.

Supervisor: Dr. David S. Wilcove (609) 258-7118
Okay to contact this supervisor: Yes

Project Manager **01/2016 – 05/2016**
Project Associate **07/2013 – 12/2015**
Sustainable Conservation Full time (40 hours/week)
98 Battery St, Suite 302, San Francisco, CA 94111 Salary: $50,000/year (2016)
Salary: $40,000/year (2013-15)

- Mapped all restorable riparian areas along California's Mokelumne River and quantified the corresponding costs and ecosystem service benefits of restoration, producing a cost-benefit analysis and report directly informing watershed-wide conservation planning. This report helped target restoration efforts and inform a feasibility analysis for a Payments for Ecosystem Services pilot program funded by a USDA Conservation Innovation Grant.
- Managed PlantRight's annual Spring Nursery Survey to track the retail market for invasive plants in California, coordinating and training more than 150 volunteers to survey more than 250 garden stores each year. Used horticultural prevalence data to directly inform annual updates to PlantRight's list of commonly sold invasive plants and non-invasive alternatives, in consultation with a committee of experts and stakeholders.
- Developed robust collaborations across diverse sectors and industries to solve environmental problems and facilitate restoration projects, including businesses (e.g., retail garden centers recruited as "PlantRight Partners"), landowners, farmers, public utilities, industry groups, volunteer groups, academics, and conservation NGOs.

Supervisors: Kelli McCune (609) 258-7118 (currently at San Francisco Bay Joint Venture)
Jan Merryweather (415) 977-0380
Okay to contact these supervisors: Yes

Data Quality Controller **05/2012 – 07/2012**
Michigan State University Full time (40 hours/week)
Agriculture Hall, 446 W Circle Dr, East Lansing, MI 48824 Salary: $800 bi-weekly

- Trained, supervised, and managed survey enumeration teams in Western Province, Zambia, for the 2012 Rural Agricultural Livelihoods Survey, a nationally-representative economic survey of 8,500 Zambian farm households.

Supervisor: Dr. Thomas S. Jayne (517) 432-9802
Okay to contact this supervisor: Yes

NSF Research Experience for Undergraduates Researcher **06/2011 – 08/2011**
University of Michigan Biological Station Full time (40 hours/week)

9133 Biological Rd, Pellston, MI 49769 Salary: $4,700 one-time stipend

- Designed and conducted two-month research project studying patterns of song interaction in two migratory populations of Pine Warblers (*Setophaga pinus*) in northern Michigan, establishing baseline data to inform further science and resulting in a co-authored peer-reviewed journal article.
- Gained hands-on experience in independent field research, writing, communication, and programming for statistics and GIS (R, SPSS, and ArcGIS).

Supervisor: Dr. J. Jordan Price (240) 895-2216
Okay to contact this supervisor: Yes

Technical Skills

- Programming & statistics in R (advanced), bash/unix (moderate), Python (beginner), JavaScript (beginner)
- Spatial analysis in R, Google Earth Engine, ArcGIS, and QGIS.
- R package expertise: tidyverse, data.table, terra, raster, sf, arrow, fixest.
- Other skills include: advanced data visualization with R (ggplot2 and base graphics), cluster computing with SLURM, version control with GitHub, reproducible research with Markdown.

Leadership, Teamwork, and Outreach

- Co-chair of AAAS STPF Biodiversity Affinity Group, coordinating biodiversity-oriented educational and professional development opportunities for current AAAS fellows and alumni, including field trips and speaking engagements with high profile policymakers (e.g., EPA's Deputy Assistant Administrator for Pesticide Programs, Jake Li).
- Communicated research findings to diverse academic and public audiences, including presenting at 4 academic and industry conferences, giving 2 invited undergraduate course lectures, and garnering press coverage from *BioScience*, Bloomberg, and The Hill.
- Mentored the next generation of science-policy leaders through one-on-one conversations and by participating in multiple panels oriented around science-policy careers for graduate students.
- Conducted outreach on environmental issues such as climate change (meeting with congressional staff and providing 2 lectures to local high schoolers as a graduate student) and invasive plants (including 7 presentations to garden groups in California and 6 online webinars as an NGO professional).
- Invited peer reviewer for academic journals such as *Science*, *BioScience*, and *International Journal of Ecology.*

Awards and Scholarships

- American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellowship 2023
- Princeton University Dean's Completion Fellowship / Postgraduate Research Associate 2022
- Princeton Energy and Climate Scholar (PECS), Princeton University 2019 – 2021
- Honorable Mention, National Science Foundation (NSF) Graduate Research Fellowships Program (GRFP) 2018
- Princeton University Graduate Fellowship, School of Public and International Affairs (SPIA) 2016 – 2021
- NSF Research Experience for Undergraduates (REU) Fellowship, University of Michigan Biological Station 2011

Speaking Engagements

Government engagements

1. "USDA Agency Hemp Updates" presented to the USDA Hemp Working Group. May 2nd, 2024.
2. "USDA Advanced Manufacturing," presented to the National Science & Technology Council (NSTC) Subcommittee on Advanced Manufacturing. April 2nd, 2024.
3. "Fundamentals of Biodiversity: Concepts, values, and why it matters for agriculture," presented to the USDA Biodiversity Working Group. March 12th, 2024.
4. "Fundamentals of Biodiversity: Concepts, values, and why it matters for agriculture," presented to the USDA Emerging Infectious Diseases Working Group. Presentation focused on the interactions between intensive agriculture and infectious diseases, tailored to this audience's needs and interests. February 1st, 2024.

Panel discussions

1. "Panel on Science Policy Pathways," hosted by Princeton University's GradFUTURES program in collaboration with the Princeton School of Public and International Affairs' Center for Policy Research on Energy and the Environment. April 11th, 2024.
2. "Alumni Panel" as part of the Princeton School of Public and International Affairs' DC Career Symposium, January 26th, 2024.

Research

1. "Rural land abandonment: implications for biodiversity and climate" with H Yin, VC Radeloff, RA Wiebe, DS Wilcove. Guest lecture presented in EEB 308, Princeton University, November 14th, 2022.
2. "Rural land abandonment is too ephemeral to provide major benefits for biodiversity and climate, despite substantial potential to create habitat and store carbon," with H Yin, VC Radeloff, RA Wiebe, and DS Wilcove. Annual meeting of the Ecological Society of America (ESA), joint with Canadian Society for Ecology and Evolution (CSEE), Montréal, Canada, August 15th, 2022.
3. "Rural land abandonment is too ephemeral to provide major benefits for biodiversity and climate," with He Yin, Volker C. Radeloff, and David S. Wilcove. North American Congress on Conservation Biology (NACCB), Reno, NV, July 19th, 2022.
4. "Timing and durability of agricultural abandonment." Science, Technology, and Environmental Policy & High Meadows Environmental Institute (STEP-HMEI) Program-wide seminar, Princeton University, April 7th, 2021.
5. "Tradeoffs between Agriculture & Biodiversity: agricultural expansion in Zambia," invited presentation to ENV 405, Princeton University, December 12th, 2018.
6. "Achieving the Biggest Bang for the Buck: Framework for Weighing Riparian Restoration Costs and Benefits," presented at the 2015 California Association of Resource Conservation Districts (CARCD) Conference, Yosemite, Nov. 20th, 2015, and SERCAL 2016 (California Society for Ecological Restoration), Kings Beach, CA, May 12th, 2016.

Public Outreach

1. "Environmental Impacts of Climate Change," with Julie Tierney and Yiheng Tao. Presentation to Energy and Climate Scholars Program, Princeton Day School, Nov. 17th, 2020.
2. "Environmental Impacts of Climate Change," with John Tracey and Nic Choquette-Levy. Presentation to Energy and Climate Scholars Program, Princeton Day School, Nov. 5th, 2019.
3. "PlantRight: Promoting Noninvasive Garden Plants for California," presented to the Santa Clara County Master Gardeners (Mar. 2014), Carmel-by-the-Sea Garden Club (Feb. 2015), Monterey Bay Master Gardeners (Feb. 2015), Kings & Tulare County Master Gardeners (Mar. 2015), and Fresno & Madera County Master Gardeners (Mar. 2015).
4. "PlantRight's Invasive Plants Webinar and Survey Training," presented six times, in February and April annually for 2014, 2015, and 2016. Included background on invasive plants, survey volunteer training, and a feature presentation by Calflora.org and Dan Gluesenkamp of the California Native Plant Society. View recording here.
5. "Planting Right: Choosing Noninvasive Plants for your Garden, Community, & Environment," presented at the 2014 University of California Master Gardener Conference, Yosemite, Oct. 7-10, 2014.

INTERESTS

- Playing peekaboo with my 1-year-old daughter, perfecting my sourdough technique, looking for birds, listening to Swedish music, taking photos of clouds, & cooking spicy food.