# CURRICULUM VITÆ

**William Austin Rutherford, Ph.D.**

U.S. Department of Agriculture (USDA)
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## EDUCATION

**Ph.D. in Natural Resources** **2016 – 2022**
**Emphasis: Ecology, Management, and Restoration of Rangelands**
University of Arizona, Tucson, AZ
*Major Advisor: Steven Archer*
*Committee: Osvaldo Sala, Willem van Leeuwen, Michael Crimmins*
Dissertation: Mechanisms and Proactive Management of Woody Plant Encroachment on Southwestern Rangelands

**Geographic Information Science Graduate Certificate** **2021**
University of Arizona, Tucson, AZ
*Advisor: Willem van Leeuwen*

**B.S. in Biology** **2008 – 2011**
Indiana University, 107 S Indiana Avenue, Bloomington, IN 47405
*Advisers: Heather Reynolds and Jonathan Bauer*
Thesis: Drought stress relations between invasive *Euonymus fortunei* and five natives in a simulated mesic forest understory

## PROFESSIONAL EXPERIENCE

**Research Ecologist (post-doc) (GS-0408-11). USDA ARS Southwest Watershed Research Center, Tucson, AZ. Supervisor, Jason Williams.** **2022 – *Present***
Projects and Skills:
- Utilize USDA Natural Resources Conservation Service National Resource Inventory data to assess rangeland plant community dynamics and health
- Geospatial analyses of woody plant encroachment and vegetation habitat dynamics in semi-arid and arid ecosystems

**Graduate Research Assistant. University of Arizona (UA), School of Natural Resources and the Environment (SNRE).** **2016 – 2022**
Projects and Skills:
- Designed and implemented field and controlled environment experiments examining shrub establishment in the Sonoran Desert
- Conducted geospatial analysis of woody plant encroachment and vegetation habitats in semi-arid and arid ecosystems

**Roots for Resilience Research Assistantship in Data Science. UA Arizona Institutes for Resilience, UA/NSF CyVerse, and the UA Data Science Institute.** **Spring 2021**

- Projects and Skills (Press: CyVerse News):
- Introduced CyVerse and its potential applications to UA SNRE faculty
- Identified tools and concepts from open science and data science for use in Natural Resources research to foster new interdisciplinary research partnerships

**Biological Science Technician (GS-0404-05). U.S. Geological Survey (USGS) Canyonlands Research Station, Moab, UT. Supervisor, Erika Geiger.** **2013 – 2016**

Projects and Skills:

- Worked on a variety of experiments with aims on how local, regional, and global change factors are affecting dryland terrestrial ecosystems. Examples:
    - Department of Energy funded research on climate change effects on vegetation and biological soil crusts;
    - Collected and analyzed hyperspectral remote sensing data for quantifying dryland energy balance and its relation to biological soil crusts;
    - Collected and analyzed multi-spectral remote sensing data to examine vegetation productivity trends; and
    - Soil mapping and characterization to study livestock grazing impacts.
- Created MS Access relational databases and R scripts for data organization and analysis

**Botany Intern. Conservation and Land Management Program, Bureau of Land Management (BLM), Carson City, NV. Supervisor, Dean Tonenna.** **2012-2013**

Projects and Skills:

- Assisted BLM Rangeland Management Specialists in data collection including plan and proposal development
- Surveyed Threatened and Endangered and/or rare plant populations
- Monitored post-wildfire vegetation and fire intensity
- Monitored and controlled invasive weed populations
- Collected and processed plant seed for the BLM *Seeds of Success* program

**Undergraduate Research Assistant. Indiana University, Dept. of Biology. Supervisor, Jonathan Bauer.** **2009 –2011**

Projects and Skills:

- Experimented and analyzed results on invasive and native plant establishment responses to drought and to arbuscular mycorrhizal fungi and rhizobia inoculations
- Managed invasive plants in mesic deciduous forests

## HONORS & AWARDS

- Society for Range Management Annual Meeting PhD Oral Presentation Competition (1st Place). 2022.
- Research Insights in Semi-arid Ecosystems Symposium (RISE) Graduate Competition (2nd Place). 2021.
- International Arid Lands Consortium Graduate Lightning Talk Competition (Finalist). 2021.
- Society for Range Management Annual Meeting PhD Poster Competition (1st Place). 2019.
- UA SNRE Outstanding Graduate Teaching Assistant Award. 2018-2019.
- RISE Graduate Competition (Honorable Mention). 2018.
- Department of Interior STAR (Special Thanks for Achieving Results) Award. 2015.

## GRANTS & SCHOLARSHIPS *External total:* $187,237*; UA Internal total:* $49,731

- USDA NIFA-AFRI-Education and Workforce Development Predoctoral Fellowship. 2021-2023: $111,527
    - Managing from a distance: conservation of semi-arid grasslands through machine learning
    - Project Director (PD): Rutherford; Mentor: Steve Archer
    - Terminated Fall 2022 due to completion of PhD degree requirements
- USDA Renewable Resources Extension Act-National Focus Fund Project. 2020-2022: $50,000
    - PD: Elise Gornish; Co-PDs: Steve Archer & Sheila Merrigan
    - Rutherford: spearheaded proposal development, drafting, and project management
- Western SARE (Sustainable Agriculture Research and Education) Graduate Student Grant. 2019-2021: $24,949
- Carson Scholars Program Scholarship. 2018: $5,000
- Global Change Summer Research Award (GC Award SNRE Press). 2020: $1,500
- Senior Data Science Ambassadorship (Data Science Institute). 2020-2021: $1,000
- Data Science Ambassadorship (Data Science Institute). 2019-2020: $1,000
- Bartley P. Cardon Scholarship (UA). 2020: $1,180
- Harry Wayne Springfield Endowment (UA). 2017: $1,000; 2018: $2,100; 2019: $2,200; 2020: $14,332; 2021: $7,692
- Bill Ross Scholarship (UA). 2018: $1,800
- UA Graduate College Fellowship. 2017: $1,000; 2018: $1,000; 2019: $1,000
- Graduate Arizona Financial Aid Trust Award. 2020: $3,000
- Horton E. Noon Memorial Scholarship (UA). 2021: $800
- H. Lynn and Marjorie M. Anderson Scholarship (UA). 2018: $319; 2020: $614
- Clifford W. Carstens, Jr. Scholarship (UA). 2018: $946
- E. Ray Cowden Scholarship (UA). 2016: $534; 2017: $1,714
- South Central Climate Science Center Early Career Professional Development Training. 2016: $761

## PROFESSIONAL SOCIETIES

- Society for Range Management (*2017 - present*)
- Ecological Society of America (*2017 – present*)
- Society for Ecological Restoration (*2019- present*)
- Honor Society of Phi Kappa Phi (*2019- present*)

## TEACHING EXPERIENCE

**Graduate Teaching Assistant,** RNR 200: *Conservation of Natural Environments*, UA (*Fall 2018*)
- Course assignment refinements/improvements
- Development of grading schemes for essay assignments
- Grading essays and exams including commenting/editing essays for student writing improvement
- Introduction and explanation of assignments to class, followed by comprehensive Q&A sessions

**Data Science Ambassador,** UA College of Agriculture and Life Sciences (2019-2020)
- Data/Software Carpentry Unix/Git/R workshop helper and organizer
- R/RStudio consulting and student instruction
- Provide data management and storage resources to Faculty
- Machine Learning Literacy Project Coach
- Research Bazaar Arizona Virtual Conference (2020) R and ggplot2 assistant

**Senior Data Science Ambassador,** UA College of Agriculture and Life Sciences (2020-2021)
- Data/Software Carpentry Unix/Git/R workshop helper and organizer
- University of Arizona Faculty and Student R/RStudio consulting and instruction
- Institute for Tribal Environment Professionals Tribal Exchange Network 2020 Virtual Data Academy and Conference Instructor
- Taught Tribal Natural Resource Professionals on how to apply the R programming language to their own unique data manipulation, organization, and visualization tasks.
- Co-Organizer & Helper/Instructor Coordinator - Research Bazaar Arizona Virtual Conference (2021)

**Osher Lifelong Learning Institute Lecturer,** UA Fall 2020
- A non-credit lifelong learning program open to all adults over the age of 50 as an affiliate of the University of Arizona through the office of Continuing and Professional Education.
- Taught an introduction to Rangelands, Range Science, and personal research summary
- Title: "*The rise of mesquite shrubs in Sonoran Desert grasslands: a story of rain, cows, ants and rats*"

**Guest Lecturer**, UA ENVS 401/501 Sustainable Management of Arid Lands, UA Fall 2021
- Taught a 2-hr lesson titled, "Introduction to statistics with the R programing language."

## TEACHING & PROFESSIONAL TRAINING

- **Title XI Training**, UA (*Annual*)
- **Teaching Assistant Training Online**, UA (*Fall 2018*)
- **Federal Education Right Protection Act Training**, UA (*Fall 2018*)
- **College of Agriculture & Life Sciences Teaching Assistant Workshop**, UA (*Fall 2018*)
- **Data Carpentry Online Instructor Training** (*Fall 2019*)
- **CyVerse Foundational Open Science Skills Training** (*Spring 2021*)
- **NRCS National Resource Inventory Grazing Land On-site Data Collection** (*Spring 2023*)
- **BLM Interpreting Indicators of Rangeland Health version 5** (*Spring 2023*)

## SERVICE & OUTREACH

**Manuscript Reviewer** (# of manuscripts):
*Arctic, Antarctic, and Alpine Research* (1); *Ecological Applications* (2); *Geoderma* (3); *Global Change Biology* (1); *New Phytologist* (1); *Plant and Soil* (3); *Remote Sensing of Environment* (1); *Remote Sensing in Ecology and Conservation* (1)

**Director South,** Society for Range Management-Arizona Section. 2023-*Present.*

**Vice-Chair, Board of Directors,** Cienega Watershed Partnership, 2023-*Present.*
**Secretary, Board of Directors**, Cienega Watershed Partnership, 2022-2023.

**Invited Speaker,** Discovering the Land: Community, Science, and Partnership in the Sonoita and Patagonia Region. Co-organized a demonstration titled, "Shrub Encroachment in Cienega Watershed: Past, Present and Future" with Scott Jones (UA) to the Sonoita and Patagonia, Arizona community members, 2022.

**Graduate Student Member,** UA SNRE Data Literacy Career Track Professor of Practice Search Committee**,** 2021.

**Ecology, Management, and Restoration of Rangelands Representative,** SNRE Natural Resources Graduate Student Organization. Elected to provide the Rangeland graduate student perspective to SNRE Director and Faculty on upcoming policies and initiatives, as well as develop and facilitate graduate student social events, 2020-2021.

**(Senior) Data Science Ambassador**, University of Arizona Data Science Institute program to serve as a resource within the College of Agriculture and Life Science to develop trainings/data literacy programs and aid researchers and educators with data science related questions through consults, training, and/or lessons, 2019-2021.

**Judge**, University of Arizona Graduate and Professional Student Council grant program reviewing applications for student travel, seminars/workshops, and research projects, 2019.

**Judge,** High School Youth Forum Oral Presentations at the Society for Range Management annual meeting, where students from the western US and Canada get the opportunity to gain experience giving professional presentations on a variety of rangeland topics, 2019, 2020. Canceled in 2021 due to COVID-19 pandemic.

**Judge,** St. Michael's School 6$^{th}$-8$^{th}$ Grade Science Fair Presentations, where students apply the scientific method on a variety of topics of their choice, 2019-2021.

**Co-developer,** BLM informational pamphlets. Designed and published pamphlets on native versus invasive vegetation and rangeland monitoring for distribution to the public, 2012.

**Instructor,** Truckee Meadows Outdoor Education Program. BLM and The Nature Conservancy cooperative program to teach Reno, NV inner city youth about ecological restoration and environmental science, spring and fall 2012.

## STUDENT MENTORING

**Tierra Seca (UA Student Club, Society for Range Management Chapter)** **2016 - *Present***

- Provided guidance in undergraduate student professional development
  - Assisted with federal agency employment and/or graduate school applications
- Volunteered at club fundraising events

**Undergraduate Student Researchers + Mentees**

- **James Pagan**, UA, *Fall 2016 – Spring 2018*
- **Jodi Poole**, UA, *Fall 2017* (Employed with NRCS Holbrook, AZ)
- **Sara Amiot**, UA, *Spring 2018 – Fall 2018* (Employed with USFS Tucson, AZ)
- **William Gray**, UA, *Fall 2018 – Spring 2020* (Employed with USFS Flagstaff, AZ)
- **Jacob Brown**, UA, *Spring 2022* (Employed with NRCS Ely, NV)
- **Alejandra Huerta**, UA, *Spring 2022* (Employed with Million Dollar Teacher Project Phoenix, AZ)

## PUBLICATIONS AND PRESENTATIONS

*Refereed Journal Articles (Submitted or In Review)*

**Rutherford, WA**, OE Sala, SR Archer. Shrub recruitment in a semi-arid grassland: continuous or episodic? *J. Applied Ecology*. (submitted 06/09/2023)

Yan, D, SC Reed, **WA Rutherford**, M Javadian, RH Reibold, M Villarreal, B Poulter, S Song, WK Smith. Hyperspectral imaging predicts differences in carbon and nitrogen status among representative biocrust functional groups of the Colorado Plateau. *Remote Sensing of the Environment*. (submitted 06/06/2023)

*Refereed Journal Articles (In Press)*

Hart S, K Raymond, CJ Williams, **WA Rutherford**, J DeGayner. Modeling Earthen Treatments for Climate Change Effects. *Heritage*. 2023; 6(5):4214-4226. https://doi.org/10.3390/heritage6050222

*Refereed Journal Articles (Published)*

Chuckran, PF, C Flagg, J Propster, **WA Rutherford**, ET Sieradzki, SJ Blazewicz, ... & P Dijkstra. (2022) Edaphic controls on genome size and GC content of bacteria in soil microbial communities. *Soil Biology and Biochemistry*. https://doi.org/10.1016/j.soilbio.2022.108935

**Rutherford, WA**, SR Archer. (2022) Trait responses of a grassland shrub invader to altered moisture regimes. *Plant and Soil*. https://doi.org/10.1007/s11104-022-05678-w

Weber-Grullon, L, L Gherardi, **WA Rutherford**, SR Archer, OE Sala (2022) Woody-plant encroachment: Precipitation, herbivory and grass-competition interact to affect shrub recruitment. *Ecological Applications* e2536. https://doi.org/10.1002/eap.2536

Smith, WK, MP Dannenberg, D Yan, S Herrmann, ML Barnes, GA Barron-Gafford, JA Biederman, S Ferrenberg, AM Fox, AR Hudson, JF Knowles, N MacBean, DJP Moore, PL Nagler, SC Reed, **WA Rutherford**, RL Scott, X Wang, J Yang (2019) Remote sensing of drylands: Progress, challenges and opportunities. *Remote Sensing of the Environment*. 233, 111401. https://doi.org/10.1016/j.rse.2019.111401

**Rutherford, WA**, TH Painter, J Belnap, GS Okin, C Flagg, SC Reed (2017) Albedo feedbacks to future climate via climate change impacts on dryland biocrusts. *Scientific Reports.* 7, 44188. https://doi.org/10.1038/srep44188

Press: USGS Press Release; High Country News; Arizona Daily Sun; The Daily Wildcat

*Presentations (Oral and Poster)*

Brown, JR, N Pierce, **WA Rutherford**. (2023). The importance of understanding shrub seed dispersal and seedling recruitment. Oral presentation; 76th Annual Society for Range Management Meeting, Boise, ID.

**Rutherford, WA**, SR Archer. (2023). Trait responses of a grassland shrub invader to altered moisture regimes. Oral presentation; 76th Annual Society for Range Management Meeting, Boise, ID.

**Rutherford, WA**. (2022). ShrubRisk: An online brush management tool for southeastern Arizona and it's sensitivity to ecological sites. *Invited* oral presentation & panelist, Arizona Geographic Information Council Education and Training Symposium, Prescott, AZ.

**Rutherford, WA**, SR Archer, S Merrigan, A Gondor. ES Gornish. (2022). An online toolkit for grassland conservation. Oral presentation; 75th Annual Society for Range Management Meeting, Albuquerque, NM. ***1st Place PhD Oral Presentation Competition*

**Rutherford, WA**, SR Archer, L. Weber-Grullon, OE Sala. (2021) Monsoon season precipitation variation, not herbaceous cover, controls shrub (*Prosopis velutina*) recruitment in Sonoran grasslands. Poster presentation; 17th Annual Research Insights in Semiarid Ecosystems (RISE) Symposium, Tucson, AZ. ***RISE 2nd Place Graduate Student Poster Award Winner*

**Rutherford, WA**, S Merrigan, SR Archer, ES Gornish. (2021). Developing online resources for managing shrub encroachment. Oral presentation & panelist; Collaborative Conservation and Adaptation Strategy Toolbox (CCAST) Grassland Restoration and Management Panel-Discussion Series: Existing and Emerging Vegetation Tools, Virtual Meeting.

**Rutherford, WA** and SR Archer. (2021) Evaluating shrub proliferation in the Sonoran Desert. Oral/Lightning presentation; International Arid Lands Consortium, Virtual Meeting.
***Finalist in Graduate Student Lightning Talk Competition (1 of 2 from U.S. Institutions of Higher Education)*

**Rutherford, WA**, S Merrigan, SR Archer, ES Gornish. (2021). Fusing range and data science: developing online resources for managing shrub encroachment. Oral presentation; Rangelands Partnership Annual Meeting, Virtual Meeting.

**Rutherford, WA**, SR Archer, L. Weber-Grullon, OE Sala. (2021) Shrub (*Prosopis velutina*) recruitment in Sonoran grasslands: precipitation, not herbaceous cover, matters most. Poster presentation; 74th Annual Society for Range Management Meeting, Virtual Meeting.

**Rutherford, WA** and SR Archer. (2020) Evaluating shrub proliferation risk on Sonoran Desert rangelands. *Invited* Oral/Inspire presentation; Ecological Society of America Annual Meeting, Virtual Meeting.

**Rutherford, WA**, SR Archer, L. Weber-Grullon, OE Sala. (2020) Monsoon season precipitation variation, not herbaceous cover, controls shrub (*Prosopis velutina*) recruitment in Sonoran grasslands. Poster presentation; Ecological Society of America Annual Meeting, Virtual Meeting.

**Rutherford, WA**, SR Archer. (2020) Predicting Woody Plant Encroachment Risk on Sonoran Desert Rangelands. Poster presentation; 73rd Annual Society for Range Management Meeting, Denver, CO.

**Rutherford, WA**, SR Archer, L. Weber-Grullon, OE Sala. (2020) Velvet mesquite recruitment in Sonoran grasslands: grass utilization is of little consequence to Monsoon season precipitation variation. Oral presentation; AZ Section-Society for Range Management Winter Meeting, Wickenburg, AZ.

**Rutherford, WA**, SR Archer. (2019) Evaluating Shrub Encroachment Risk on Sonoran Desert Rangelands. Poster presentation; Society for Ecological Restoration-Southwest, Tucson, AZ.

Mathis, KA, **WA Rutherford**, SR Archer. (2019) The role of ant seed dispersers in woody plant encroachment in arid grasslands. Oral presentation; Entomological Society of America, St. Louis, MO.

Jones, S**, WA Rutherford,** SR Archer. (2019) Evaluating Woody Plant Encroachment in Sonoran Grasslands for Brush Management Planning. Oral presentation (co-presented by Jones and Rutherford); Science on the Sonoita Plain Symposium, Sonoita, AZ.

**Rutherford, WA**, SR Archer, L. Weber-Grullon, OE Sala. (2019) Shrub recruitment in Sonoran grasslands: grass utilization is of little consequence to intra-seasonal precipitation variation. Poster presentation; 72nd Annual Society for Range Management Meeting, Minneapolis, MN.
***1st Place PhD Poster Presentation Competition*

**Rutherford, WA**, SR Archer, WJD van Leeuwen (2018) A Decision Support Tool for Predicting Risk of Woody Plant Encroachment on Rangelands. Poster presentation; Southwest Vegetation Management Association Annual Meeting and 15th Annual Research Insights in Semiarid Ecosystems (RISE) Symposium, Tucson, AZ.
***RISE Honorable Mention Graduate Student Poster Award Winner*

**Rutherford, WA**, SR Archer. (2018) Rise of the shrubs: Fire regimes in the Sonoran Desert. Oral presentation; University of Arizona Borderlands Science Café, Tucson, AZ. As part of series: *A Song of Ice (and Floods) and Fire: Consequences of a Changing Climate on Our Ecosystems and Societies.*

**Rutherford, WA**, SR Archer, L. Weber-Grullon, OE Sala. (2018) Shrub (*Prosopis velutina*) recruitment in a semi-arid grassland: precipitation-herbivory interactions reveal few constraints. Poster presentation; Ecological Society of America Annual Meeting, New Orleans, LA.

**Rutherford, WA**, KA Mathis, L. Weber-Grullon, OE Sala, SR Archer. (2017) Does seed predation limit velvet mesquite (*Prosopis velutina*) recruitment in grasslands? Poster presentation; 14th Annual Research Insights in Semiarid Ecosystems (RISE) Symposium, Tucson, AZ.

Weber-Grullon, L, OE Sala, **WA Rutherford**, SR Archer. (2017) Woody-plant encroachment in the Chihuahuan Desert: Mechanisms of invasion and opportunities for containment. Poster presentation; Ecological Society of America Annual Meeting, Portland, OR.

Reed, SC, S Ferrenberg, C Tucker, **WA Rutherford**, T Wertin, T McHugh, E Morrissey, C Kuske, R Mueller, J Belnap. (2016) Abiotic and biotic controls over biogeochemical cycles in drylands: Insights from climate change and nitrogen deposition experiments on the Colorado Plateau. Invited Oral presentation; American Geophysical Union Fall Meeting, San Francisco, CA.

**Rutherford, WA**, TH Painter, J Belnap, GS Okin, C Flagg, SC Reed. (2016) The energy of biocrusts: how climate change disturbances in drylands may induce large, novel global climate change feedbacks. Oral presentation; 3rd International Workshop on Biological Soil Crusts (Biocrust3), Moab, UT.

**Rutherford, WA**, SC Reed, S Ferrenberg, and J Belnap. (2015) Seasonal precipitation effects on the native grass, *Pleuraphis jamesii*, on the Colorado Plateau. Oral presentation; 13th Biennial Conference of Science & Management on the Colorado Plateau & Southwest Region, Flagstaff, AZ.

Reed, SC, S Ferrenberg, T Wertin, A Darrouzet-Nardi, **WA Rutherford**, C Tucker, J Belnap. (2015) Dryland feedbacks to climatic change: Results from a climate manipulation experiment on the Colorado Plateau. Invited Oral presentation; American Geophysical Union Fall Meeting, San Francisco, CA.

**Rutherford, WA**, Flagg C, Painter TH, Okin GS, Belnap J, Reed SC. (2014) Climate and physical disturbance effects on the spectral signatures of biological soil crusts: implications for future dryland energy balance. Poster presentation; American Geophysical Union Fall Meeting, San Francisco, CA.

## PROFESSIONAL REFERENCES

**C. Jason Williams, Ph.D.**
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