**HEATHER E. GAYA**

Graduate Student - Wildlife Ecology and Management

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**RESEARCH INTERESTS**

Quantitative Ecology, Bayesian Modeling, Wildlife Management, Herpetology

**EDUCATION**

2019 - 2023 **PhD** in Wildlife Ecology and Management, University of Georgia, Athens, GA

Advisor: Richard Chandler, PhD

Dissertation: *Trailing-Edge Population Dynamics in the Southern Appalachian Mountains*

GPA: 4.0/4.0

2019 – 2022 Graduate Certificate in Agricultural Data Science, University of Georgia, Athens GA

2017 - 2019 **MS** in Wildlife Ecology and Management, University of Georgia, Athens, GA

Advisor: Clinton Moore, PhD

Thesis: *Improving Line-Transect Distance Sampling (LTDS) for Gopher Tortoise (Gopherus polyphemus) Populations*

GPA: 4.0/4.0

2012- 2016 **BA** Environmental Studies – Biology, Whitman College, Walla Walla, WA

 Advisor: Tim Parker, PhD

Thesis: *Why is the Grass Dying? An Integral Projection Model for a Pseudoroegneria spicata (Bluebunch Wheatgrass) Population in Eastern Washington*

GPA: 3.79/4.0

**EXPERIENCE**

2023– Present Postdoctoral Researcher, Warnell School of Forestry and Natural Resources,

 University of Georgia, Athens, GA

* Developed and implemented a spatially-explicit, dynamic population model of coyote abundance in response to supplement foraging resources (pig carcasses)
* Created and implemented an integrated population model to assess abundance, movement and survival of coyotes at the Savannah River Site, South Carolina across the past decade
* Developed a spatially-explicit model to predict future population dynamics for a deer herd in Arkansas with high levels of chronic-wasting disease (CWD)
* Provided statistical assistance to graduate students in the lab

2021– Present Co-Owner, H and H Ecological Analysts LLC, Athens, GA

* Developed a climate forecasting R-Shiny Application (CPAT 2.0) to help forest owners implement sustainable practices under climate change
* Developed an R-Shiny Application (COLE v2) to estimate forest biometrics and potential carbon offsets based on stand characteristics and future climate scenarios
* Developed and presented workshops on statistical methods such as Bayesian Inference in R, machine learning and Introduction to R programming
* Provided statistical consulting for a variety of ecological projects

2019– 2023 Graduate Research Assistant, Warnell School of Forestry and Natural Resources,

 University of Georgia, Athens, GA

* Developed extensions to SCR models to include species spatial interactions
* Performed point counts, mark-resight searches, constant effort mist-netting and banded over 400 individual birds from 40+ species
* Developed an individual-based modeling framework for inference about wildlife populations
* Installed and maintained 3 MOTUS towers for tracking avian migration
* Quantified the role of climate change on songbird population dynamics through both community and individual level data

2017 – 2019 Graduate Research Assistant, Warnell School of Forestry and Natural Resources,

 University of Georgia, Athens, GA

* Designed a Bayesian hierarchical model to account for estimation bias against individuals with low detection probabilities in line-transect distance sampling (LTDS)
* Developed improvements for LTDS field techniques to increase detection probability of juvenile gopher tortoise (*Gopherus polyphemus)* burrows
* Designed a rapid habitat assessment protocol to integrate vegetation covariates into gopher tortoise LTDS methodology
* Assisted with field validation of gopher tortoise habitat suitability models

2016 – 2016 Field Technician, National Ecological Observatory Network (NEON), Manhattan, KS

* Followed protocols relating to beetles, ticks, mosquitoes, small mammals, and soils
* Followed multiple NEON aquatics and flora protocols including stream reaeration, rapid habitat assessment, herbaceous biomass sampling, phenology and diversity sampling
* Learned to identify relevant fauna to genus and species levels using field guides, dichotomous keys and internet resources as necessary

2015 – 2015 Evolution and Development Lab Prep Assistant, Whitman College, Walla Walla, WA

* Assisted with breeding and care of 10 different strains of *Drosophila*
* Watered and tended snapdragons for plant development and pollination research

2014 – 2015 Ecology Research Intern, Whitman College, Walla Walla, WA

* Tracked plant size, reproductive output and survival of native wheatgrass plants at 14 plots in the Wallula Gap area
* Designed an integral projection model to estimate survival probabilities, as well as stochasticity and elasticity of survival in relation to survival and reproductive covariates
* Experimented with competition and disturbance plots and evaluated subsequent effects on the success of native grasses

# PUBLICATIONS

\* indicates an invited paper

**Gaya, H. E.** & A. Ketz. 2024. Comparison of WAIC and posterior predictive approaches for N-mixture models. *Accepted At: Scientific Reports*

**Gaya, H. E.** & Chandler, R.B. 2024. Individual-level biotic interactions and species distribution models. *Journal of Biogeography,* 00, 1–13. <https://doi.org/10.1111/jbi.14972>

**Gaya, H. E**., C. Cooper, C. D. Delancey, J. Hepinstall-Cymerman, B.A. Kurimo-Beechuk, W. B. Lewis, S. A. Merker. & R. B. Chandler. Directional natal dispersal in a trailing-edge population of black-throated blue warblers. *Movement Ecology*, 12(1), 28. https://doi.org/10.1186/s40462-024-00470-0

**Gaya, H. E.**, Smith, L. L., and Moore, C. T.. 2023. Accounting for spatial heterogeneity in visual obstruction in line-transect distance sampling of gopher tortoises. *Journal of Wildlife Management* 87:e22338. <https://doi.org/10.1002/jwmg.22338>

Shriver, R. K., Campbell, E., Dailey, C., **Gaya, H**., Hill, A., Kuzminski, S., Miller‐Bartley, M., Moen, K., Moettus, R., Oschrin, E., Reese, D., Simonson, M., Willson, A., and Parker, T. H.. (2021). Local landscape position impacts demographic rates in a widespread North American steppe bunchgrass. *Ecosphere* 12(1):e03351. doi:10.1002/ecs2.3351

\*Tuberville, T.D., McKee, R.K., **Gaya, H.E**. and Norton, T.M. (2021), Survival of Immature Gopher Tortoises Recruited into a Translocated Population. *Journal of Wildlife Management* 85: 631-639. <https://doi.org/10.1002/jwmg.21933>

# MANUSCRIPTS UNDER REVIEW

**Gaya, H. E**, G. J. D’Angelo , J.L. Youngmann, S. L. Lance, & J. C. Kilgo. An integrated population model of a high-density coyote population in South Carolina.*In Review At: Scientific Reports*

**Gaya, H. E**, G. J. D’Angelo , J.L. Youngmann, S. L. Lance, & J. C. Kilgo. Invasive wild pig carcass availability does not affect coyote abundance. *In Review At: Wildlife Research*

**Gaya, H. E.** & Chandler, R.B..Warm-adapted encroachment outpaces cool-adapted retreat in a hotspot of trailing-edge population diversity in the southern Appalachian Mountains. *In Review At: Ornithological Applications*

# MANUSCRIPTS IN PREPARATION

Youngmann, J. L., J. C. Kilgo, S. L. Lance, **H. E. Gaya**, R. B. Chandler, C. Ruth, J. Cantrell, and G. J. D’Angelo. Density estimation of coyotes across South Carolina using non-invasive genetic sampling and spatial capture-recapture. *Intended Outlet: Journal of Wildlife Management*.

**Gaya, H. E.** R. B. Chandler. An individual-based modeling framework for inference on population dynamics. *Intended Outlet: Trends in Ecology and Evolution.*

Carlson, J., K. Buhlmann, **H. E. Gaya**, & T. Tuberville. Ten years of decline in a population of Texas tortoises at the Palo Alto National Battlefield. *Intended Outlet: Journal of Wildlife Management*

Thesing, B., C. Cox, **H. Gaya** & N. Nibbelink. An agent-based model describing patterns of juvenile gopher frog (*Rana capito*) dispersal. *Intended Outlet: Journal of Wildlife Management*

# POSTERS AND PRESENTATIONS

\* indicates an invited talk

**\*Gaya, H. E**, G. J. D’Angelo , J.L. Youngmann, S. L. Lance, & J. C. Kilgo. (2024). Invasive wild pig carcass availability does not affect coyote abundance. Oral presentation in *USDS Forest Service – Southern Research Station Annual Research Colloquium,* 17 April, 2024, Virtual.

**Gaya, H. E**. & Chandler, R.B. (2023). A Spatially-Explicit Individual-Based Modeling Framework for Estimating Demographic Parameters. Oral presentation in *The Wildlife Society 30th Annual Conference,* 5 – 10 November, 2023, Louisville, KY.

**Gaya, H. E**. & Chandler, R.B. (2023). Population dynamics in the southern Appalachian Mountains. Oral presentation in *2023 Warnell Graduate Student Symposium,* 2-3 February, 2023, University of Georgia, Athens, GA.

**Gaya, H. E**., C. Cooper, C. Delancey, J. Hepinstall-Cymerman, B. Kurimo-Beechuk, W. Lewis, S. Merker. & Chandler, R.B. (2022). Directional Natal Dispersal in a Trailing-edge Population of Black-throated Blue Warblers. Oral presentation in *100th Meeting of the Association of Field Ornithologists,* 11-14 October, 2022, Plymouth, MA.

**\*Gaya, H. E**. (2022). Trailing-Edge Community Dynamics in the Southern Appalachian Mountains. Keynote presentation in *2022 Fall Georgia Ornithological Society Meeting ,* 8-10 October, 2022, Jekyll Island, GA.

**Gaya, H. E**., C. Cooper, C. Delancey, J. Hepinstall-Cymerman, B. Kurimo-Beechuk, W. Lewis, S. Merker. & Chandler, R.B. (2022). Directional Natal Dispersal in a Trailing-edge Population of Black-throated Blue Warblers. Oral presentation in *2022 Warnell Graduate Student Symposium,* 9-11 February, 2022, University of Georgia, Athens, GA.

**Gaya, H. E**. & Chandler, R.B. (2021). Modelling Species Interactions With Spatial Capture-Recapture Models. Oral presentation in *EURING 2021 Analytical Meeting,* 1-11 June, 2021, Virtual.

**Gaya, H. E**. & Chandler, R.B. (2021). Trailing-Edge Population Dynamics in the Southern Appalachian Mountains. Oral presentation in *2021 Warnell Graduate Student Symposium,* 11-12 February, 2021, Virtual.

**Gaya, H. E**. & Chandler, R.B. (2020). Modelling Species Interactions With Spatial Capture-Recapture Models. Oral presentation in *7th Annual North American Ornithological Conference,* 11-15 August, 2020, Virtual.

**Gaya, H. E**. & Chandler, R.B. (2020). Modelling Species Interactions Using Spatial Capture-Recapture Models. Oral presentation in *2020 Warnell Graduate Student Symposium,* 12-14 February, 2020, University of Georgia, Athens, GA.

**Gaya, H. E**., Nuse, B. L., & Moore, C. T. (2019). Assessing Stability of Gopher Tortoise Populations Through Line-Transect Distance Sampling. Oral presentation in *41st Annual Gopher Tortoise Council Meeting,* 15-17 November 2019, Gulf Shores, Alabama.

**\*Gaya, H. E**., Nuse, B. L., & Moore, C. T. (2019). Assessing Stability of Gopher Tortoise Populations on Working Lands Through Line-Transect Distance Sampling. Oral presentation in *The Wildlife Society 26th Annual Conference,* 29 September – 3 October 2019, Reno, NV.

**Gaya, H. E**. (2019). Enhancing Line-Transect Distance Sampling to Increase Detectability of Gopher Tortoises (*Gopherus polyphemus*) in Population Surveys. Master’s Thesis Defence, 10 May 2019, University of Georgia, Athens GA.

**Gaya, H. E.,** L. L. Smith, & C. T. Moore. (2019). Enhancing Line-Transect Distance Sampling for Gopher Tortoise Populations. Oral presentation in *2019 Warnell Graduate Student Symposium*, 6-8 February 2019, University of Georgia, Athens, GA.

**Gaya, H. E.,** Nuse, B. L., & Moore, C. T. (2018). A Bayesian Hierarchical Model to Account for Size Bias in Gopher Tortoise Distance Surveys. Oral presentation in *40th Annual Gopher Tortoise Council Meeting,* 11-14 October 2018, Archbold Biological Station, Lake Placid, FL.

**Gaya, H. E.,** Nuse, B. L., & Moore, C. T. (2018). An Interesting Nuisance: A Bayesian Hierarchical Model for Distance Sampling When a Detection Covariate Is Also a Demographic Property of Interest. Oral presentation in *The Wildlife Society 25th Annual Conference,* 7-11 October 2018, Cleveland, OH.

**Gaya, H. E.,** L. L. Smith, & C. T. Moore. (2018). Where are All the Tortoises? Oral presentation in *2018 Annual SEPARC Meeting,* 22-25 February 2018, Helen, GA .

**Gaya, H. E.,** L. L. Smith, & C. T. Moore. (2018). Where are All the Tortoises? Oral presentation in *2018 Warnell Graduate Student Symposium*, 31 January – 2 February 2018, University of Georgia, Athens GA.

**Gaya, H. E.,** L. L. Smith, & C. T. Moore. (2017). Improving Line-Transect Distance Sampling (LTDS) for Gopher Tortoise (*Gopherus polyphemus*) Populations. Oral presentation in *39th Annual Gopher Tortoise Council Meeting*, 13-15 October 2017, Edgefield, SC.

**Gaya, H. E.,** L. L. Smith, & C. T. Moore. (2017). Improving Line-Transect Distance Sampling (LTDS) for Gopher Tortoise (*Gopherus polyphemus*) Populations. Poster in *The Wildlife Society 24th Annual Conference*,23-27 September 2017, Albuquerque, NM.

**Gaya, H. E.,** L. L. Smith, & C. T. Moore. (2017). Improvements to Line-Transect Distance Sampling for Surveying Gopher Tortoise (*Gopherus polyphemus*) Populations. Oral presentation in *2017 Georgia DNR-UGA Wildlife Research Meeting*, 8 August 2017, Mansfield, GA.

**Gaya, H.E.** (2016). An Integral Projection Model for Bluebunch Wheatgrass*.* Oral presentation in *2016 Whitman College Undergraduate Conference,* 12 April 2016,Whitman College, Walla Walla, WA.

# RECENT HONORS AND AWARDS

2023 First Place Oral Presentation – Statistics and Modeling (Warnell School of Forestry and Natural Resources Graduate Student Association)

2022 Conservation Grant (Oconee Rivers Audubon Society). *$500*

2022 Student Travel Award (Association of Field Ornithologists). *$191*

2022 Outstanding Teaching Assistant Award (University of Georgia).

2022 Howe Graduate Student Research Grant (Georgia Ornithological Society). *$6,000*

2021 Conservation Grant (Oconee Rivers Audubon Society). *$510*

2021 Howe Graduate Student Research Grant (Georgia Ornithological Society). *$3,000*

2021 First Place Oral Presentation – Statistics and Modeling (Warnell School of Forestry and Natural Resources Graduate Student Association). *$100*

2020 Young Alumni Award for Leadership and Training (Warnell School of Forestry and Natural Resources). *$1,000*

2019 Biometrics Working Group Student Travel Award (The Wildlife Society Biometrics Working Group). *$700*

2018 Bob Herrington Student Travel Grant (Gopher Tortoise Council). *$100*

2017 Bob Herrington Student Travel Grant (Gopher Tortoise Council). *$100*

# PROFESSIONAL MEMBERSHIP

2024- Present American Ornithological Society

2021- Present Blue Key Honor Society

2021- Present Oconee River Audubon Society

2020- Present Georgia Ornithological Society

2019- 2023 Phi Kappa Phi Honor Society

2018- Present The Wildlife Society Biometrics Working Group

2017- Present The Wildlife Society

**TEACHING EXPERIENCE**

2020, 2021, 2022 WILD 8390: Estimating Fish/Wildlife Populations, University of Georgia, GA

2016 Biology 289L: Marine Biology, Whitman College, WA

2015, 2016 Advanced Studies Enrichment (ASE) Tutor, Whitman College, WA

# TECHNICAL ASSISTANCE

 2024 *Dustin Maloney (Utah State University)*

Helped Dustin code a staggered entry known-fate model for golden eagle natal and fledgling survival. Assisted with troubleshooting code issues, censoring data without introducing bias and using time-varying individual covariates in RMark.

 2023 *David Weber (University of Georgia)*

Assisted David with selecting reasonable priors for a multispecies occupancy model. Assisted with troubleshooting code issues and explained the process of prior predictive checks

2022 *Sam Merker (University of Connecticut)*

Collaborated on a spatially explicit line-transect distance sampling model with non-linear transects to compare abundance of sparrows in two Connecticut populations.

 2022 *Cyndi Carter (University of Georgia)*

Worked with Cyndi to develop a Bayesian dynamic multi-state model for telemetry tracked salamanders in the southern Appalachian Mountains.

 2021 *Samuel Robinson (University of Georgia)*

Helped Sam develop a multi-species dynamic occupancy in a likelihood-based framework for 6 species of amphibian in central Georgia. Aided with coding, data wrangling and model selection.

 2020 *Sarah Chinn (Savannah River Ecology Lab, University of Georgia)*

Helped Sarah code a Bayesian staggered entry known-fate model for feral hog neonate survival. Provided code for WAIC model selection and discussed interpretation of model output. Assisted with writing and editing for the methods section of a manuscript using the model results. Final manuscript: <https://www.nature.com/articles/s41598-021-90495-x#Abs1>

 2019 *Megan Buland (University of Georgia)*

Helped Megan choose a smoothing function for zero-inflated collection data of root beetles. Provided online resources for additional information on smoothing functions and offered advice on reading R help pages. Discussed different strategies for displaying and analyzing beetle phenology data.

 2019 *Mischa Schultz (University of Georgia)*

Helped Mischa use package RMark in R to prepare data, run a closed population model, and analyze results for a great white shark dataset with inconsistent sampling intervals. Taught her graphing techniques for confidence intervals in base R.

 2019 *Florida Natural Areas Inventory*

Provided R code and JAGS model to FNAI to analyze two line-transect distance sampling datasets thought to be influenced by vegetation obstruction. Discussed strategies for minimizing bias in future abundance estimates on site.

2019 *Chris Murphy (University of Georgia)*

Advised Chris on available methods for implementing line-transect distance sampling in areas with heterogenous vegetation. Provided R code for analyzing results.

2019 *Ashley Lohr* *(University of Georgia)*

Provided R code to estimate minimum daily distance traveled for wild turkeys in SE Georgia from a dataset with GPS error and inconsistent GPS fixes. Helped tailor code to specific dataset issues and taught Ashley strategies for dealing with messy data and debugging code.

 2018 *Florida Fish and Wildlife Conservation Commission*

Advised FWCC on the problems with current line-transect distance sampling surveys for gopher tortoises. Suggested alternatives to account for imperfect detection on transect line. Provided R code and JAGS model to decrease bias in density and demographic estimates.

 2018 *Matthew Elliot (Georgia Department of Natural Resources)*

Performed a follow-up survey for gopher tortoises at Yuchi WMA in eastern Georgia after no juvenile tortoises were found by a line-transect distance sampling survey of the property. Incorporated intensive-search units into the normal transect survey and confirmed juveniles were present at the site but difficult to detect.

 2018 *J.T. Pynne (University of Georgia)*

Provided code to account for vegetation in line-transect distance sampling for southeastern pocket gophers

2018 *Pearson McGovern (University of Georgia)*

Helped Pearson use package Rmark in R to prepare data, run a robust design model to estimate survival, and analyze results for a Blanding's turtle dataset.

 2017 *Rebecca Mckee (University of Georgia)*

Taught Rebecca how to convert shapefile in ArcMap to KMZ files and transfer spatial data to a GPS unit. Assisted with line-transect distance sampling surveys for gopher tortoises at the Aiken Gopher Tortoise Heritage Preserve in SC. Helped Rebecca debug JAGS code for a multi-state model estimating gopher tortoise age class transition probability and apparent survival.

# VOLUNTEER EXPERIENCE

2023 – Present President, Oconee River Audubon Society, Athens, GA

2022 – 2023 Graduate Affair Committee Member, University of Georgia, Athens, GA

2022 – 2023 Multiple Violations Review Board Member, University of Georgia, Athens, GA

2022 – 2023 Vice President, Oconee River Audubon Society, Athens, GA

2021 – 2023 Academic Honesty Panel Member, University of Georgia, Athens, GA

2021 – 2022 Co-President, Oconee River Audubon Society, Athens, GA

2020 – 2021 Website Coordinator, Warnell Graduate Student Association, Athens, GA

2020 Coordinator, ComSciCon Atlanta 2020, Athens, GA

2019 – 2020 President, Warnell Graduate Student Association, Athens, GA

2019 – 2020 Graduate co-Chair, University of Georgia Herpetological Society, Athens, GA

2019 – 2022 Coordinator and Outreach, Circle of Friends Animal Society, Athens, GA

2018 – 2019 Vice President, Warnell Graduate Student Association, Athens, GA

2017 – 2018 Treasurer, Warnell Graduate Student Association, Athens, GA

2017 – 2018 Treasurer, University of Georgia Herpetological Society, Athens, GA

2017 – 2019 Animal Care Intern, Sandy Creek Nature Center, Athens, GA

# OUTREACH PRODUCTS

**Gaya, H.E.** 2024. “Probability Distributions” *R Shiny App* <https://heathergaya.shinyapps.io/ChronicWastingDisease/>

**Gaya, H.E.** 2022. “Building an Access Database for Wildlife Research” *Tutorial* [*https://sonat.com/@heather-e-gaya/access-database/front-page-2-685d*](https://sonat.com/%40heather-e-gaya/access-database/front-page-2-685d)

**Gaya, H.E.** 2022. “Bayesian Tutorials” *Repository* [*https://sites.google.com/view/heather-gaya/tutorials*](https://sites.google.com/view/heather-gaya/tutorials)

**Gaya, H.E.** 2021. “Probability Distributions” *R Shiny App* [*https://insects.shinyapps.io/Probability\_Dists/*](https://insects.shinyapps.io/Probability_Dists/)

**Gaya, H.E.** 2019. “What is Bird Banding?” *YouTube.* [*https://www.youtube.com/watch?v=eDzXmK9mJ20*](https://www.youtube.com/watch?v=eDzXmK9mJ20)

**Gaya, H.E.** 2019. Bayesian LTDS Made “Simple.” *Github repository.* [*https://github.com/heathergaya/Shiny\_Torts*](https://github.com/heathergaya/Shiny_Torts)

**Gaya, H.E.** 2018. Co-Producer and Editor. “Big Brother: The Lost Tortoise Episode.” *YouTube.* [*https://www.youtube.com/watch?v=\_QvGMIQ0M-8&t=1s*](https://www.youtube.com/watch?v=_QvGMIQ0M-8&t=1s)

**Gaya, H.E.** 2016. Director, Producer and Editor. “Why is the Grass Dying?” *YouTube.* [*https://www.youtube.com/watch?v=eNhyXhdVJKU*](https://www.youtube.com/watch?v=eNhyXhdVJKU)

# CERTIFICATIONS AND SKILLS

* Graduate Certificate in Agricultural Data Science (2022)
* Trained with GIS, R, SAS, Linux, MARK, JAGS, NIMBLE, Microsoft Access and FileMaker Pro
* Familiarity with Python, C++, SQL, Flask, and Matlab
* Proficient with wildlife analysis techniques such as mark-recapture, spatial capture-recapture, distance sampling, occupancy modeling and home range analysis
* Proficient with a variety of power tools, electrical equipment, GPS units and radio telemetry
* CPR and First Aid Trained (most recent certification: Nov 2022)
* Ability to work logically and calmly under pressure and troubleshoot when necessary
* Experience working in remote areas with minimal supervision