

Dr. Tara Joy Massad

Gorongosa BioEducation Program Director
BioEducation Program
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Career objective

I seek to contribute to conservation through research and education. I am committed to honoring diversity and working with underserved populations.

Education

2009: PhD in the Department of Ecology and Evolutionary Biology, Tulane University, GPA 4.0
Dissertation Title: 'The efficacy and environmental controls of plant defenses and their application to tropical reforestation'

2004: Organization for Tropical Studies Graduate Tropical Ecology Field Course

1999: BS with Honors in Biology with minors in Chemistry, Spanish, and the Clark Honors College, University of Oregon, GPA 3.81

1998: Tropical ecology exchange program, Universidad de Costa Rica, GPA 4.0

Research, teaching, and leadership

2023-present: Instructor, College of Earth, Oceanic, and Atmospheric Sciences, Oregon State University
Teaching: Environmental Assessment, Tropical Ecology and Conservation

2023-present: Ecology and BioEducation consultant, Gorongosa National Park, Mozambique
Mentor master's students in the Master's in Conservation Biology Program
Teaching: Conservation Biology, Integrated Methods in Conservation Biology, Research Methods
Research: Savanna ecology (effects of fire and herbivores), tropical reforestation, phytochemical diversity

2018-2023: Gorongosa BioEducation Program Director, Gorongosa National Park, Mozambique
Run Gorongosa National Park's Master's in Conservation Biology Program (teaching, advising, curriculum design, administration, outreach, research)
Run Biodiversity Internship and Advanced Science Workshop Programs
Advise Mozambican master's students in thesis research
Grant writing to support science education programs
Teaching: Conservation Biology, Integrated Methods in Conservation Biology, Research Methods
Research: Savanna ecology (effects of fire and herbivores), tropical reforestation, plant defense metabolomics, phytochemical diversity and plant-herbivore interactions, application of chemical ecology to reforestation, carbon sequestration in savannas, tri-trophic interactions (Lepidoptera focus)

September-December 2020: Adjunct Professor, Portland State University, Portland, OR, USA
Teaching: Environmental Sustainability (synchronous online courses)

2017-2018: Lecturer, Organization for Tropical Studies, South Africa
Teaching: Conservation, Savanna Ecology with an emphasis on field skills and data analysis

Research: Drivers of tropical forest diversity with a focus on phytochemical diversity, genetic diversity, and herbivory across a latitudinal gradient

2015-2017: Assistant professor, Rhodes College, Memphis, TN, USA

Teaching: Environmental Science (lecture and lab), Conservation Biology (lecture and lab), Conservation in Southern Africa (lecture and trip to Namibia), Introductory Biology (lecture and lab)

Research: Drivers of tropical forest diversity with a focus on phytochemical diversity, genetic diversity, and herbivory across a latitudinal gradient, urban forest regeneration

Service: Faculty mentor to student bee-keeping group, student academic adviser, organize department seminars, participate in student recruitment activities

2014-2015: Research Manager, EO Wilson Laboratory, Gorongosa National Park, Moçambique

Research: Seedling ecology and drought, savanna restoration (focus on large mammal populations), plant-insect herbivore interactions (focus on Lepidoptera), biodiversity surveys

Conservation: Develop programs for the control of invasive plants, collaborate on community conservation efforts, grant writing to support education programs for Mozambican students

Mentorship: Mentor Mozambican technicians, ecology tutoring, advise visiting scientists on research

Administration: Organize research logistics for biodiversity studies and for visiting researchers

2013-2014: Postdoc at the University of São Paulo, Brasil; Dr. Massuo Kato, Dr. Chris Jeffrey, supervisors

Lab work: Plant secondary metabolite metabolomics using nuclear magnetic resonance spectroscopy, gas chromatography

Fieldwork: Measure herbivory and plant diversity in the Atlantic Rainforest

Data analysis: Community similarity measures of metabolomics, structural equation modeling

2011-2013: Henry Chandler Cowles Lecturer in the Program on the Global Environment, University of Chicago, USA

Teaching: Human Impact on the Global Environment, Restoration Ecology, Tropical Ecology, create and run a Tropical Conservation Field Course in Costa Rica

Research: Sapling-herbivore interactions and sapling defenses in tropical reforestation

2009-2011: Postdoc at the Max Planck Institute for Biogeochemistry, Germany; Dr. Sue Trumbore, supervisor

Fieldwork: Forest regeneration in large-scale fire experiment in Mato Grosso, Brazil

Lab work: ¹³C isotope labeling of *Populus trichocarpa* seedlings to measure carbon allocation to phenolic glycoside secondary metabolites

Data analysis: Hierarchical split-split plot mixed modeling, repeated measures analyses, logistic regression, meta-analysis

2003-2009: Doctoral dissertation work on tropical reforestation and plant chemical defenses; Tulane University; Dr. Lee Dyer, advisor

Fieldwork: Reforestation in Costa Rica and Brazil addressing the role of diversity and chemical defenses in reforestation

Lab work: Chemical analysis of saponin defenses using high performance liquid chromatography; photosynthesis measurements using a LI-COR 6400

Data analysis: Structural equation modeling, logistic regression, general linear models, meta-analysis

2003-2007: Graduate Teaching Assistant (teach general biology and ecology laboratories)

Oct.-Dec. 2005: Intern with the Conservation Science Program of World Wildlife Fund (conduct herbarium study of range-restricted plant family distributions)

Oct. 2000-Nov. 2002: Peace Corps Volunteer in Mozambique (teach high school biology and English)

June-Aug. 2000: Oregon Museum of Science and Industry teen summer volunteer coordinator

Oct. 1999-Mar. 2000: Environmental Educator with AmeriCorps (teach middle school environmental education and physical science)

Jan.-Aug. 1999: Undergraduate Teaching Assistant at the University of Oregon (teach introductory biology laboratories)

1998-1999: Undergraduate honors thesis on zebrafish (*Danio rerio*) neural crest development; University of Oregon; Dr. Judith Eisen, advisor
Lab work: RNA synthesis, RNA injections, *in situ* hybridizations

Publications

- Massad. In review. Grime Review: Plant defences as functional traits: A comparison across savannahs with different degrees of herbivore specialization. *Journal of Ecology*.
- Cossa, **Massad**, Figueiro, Ribeiro, Coutinho, Fraga, Ribeiro-Barros. In review. Belowground carbon storage in coffee agroforestry systems: A strategy to mitigate climate change. *Agroforestry Systems*.
- Fijamo, Ribeiro, **Massad** (corresponding author). In review. The effects of herbivory, land-use and climate change on seedling establishment in southern Africa. *Southern African Journal of Botany*.
- Grele, **Massad**, Stireman, Smilanich, Walla, Richards, Dyer, Garcia, Tepe, Parchman, Forister, Uckele, Braga, Sulca-Garro, Kato, Nascimento, Simaa. In review, *Ecology*. Reduction of intraspecific and interspecific tropical plant diversity alters insect richness, herbivory, and ecosystem resilience.
- Massad, Dyer, Nascimento, Sulca-Garro, Garcia, Simbaña, Campos-Moreno, Forister, Tepe, Richards, Stireman, Walla, Grele, Uckele, Parchman, Kato. In revision, *Oikos*. Determinants of intense herbivory its distribution in populations, communities, and forests across the Neotropics.
- Serejo Rabelo, Dyer, Yamaguchi, Diniz, Simbaña, Kussano, Kato, **Massad** (corresponding author). In revision. Plasticity in plant defense and the role of phytochemical dissimilarity in limiting specialist herbivory. *Frontiers in Ecology and Evolution*.
- Massad, Richards, Philbin, Yamaguchi, Kato, Jeffrey, Oliveira, Oschenrider, Moraes, Tepe, Torrejon, Sandivo, Dyer. 2022. The chemical ecology of tropical community diversity: Connections between abiotic variables, phytochemical similarity, herbivory, and plant richness. *Ecology*.
- António, Obieze, Jacinto, Maquia, **Massad**, Ramalho, Ribeiro, Máguas, Marques, Ribeiro-Barros. 2022. Linking Bacterial Rhizosphere Communities of Two Pioneer Species, *Brachystegia boehmii* and *B. spiciformis*, to the Ecological Processes of Miombo Woodlands. *Forests* 13:1840
- Serejo Rabelo, Dyer, Lepesqueur, Salcido, Pereira da Silva, Rodrigues, Barbosa Trindade, Diniz, Rangel Nascimento, Tepe, **Massad** (corresponding author). 2021. Tritrophic interaction diversity in gallery forests—a biologically rich and understudied component of the Brazilian cerrado. *Arthropod-Plant Interactions* 15:773–785.
- Campos-Moreno, Dyer, Salcido, **Massad**, Pérez-Lachaud, Tepe, Whitfield, Pozo. 2021. Importance of interaction rewiring in determining spatial and temporal turnover of tritrophic (*Piper*-caterpillar-parasitoid) metanetworks in the Yucatán Península, México. *Biotropica* DOI: 10.1111/btp.12946
- Chinder, Hattas, **Massad** (corresponding author). 2020. Growth and functional traits of *Julbernardia globiflora* (Benth) resprouts and seedlings in response to fire frequency and herbivory in miombo woodlands. *South African Journal of Botany* 135:476-483.
- Wigley et al. (I am one of 21 authors). 2020. A handbook for the standardised sampling of plant functional traits in disturbance-prone ecosystems with a focus on savanna and grassland. *Australian Journal of Botany* 68:473-531.
- White, Stevens, Berndt, Coetzee, **Massad**, Nupen, Tye, Midgley. Understanding recruitment limitations in a critically endangered species: The story of the iconic Cape cedar (*Widdringtonia wallichii*). 2020. *Global Ecology and Conservation*. 23: e01062.
- Kattge et al. (I am one of over 100 authors). 2020. TRY plant trait database – Enhanced coverage and open access. *Global Change Biology* 26:119-188.
- Madera, Vanickova, Pompeiano, **Massad**, Vahalik. 2020. Terpenoid profiles of resin in the genus *Dracaena* are species specific. *Phytochemistry* 170:112197.
- Massad, Williams, Wilson, Hulsey, Deery, Bridges. 2019. Regeneration dynamics in old-growth urban forest gaps. *Urban Forestry & Urban Greening* 43:126364.

- Stalmans, **Massad**, Peel, Tarnita, Pringle. 2019. War-induced collapse and asymmetric recovery of large-mammal populations in Gorongosa National Park, Mozambique. *PLoS One*.
- Dyer LA, Philbin, Ochsenrider, Richards, **Massad**, Smilanich, Forister, Parchman, Galland, Hurtado, Espeset, Glassmire, Harrison, Mo, Yoon, Pardikes, Muchoney, Jahner, Slinn, Shelef, Dodson, Kato, Yamaguchi, Jeffrey. 2018. Modern approaches to study plant–insect interactions in chemical ecology. *Nature Reviews Chemistry* 2:50-64.
- Massad, Martins, Philbin, Oliveira, Cebrian Torrejon, Yamaguchi, Jeffrey, Dyer, Kato. 2017. Chemical community similarity and plant-herbivore interactions: Volatile similarity leads to increased herbivory and greater tropical forest diversity. *Ecology* 98:1750-1756.
- Massad, Castigo. 2016. Investigating possible effects of climate change on tree recruitment: Responses of abundant species to water stress in Gorongosa National Park. *South African Journal of Botany* 106:96-100.
- Balch, Brando, Nepstad, Coe, Silvério, **Massad**, Davidson, Lefebvre, Oliveira-Santos, Rocha, Cury, Thissella, Carvalho. 2015. The tolerance and susceptibility of southeastern Amazon forest to fire: Insights from large-scale experimental burns. *BioScience* 65:893-905.
- Massad, Balch, Lahís Mews, Marimon Jr, Porto, Mota Quintino, Vieira, Trumbore. 2015. Early responses of regenerating forest communities to interactions between frequent fires, nutrients, and herbivory in the southern Amazon. *Oecologia* 178:807-817.
- Massad, Trumbore, Ganbat, Reichelt, Unsicker, Boeckler, Gleixner, Gershenzon, Ruelow. 2014. An optimal defense strategy for phenolic glycoside production—*Populus trichocarpa* saplings simultaneously prioritize growth and defense. *New Phytologist* 203: 607-619.
- Dyer, **Massad**, Forister. 2015. The problem of scale in ecology *in* Hanley T and La Pierre K (eds) *Trophic Ecology: Bottom-Up and Top-Down Interactions across Aquatic and Terrestrial Systems*. Cambridge University Press.
- Massad, Balch, Davidson, Brando, Lahís Mews, Mota Quintino, Porto, Vieira, Marimon Jr, Trumbore. 2013. Interactions between fire, nutrients, and insect herbivores affect the recovery of diversity in the southern Amazon. *Oecologia* 172:219-229.
- Massad. 2013. Ontogenetic differences of herbivory on woody and herbaceous plants: A meta-analysis demonstrating unique effects of herbivory on the young and the old, the slow and the fast. *Oecologia* 172:1-10.
- Massad. 2013. Tropical seedling-insect interactions: Basic and applied examples of the importance of herbivory from the species to community level. Pp 309-326 *in* Busso CA (ed) *Seedlings: Ecology, Growth and Environmental Influences*. Nova Publishers, NY.
- Balch, **Massad**, Brando, Nepstad, Curran. 2012. Effects of high-frequency understory fires on woody plant regeneration in southeastern Amazonian forests. *Philosophical Transactions of the Royal Society B* 368:SI 20120157.
- Massad, Dyer, Vega. 2012. Costs of defense and a test of the predictive power of the carbon-nutrient balance and growth-differentiation balance hypotheses for saponins and phenolics in a neotropical tree. *PLoS One* 7(10): e47554. doi:10.1371/journal.pone.0047554
- Massad. 2012. Interactions in tropical reforestation—how plant defenses and polycultures can reduce growth-limiting herbivory. *Applied Vegetation Science* 15:338-348.
- Dyer, Wagner, Greeney, Smilanich, **Massad**, Robinson, Fox, Hazen, Glassmire, Pardikes, Fredrickson, Pearson, Gentry, Stireman. 2012. Novel insights into tritrophic interaction diversity and chemical ecology using 16 years of volunteer supported research. *American Entomologist* 58:15-19.
- Massad, Fincher, Smilanich, Dyer. 2011. A quantitative evaluation of major plant defense hypotheses, nature versus nurture, and chemistry versus ants. *Arthropod-Plant Interactions* 5:125-139.
- Massad, Chambers, Rolim, Jesus, Dyer. 2011. Restoration of pasture to forest in Brazil's Mata Atlântica: The roles of herbivory, seedling defenses, and plot design in reforestation. *Restoration Ecology* 19:257-267.
- Kattge J, et al. (I am one of over 100 co-authors). 2011. TRY – a global database of plant traits. *Global Change Biology* 17:2905-2935.
- Massad, Dyer. 2010. A meta-analysis of the effects of global environmental change on plant-herbivore interactions. *Arthropod-Plant Interactions* 4:181-188.
- Pearson, **Massad**, Dyer. 2008. Diversity cascades in alfalfa fields: From plant quality to agroecosystem diversity. *Environmental Entomology* 37:947-955.

Grants awarded

2020: Howard Hughes Medical Institute grant for the BioEducation Program at Gorongosa National Park (\$2,000,000 for five years)

I cowrote the proposal and am responsible for the programs funded by the grant.

2017: REU supplement to the Dimensions US-Biota São Paulo grant (below) to support two students in tropical fieldwork

2016: Mellon Grant Faculty Innovation Fellowship Program (\$7,500, one year)

2015: Howard Hughes Medical Institute grant for the BioEducation Program at Gorongosa National Park (\$2,642,000 for five years)

I cowrote the proposal and administered the grant in 2018-2020.

2014: National Science Foundation and Fundação de Amparo à Pesquisa do Estado de São Paulo (São Paulo Science Foundation) Collaborative Research Grant (Dimensions US-Biota São Paulo): 'Chemically mediated multi-trophic interaction diversity across tropical gradients' (\$3.8 million, five years)

I am a collaborator on this grant and contributed to its development.

2012: Eloise Gerry Fellowship from Graduate Women in Science (\$9,891.52, one year)

2007: Environmental Protection Agency Science to Achieve Results (STAR) Fellowship (\$5,000 in research funds for two years, living stipend for two years)

2007: Philanthropic Education Organization Scholar Award (\$10,000, one year)

2007: Torrey Botanical Society Research Grant (\$1,000, one year)

2006: Sigma Xi Research Grant (\$600, one year)

2005: Organization for Tropical Studies Fellowship for fieldwork (\$3,000, one year)

2004 & 2005: Center for Latin American Studies Summer Research Grant (travel and research stipend)

2004: Organization for Tropical Studies Post-Course Award for fieldwork (~\$1,500, one year)

Presentations and organized symposia

2021: Organized 'Conservation on the Ground: Bringing conservation to rural communities,' a solutions orientated workshop at Gorongosa National Park on conservation related behavior change with participants from seven African countries

2021: Devaneios do Cerrado (Brazilian symposia on community conservation in the cerrado); Talk: 'O Parque Nacional da Gorongosa: Sua história de restauração e monitoria' (Gorongosa National Park: A story of restoration and monitoring)

2017: National Conference on Undergraduate Research; Poster: 'Urban forest regeneration: Gap dynamics in Overton Park;' presented by student mentees

2013: Organized 'Conserving more than Carbon: Valuing biodiversity in a changing world' conference at the University of Chicago

2013: Gordon Research Conference on Plant-Herbivore Interactions; Poster: 'Interacting effects of fire, nutrient availability, and herbivores on the recovery of tropical forest diversity post-fire'

- 2013: Organized 'Social and biological impacts of rising seas and reduced lake levels' symposium at the Shedd Aquarium
- 2012: Ecological Society of America Annual Meeting; Talk: 'Post-fire regeneration dynamics in the southern Amazon—How early interactions between fire history, nutrient availability, and herbivory affect the recovery of diversity'
- 2012: Organized 'Wetlands, Wilderness, and Their Publics: Conservation, Policy, and Research as Problem and Practice' lecture series at the University of Chicago
- 2011: Ecological Society of America Annual Meeting; Talk: 'Recruitment diversity after fire in the southern Amazon'
- 2009: Ecological Society of America Annual Meeting; Talk: 'The chemical ecology of tropical reforestation'
- 2008: Association for Tropical Biology Annual Meeting; Poster: 'The chemical ecology of tropical reforestation'
- 2008: Participant in NSF Pan-American Advanced Studies Institute Program (PASI) on Interdisciplinary Studies in the Chemical Ecology of the Tropics, Peru
- 2006: Society for Conservation Biology Annual Meeting; Talk: 'The distribution and conservation status of restricted range vascular plant families'

Peer-review contributions

Co-editor of special volume of *Frontiers Plant Science* (<https://www.frontiersin.org/research-topics/6458/the-ecology-of-plant-chemistry-and-how-it-drives-multi-species-interactions>)

Reviews for *Ecology*, *The Journal of Applied Ecology*, *Functional Ecology*, *Oecologia*, *Oikos*, *PLoS One*, *Biotropica*, *Annals of Forest Science*, *Acta Oecologica*, *Arthropod-Plant Interactions*, *Trees-Structure and Function*, *Forest Ecology and Management*, *Forests*, and other journals

Grant reviewer for the National Science Foundation, Graduate Women in Science, The Netherlands Scientific Organization

Mentorship

2018-present: Mentor Mozambican students in Gorongosa National Park's Master in Conservation Biology Program (mentor to 36 students; advisor or co-advisor of 16 master's theses)

2017: Mentor Mozambican intern in the Gorongosa Biodiversity Science Education Program

2015-2017: Mentor eight Rhodes College students in urban forest regeneration project

2014: Mentor young Mozambicans in biodiversity surveys and ecological monitoring

2013-2014: Mentor Brazilian undergraduate students in lab and field work

2011-2013: Advisor for undergraduate theses in environmental studies at the University of Chicago

2010-2013: Co-advisor to master's student at the University of Mato Grosso, Brazil

May and Dec. 2005-2008: Assistant leader for EarthWatch teams in Costa Rica (train volunteers, coordinate and monitor field and lab work for caterpillar and parasitoid diversity study)

Oct. 2007: Resource person on Organization for Tropical Studies Undergraduate Tropical Ecology Course at La Selva Biological Station (mentor students and lead course field project)

June-Aug. 2005 & 2007: Mentor for Louisiana Alliance for Minority Participation (LAMP) students in summer research program (advise students in chemical ecology lab work)

July 2005 & 2006: Assistant leader for EarthWatch teams of high school students at the Southwest Research Station (mentor and train volunteers, coordinate and monitor field and lab work for caterpillar and parasitoid diversity study)

Outreach activities

May 2020-2021: Red Cross volunteer

January 2019: Volunteer with Refugee for Refugees, Lesbos, Greece

July 2016, 2017: Taught conservation biology workshops for Mozambican students in Gorongosa National Park

2017: Volunteer English as a Second Language tutor at the Refugee Empowerment Program, Memphis

2017: Career talk for the Memphis Graduate Women in Science chapter

2016-2017: Member of Rhodes College Farmers' Market steering committee

May 2016: Co-taught a course in ecological methods at the University of Brasilia

2012-2013: Editor for Millennium Alliance for Humanity and the Biosphere newsletter

2012: Initiated a Graduate Women in Science chapter in Chicago

2012: Charter member of Graduate Women in Science International Chapter

2012: Reviewer for University of Chicago student Carnegie Award

2004-2008: Department representative in the Graduate School Student Association

2007-2008: President of the Ecology and Evolutionary Biology Graduate Student Club

2006-2007: Graduate Student Association Financial Officer

2006-2007: Graduate and Professional School Association Senator

Spring 2006: Tutor at New Orleans Science and Math High School

Honors and professional society memberships

2012: Graduate Women in Science lifetime member

2009: Ecological Society of America member

2006: Sigma Xi member

2005: Graduate Teaching Assistant of the Year Award from Tulane University

1999: Graduated Magna Cum Laude from University of Oregon

1998: Phi Beta Kappa member

Special skills

Fluent in Spanish and Portuguese

Advanced Conservation GIS course through the Smithsonian Institute, March 2009

References

Dr. Lee Dyer, PhD advisor, nolaclimber@gmail.com, 775-784-1360

Dr. Laurence Kruger, Director OTS South Africa, laurence.kruger@tropicalstudies.org, +27-82-422-6225

Dr. Carolyn Jaslow, Chair of Biology Department, Rhodes College, cjaslow@rhodes.edu, 901-843-3563

Dr. Sue Trumbore, Postdoc (research) supervisor, trumbore@bgc-jena.mpg.de, +49 (3641) 57-60

Dr. Piotr Naskrecki, Associate Director of the EO Wilson Biodiversity Lab, Gorongosa National Park, pnaskrec@oeb.harvard.edu, +258 84 870 8609