Jeff Garnas, PhD

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Profile

I am a population and community ecologist and evolutionary biologist focused on questions related to insects and fungi that interact with plants, primarily forest trees. I use a variety of approaches and tools, including observational studies, field and lab experiments, modeling and molecular analyses to test hypotheses and search for strong inference in the systems I study. I approach ecological and evolutionary questions using a strong theoretical framework while producing and communicating products with applied value to conservation and to land and forest managers. In particular, I am interested in the drivers of host use and community overlap in fungi and insects colonizing native and exotic tree species, and in understanding the evolutionary, population genetic and ecological consequences of invasion of plants, fungi and insects.

Current appointment

Sr. Lecturer, Department of Zoology and Entomology, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, South Africa	2009-present

Education and Experience

PhD. Ecology and Evolution, Dartmouth College, Hanover, NH	2009
MSc Ecology and Evolution, University of Maine, Orono, ME	2005
Littler Mendelson, Database design/programming; IT support, San Francisco, CA	1999-2002
Macromedia, Application development, San Francisco, CA	1998-1999
B.A. Psychology, University of Colorado, Boulder, CO	1997

Current projects

Endophytic fungal diversity in native and introduced tree hosts (using 454 and Illumina sequencing technology)

Reconstructing pathways of global spread in the red gum lerp psyllid (*Glycaspis brimblecombei*) using bacterial endosymbiont genomes and insect population diversity

Determinants of host use and community overlap among insects on African and Australian acacias

Implications of cryptic diversity in the Eucalyptus snout beetle on the ecology, host plant use and effectiveness of biological control by an egg parasitic wasp

Population dynamics of invasive European woodwasp (*Sirex noctilio*) as driven by abiotic variability and community interactions in the larval environment

Biology, host use and microbial associates of a native wood-boring moth (*Coryphodema tristis*) on native and exotic trees

Insect and pathogen biodiversity on native pine, with particular focus on native bark beetle-Ophiostomatoid fungi interactions in Central America

Publications (Researcher ID: C-4363-2008)

Garnas JR, Groden E, and Drummond FA (2014). Mechanisms of competitive displacement of native ant fauna by invading *Myrmica rubra* (Hymenoptera:Formicidae). *Environmental Entomology*, 43(6):1496–1506.

Hurley BP, **Garnas JR**, and Cooperbrand CMF (2014). Assessing trap and lure effectiveness for the monitoring of the European woodwasp, *Sirex noctilio*. *Agricultural and Forest Entomology*, *Published online*:1–7.

Nadel RL, Wingfield MJ, Scholes MC, **Garnas JR**, Lawson SA, et al. (2014). Population dynamics of *Thaumastocoris peregrinus* in *Eucalyptus* plantations of South Africa. *Journal of Pest Science*, *Published online*:1–10.

Kemler M, **Garnas JR**, Wingfield MJ, Gryzenhout M, Pillay KA, et al. (2013). Ion Torrent PGM as tool for fungal community analysis: A case study of endophytes in *Eucalyptus grandis* reveals high taxonomic diversity. *PLoS ONE*, 8(12):e81718.

Lantschner MV, Villacide JM, **Garnas JR**, Croft P, Carnegie AJ, et al. (2013). Temperature explains variable spread rates of the invasive woodwasp *Sirex noctilio* in the Southern Hemisphere. *Biological Invasions*, 16(2):329–339.

Mutitu KE, **Garnas JR**, Hurley B, Wingfield MJ, Harney M, et al. (2013). Biology of *Cleruchoides noackae* (Hymenoptera:Mymaridae), a potential biological control agent for *Thaumastocoris peregrinus* (Hemiptera: Thaumastocoridae). *Journal of Economic Entomology*, 106(5):1979–1985.

Wooding AL, Wingfield MJ, Hurley BP, **Garnas JR**, de Groot P, et al. (2013). Lack of fidelity revealed in an insect-fungal mutualism after invasion. *Biology Letters*, 9(4):20130342.

Garnas JR, Houston DR, Twery MJ, Ayres MP, and Evans C (2013). Inferring controls on the epidemiology of beech bark disease from spatial patterning of disease organisms. *Agricultural and Forest Entomology*, 15(2):146–156.

Degefu D, Hurley BP, **Garnas JR**, Wingfield MJ, Ahumada R, et al. (2012). Parallel host range expansion in two unrelated cossid moths infesting *Eucalyptus nitens* on two continents. *Ecological Entomology*, 38(1):112–116.

Wingfield MJ, Roux J, Slippers B, Hurley BP, **Garnas JR**, et al. (2012). Established and new technologies reduce increasing pest and pathogen threats to Eucalypt plantations. *Forest Ecology and Management*, 301:35–42.

Garnas JR, Hurley BP, Slippers B, and Wingfield MJ (2012). Biological control of forest plantation pests in an interconnected world requires greater international focus. *International Journal of Pest Management*, 58(3):211–223.

McPhee K, **Garnas JR**, Drummond F, and Groden E (2012). Homopterans and an invasive red ant, *Myrmica rubra* (L.), in Maine. *Environmental Entomology*, 41(1):59–71.

Garnas JR, Houston DR, Ayres MP, and Evans C (2012). Disease ontogeny overshadows effects of climate and species interactions on population dynamics in a nonnative forest disease complex. *Ecography*, 35(5):412–421.

Garnas JR, Ayres M, Liebhold A, and Evans C (2011). Subcontinental impacts of an invasive tree disease on forest structure and dynamics. *Journal of Ecology*, 99:532–541.

Dukes JS, Pontius J, Orwig D, **Garnas JR**, Rodgers VL, et al. (2009). Responses of insect pests, pathogens, and invasive plant species to climate change in the forests of northeastern North America: What can we predict? *Canadian Journal of Forest Research*, 39(2):231–248.

Garnas JR, Groden E, and Drummond F (2007). Intercolony aggression within and among local populations of the invasive ant, *Myrmica rubra* (Hymenoptera: Formicidae), in coastal Maine. *Environmental Entomology*, 36(1):105–113.

Groden E, Drummond FA, **Garnas JR**, and Franceour A (2005). Distribution of an invasive ant, *Myrmica rubra* (Hymenoptera: Formicidae), in Maine. *Journal of Economic Entomology*, 98(6):1774–1784.

Publications in submission, review or preparation

Garnas JR, Wingfield MJ, Slippers B, Naidoo S. Managing disease risks in forestry using evolutionary principles. *In review.*

Degefu D, Slippers B, Hurley BP, Wingfield MJ, and **Garnas JR**. Artificial diets and field assays suggest potential *Eucalyptus* host range of *Coryphodema tristis* (Lepidoptera: Cossidae). *In review.*

Sullivan J, Ayres M, and **Garnas JR**. Patterns of variation in adult body size in North American populations of invasive European woodwasp, *Sirex noctilio. In prep.*

Garnas JR, Hurley BP, Wingfield MJ, Slipper B, Roux J. Insects and pathogens of Mediterranean forest ecosystems: A South African perspective. *In: Mediterranean Forest Insects.* Editors: Paine T and Lieutier F. *In prep.*

Garnas JR, Roques A, Roy H, Liebhold A, Slippers B. Consequences of complex pathways and patterns of global spread of forest insect invaders, *In prep.*

Termer K, Hurley BP, and **Garnas JR**. Biotic and abiotic determinants of larval resource quality in an invasive woodwasp, *Sirex noctilio. In prep.*

Garnas JR, Hurley BP, Wingfield MJ, and Slippers B. Patterns of cryptic diversity in the *Gonipterus scutellatus* complex in South Africa and worldwide. *In prep.*

Wooding AL, **Garnas JR**, Hurley BP, Greef J, Wingfield MJ, and Slippers B. Understanding sex ratio variation in the invasive Hymenopteran, *Sirex noctilio. In prep.*

Grants and funding

2014-2017 Modeling pest and disease risk in plantation and natural forest species in response to climate change. Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL), Council for Scientific and Industrial Research (CSIR), ZAR300 000.

2014-2015 Toward a population genomics approach to understanding the biology, movement and global spread of the red gum lerp psyllid (*Glycaspis brimblecombei*) and its primary endosymbiont (*Carsonella ruddii*). Genomics Research Institute (GRI), University of Pretoria, ZAR62 000.

2013-2014 Biotic, abiotic and biogeographic determinants of endophyte diversity and community structure in *Senecio inaequidens* in its native and invasive range. Genomics Institutional Research Theme (IRT), University of Pretoria, ZAR60 840.

2010-2013 Interactions among forest insect pests – evaluating the potential for synergism and antagonism in an increasingly complex community; University of Pretoria Research Development Programme (RDP), ZAR150 000.

2011-2013 Understanding pest and pathogen threats to pine under expanding global cultivation; North Carolina State University-University of Pretoria Collaborative Seed Grant; ZAR120 000.

2010-2012 Assessing synthetic pheromone lure effectiveness for the monitoring of *Sirex noctilio*; USDA-APHIS; US$90 000.

2012-2013 The need, effectiveness, and potential success of biological control nematodes for *Sirex noctilio* in North America; US$20 000.

Awards

National Research Foundation (NRF) Y-rated scientist (established young researcher)
Edith Patch Award for Excellence in Entomology, 2005
Maine Alumni Travel Grant for study at Harvard Museum of Comparative Zoology, 2005

Conference papers (selected)

Impacts of insect host diversity, tree species and temperature on parasitism of the Eucalyptus snout beetle (*Gonipterus* spp.) by *Anaphes nitens*. International Union of Forest Research Organizations (IUFRO), 2014, Salt Lake City, UT

Population genetics studies reveal complex patterns of global movement of pests and pathogens in *Pinus* and *Eucalyptus* plantations. International Union of Forest Research Organizations (IUFRO), 2014, Salt Lake City, UT

A genomics approach to understanding global spread in the red gum lerp psyllid, *Glycaspis brimblecombei*, Arthropod Genomics Symposium, 2014, Urbana, IL (poster)

Babies, bathwater and barcoding: assessing the prevalence and consequences of pseudogenes in molecular-based studies of insect diversity, Entomological Society of Southern Africa, 2013, Potchefstroom, South Africa

Biotic and abiotic determinants of resource quality for the European woodwasp, *Sirex noctilio*, Gordon Research Conference on Plant-Herbivore Interactions, 2013, Ventura, CA (poster)

Predicting forest pest abundance and distribution in a changing climate: an African perspective, International Union of Forest Research Organizations (IUFRO)-FORNESA Joint Conference, 2012, Nairobi, Kenya

Predicting and understanding forest insect dynamics changing climate: an African perspective Climate Change and Plantation Health, 2012, Council for Scientific and Industrial Research (CSIR), 2012, Durban, South Africa, Invited

Cryptic diversity in the Eucalyptus snout beetle swamps that of its biocontrol agent, *Anaphes nitens*, in South Africa. Ecological Society of America Annual Meeting, 2011, Austin, TX

Origin and diversity of the wood-boring moth, *Coryphodema tristis*, newly associated with *Eucalyptus nitens* in South Africa, IUFRO, 2011, Colonia del Sacramento, Uruguay

Assessing the consequences of cryptic diversity in a tree pest-biocontrol system: the Eucalyptus snout beetle and its myrmarid parasitoid in South Africa, Entomological Society of Southern Africa, 2011, Bloemfontein, South Africa

Native and introduced insects as a threat to South African forestry, Institute for Commercial Forest Research (ICFR), Forest Science Symposium, 2010, ICFR, Pietermaritzburg, South Africa

The shape of forest pestilence – population dynamics of the beech scale and associated *Neonectria* species. Poster, USDA Interagency Research Forum on Invasive Species, 2009. Annapolis, MD

Spatial dispersion in agents of forest disease: beech bark disease-associated organisms in space and time. Presentation, International Congress of Entomology, 2008. Durban, South Africa and Ecological Society of America, 2007. San Jose, CA

Modeling the influence of beech bark disease on root sprout regeneration in hardwood forests of northeastern North America. Poster, North American Forest Insect Work Conference (NAFWIC), 2007. Asheville, NC

The dynamics of eastern hardwood forests with and without beech bark disease. Presentation, USDA Interagency Research Forum on Invasive Species (IRFIS), 2007. Annapolis, MD, Invited

Alternative stand trajectories in beech bark disease-impacted forests, an analysis of Vermont Forest Inventory and Analysis data. Presentation, Northeastern Forest Pest Council (NEFPC), 2007. Portland, ME

Society and professional membership

International Union of Forest Research Organizations (IUFRO)
Ecological Society of America (ESA)
Entomology Society of America (EntSoc)
Entomological Society of Southern Africa (ESSA)
Society for the Study of Evolution (SSE)
Southern Africa Association for the Advancement of Science (S2A3)

Teaching experience

Lecturing, course design (University of Pretoria)

Population Ecology (3rd year course, shared) – 2010 to present (annual)
Plant-Insect Interactions (Honors [4th year] course) – 2010 to present (annual)
Using R for graphics and statistical analysis (2-day workshop, June 2012)

Teaching Assistantships (Dartmouth College, University of Maine)

Tropical and Marine Ecology, Foreign Studies Program in Costa Rica/Little Cayman, 2008
Ecology and Evolution, 2006 and 2007
Biostatistics, 2006
Introduction to Environmental Science, 2006
Physiological Ecology, 2005
Biology of Organisms, 2003 and 2004

Guest lectures

Evolution of resistance to pesticides
The role of insects and pathogens in forest ecosystems
Introduction to the arthropods (field sampling methods, diversity and identification)
Population biology of parasites and pathogens
Plant defenses to herbivory/herbivore offense

Laboratory, field and other relevant skills

General molecular biology laboratory techniques, population and phylogenetic analyses
Fungal isolation, culturing and identification
Plant and insect identification; expertise with ant and scolytid (beetle) taxa of North America
Expertise in standard forestry sampling and mensuration techniques, numerous and varied ecological sampling methods across habitats, and experimental design and analysis
Statistical and population modeling in R and MATLAB

Computer skills

Strong general skills in Windows, Mac and Linux environments
Statistics and modeling, primarily in R (also MATLAB, Systat, SAS, JMP, Excel, etc.)
Facility with numerous phylogenetic programs and bioinformatics pipelines
Mapping and analysis in ArcGIS 10.1
Database programming and maintenance using MS Access and MySQL
Basic programming in Python and Perl, working knowledge of C++ and VBA

Extension and service

Field day presentations on tree pests and diseases for local foresters and growers (2-3 per year)
Core contributing member, national Sirex Control Programme, South Africa
Management team, Tree Protection Cooperative Programme (TPCP), South Africa
Management team, Center of Excellence for Tree Health Biotechnology (CTHB), South Africa

Languages

Strong communication skills in native English
Verbal and written fluency in Spanish