

SENAIT D. SENAY

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INTEREST

I have a unique interest in working on climate change adaptation issues especially regarding the increased risk from alien invasive species on livelihoods, food safety and biodiversity. I believe it is important to develop strategies that counter homogenization of species distribution, as novel climates resulting from climate change create suitable habitats for invading species. My ideal projects cover biodiversity, conservation and biosecurity. I am particularly interested in feasibility and habitat suitability studies for exotic crops and spatial risk analysis for various natural reserves, agricultural schemes and industrial projects. I am also interested in invasive species studies, integrated agricultural, horticultural and forestry project evaluations, disaster risk management and early warning systems for natural disasters. However, any project that involves problem solving using GIS, remote sensing, modelling tools and generally science, interests me. I am willing to take the challenge in applying these tools in areas they have not been used before. I am particularly interested in teaching and sharing my experience as I learn in the process.

EDUCATION

Lincoln University • August 2014 • New Zealand

Ph.D. in Ecological and Biosecurity Informatics

Thesis title: Modelling invasive species-landscape interactions with high resolution spatially explicit models • Supervised by Associate Professor Susan P. Worner at the Bio-Protection Research Centre in Lincoln University, New Zealand.

- Bio-Protection Research Centre PhD Scholarship Award-2010
- Bio-Protection Research Centre Writing Scholarship award-2012
- Bio-Protection Research Centre Writing Scholarship award-2014

Wageningen University • January 2003 • Netherlands

M.Sc. in GIS (Geo-information Science)

- Nuffic Scholarship Award

Wondo Genet College of Forestry* • July 2000 • Ethiopia

*Now named College of Forestry and Natural Resources (CFNR) in Hawassa University, Ethiopia

B.Sc. in Forestry

WORK EXPERIENCE

Research Associate • May 2015 – to date

International Science and Technology Practice and Policy (InSTePP),

Department of Applied Economics, University of Minnesota, St. Paul, Minnesota, U.S. A

- Developing and enhancing spatial models that can be used to predict global distribution of agricultural pests and diseases.
- Develop pest/pathogen dispersal models at a landscape level considering climatic, environmental and social factors. Outputs are used to inform decision making for an optimized pest control, monitoring, and eradication.
- Analysis of the spatial interaction between agricultural pests, their hosts and the environment.
- Work on collaborative projects that enable the use of complex ecological informatics model outputs within the various economic analysis models developed in-house.
- Provide geo-spatial analysis support for staff and students at the Department of Applied Economics/ InSTePP center.
- Cover GeoStatistics for the APEC 5721, Economics of Science and Technology Policy course
- Developing relevant geospatial data and metadata, and analytical tools for the International AgroInformatics (IAA) GxExMxS data infrastructure.
- Develop and/or customize analytical tools to be used for efficient analysis of data with a spatial component on the IAA platform.

GIS Data Manager • October 2014 – April 2015

Department of Conservation, Nelson, New Zealand

- Update, develop and implement improvements to data collection processes
- Lead implementation of data quality checks and associated reporting.
- Work closely with the operations manager and planner to drive informed planning decisions.
- Provide rapid assessments of new information and relevant analysis of findings.
- Ensure appropriate systems and processes are in place to provide field staff with fit-for-purpose tools.
- Develop and provide regular situation updates on progress against operational and strategic plans and key performance measures.

Programmer/Analyst • May 2014 – September 2014

Bio-Protection Research Centre, Lincoln University, New Zealand

- Programming and training to make the Multi-Model pest risk modelling and mapping programme accessible to new PhD students
- Training new students in applying GIS methods for pest risk analysis and mapping
- Giving lectures for the course Bio-Protection and Biosecurity (PLPT326)

Information Management Analyst • August 2008 – April 2010

UNOCHA, Addis Ababa, Ethiopia

- Giving GIS/RS support to the OCHA-ETH staff
- Prepare mission maps for upcoming events, missions, field visits etc...
- Releasing up to date GIS information on the UNOCHA-ETH website
- Giving Technical and Advisory GIS assistance to other UN agencies

Managing Director/GIS Specialist/Consultant • February 2007– April 2010

GEOTECHSS P.L.C, Addis Ababa, Ethiopia

- Managing lateral and vertical relationships between GEOTECHSS and GeoSAS and other subsidiaries
- Working on project proposals and plans
- Overseeing training for different level of trainees (beginners to advanced GIS and RS)
- Working on Data standard and Geo-Database development
- Organizing reports and achievement evaluation frame works for the company

GIS Specialist • February 2006– August 2008

UNDP/DPPA, Addis Ababa, Ethiopia

- Organizing the vast GIS information the ICT department gets into a simple and easily accessible database
- Producing various maps regarding Humanitarian Appeal, Pledges and other data based on the information obtained from the Early Warning System Department, Governmental bureaus , NGO's and other sources.
- Developing core datasets of the GIS database, i.e. Administrative, Topographic, Soil, Land Cover, Cadastre etc...
- Managing the Vulnerability analysis and Mapping (VAM) server located in DPPA /Disaster Prevention and Preparedness Agency/
- Responsible for geo-database development, mapping and visualization of the Baseline Risk Project at the DPPA which involves a backlog of 50 years of Hazard, Disaster, Response and Vulnerable Areas Data.

GIS Expert • October 2005 – February 2006

Lahmeyer International, Addis Ababa, Ethiopia

- Data Standardization and Preparation for Analysis
- Data Analysis
- Data modelling and visualization
- Mapping and Suitability analysis
- Satellite Image Analysis
- Reporting and database organization

Consultant • May 2003 – October 2005

Senay GIS consultancy, Addis Ababa, Ethiopia

- Establishing the consultancy, work on pilot projects
- Building up of various GIS database to be used as a core dataset for consultancy purposes e.g.: land use, cadastre, soil etc.

Graduate assistant/ Junior researcher • September 2000– June 2001

Alemaya University, Alemaya, Ethiopia

- Laboratory session assistant for the courses plant physiology and plant morphology
- Field assistant for the course introduction to forestry
- Coordinating the senior seminar program for graduates and reviewing senior seminar papers.
- Main research area: Studying the different tree species which are resistant to high level of salinity for forestation in a highly saline grounds.

PUBLICATIONS

- Lustig, A., SP Worner, JPW Pitt, C Doscher, DB Stouffer, **SD Senay**. 2017. A modelling framework for the establishment and spread of invasive species in heterogeneous environments. *Ecology and Evolution*. DOI: 10.1002/ece3.2915
- Kriticos, D. J., J. M. Kean, C. B. Phillips, **S. D. Senay**, H. Acosta, and T. Haye. 2017. The potential global distribution of the brown marmorated stink bug, *Halyomorpha halys*, a critical threat to plant biosecurity. *Journal of Pest Science*:1-11.
- Senay, S.D.**, Pardey, P.G., Liebenberg, F., Greyling, J.C., Beddow, J.M. 2017. The shifting geography of African maize production in the 20th century and beyond: A first look. HarvestChoice project deliverable. Rep #: TBD.
- Senay, S.D.**, Hurley, T.M., Pardey, P.G., Chai, Y., Beddow, J.M. 2016. A Composite multi-pest spatial assessment of biotic risks to African Wheat, Maize and Cassava Production. HarvestChoice project deliverable. Rep #: TBD.
- Chai, Y., Hurley, T.M., Pardey, P.G., Beddow, M., **Senay, S.D.** 2016. A spatio-temporal, multi-peril assessment of wheat rust losses worldwide. HarvestChoice project deliverable. Rep #: TBD
- Narouei-Khandan, H. A., C. L. Harmon, P. Harmon, J. Olmstead, V. V. Zelenev, W. van der Werf, S. P. Worner, **S. D. Senay**, and A. H. C. van Bruggen. (2017). Potential global and regional geographic distribution of *Phomopsis vaccinii* on *Vaccinium* species projected by two species distribution models. *European Journal of Plant Pathology*:1-12. doi: 10.1007/s10658-017-1146-4
- Harvey, J., M. Macdevette, S. Mutiga, J. Mutuku, T. Eldridge, P. Emmrich, D. Grace, **S. Senay**, A. Abate, and R. Darnell. (2016.) Poisoned chalice: Toxin accumulation in crops in the era of climate change. UNEP.
- Worner, S.P., Lankin, G., Lustig, A., Narouei Khandan, H.A., **Senay, S.D.** (2015) Being better than average: the application of computational intelligence in pest management and biosecurity. Pp 141-153. In *The Plant Protection Data Toolbox*, eds. R.M. Beresford, K.J. Froud, J.M. Kean and S.P. Worner, (New Zealand Plant Protection Society (Inc.), 2015), New Zealand.
- Senay, S. D.** (2014). Modelling invasive species-landscape interactions using high resolution, spatially explicit models (Doctoral dissertation, Lincoln University).
- Senay, S. D.**, Worner, S. P., & Ikeda, T. (2013). Novel Three-Step Pseudo-Absence Selection Technique for Improved Species Distribution Modelling. *PLoS ONE*, 8(8), e71218.
- Logan DP, **Senay SD**, & Narouei khandan HA. (2013) Habitat suitability predictions for selected glasshouse biological control agents using Maxent and Multi-modelling. *Plant & Food Research*. SPTS No. 8061. Te Puke, New Zealand.
- Senay, Senait D** (2003) Comparison between supervised and unsupervised neural networks image classification. M.Sc. Thesis. Wageningen, The Netherlands.

CONFERENCE ABSTRACTS AND ORAL PRESENTATIONS

- Senay, S.D.** (2017). The Achilles heel of predictive models: lack of quality data and interoperability and possible solutions. Renewed Strategies for *Striga* Management Workshop. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) & Biosciences Eastern and Central Africa (BeCA-ILRI). November 29, Nairobi, Kenya.
- Allan, G., J. Erdmann, A. Gustafson, A. Joglekar, M. Milligan, G. Onsongo, K. Pamulaparthi, P. Pardey, T. Prather, and **S. Senay**. GEMStm: An Innovative Agriinformatics Data Discovery and Analysis Platform. https://rdmi.uchicago.edu/papers/08162017165531_paperwilgenbusch081617.pdf.
- Senay, S. D.** (2016). Landscape mapping for spatially explicit species dispersal models, Guest lecture at the Department of Ecology, Environment and Plant Sciences (DEEP), Stockholm University, August 29, Stockholm, Sweden.
- Senay, S. D.** CB Phillips, U Torres, J Kean, RC Venette and SP Worner. (2016). Using multi-models to predict potential distribution of *Halyomorpha halys*. Presented at the International Pest Risk Research Group (IPRRG) Conference, August 24, Parma, Italy.

- Senay, S. D.** & Worner, S.P. (2015). A random forest climatic suitability prediction for *Puccinia striiformis* f. sp. *tritici*. Presented at the International Pest Risk Mapping Workgroup IX, August 26, Fort Collins, Colorado, USA.
- Senay, S. D.** & Worner, S.P. (2014). Multi-scenario species distribution modelling: an essential framework to quantify prediction uncertainty. Presented at the International Pest Risk Mapping Workgroup VIII, September 9, Canberra, Australia.
- Senay, S. D.,** Phillips, C. & Worner, S.P. (2014). Landscape recoding for targeted species dispersal modelling. Presented at the International Pest Risk Mapping Workgroup VIII, September 10, Canberra, Australia.
- Senay, S. D.** (2014). Landscape recoding for targeted species dispersal modelling. (Awarded 3rd place prize). Presented at the Lincoln University Post- Graduate Conference, Lincoln University, Lincoln, New Zealand.
- Senay, S. D.** (2014). Spatial modelling: a small step for science but a giant leap for biosecurity. Presented at the Better Border Biosecurity (B3) Conference, May 2014, Wellington, New Zealand.
- Senay, S.D.** (2014). Progress using SDM's for biosecurity decision making. Presented at the Tripartite International Collaborative Research Initiative Knowledge Engineering and Discovery Research Institute (KEDRI) Auckland University of Technology, Shanghai Jiao Tong & Xinjiang Universities China, Bio-Protection Research Centre, Lincoln, New Zealand.
- Senay, S. D.,** Worner, S. P., & Ikeda, T. (2013). Improved pseudo-absence selection technique for species distribution models. Presented at the Bio-Protection Research Seminar Series, Lincoln University, Lincoln, New Zealand.
- Senay, S. D.,** & Worner, S. P. (2013). Why do models predict differently for the same species/location? (Awarded 2nd prize). Presented at the Lincoln University Post- Graduate Conference, Lincoln University, Lincoln, New Zealand.
- Senay, S. D.,** & Worner, S. P. (2013). Correlative species distribution models-issues and solutions. Presented at the B3 Pest risk modelling and mapping workshop for biosecurity. Plant & Food CRI, Lincoln, New Zealand.
- Worner, S. P., **Senay, S. D.,** Khandan, H. A. N., & Lustig, A. (2013). Characterizing the likelihood of establishment and spread on invasive pests on the post border pathway: current issues challenges and potential for hybrid or integrated models. Paper presented at The Second International Congress on Biological Invasions, Qingdao, China.
- Senay, S. D.,** Worner, S. P., & Ikeda, T. (2012). A novel three-step pseudo-absence generation method with ecological, spatial and environmental aspects of species requirements considered. Paper presented at the 8th International Conference on Ecological Informatics: Ecological Informatics for Biodiversity and conservation Biodiversity and Conservation., Brasilia, Brazil.
- Senay, S. D.,** Worner, S. P., & Ikeda, T. (2012). A novel three-step pseudo-absence selection method that balances environmental and geographical spaces. Paper presented at the Pest Risk Modelling and Mapping workshop VI, Tromsø, Norway.
- Senay, S. D.,** Worner, S. P., & Ikeda, T. (2012). Species distribution models and risk assessment. Presented at the On Campus Event Relative risk of Augmented Pest Control, Bio-Protection Research Centre, Lincoln, New Zealand. The Australian and New Zealand organisation of the Society for Risk.
- Senay, S. D.,** & Worner, S. P. (2012). Spatial distribution models from the truth to the whole truth. (Invited) Presented at the Canterbury statistics Open day, Canterbury University, Christchurch, New Zealand.
- Senay, S. D.** (2012). Modelling alien invasive species-landscape interactions using high resolution spatially explicit models. Presented at a Collaboration meeting between the Bio-Protection Research Centre and Plant and Food Research Centre, Te Puke, New Zealand.
- Senay, S. D.** (2011). Species distribution models used in biosecurity. Insect invasion team research presentation. Presented at the Tripartite International Collaborative Research Initiative Knowledge Engineering and Discovery Research Institute (KEDRI) Auckland University of Technology, Shanghai Jiao Tong & Xinjiang Universities China, Bio-Protection Research Centre, Lincoln, New Zealand.
- Senay, S. D.** (2011). Winning the war against alien bugs: new tools and tactics (Thr3sis competition). Presented at the Thr3sis competition, Lincoln, New Zealand.
- Senay, S. D.,** & Worner, S. P. (2011). Using non-linear dimension reduction methods for multi-sourced, multi-format and multi-temporal geo-environmental predictors. Paper presented at the Pest Risk Modelling and Mapping workshop V: Pest risk in a changing world, Fort Collins, USA.
- Senay, S. D.,** & Worner, S. P. (2011). Using non-linear dimension reduction methods for multi-sourced, multi-format and multi-temporal geo-environmental predictors. Presented at the Lincoln University Post Graduate Conference, Lincoln, New Zealand.
- Worner, S. P., Ikeda, T., Wang, D., **Senay, S. D.,** & Khandan, H. A. N. (2011). Computational Intelligence and modelling in applied ecology. Paper presented at the Computational Intelligence: methods systems and

applications for ecological and environmental modelling in China and New Zealand, Auckland, New Zealand.

REVIEWING

- Ecological Informatics journal
- Methods in Ecology and Evolution journal
- PLoS one
- Ecography
- Environmental entomology
- Forest ecology

RESEARCH GRANTS

- ENRTF, "Tactical Invasive Plant Management Plan Development". PIs Monika Chandler & Matt Russell, July 2017 – June 2020, \$296,832. ENRTF ID: 122-D.
- MITPPC, "Developing a spatially explicit bio-economic dispersal model to aid with the management of *Halyomorpha halys*." PIs Senait D. Senay and Terrence M. Hurley, Date and ID: TBD, \$5999,000. Status: Conditionally awarded under final review.

SKILLS

- Dispersal and spread modelling and simulation using modular spatial programming (using MDiG, Python, and R)
- Experience in ESRI products, MapInfo, GRASS, MATLAB, Python and R
- Image analysis and interpretation with ERDAS imagine, ENVI, Windisp and Idrisi
- GIS Database management with ArcSDE and Postgres/PostGIS
- Experience in Spatial analysis, AML, Python, R and Matlab programming for various GIS Process executions and 2D and 3D visualizations.
- knowledge of the most used UN GIS Data Exchange platforms, DEVINFO and VAM

MEMBERSHIPS

- International Pest Risk Research Group (IPRRG): member from 2011, elected executive committee member in 2017.
- Geographic Information Systems Society of Ethiopia (GISSE): founder and member from 2007
- Society for Risk Analysis, Australia & New Zealand (SRA-ANZ): member 2012 -2014

EXTRACURRICULAR ACTIVITIES

- Member of the University of Minnesota Postdoctoral Association (UMN PDA) 2015- To Date
- Member of the Lincoln University Postgraduate Society 2014 - To date.
- Member of the postgraduate-postdoc (PGPD) committee at the Bio-Protection Research Centre 2011 - 2014.
- Member and Secretary of the ISO-W (International students' organization of Wageningen University) & Member of the ISP (International Students Panel), Wageningen, The Netherlands. December 2002 – January 2003
- Member and Chairwoman of the Environmental club of Southern University, Wondo Genet College. Wondo Genet, Ethiopia. September 1999 – July 2000

REFERENCES

- Prof. Philip Pardey (PhD), International Science and Technology and Research Practice (InSTePP), 1994 Buford Avenue, Saint Paul, Minnesota, 55108, United States. Email: ppardey@umn.edu (Center Director and Direct supervisor)
- Robert C. Venette (PhD), Minnesota Invasive Terrestrial Plants and Pest Center, University of Minnesota, 1992 Folwell Ave, Saint Paul, Minnesota, 55108, United States. Email: venet001@umn.edu (Mentor)
- Assoc. Prof. Susan Worner (PhD), Bio-Protection Research Center, PO Box: 85084, Lincoln University 7647, Canterbury, New Zealand. Email: susan.worner@lincoln.ac.nz (PhD supervisor)
- Craig Phillips (PhD), AgResearch, Lincoln Science Centre, PB 4749, Christchurch 8140, New Zealand. Email: craig.phillips@agresearch.co.nz (Collaborator)