University of Nebraska Lincoln

INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
DEPARTMENT OF PLANT PATHOLOGY

December 21, 2018

Dr. Loren Giesler, Head and Professor
Department of Plant Pathology
University of Nebraska
Lincoln, NE 68583-0722

Dear Dr. Giesler,

This letter and accompanying documents are submitted for your consideration of early Promotion and Tenure in the Department of Plant Pathology. I joined the department in August of 2014 in the position of Quantitative Ecologist, which carries a 9-month appointment with a full-time equivalent of 78% research, 20% teaching, and 2% service. UNL Institute for Agriculture and Natural Resources (IANR) guidelines state: "Early tenure implies that a candidate has exceeded in a shorter time period the type of sustained high-level performance than would be expected over the normal probationary period." Thus, the enclosed dossier is assembled to highlight achievements and impacts of my work that are in accordance with my position description and expectations outlined by the Department of Plant Pathology, CASNR, ARD and IANR. This letter provides selected highlights of the most significant impacts.

In my current position as an Assistant Professor at the University of Nebraska, I have established a vigorous and internationally recognized research program to study plant pathogens important in the Midwest, most notably *Sclerotinia sclerotiorum* that infects multiple economic hosts. During my time in rank, I have received a total of 10 contracts or grants that, together with my collaborators, has procured over $2.62 million in extramural funding, which has provided full or partial support for six personnel and several undergraduates. In total, I have advised / mentored a total of 22 personnel in my lab, including 11 undergraduates, 4 Ph.D. students, 2 graduate rotations, 4 postdocs, and one research technologist, in addition to being a committee member for 4 Ph.D. and 5 M.S. students advised by others. During my time in rank, I have published a total of 17 peer-reviewed manuscripts in highly ranked journals, with two additional manuscripts in revision and two others in review, and I was invited to give 11 oral presentations to various audiences. Among the most notable was the selection to receive the *American Phytopathological Society (APS) Schroth Faces of the Future Award in Epidemiology*, for which I gave a talk at the annual APS meeting in Tampa, FL, and being invited to Uberlandia, Brazil to give two presentations at the 16th International Sclerotinia Workshop in 2017.

The most significant publications produced by my research group has improved our understanding of the biology, epidemiology, evolution, and management of the fungal plant pathogen, *Sclerotinia sclerotiorum*. Disease losses caused by this pathogen result in an annual loss of

~$252M on sunflower, soybeans, dry edible beans, canola, and pulse crops, with severe disease outbreaks that can lead to complete loss. Because *S. sclerotiorum* is a necrotrophic pathogen and is capable of infecting more than 450 plants, breeding efforts are limited and management relies heavily on well-timed fungicide use. Nationally, fungicides account for a 50% yield increase for 22 major crops in the U.S., which is equivalent to 97 billion pounds of food and fiber, valued at $12.8B. However, there are already 203 species of fungal plant pathogens that have fungicide resistance. Thus, in-depth knowledge of the biology, epidemiology, and population genetics of plant pathogens is essential to develop management recommendations that mitigate disease and maximize the usable life of fungicides and host resistance.

One of the most significant projects completed by my research group is a landscape-level population genetic analysis of *S. sclerotiorum* collected from dry bean fields across the United States (Kamvar *et al.* 2017 *PeerJ* with corresponding raw data and R scripts available on the Open Science Framework osf.io/ejb5y). Our research showed there was less population structure and greater connectivity across widely separated geographic locations than expected. However, it also underscored the importance of using multi-site screening nurseries for plant breeding. We also identified a need for future studies to investigate the role of seed-borne dissemination and climate-driven diversification. Although this research was published in *PeerJ* on December 7th, it was awarded one of the "Top 5 Most Viewed Articles of 2017" in *PeerJ*'s sections on Agriculture Science, Genetics, and Mycology, and has presently accrued 1,588 views and 274 downloads.

The second most significant project completed by my lab group sought to better understand the underlying biological processes that may give rise to genetic variation and fungicide resistance within pathogen populations. To address this, my research group used *S. sclerotiorum* as a model system to investigate processes of novel trait emergence, specifically focused on the role of fungicide-induced cellular stress in emergence of genetic variability and fungicide resistance. Our research showed sub-lethal fungicide exposure altered the genomic landscape of *S. sclerotiorum*, a potentially important and overlooked mechanism of genetic variant emergence (Amaradasa & Everhart 2016, *PLoS ONE*), which has currently been viewed and/or downloaded 3,130 times. Current work is underway to further characterize fungicide-exposed isolates using whole-genome sequencing.

Products of my research group on *S. sclerotiorum* has led to 19 presentations, 15 posters, three research reports, and six manuscripts. As described above, this research has garnered national and international recognition, best exemplified by the invitation to give two presentations at the International Sclerotinia Workshop in Uberlandia, Brazil, and funding from multiple sources, including the North Central Soybean Research Program and the USDA National Sclerotinia Initiative. Collectively, knowledge generated by this body of research enables more sustainable management of diseases caused by *S. sclerotiorum*, an economically important and pervasive fungal pathogen. Moreover, research already completed by my lab group set the groundwork for future studies, as outlined in depth in my research statement.

Beyond research, my teaching has made impact locally and nationally. This was done through revision of an existing course that significantly improved student evaluation scores, in creating new courses, and by creating non-credit workshops that have now been taught to more than 250 attendees in the last two years. I have also made significant contributions in graduate student professional development and mentoring, within my department, university, and

profession, as well as co-developing an outreach program, called *Cultivate ACCESS*, for high school students considering agSTEM careers. This program received grant funding from the USDA Women and Minorities in Science, Technology, Engineering and Mathematics Fields Program (WAMS). The latter is most recent and evolved from an idea that I had to use technology to facilitate mentoring for women and minority youth in rural towns in Nebraska. Partnering with faculty in science literacy, we created a mentoring program that connects high school youth in rural towns with a career professional, who engages the young person on topics related to professional skills and career-related experiences. This was recently highlighted in the UNL *Strategic Discussions for Nebraska 2018* that focused on "Science Literacy" (see: sdn.unl.edu).

In professional service, I am actively engaged in my department and in the American Phytopathological Society. In 2016, I was invited to serve on the APS Annual Meeting Board and am an active member of both the Epidemiology (currently vice-chair) and Diversity & Equality Committees. Within the Department, my most significant contribution was leading a team of faculty to write a proposal to create a new graduate program for M.S. and Ph.D. degrees in Plant Pathology. For nearly 100 years our department has routed graduate students through other departments and currently has 28 students enrolled. As one of 13 remaining Departments of Plant Pathology in the U.S. and being the only one that does not offer graduate degrees in Plant Pathology, establishing this new program was significant and will transform the future of our department. These, and other activities, give me a sense of ownership in my professional society and institution.

Enclosed you will find my *Curriculum Vitae*, *Candidate Statement*, and *Appendices*, which are assembled according to the IANR documentation request. In addition to reviewing these documents, I would also like to invite you and others reviewing this document to attend my departmental seminar at 4:00PM on Monday, January 14th, 2019. I will be presenting a talk that highlights this research in more detail. If you are unable to attend, please feel free to watch the recording of my talk that will be available here after that date.

Sincerely,

Sydney E. Everhart, M.S., Ph.D.
Assistant Professor
Department of Plant Pathology
University of Nebraska
Lincoln, NE 68583-0722
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File for Consideration of Promotion to Associate Professor with Tenure

Sydney E. Everhart
University of Nebraska–Lincoln
2018

Submitted December, 2018

TABLE OF CONTENTS

II. CANDIDATE SECTION

Sydney E. Everhart, Ph.D.

everhart@unl.edu | everhart.unl.edu | 402-472-2879 office | 402-802-1743 cell
406G Plant Sciences Hall, Department of Plant Pathology
University of Nebraska, Lincoln, NE

EDUCATION

2012	**Ph.D.** in Plant Pathology, University of Georgia (UGA)
2007	**M.S.** in Biology (Ecology), University of Central Missouri (UCM)
2005	**B.S.** in Biology, University of Iowa

PROFESSIONAL RESEARCH POSITIONS

2014 – present	**Assistant Professor**, Department of Plant Pathology, University of Nebraska
2016 – present	**Adjunct Assistant Professor,** Department of Plant and Environmental Science, University of Clemson, Clemson, SC
2012 – 2014	**USDA-AFRI-NIFA Postdoctoral Fellow,** Department of Botany & Plant Pathology, Oregon State University

EXPERTISE

Population genetics / genomics, spatiotemporal epidemiology, fungicide resistance, fungal genetics, whole-genome sequencing, community sequencing, development of genetic markers, multivariate analysis of community and population genetic data in R.

SUMMARY OF ACCOMPLISHMENTS DURING TIME IN RANK

Invited Seminars and Symposia: 11

Peer-reviewed Manuscripts: 17 (+2 in revision)

First and/or Corresponding Author on Peer-Reviewed Manuscripts: 8 (+1 in revision)

Books, Chapters, Proceedings, Magazine Articles, and R Packages: 10

Scientific Poster and Oral Presentations: 40 total; 27 presented by myself or member of the Everhart Lab

Students and Postdoctoral Scholars Supervised in my Lab: 20

PI/Co-PI on grants and contracts: 10, valued at $2.62M with $384,314 to my program

Funding rate: 37.04%, with 3 additional proposals pending

Revised core curricular course PLPT802: *Ecology & Management of Plant Pathogens* and significantly improved student evaluations from the 10th percentile to the 70th percentile

Created and taught *Intro to R for Plant Pathologists* workshop to: >250 attendees at local, regional, and international meetings

Led team of faculty to write a proposal to create a new graduate program in Plant Pathology to enable our department to offer the M.S. and Ph.D. degrees in Plant Pathology

Awarded *Schroth Faces of the Future Award in Epidemiology* from the American Phytopathological Society (APS) in 2016

Invited to serve on the Annual Meeting Board of APS in 2016

Elected as Vice Chair of the Epidemiology Committee of APS in 2018

MANUSCRIPT RECOGNITIONS DURING TIME IN RANK:

Three manuscripts published in the 2018 ***Special Issue on Sclerotinia*** in *Tropical Plant Pathology*

Kamvar *et al.* 2017 rated "***Top 5 Most Viewed Articles of 2017***" in *PeerJ*'s section on Agriculture Science, Genetics, and Mycology

Grünwald *et al.* 2017 selected for **Sept. 2017 *Phytopathology* Cover Image**

Dugan and Everhart 2017 selected as **Feb. 2017 *Plant Health Progress* Editor's Pick**

AWARDS AND HONORS (SELECTED FROM 25 TOTAL): ** Indicates completion while in rank*

2016: *Schroth Faces of the Future Award, American Phytopathological Society (APS);
*Faculty Travel Award, Institute of Agriculture and Natural Resources (IANR), UNL
2015: *Faculty Travel Award, IANR, UNL
2012: Postdoctoral Fellowship, USDA-AFRI-NIFA Fellowship Grant
K.E. Papa Outstanding Ph.D. Student, Department of Plant Pathology, UGA
2011: 11th I.E. Melhus Graduate Student Symposium Award, APS
R.J. Tarleton Fellowship, APS
2010: Outstanding Graduate Teaching Assistant, Department of Plant Pathology, UGA
2009: C. Lee Campbell Student Travel Award, APS
First Place Student Presentation, Georgia Association of Plant Pathologists
2008: First Place Graduate Thesis Award, UCM
2007: Microbiology Research Award, Association of Southeastern Biologists
Outstanding Graduate Student, Department of Biology, UCM
Quarterman-Keever Poster Award, Southeastern Ecological Society of America

INVITED SEMINARS AND SYMPOSIA (13 Total): *All completed while in rank*

2018: Department of Plant Pathology, Kansas State University, Manhattan, KA
Department of Plant Pathology and Environmental Microbiology, Penn State University, State College, PA (***and two workshops***)
2017: 16th International Sclerotinia Workshop, Uberlandia, Brazil (***two invited talks***)
Department of Plant Pathology, Ohio State University, Wooster, OH (***and workshop***)
Department of Microbiology and Plant Pathology, Iowa State University, Ames, IA
2016: Schroth Faces of the Future Symposium, Epidemiology, APS Meeting, Tampa, FL
Department of Plant Pathology, UNL, Seminar Series, Lincoln, NE
2015: Department of Plant and Environmental Sciences, Clemson University, Clemson, SC
Department of Biology and Agriculture, University of Central Missouri, Warrensburg, MO
2014: Plant Science Retreat, University of Nebraska, Nebraska City, NE

Research (78% FTE)

REFEREED PUBLICATIONS

*^Co-first author; **Corresponding author*

The following codes denote my contributions to manuscripts: **I** = Ideas Experimental or Conceptual, **F** = Produced with extramural funding to my program; **E** = Experiment Implementation, **A** = Analysis of Data, **W** = Writing and/or Critical Editing; The number of views and downloads are reported to the extent available from publishers. PDFs of all manuscripts available here.

2019

1. Dale, A.L., N. Feau, **S.E. Everhart**, G. Bilodeau, B. Dhillon, J. Tabima, C. Brasier, N. Grünwald, and R.C. Hamelin. 2019. Mitotic recombination and a two-speed genome drive evolution in asexual lineages of the sudden oak death pathogen *Phytophthora ramorum*. *mBio*. Accepted with revision. [I E A W; Impact factor = 6.689; H-index = 71] (*finalized from previous position*)

2. Miorini, T.J.J., Z.N. Kamvar, R. Higgins, C.G. Raetano, J.R. Steadman, and **S.E. Everhart**.** 2019. Variation in pathogen aggression and cultivar performance against *Sclerotinia sclerotiorum* in soybean and dry bean from Brazil and the U.S. *Tropical Plant Pathology*. In press. [I F E A W; Views = 257; Downloads = 166; Cited by 0; Impact Factor = 0.810; H-index = 16]
   - » *This manuscript is part of a special issue on Sclerotinia sclerotiorum*

2018

3. Bogo, A., C.C. Comparin, R.M.V. Sanhueza, P. Ritschel, R.T. Casa, F.N. Silva, and **S.E. Everhart**. 2018. Characterization of *Neofabraea actinidiae* and *N. brasiliensis* as causal agents of apple bull's-eye rot in southern Brazil. *Canadian Journal of Plant Pathology* DOI: 10.1080/07060661.2017.1421588 [W; Views = 112; Cited by 0; Impact Factor = 0.898; H-index = 49]

4. Kamvar, Z.N., and **S.E. Everhart****. 2018. Something in the agar does not compute: On the discriminatory power of mycelial compatibility in *Sclerotinia sclerotiorum*. *Tropical Plant Pathology*. [I F E W; Views = 333; Downloads = 197; Cited by 0; Impact Factor = 0.810; H-index = 16]
   - » *This manuscript is part of a special issue on Sclerotinia sclerotiorum*

5. Nieto-López, E. H., **S.E. Everhart**, V. Ayala-Escobar, M. Camacho-Tapia, N.B. Lima, R. Nieto-Angel, and J.M. Tovar-Pedraza. 2018. First report of *Colletotrichum gloeosporioides* causing anthracnose of tejocote (*Crataegus gracilior*) fruits in Mexico. *Plant Disease*. 102:1855. [W; Cited by 0; Impact Factor = 3.02; H-index = 91]

6. Pannullo, A.P., Z.N. Kamvar, T.J.J. Miorini, J.R. Steadman, and **S.E. Everhart****. 2018. Genetic variation and structure of *Sclerotinia sclerotiorum* populations from soybean in Brazil. *Tropical Plant Pathology*. [I F E A W; Views = 291; Downloads = 180; Cited by 0; Impact Factor = 0.810; H-index = 16]
   - » *This manuscript is part of a special issue on Sclerotinia sclerotiorum*

2017

7. Dowling, M., G. Schnabel, H. Boatwright[†], and **S.E. Everhart****. 2017. Novel gene-sequence markers for isolate tracking within *Monilinia fructicola* lesions. *Pest Management Science* 73:1822-1829. [I E A W; Abstract views = 25; Downloads = 85; Cited by 0; Impact Factor = 3.241; H-index = 100]

8. Grünwald, N.J., **S.E. Everhart**, B.J. Knaus, and Z.N. Kamvar. 2017. Best practices for population genetic analyses. *Phytopathology*. 107:1000–1010. [I E A W; Abstract views = 39; Downloads = 471; Cited by 5; Impact Factor = 2.896; H-index = 112] (*finalized from previous position*)
   - » *Phytopathology Cover Image for September 2017 issue*

9. Kamvar, Z., Amaradasa, B.S., R. Jhala, S. McCoy, J.R. Steadman, and **S.E. Everhart**.** 2017. Population structure and phenotypic variation of *Sclerotinia sclerotiorum* from dry bean in the

United States. PeerJ. 5:e4152 doi.org/10.7717/peerj.4152 [I F E A W; Views = 1,588; Downloads = 274; Cited by 6; Impact Factor = 2.118; H-index = 35]

» *Top 5 Most Viewed in 2017 for Sub-Category in PeerJ*

10. Miorini, T.J.J., C.G. Raetano, and **S.E. Everhart****. 2017. Control of white mold of dry bean and residual activity of fungicides applied by chemigation. *Crop Protection*. 94:192-202. [F A W; Cited by 0; Downloads = 194; Impact Factor = 1.920; H-index = 81]

2016

11. Amaradasa, B.S., and **S.E. Everhart****. 2016. Effects of sublethal fungicides on mutation rates and genomic variation in fungal plant pathogen, *Sclerotinia sclerotiorum*. *PLoS ONE*. 11(12): e0168079. DOI 10.1371/journal.pone.0168079. [I F E A W; Views & Downloads = 3,130; Cited by 6; Impact Factor 2.766; H-index = 241]

» *This is the all-time highest H-index journal that I have published in.*

12. de Bem, B.P., A. Bogo, **S.E. Everhart**, R.T. Casa, M.J. Gonçalves, J.L. Marcon, L.R. Rufato, F.N. Silva, R. Allebrandt, and I.C. da Cunha. 2016. Effect of four training systems on the temporal dynamics of downy mildew in two grapevine cultivars in southern Brazil. *Tropical Plant Pathology*. DOI 10.1007/s40858-016-0110-8. [A W; Views & Downloads = 428; Cited by 5; Impact Factor = 0.810; H-index = 16]

13. Dowling, M., P.K. Bryson, H. Boatwright†, J.R. Wilson, Z. Fan, G. Schnabel, **S.E. Everhart**, and P. Brannen. 2016. Effect of fungicide application on *Monilinia fructicola* population diversity and transposon movement. *Phytopathology* 106:1504–1512. [I E A W; Reads = 74; Cited by 4; Impact Factor = 2.896; H-index = 112]

14. Dugan, F.M., and **S.E. Everhart**. 2016. Cryptic species: A leitmotif of contemporary mycology has challenges and benefits for plant pathologists. *Plant Health Progress* 17:250-253. DOI10.1094/PHP-RV-16-0046 [I W; Views & Downloads = 62; Cited by 1; Impact Factor = NR; H-index = 2]

» *This article selected as the Plant Health Progress Editor's Pick in February 2017*

15. Tabima J.F., **S.E. Everhart**, M.M. Larsen, A.J. Weisberg, Z.N. Kamvar, M.A. Tancos, C.D. Smart, J.H. Chang, and N.J. Grünwald. 2016. Microbe-ID: An open source toolbox for microbial genotyping and species identification. *PeerJ* 4:e2279 DOI 10.7717/peerj.2279. [I A W; Views = 2,298; Downloads = 432; Cited by 1; Impact Factor = 2.118; H-index = 35] (*finalized from previous position*)

2015

16. Chen, F., **S.E. Everhart^,** P.K. Bryson, C.L., X. Song, X.L., G. Schnabel. 2015. Fungicide-induced transposon movement in *Monilinia fructicola*. *Fungal Genetics and Biology* 85:38–44. [I E A W; Views & Downloads = 156; Cited by 7; Impact Factor = 3.476; H-index = 93]

17. de Bem, B.P., Bogo, A., **S.E. Everhart**, R.T. Casa, M.J. Gonçalves, J.L.M. Filho, and I.C. da Cunha. 2015. Effect of Y-trellis and vertical shoot positioning training systems on downy mildew and botrytis bunch rot of grape in highlands of southern Brazil. *Scientia Horticulturae* 185:162–166. [A W; Views & Downloads = 428; Cited by 13; Impact Factor = 1.760; H-index = 84]

18. **Everhart, S.E.,** and H. Scherm. 2015. Clonal disease foci of *Monilinia fructicola* during brown rot epidemics within peach tree canopies. *Phytopathology*. 105:542–549. [I E A W; Views & Downloads = 64; Cited by 11; Impact Factor = 2.896; H-index = 112] (*finalized from previous position*)

2014

19. Schnabel, G., F. Chen, **S.E. Everhart**, W.C. Bridges and X.L. Liu. 2014. Studies on sensitivity reduction in solo and mixture treatments and fungicide-induced mutagenesis in *Monilinia fructicola*. *In*: H.W. Dehne, H.B. Deising, U. Gisi, B. Fraaije, U. Gisi, D. Hermann, A. Mehl, E.C. Oerke, P.E. Russel, G. Stammler, K.H. Kuck, H. Lyr (Eds). "Modern Fungicides and Antifungal Compounds", Vol. VII, pp 263-268. 2014 Deutsche Phytomedizinische Gesellschaft, Braunschweig, ISBN: 978-3-941261-13-6. [I E A W; Views & Downloads = 96; Cited by 4;] (*finalized from previous position*)

2013 ***Published prior to time in rank:***

20. **Everhart, S.E.,** A. Askew, L. Seymour, and H. Scherm. 2013. Spatio-temporal patterns of pre-harvest brown rot epidemics within individual peach tree canopies. *European Journal of Plant Pathology* 135:499–509. [I E A W; Views & Downloads = 28; Cited by 8; Impact Factor = 1.466; H-index = 81]

2012

21. **Everhart, S.E.,** A. Askew, L. Seymour, T.C. Glenn, and H. Scherm. 2012. Spatial patterns of brown rot epidemics and development of microsatellite markers for analyzing fine-scale genetic structure of *Monilinia fructicola* populations within peach tree canopies. Online. *Plant Health Progress* doi:10.1094/PHP-2012-0723-04-RS. [I E A W; Views & Downloads = 99; Cited by 8; Impact Factor = NR; H-index = 2]

2011

22. **Everhart, S.E.,** A. Askew, L. Seymour, I.J. Holb, and H. Scherm. 2011. Characterization of three-dimensional spatial aggregation and association patterns of brown rot symptoms within intensively mapped sour cherry trees. *Annals of Botany* 108:1195–1202. [I E A W; Views & Downloads = 20; Cited by 20; Impact Factor = 3.646; H-index = 146]

2010

23. **Everhart, S.E.**** 2010. Upper canopy collection and identification of grapevines (*Vitis*) from the tree canopy of select forests in the southeastern United States. *Castanea* 75: 141–149. [I E A W; Views & Downloads = 268; Cited by 3; Impact Factor = 0.538; H-index = 24]
    - » *This is my only single-author manuscript*

24. Keller, H.W., and **S.E. Everhart** 2010. Importance of Myxomycetes in biological research and teaching. *Fungi* 3(1):13–27. [I E A W; Views & Downloads = 1,497; Cited by 37; Impact Factor = NR; H-index = NR]

2009

25. **Everhart, S.E**.,** J.S. Ely, and H.W. Keller. 2009. Evaluation of tree canopy epiphytes and bark characteristics associated with corticolous myxomycetes. *Botany* 87:509–517. [I E A W; Cited by 15; Impact Factor = 1.178; H-index = 76]

26. Keller, H.W., **S.E. Everhart,** M. Skrabal, and C.M. Kilgore. 2009. Tree canopy biodiversity in temperate forests: Exploring islands in the sky. *Southeastern Biology* 56:52–74. [I E A W; Cited by 3; Impact Factor = NR; H-index = NR]

2008

27. **Everhart, S.E.,** and H.W. Keller. 2008. Influence of bark pH on the occurrence and distribution of tree canopy myxomycete species. *Mycologia* 100:191–204. [I E A W; Reads = 66; Cited by 34; Impact Factor = 2.471; H-index = 94]

28. **Everhart, S.E.,** and H.W. Keller. 2008. Life history strategies of corticolous myxomycetes: The life cycle, fruiting bodies, plasmodial types, and taxonomic orders. *Fungal Diversity* 29:1–16. [I E A W; Reads = 2,297; Cited by 55; Impact Factor = 13.465; H-index = 71]
    - » *This is my most-cited manuscript of all time.*

29. Keller, H.W., and **S.E. Everhart** 2008. Myxomycete species concepts, monotypic genera, the fossil record, and additional examples for good taxonomic practice. *Revista Mexicana de Micologia* 27:9–19. [I E A W; Reads = 98; Cited by 11; Impact Factor = 0.1471; H-index = NR]

30. Keller, H.W., C.M. Kilgore, **S.E. Everhart,** G. Carmack, C. Crabtree, and A. Scarborough. 2008. Myxomycete plasmodia and fruiting bodies: Unusual occurrences and user friendly study techniques. *Fungi* 1:24–37. [E A W; Reads = 128; Cited by 18; Impact Factor = NR; H-index = NR]

31. Kilgore, C.M., H.W. Keller, **S.E. Everhart,** A. Scarborough, K. Snell, M. Skrabal, C. Pottorff, and J.S. Ely. 2008. Tree canopy research and student experiences using the double rope climbing method. *Journal of Botanical Research Institute of Texas* 2:1309–1336. [E A W; Reads = 294; Cited by 10; Impact Factor = 0.26; H-index: 19]

Publications Currently in Review:

201X

32. Miorini, T.J.J., N.K. Gambhir, E.N. Lopez, L.K. Mehra, A. Pannullo†, and **S.E. Everhart****. 201X. Comparison of methods used to assess fungicide sensitivity in *Sclerotinia sclerotiorum*. *Pest Management Science*. *In review*. [I E A W]
33. Ajayi, O.O., **S.E. Everhart**, P.J. Brown, A.U. Tenuta, A.E. Dorrance, and C. Bradley. 201X. Genetic structure of *Rhizoctonia solani* AG-2-2IIIB from soybean in Illinois, Ohio, and Ontario. *Phytopathology*. *In review*. [E A W]

Other Products:

Book Chapters, Software, Proceedings, & Magazine Articles

Excluded are 8 published prior to time in rank

2018

1. **Everhart, S.E.**, and K. Ivors. 2018. E-Posters: Out with the old and in with the new. *Phytopathology News*. Page 3.
2. Gambhir, N., **S.E. Everhart**, S. Kodati, and A. Adesemoye. 2018. Fungicide resistance: Risk and management. *SoybeaNebraska*, Spring 2018, Page 22.
3. Kodati, S., A. Adesemoye, N. Gambhir, and **S.E. Everhart**. 2018. Rhizoctonia diseases in soybean. *SoybeaNebraska*, Spring 2018, Page 23.
4. R. Higgins, Z.N. Kamvar, **S.E. Everhart**, and J.R. Steadman. 2018. New sources of white mold resistance derived from wide crosses in common bean and evaluated in the greenhouse and field using multi-site screening nurseries comparing 2016 and 2017 data. *Bean Improvement Cooperative*.

2017

5. Keller, H.W., **S.E. Everhart,** and C.M. Kilgore. 2017. The Myxomycetes: Biology, life cycle, genetics and reproduction. In: Stephenson, S. and C. Lado (editors) "Myxomycetes: Biology, Systematics, Biogeography and Ecology", Elsevier, Atlanta, GA.
6. Miorini, T.J., A. Pannullo†, T. Hornby†, R. Higgins, **S.E. Everhart,** and J.R. Steadman. 2017. Phenotypic and genotypic characterization of relevant *Sclerotinia sclerotiorum* isolates. *Bean Improvement Cooperative*.

2016

7. Kamvar, Z., J. Tabima, **S.E. Everhart,** J. Brooks, S. Krueger-Hadfield, E. Sotka, and N. Grunwald, 2016. Package 'poppr'. https://cran.r-project.org/web/packages/poppr/index.html
8. **Everhart, S.E.,** B. Amaradasa, R. Jhala, R. Higgins, and J.R. Steadman. 2016. Population structure and fungicide sensitivity of 366 *Sclerotinia sclerotiorum* isolates from dry common bean. *Bean Improvement Cooperative*. 59:131-132.

2015

9. Grunwald, N.J., Z.N. Kamvar, and **S.E. Everhart.** 2015. Population Genetics in R. Online book: http://grunwaldlab.github.io/Population_Genetics_in_R/
10. **Everhart, S.E.,** T.F. Tabima, and N.J. Grünwald. 2014. *Phytophthora ramorum*. In: Dean, R.A., A. Lichens-Park, and C. Kole (eds) Genomics of Plant Associated Fungi and Oomycetes, Springer, New York, NY. Pp. 159-174.

Poster and Oral Presentations: ^ = presenting author and member of Everhart Lab (35 total)

Excluded are 42 presented prior to time in rank

2018

1. Arneson, N., L.J. Giesler, R. Werle, and **S.E. Everhart**. 2018. Effect of soil-applied protoporphyrinogen oxidase inhibitor herbicides on root rot severity of soilborne pathogens in soybean [*Glycine max* (L.) merr.]. ICPP / APS National Meeting
2. **Everhart^, S.E.** 2018. Landscape-level Population Structure: Disentangling complex factors shaping populations of *Sclerotinia sclerotiorum*. Department of Plant Pathology and Environmental Microbiology, Pennsylvania State University, State College, PA.
   - » *Invited by Graduate Students in Department of Plant Pathology and Environmental Microbiology, PSU.*
3. **Everhart^, S.E.** 2018. Landscape-level Population Structure: Disentangling complex factors shaping populations of *Sclerotinia sclerotiorum*. Department of Plant Pathology, Kansas State University, Manhattan, KS.
   - » *Invited by Dr. David Cook, KSU*
4. **Everhart^, S.E.**, and A.O. Adesemoye. 2018. Fungicide resistance in *Rhizoctonia solani* and implications for soybean fields in Nebraska. *Research Update*. Nebraska Soybean Board, Columbus, NE, January 10, 2018.
5. Gambhir^, N., Z.N. Kamvar, **S.E. Everhart**. 2018. Genome-wide mutations in *Sclerotinia sclerotiorum* after sub-lethal fungicide exposure. Plant Science Retreat, Nebraska City, NE.
6. Gambhir^, N., S. Kodati, A.O. Adesemoye, and **S.E. Everhart**. 2018. Fungicide sensitivity of *Rhizoctonia zeae* from soybean and corn in Nebraska. Invited presentation at International Rhizoctonia Workshop: Rhizoctonia at crossroads: Research advances and challenges, Boston, MA.
7. Gambhir^, N., S. Kodati, A.O. Adesemoye, and **S.E. Everhart**. 2018. Fungicide sensitivity of *Rhizoctonia* spp. isolated from soybean fields in Nebraska. ICPP / APS National Meeting
8. Gambhir^, N., Z.N. Kamvar, and **S.E. Everhart**. 2018. Genomic signatures of sub-lethal fungicide stress in *Sclerotinia sclerotiorum*. ICPP / APS National Meeting
9. Gazis, R.O., **S.E. Everhart**, A. Graves, Z.N. Kamvar, S.N. Trigiano, S.J. Seybold, and D. Hadziabdic. 2018. When natives become invasive: Population genetic signatures following range expansion in members of thousand cankers disease complex. ICPP / APS National Meeting
10. Kamvar, Z.N. and **S.E. Everhart^**. 2018. The open road: A case study of reproducible research in plant pathology. ICPP / APS National Meeting
11. Kamvar, Z.N., B.S. Amaradasa, R. Jhala, S.B. McCoy, J.R. Steadman, and **S.E. Everhart^**. 2018. White mold/dry bean: Population structure and phenotypic variation of *Sclerotinia sclerotiorum* from dry bean in the USA. ICPP / APS National Meeting
12. Marroquin-Guzman^, M.R., C. Proctor, J. McMechan, R. Werle, A.O. Adesemoye, and **S.E. Everhart**. 2018. Soil fungal diversity during a soybean-cover crop rotation using community sequencing. ICPP / APS National Meeting
13. Matczynszyn, J., **S.E. Everhart**, T. Harris, K. Powers, T.O. Powers. 2018. Phylogenetic and population structure of *Mesocriconema xenoplax* across the United States. Plant Science Retreat, Nebraska City, NE.
14. Nieto-Lopez^, E., T.J.J. Miorini, and **S.E. Everhart**. 2018. Fungicide sensitivity of 42 *Sclerotinia sclerotiorum* isolates in the North Central U.S. and determination of discriminatory concentrations. APS North Central Division Meeting

2017

15. Arneson, N., L.J. Giesler, R. Werle, and **S.E. Everhart**. 2017. Effect of soil-applied sulfentrazone and flumioxazin on soybean seedling disease severity under field conditions. North Central Weed Science Society Annual Meeting.

16. **Everhart^, S.E.,** Z.N. Kamvar, B.S. Amaradasa, T.J.J. Miorini, R. Jhala, A. Pannullo, R. Higgins, J.R. Steadman. 2017. *Sclerotinia sclerotiorum* in North America: Recent disease outbreaks and variability of populations across the United States and Mexico. 16th International Sclerotinia Workshop in Uberlandia, Brazil.
    - » *Invited by Dr. David Jaccoud Filho, Ponto Grossa State University, Brazil*
17. **Everhart^, S.E.,** N.K. Gambhir, Z.N. Kamvar. 2017. Effect of sublethal fungicide exposure on genomic variation in *Sclerotinia sclerotiorum*. 16th International Sclerotinia Workshop in Uberlandia, Brazil.
    - » *Invited by Dr. Eduardo Mizubuti, University of Viçosa, Brazil*
18. **Everhart^, S.E.,** 2017. Causes and consequences of population genetic variation in *Sclerotinia sclerotiorum*. Seminar in Department of Plant Pathology and Microbiology at Iowa State University.
    - » *Invited by Dr. Mark Gleason, ISU.*
19. **Everhart^, S.E.,** 2017. Causes and consequences of population genetic variation in *Sclerotinia sclerotiorum*. Seminar in Department of Plant Pathology at Ohio State University, Wooster, OH.
    - » *Invited by Dr. Anne Dorrance, OSU.*
20. Gambhir^, N., Z.N. Kamvar, and **S.E. Everhart.** 2017. Effects of sublethal fungicide stress on genomes of *Sclerotinia sclerotiorum*. APS National Meeting
21. Gambhir^, N., Z.N. Kamvar, and **S.E. Everhart**. 2017. Genomic alterations in *Sclerotinia sclerotiorum* after sublethal exposure to a mitosis-inhibiting fungicide. APS North Central Division.
22. Kamvar^, Z.N., **S.E. Everhart**, and N. Grünwald. 2017. I think we're a clone now: Factors influencing inference of clonality in diploid populations. APS National Meeting
23. Kodati, S., N. Gambhir^, **S.E. Everhart**, and A.O. Adesemoye. 2017. Prevalence and pathogenicity of *Rhizoctonia* spp. from soybean in Nebraska. APS National Meeting.
24. Miorini^, T.J., A. Pannullo†, J.R. Steadman, and **S.E. Everhart.** 2017 Fungicide sensitivity and population structure of *Sclerotinia sclerotiorum* isolates from Argentina, Brazil, and USA. APS National Meeting
25. Miorini^, T.J.J., **S.E. Everhart**, and J. Steadman. 2017. Fungicide sensitivity of *Sclerotinia sclerotiorum* isolates from Brazil, Argentina, and the USA. APS National Meeting
26. Nieto-Lopez^, E.H., and **S.E. Everhart**. 2017. Fungicide sensitivity of *Sclerotinia sclerotiorum* from soybean in the North Central United States. APS North Central Division Meeting.
27. Pannullo^, A., T.J.J. Miorini, Z. Kamvar, and **S.E. Everhart**. 2017. Population genetic diversity of *Sclerotinia sclerotiorum* populations from Brazilian soybean. APS North Central Division
28. Stengel, A., S. Ramirez II, E.S. Jeske, V.L. Jin, J. Cui, **S.E. Everhart**, J. Herr, and R Drijber. 2017. Nitrogen and crop rotation as drivers of the maize-associated soil microbiome. *Argonne Soil Metagenomics Meeting,* Chicago, IL.

2016

29. Amaradasa^, B.S., and **S.E. Everhart**. 2016. Sub-lethal fungicides induce microsatellite mutation in *Sclerotinia sclerotiorum*. *Phytopathology* 106:S4.139.
30. Amaradasa^, B.S., and **S.E. Everhart**. 2016. Sub-lethal fungicides induce microsatellite and AFLP marker mutation in *Sclerotinia sclerotiorum*. *Phytopathology* 106:S4.184.
31. Dowling, M., H. Boatwright†, G. Schnabel, P. Bryson, J. Wilson, Z. Fan, **S.E. Everhart**, and P. Brannen. 2016. Effect of fungicide applications on *Monilinia fructicola* population diversity and transposon movement. *Phytopathology* 106:S4.62.
32. **Everhart^, S.E.,** and B.S. Amaradasa. 2016. Fungicide stress induces genome mutation in *Sclerotinia sclerotiorum*. *Phytopathology* 106:S4.169.

33. **Everhart^, S.E.,** R. Higgins, and J.R. Steadman. 2016. Sources of white mold resistance derived from wide crosses in common bean and progress in characterization of relevant pathogen isolates. National Sclerotinia Initiative Meeting, Minneapolis, MN.
34. Gambhir^, N., A. Pannullo†, S. Campbell†, B.S. Amaradasa, R. Jhala, J. Steadman, and **S.E. Everhart**. 2016. Comparison of four methods for fungicide sensitivity determination of *Sclerotinia sclerotiorum*. *Phytopathology* 106:S4.188.
35. T.J. Miorini^, C.G. Raetano, and **S.E. Everhart**. 2016. Residual effect of fungicides applied by chemigation for white mold control in dry bean. *Phytopathology* 106:S4.190.
36. T.J. Miorini^, R. Werle, A. Stavievski, C.G. Raetano, and **S.E. Everhart**. 2016. Evaluation of residual fungicide in soybean leaves using analytical chemical quantification and *Sclerotinia sclerotiorum* bioassay. *Phytopathology* 106:S4.189.

2015

37. Amaradasa^, B.S., and **S.E. Everhart**. 2015. Sub-lethal doses of fungicide induce resistance emergence in *Sclerotinia sclerotiorum*. *Phytopathology*. 105:S4.7.
38. **Everhart^, S.E.**, R. Jhala, B.S. Amaradasa, R. Higgins, J.R. Steadman. 2015. Worldwide population structure of *Sclerotinia sclerotiorum* from cultivated common bean. *Phytopathology* 105:S4.41.
39. **Everhart^, S.E.** 2015. Current advances in population genetic analyses for non-model organisms. Department of Plant and Environmental Sciences, Clemson, University, Clemson, SC.
    - » *Invited by Dr. Guido Schnabel, Clemson University*

2014

40. **Everhart^, S.E.,** J.R. Steadman, R. Jhala, and B.S. Amaradasa. 2014. Emergence and evolution of fungicide resistance in fungal plant pathogens. NSF I/URUC Planning Meeting for Center for Emergence and Evolution of Pesticide Resistance. Lincoln, NE.

GRANTSMANSHIP ACTIVITIES

All completed while in rank

TRAINING IN GRANTSMANSHIP:

Research Development Fellows Program, UNL, 2014–2015

> "The Research Development Fellows Program (RDFP) is an Office of Research and Economic Development (ORED) initiative designed to provide full-time, pre-tenure faculty with the information, resources and approaches necessary to prepare competitive grant proposals. The year-long program is composed of three primary components: learning activities, consultation, and sponsor engagement."

PROGRAM DIRECTOR VISITS:

Traveled to Washington D.C.:

See *Appendix A2 for Tear Sheets presented during these meetings*, p.41 [Link]

- 2017 trip funded partially by Department, ARD, and ORED, and met with:
    - Dr. Ray Ali, Director of the USDA-NIFA-ALI Program
    - Dr. Mary Purcell-Miramontes, Director of the USDA-NIFA Foundational Programs
    - Dr. George Gilchrest, Director of NSF-DEB
- 2015 trip funded by RDFP program and met with:
    - Dr. Ann Lichens-Park, Director of the USDA-NIFA Foundational Programs
    - Dr. Wayne Parrott, Director of the NSF Plant Genome Research Program and also discussed the NSF BREAD Program

Teaching (20% FTE)

CLASSROOM AND LABORATORY TEACHING AT UNL: *All completed while in rank*

See *Teaching Statement*, p.26 [Link]

See *CASNR Calculated FTE* in Appendix, p.41 [Link]

See Course Descriptions and CIEQ Student Evaluations in Appendix, p.42 [Link]

- Success in the Sciences, UNL, Summer 2018
- Ecology and Management of Plant Pathogens, UNL, Spring 2016, 2017, 2018, and every spring
- Plant Diseases Across Nebraska, UNL, Summer 2016, 2017
- Population Genetics and Advanced Epidemiology in R, UNL, Summer 2016
- Disease Dynamics and Evolution, UNL, Spring 2016

WORKSHOPS & OTHER NON-CREDIT TRAINING: *All completed while in rank*

R (Computing) Workshop: Intro to R for Plant Pathologists

Everhart, S.E., N.G. Gambhir, and Z.N. Kamvar. 2018.

See *Teaching Statement*, p.26 [Link]

This four-hour workshop introduces participants to R using examples of plant pathology field data. Participants learn how to: read in data, manipulate data, summarize and visualize data, perform comparisons, find and load packages, and troubleshoot common problems. The workshop uses base packages and newer tools, such as dplyr and ggplot2. Most recent workshop website everhartlab.github.io/IntroR-at-PennState

- 26 attendees, Penn State University, State College, PA, October 16, 2018
- 64 attendees, International Congress of Plant Pathology, Boston, MA, August 28, 2018
- 45 attendees, University of Nebraska, Lincoln, NE, June 27, 2018;
- 20 attendees, Ohio State University, Wooster, OH, October 16, 2017;
- 22 attendees, APS North Central Division Meeting in Champaign, IL, June 14, 2017;
- 56 attendees, University of Nebraska, Lincoln, NE, May 24, 2017;

Computing Café

Everhart, S.E. Spring and Fall 2018.

I created the Computing Café as a place to work on a computing-based project and get input from colleagues. The café was open up to four days per week. Examples of computing tools used in the cafe include:

- Canvas
- Drupal 7 and 8 (UNL web framework)
- Git / GitHub
- R, RStudio, and various R packages
- HCC-related bash/shell and linux command-line work

Journal Club: Beginner's Guide to Population Genetics

Everhart, S.E. Organizer and Presenter, Summer 2018

This journal club covered: 1. development of population genetic markers; 2. application of molecular markers for genotyping (data collection); 3. data evaluation and analysis, with example papers presented by attendees

- 11 attendees of 10 meetings, featuring six student/postdoc-led journal discussions

Journal Club: Soilborne Biocontrol / Pathogens

Everhart, S.E. Organizer and Presenter, Fall 2015

This journal club was organized for graduate students to discussion research related to soilborne microbes, including pathogens and biological control.

- 22 attendees of 8 meetings, including faculty, postdocs, and graduate students

SCHOLARSHIP OF TEACHING AND LEARNING (SOTL): *All completed while in rank*

Products and Presentations in Teaching & Learning

1. **Everhart, S.E.** 2018. Rubrics: Defining success. Presentation in the 2018 ARISE: Learning by Design workshop. October 26, 2018.
2. **Everhart^, S.E.** & R. Ibach. 2018. Cultivate ACCESS. *Rapid-Fire Presentation*. UNL College of Agriculture and Natural Resources Annual Meeting, August 7th, 2018.
3. **Everhart, S.E.** 2016. PLPT 496/892: Disease Dynamics & Evolution—A Peer Review of Teaching Project Benchmark Portfolio. http://digitalcommons.unl.edu/prtunl/20

TRAINING IN THE SCHOLARSHIP OF TEACHING AND LEARNING (SOTL):

STEM Implementation of Peer Instruction, January 2018 – April 2018

The instructional strategy targeted in this program is called peer instruction. This program helped faculty develop an active learning environment for students in their classrooms, increasing student engagement and comprehension without having to completely revamp the focus of classroom content.

ARISE: Learning by Design, October 2017 – November 2017

In this program, participants learned how to use the evidence-based backward-design process to create a new course or envision new ways to address challenges in courses currently taught. Participants learned fundamental course design principles and applied them to design of their new/existing course.

Fall Teaching Symposium and Workshop, October 9, 2017

The focus of the Fall 2017 Symposium was on course design strategies that support student learning. The interactive workshop-style breakout sessions highlighted major principles noted in the keynote address, while providing immediately applicable strategies.

Current State of Introductory Plant Pathology Courses, Workshop, August 5, 2017

This was a highly interactive workshop at the APS National Meeting. Information was presented on recent research on alignment between US plant pathology courses and US employer expectations for these courses, as well as more general employer needs and expectations that should be considered in curriculum development. Participants formed groups and discussed ideas to incorporate needs of employers into courses.

Peer Review of Teaching, September 2015 – May 2016

A year-long program to developing a benchmark teaching portfolio. The program used a structured model to combine inquiry into intellectual work of a course, investigation of student understanding, and teaching effectiveness. The program culminated in the development of a course portfolio.

Teaching for the 21st Century, September 16, 2015

This Faculty Development Workshop provided a review of approaches known to foster deep learning, demonstrated how such approaches can be incorporated into teaching, and gave feedback to participants.

MENTORING

All completed while in rank

Current lab members (9): Margarita Marroquin-Guzman (postdoc), Nikita Gambhir (Ph.D. student), Edgar Nieto Lopez (Ph.D. student), Karen Ferreira Da Silva (Ph.D. student), Julianne Matcynszyn (Ph.D. student), Rachel Persson (undergraduate student), Olivia Renelt (undergraduate student), Cristian Wulkop (undergraduate student), Rebecca Higgins (research technologist)

Postdoctoral Scholars (4):

Includes current and previous postdocs

1. Margarita Marroquin-Guzman, meta-barcoding soil microbial communities, June 2017–**present**

   Dr. Marroquin-Guzman is conducting a meta-barcoding community soil analysis as part of the USDA grant.

2. Zhian Kamvar, population genetics and genomics, January 2017–April 2018

   Dr. Kamvar is presently a Postdoctoral Scholar with Dr. Thibaut Jombart in the Department of Infectious Disease Epidemiology at Imperial College of London, with research on tools for disease outbreak analysis.

3. Thomas Miorini, phenotyping *S. sclerotiorum*, March 2016–April 2017; January 2018 – April 2018

   Dr. Miroini is currently a Postdoctoral Scholar working with Dr. Michael Wunsch in the Department of Plant Pathology at North Dakota State University, managing multiple fungicide field trials on multiple crops.

4. B. Sajeewa Amaradasa, sub-lethal fungicide analysis of *S. sclerotiorum*, Aug. 2014 – Jul. 2016

   Dr. Amaradasa is currently a Research Associate at the Institute for Advanced Learning and Research in Danville, VA, investigating novel biological control agents.

Graduate Students (4):

5. Nikita Gambhir (Ph.D.), August 2015 – **present**; Expected graduation May 2020

   Nikita's research is on fungicide resistance and population genetics in *Rhizoctonia* spp., and genomic analysis of *Sclerotinia sclerotiorum*. Nikita has earned the following nine awards: 2018: First Place in Poster Presentation, North Central APS Meeting; Goss Memorial Scholarship, UNL; Larrick and Whitmore Travel Award, UNL; 2017: Widaman Distinguished Graduate Assistant Fellowship, UNL; Munnecke Student Travel Award, APS; North Central APS Travel Award; Winner of Creative Activities Poster Session, UNL Graduate Research Fair; 2016: Third Place Poster, North Central APS Meeting; North Central APS Travel Award.

6. Edgar Nieto Lopez (Ph.D.), August 2016 – **present**; Expected graduation May 2021.

   Edgar received a fellowship from Mexico's CONNACyT program ($124,620 for 4 years of GRA support) to conduct research on fungicide sensitivity and population genetics of *Sclerotinia sclerotiorum* from soybean and dry bean in the U.S. and Mexico. In addition to the fellowship, Edgar received the North Central Division APS travel award in 2017 and his research was competitively selected for an oral presentation at the 2018 meeting.

7. Karen Ferreira Da Silva (Ph.D.), co-advised with Joe Louis (Entomology), June 2018–**present**; Expected graduation August 2019.

   Karen joined my lab in June 2018 after completing 3 years with other advisors. Two projects were developed under my supervision, which includes 1) a nationwide survey of leadership preparation/needs for graduate students in the agricultural plant sciences and 2) a novel meta-population genetic analysis of Sclerotinia sclerotiorum as proof-of-concept for creating a DNA reference panel. Her third project is a continuation of previous work, evaluating interactions of Goss's bacterial wilt pathogen, *Clavibacter michiganensis* pv. *nebraskensis*, and the fall armyworm, *Spodoptera frugiperda*, on corn.

8. Julianne Matcynszyn (Ph.D.), December 2018 – **present**; Expected graduation May 2018.

   Julianne joined my lab in December 2018, after completion of 4.5 years with Tom Powers. I have worked closely with Julianne for the past year on population genetic analysis of the plant parasitic nematodes in *Mesocriconema xenoplax* and am currently working with her on a community + population genetic analysis of plant parasitic nematodes in the Great Smoky Mountains National Park, which will complete her dissertation.

Graduate Student Rotations and Internships (2):

9. Callie Braley (D.P.H.), co-directed project with Loren Giesler on *Cercospora sojina* fungicide sensitivity, Summer 2018 and planning to return for Summer 2019
10. Bridget Tripp (Ph.D. Complex Biosystems), completed a lab rotation project on reference-guided sequence alignment for identification of genomic variants and marker development, Fall 2015. While working with me Bridget also submitted an NSF-GFRP proposal, but was not selected.

Undergraduate Research Assistants and Honors Thesis Students (11):

11. Rachel Persson, UCARE recipient and general laboratory worker, May 2018–**present**

    Rachel received a UCARE award ($2,500) for research on *Sclerotinia sclerotiorum* to create a DNA reference panel analogous to those used in forensic science so that data from multiple studies can be combined.
12. Olivia Renelt, general laboratory work, October 2018–**present**
13. Cristian Wulkop, general laboratory work, November 2018–**present**
14. Isabel Chavez, general laboratory work, November 2017–May 2018
15. Audrey Vega, general laboratory work, November 2017–May 2018
16. Alex Johnson, general laboratory and molecular research, July 2017–January 2018
17. Anthony Pannullo, fungicide sensitivity of *Sclerotinia sclerotiorum* and Honors Thesis Research, May 2015–August 2017.

    Anthony worked in my lab for a year and then received the IANR Undergraduate Research Award ($2,500) and the North Central APS Travel Award, which allowed him to present his work at the meeting in Illinois. Anthony is now a graduate student in the Department of Microbiology at the University of Iowa. His research was recently published in *Tropical Plant Pathology's* 2018 Special Issue on *Sclerotinia*.
18. Josh Hanson, culturing of *Sclerotinia sclerotiorum*, Oct. 2014–December 2017
19. Morgan Thompsen, general laboratory work, May 2016–December 2016.
20. Sarah Campbell, culturing and genotyping of *Sclerotinia sclerotiorum*, October 2014–May 2016.

    Sarah applied for a UCARE award for independent research in 2015, but was not selected. She is now a M.S. student with Drs. Brannen and Scherm in the Department of Plant Pathology at the University of Georgia
21. Flavio Nunes da Silva, isolation of *Rhizoctonia*, May–July, 2015 (10-week internship)

Research Technologists (1):

22. Rebecca Higgins, half-time appointment for *Sclerotinia* bean line screening, October 2018–**present**

Committee Member for (9): *† = **Member and co-chair for***

1. *†* Gulçin Ercan (Anthony Adesemoye), M.S. Plant Pathology Specialization, June 2017–**present**
2. Raquel Rocha (Richard Wilson), Ph.D. Plant Pathology Specialization, August 2014–**present**
3. Nicholas Arneson (Loren Giesler), M.S. Entomology, August 2016–**present**
4. Ashley Stengel (Rhae Drijiber / Josh Herr), Ph.D. Complex Biosystems, May 2016–**present**
5. Srikanth Kodati (Anthony Adesemoye), Ph.D. Plant Pathology Specialization, August 2015–**present**
6. Tugce Karacoban (Judy Wu-Smart), M.S. Entomology, August 2016–December 2018
7. Bryant Gabriel (Troy Anderson), M.S. Entomology, August 2016–May 2018
8. Madeline Dowling (Guido Schnabel), Ph.D. Plant and Environmental Sciences, Clemson University, May 2015–May 2018
9. Ashley Foster (Ashley Hall), M.S. Applied Science, October 2014–May 2016

GRANTS AND CONTRACTS

TOTAL FUNDING DURING TIME IN RANK: ***$2.62M ($384,315 direct to my program)***

ACTIVE AWARDS:

RESEARCH:

Improved white mold resistance in dry and snap beans through multi-site screening and pathogen characterization throughout major production regions

PI: **Everhart, S.E.** (J.R. Steadman and 7 others as cooperators)
Previous PI (2016/2017): J.R. Steadman (S.E. Everhart and 7 others as cooperators)

Funding for study of the biology, epidemiology, and variation in aggressiveness of *S. sclerotiorum* isolates from the U.S., and screening of dry bean cultivars using greenhouse and multiple field sites.

- Agency: USDA National Sclerotinia Initiative
- Award and duration: $267,975 awarded for 3-years (2016 to 2019); renewal up to 5 year-project
- Sub-award: $106,285 for postdoc support, hourly workers, supplies, travel, and publication

Optimizing cropping systems for resilience to stress: The role of maturity group selection and cover crops on yield, weeds, insects, and microbes

PIs: Proctor, C., ..., **S.E. Everhart** (with 13 others at 10 institutions)

This is an interdisciplinary team of scientists at UNL and from multiple states, where my role in the project is to assess the microbial diversity associated with different cover crop treatments to determine whether there is evidence of green bridge effects of this crop management practice.

- Agency: USDA-NIFA Foundational Program on Pests and Beneficial Species
- Award and duration: $461,187 for 3-year project from 2017 to 2020
- Sub-award: $24,212 for postdoc salary

Fungicide resistance in *Rhizoctonia solani* and implications for soybean in Nebraska

PIs: **Everhart, S.E.** and A. Adesemoye

- Agency: Nebraska Soybean Board
- Award and duration: $121,961 for 3-year project from 2015 to 2018; no-cost extension to 2019
- Sub-award: $77,193 for GRA support, supplies, travel, and publication

Seedling diseases: Identification, management, and education

PIs: Bond, J., ..., **S.E. Everhart** (with 13 others at 10 institutions)

This is a large team of scientists from multiple states assembled to improve our understanding and management of soybean seedling disease agents. I collaborated with A. Adesemoye (UNL) to characterize *Rhizoctonia* species and anastomosis groups responsible for disease, specifically focused on improving our understanding of fungicide sensitivity and population genetic structure of this group.

- Agency: North Central Soybean Research Program
- Award and duration: $1,171,920 awarded for 4-year project from 2015 to 2019
- Sub-award: $72,000 for GRA support and supplies

TEACHING & OUTREACH:

Cultivating ACCESS: Agriculture Career Communities to Empower Students in STEM

PIs: Keshwani, J., J. Obermeyer, L. Sandall, **S.E. Everhart**, and D. Keshwani

This outreach program connects high school youth in rural Nebraska communities (Scholars) with an established agSTEM professional (Mentors), using undergraduate UNL students to bridge the two groups (Ambassadors). My role is design and development of the website that we call the ACCESS Portal.

- Agency: USDA-NIFA Women and Minorities in STEM Fields Program
- Award and duration: $94,387 for 3-year project from 2017 to 2020
- Sub-award: $5,000 for website development at cultivate.unl.edu

Bridging the Gap: Educating multidisciplinary professionals to steward pest management technologies for sustainable agriculture

PIs: Hein, G., **S.E. Everhart**, (and 6 others)

The purpose of this funding is to support graduate student training in the Doctor of Plant Health program that focuses on developing outreach materials on fungicide, herbicide, and insecticide resistance management. Callie Braley is one of the fellows and worked in my lab in the summer of 2018 and will be returning in the summer of 2019 to conduct a survey of *Cercospora sojina* fungicide sensitivity

- Agency: USDA National Needs Fellowship Program
- Award and duration: $238,500 for student fellowships for 3-year program 2016 to 2019

COMPLETED AWARDS: *All completed during time in rank*

Population genetic analysis of the fungal pathogen *Gemmamyces piceae* to determine native (sexual), introduced (clonal), or invasive (mixed) reproduction on spruce

PIs: Adams, G., **S.E. Everhart,** and Z.N. Kamvar

- Agency: USDA Forest Service
- Award and duration: $10,000 for 1-year project (2017 to 2018)
- Sub-award: $9,000 for postdoc salary, hourly workers, and supplies

Biology and control of Sclerotinia Stem Rot of soybean

PIs: Kabbage, M., D. Smith, D. Mueller, M. Chilvers, and **S.E. Everhart**

This project focuses on Sclerotinia stem rot of soybean and investigates aspects of host resistance, predictive modeling, and fungicide efficacy in the field, in addition my research that investigates pathogen fungicide sensitivity, resistance emergence, and population structure.

- Agency: North Central Soybean Research Program
- Award and duration: $240,000 for 3-year project from 2015 to 2018
- Sub-award: $75,000 for postdoc salary

Impact of sub-lethal fungicides on genome evolution: A potential new mechanism of resistance emergence in fungi

PI: Everhart, S.E.

- Agency: Agricultural Research Division, UNL
- Award and duration: $10,000 for 1-year project (2015 to 2016)

***In vitro* fungicide testing of SDS pathogen, *Fusarium virguliforme* (current name *Neocosmopara virguliforme*)**
PI: Everhart, S.E.

- Agency: Gowan Company
- Award and duration: $5,625 for 1-year project (2016 to 2017)

Service (2% FTE)

DEPARTMENTAL SERVICE AT UNL

All completed while in rank

Curriculum Development:

See *Statement on Service*, p.31 [Link]

- Member, Curriculum Committee (2018–**present**)
- Co-Chair, *Ad hoc* Plant Pathology Graduate Program Proposal Committee, 2018–**present**

Digital Communications:

See *Statement on Service*, p.31 [Link]

- Creator/Maintainer for Twitter account @UNL_PlantPath, January 2018–**present**
- CASNR Web Framework, 2015–**present**
- Chair, Website Committee (2015–2018)
- Developer/Administrator for Department of Plant Pathology website, January 2015–April 2018
- Supervisor for Jimin Kamvar, *Digital Communications Liaison*, October 2017–December 2017

Vision Development:

- Member, *Ad hoc* Vision Team Committee, 2017–2018

> This team co-developed a vision statement for the Department in response to the 2015 departmental review.

Laboratory Equipment Procurement:

- Identified department needs, obtained bids, and coordinated delivery, computer upgrades, installation, and training for approximately $20,000 in lab equipment purchased for the Department (ChemiDoc Gel System and QuBit Fluorometer), 2016

Host for Seminar Speakers at UNL:

- Dr. Jerry Weiland, USDA-ARS Horticultural Crops Research Unit, November 6, 2017
- Dr. Jane Stewart, Colorado State University, October 8, 2018
- Dr. Stacy Krueger-Hadfield, University of Alabama, November 15, 2017

SERVICE TO THE UNIVERSITY

All completed while in rank

- Co-manage UNL Stress HATCH group and annual reporting, 2015–**present**
- Member, UNL Team HATCH Review Committee for ARD, April 10, 2018
- Member, Academic Review Committee for Department of Entomology at UNL, October 2016

SERVICE TO THE PROFESSION

All completed during time in rank

Professional Positions:

- Annual Meeting Board of APS, invited position, 2016–**present**
- Vice-Chair of the Epidemiology Committee of APS, 2018–**present**
- Chair of the Mycology Committee of APS, 2014-2015

Editorships for Scientific Journals

- Section Editor for *Tropical Plant Pathology*, 2018–**present**
- Associate Editor for *Ciencias Rural*, 2014-2015

Grant Panel Reviewer:

- USDA Foundational Program for Pests and Beneficial Species, December 2017
- USDA External Review of Research Plans, January 2017

Ad hoc Peer Reviews for:

Annals of Botany, Crop Protection, Ciencias Rural, European Journal of Plant Pathology, Journal of Phytopathology, Molecular Plant Microbe Interactions, PeerJ, Plant Disease, PLOS ONE, Phytopathology, Scientia Agricola, Tropical Plant Pathology

STATEMENT

Research

Goals of my research are to improve our understanding of disease epidemics and population dynamics over space and time, with the long-term goal to better understand the underlying processes that shape pathogen populations and the pattern of disease. A major underlying process is the emergence and evolution of fungicide resistance.

Fungicide resistance is an economically important phenotype that, when present in pathogen populations, can be an underlying driver of disease outbreaks when fungicides applied are no longer effective. There are already 203 species of fungal plant pathogens reported to have resistance by the Fungicide Resistance Action Committee and fungicide resistance is an increasing concern. Although use of genetically modified crop plants decreases the need for chemical intervention, integration of resistance to necrotrophic pathogens is limited. This is due to the need for identification and integration of multiple minor genes, many of which may not yet be described and may be challenging to simultaneously integrate. Nationally, fungicides account for a 50% yield increase for 22 major crops in the U.S., which accounts for 97 billion pounds of food and fiber, valued at $12.8B[1]. Among the 45 active ingredients on the market, there exist only 10 modes of action[1,2], which is the fundamental unit to which resistance develops. New modes of action are sought and rarely discovered, so relying on this option to replace modes of action that are no longer effective is not realistic. Moreover, to develop a new product, it is estimated to take about 10 years and cost $200M. There is a pressing need to ensure that existing modes of action remain effective; this is the mission of my research. Surprisingly, mechanisms of fungicide resistance emergence are relatively un-studied in fungal plant pathogens and, if investigated, could enable formulations that prevent resistance development. Complementary research to evaluate new breeding lines and concomitant research on pathogen genetic and phenotypic variability are also critical to reduce reliance on chemical intervention. It is important to understand the pathogen population structure because species capable of out-crossing, production of both sexual and asexual reproduction, and migrating long-distances, pose greater risk of evolution of fungicide resistance and overcoming host resistance.

In-depth knowledge of the biology, epidemiology, and population genetics of plant pathogens is essential to develop management recommendations that maximize the usable life of fungicides and host resistance. Quantitative approaches and molecular techniques are vital in my approach to address these pressing disease management issues. Below are the most impactful examples of my research, studies underway, selected examples of how I have applied my skills to collaborate, and my vision for future research.

[1] Gianessi, L.P. & N. Reigner. 2005. The value of fungicides in U.S. Crop Production. *Crop Protection Research Institute, CropLife Foundation,* Washington D.C. *pp. 243.*
[2] FRAC. 2018. FRAC Code List 2018: Fungicides sorted by mode of action (including FRAC Code numbering). Fungicide Resistance Action Committee, *CropLife Foundation, Washington D.C. pp. 14.*

Sclerotinia sclerotiorum, Causal Agent of White Mold (Sclerotinia stem rot)

The most significant body of work produced by my group has improved our understanding of the biology, epidemiology, evolution, and management of the fungal plant pathogen, *Sclerotinia sclerotiorum*. Disease losses caused by this pathogen cause an annual loss of ~$252M on sunflower, soybeans, dry edible beans, canola, and pulse crops. Severe disease outbreaks can lead up to 100% loss. Because *S. sclerotiorum* employs a necrotrophic lifestyle and is capable of infecting more than 450 plant species, breeding efforts are limited and management relies on well-timed fungicide use, in addition to cultural techniques to reduce sclerotia survival in the soil. Below are examples of my work investigating the landscape-level population genetic variation, possible mechanisms of novel trait emergence, fungicide efficacy through application and resistance, and cultivars for resistance.

***Landscape Genetics of* S. sclerotiorum –** Work in my lab has characterized the landscape genetics of *Sclerotinia sclerotiorum* from dry bean across the U.S. (**Kamvar *et al.* 2017**). Since multi-site screening nurseries are used to identify dry bean lines with increased resistance to white mold, our work sought to determine whether pathogen populations within nurseries were genotypically and phenotypically representative of producer fields across the dry bean producing region of the U.S. There were 366 genotyped isolates from states that collectively produce more than 85% of dry beans (**Fig. 1A**). These isolates were collected across 10 years from multi-site screening nurseries and nearby producer fields. Phenotypic traits, such as pathogen aggressiveness and mycelial compatibility group, were also determined. Since none of the typical multivariate methods used in population genetic analyses were capable of identifying factors underlying patterns of genetic variation, I adapted a method from community ecology, called distance based redundancy analysis (dbRDA). This method was able to simultaneously evaluate environmental, phenotypic, host, and temporal variation to identify variables most likely to be connecting and driving pathogen spread (**Fig. 1B**). As the largest population genetic study of *S. sclerotiorum* to date, this was a complex and challenging project. Results underscored the importance of using multi-site nurseries for plant breeding and, in a recent review, we demonstrated that mycelial compatibility should no longer be performed to assess population structure in *S. sclerotiorum* (**Kamvar & Everhart 2018**). Also identified was a need for future studies to investigate seed-borne dissemination and climate- or fungicide-driven diversification.

[1]See Peer-Reviewed Publications in CV for full citation, p.16 [Link]

This project was published in *PeerJ* with corresponding raw data and R scripts available on the Open Science Framework (https://osf.io/ejb5y). Although published Dec. 7th, it ranked in the Top 5 most viewed articles of 2017 in *PeerJ*'s section on Agriculture Science, Genetics, and Mycology. Currently, this article has had 1,588 views, 274 downloads, and cited six times. I was invited to present this work at the 16th Annual International Sclerotinia Workshop in Uberlandia, Brazil in 2017. This research received support from the USDA-National Sclerotinia Initiative.

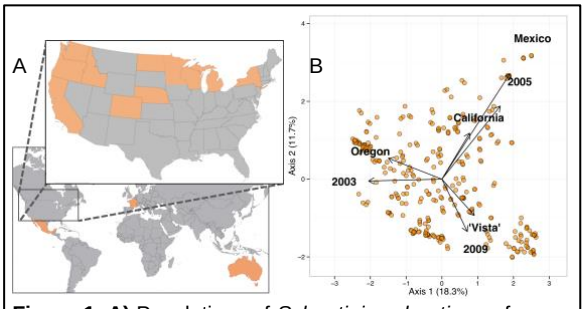

Figure 1. A) Populations of *Sclerotinia sclerotiorum* from across the United States, Mexico, France, and Australia, genotyped and phenotyped. **B)** Multivariate analysis used to identify strongest predictive variables within the data (Kamvar *et al.* 2017 *PeerJ*).

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This study yielded several new avenues of scientific inquiry. For example, we found an unexpected pattern in the data that showed Mexican populations of *S. sclerotiorum* were more genetically differentiated than those on different continents (France and Australia). One hypothesis to explain this is that increased diversity arises in subtropical environments, which allow for more cycles of sexual reproduction and outcrossing, due to the conducive weather and continuous year-round cropping. To test this hypothesis, undergraduate honors student, Anthony Pannullo, genotyped an additional 94 isolates of *S. sclerotiorum* that originated from soybean in subtropical regions of Brazil to capture continental-level population structure. Our study found a high degree of genetic diversity within both Brazilian and U.S. populations, thus rejecting the hypothesis that subtropical regions are inherently more diverse (**Pannullo *et al.* 2018**). This project is significant because few studies have compared population genetic structure across different continents and provides the opportunity to combine these data with our existing database of genotypes.

See Peer-Reviewed Publications in CV for full citation, p.3 [Link]

This project was conducted by Honors Undergraduate Student, Anthony Pannullo, who also received the UNL-IANR Undergraduate Research Award to conduct this research project. This manuscript was published as part of a special issue on *Sclerotinia* research in *Tropical Plant Pathology.*

***Emergence of Fungicide Resistance and Novel Traits in* S. sclerotiorum –** Another hypothesis for increased diversity in our previous study is that non-lethal fungicide exposure causes oxidative stress that increases mutation rates and genetic diversity within pathogen populations, and may serve as a heretofore unexplored mechanism of fungicide resistance emergence. Although my collaborators and I previously examined the effects of fungicides on mutation rates in *Monilinia fructicola* **(Schnabel *et al.* 2014, Chen *et al.* 2015, Dowling *et al.* 2016),** genomic studies were limited because there is no publicly available genome sequence. Thus, my lab initiated a study with *S. sclerotiorum* as the model organism, which has a publicly available and optically mapped genome. We performed an intensive experiment to expose *S. sclerotiorum* for multiple generations to fungicides with different modes of action. Results of our work were similar to those in *M. fructicola*, and showed fungicide exposure altered AFLP profiles and increased mutation rates at SSR loci (**Amaradasa & Everhart 2017**), which were inferred to be due to derepression of transposable elements (AFLP) or polymerase slippage (SSR).

This work on *Monilinia* was a collaboration between myself and Guido Schnabel at Clemson University. In 2016, I was invited to Clemson to give a talk, received Adjunct status, and served on Madeline Dowling's Ph.D. committee from 2016 to 2018.

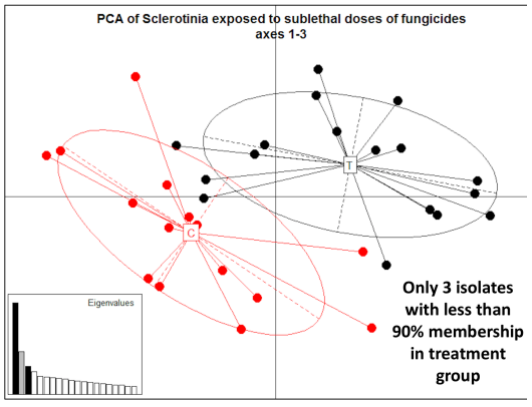

Figure 2. Principal Coordinate Analysis of AFLP genotypes, color-coded and labeled according to whether the isolate was fungicide-exposed (black; labeled T) or had no exposure (red; labeled C). From Amaradasa & Everhart 2016 *PLoS ONE.*

In 2016, I was selected for the APS Schroth Faces of the Future award and presented this at the Schroth Symposium in the APS national meeting. Amaradasa & Everhart 2016 *PLoS ONE* has been Viewed & Downloaded a total of 3,160 times.

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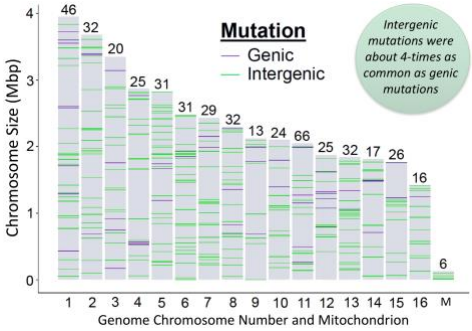

Figure 3. Chromosomal location of SNP and INDEL mutations identified in one isolate of *Sclerotinia sclerotiorum* and mapped to the 16 chromosomes + mitochondrion (M) of the *S. sclerotiorum* reference genome; mutations in genic regions are purple and intergenic mutations are green (Gambhir and Everhart, *In preparation*).

To determine whether there is a pattern of mutation unique to each fungicide, we obtained 15X coverage whole-genome short-read sequence data for 55 isolates that were part of our 2016 publication. Using reference-guided assembly, we have identified polymorphic SNPs and INDELs in the control and fungicide-exposed isolates. Although we have not found support for global modifications of genomes by fungicide exposure, we have found that there appear to be chromosomes and locations in the genome with a greater number of mutations that can be considered hotspots (**Fig. 3**). We have also found a significant difference in the total number of mutations accumulated in each isolate, thus leading us to conclude that they differ in their "mutability", with some genes consistently mutating more than others (**Gambhir & Everhart *In preparation***). Data analysis is still underway and will require *de novo* assembly to fully characterize variation in genomes. Although there are an increasing number of population genomic studies of fungal plant pathogens, this study is significant because there remains a dearth of information on variation in mutation rates across the genome. Such studies are important for models that predict emergence of novel traits.

This project is conducted by Ph.D. student, Nikita Gambhir, who presented this as four poster/oral presentations at the regional and national APS meetings, in addition to two departmental seminars. She received the first place poster award at the 2018 APS North Central Division meeting in Fargo, ND. This project received grant support from the North Central Soybean Research Program and UNL Layman Award.

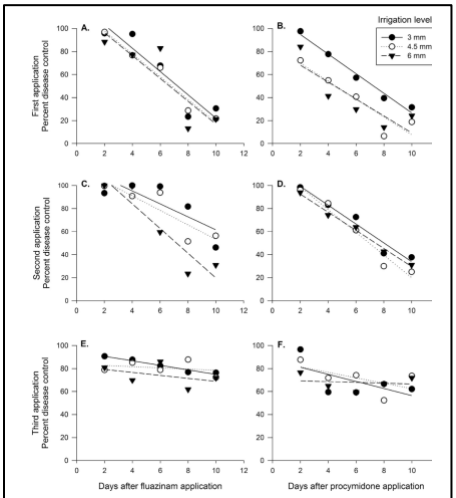

Figure 4. Decrease in effect of fungicide activity over time after successive applications of a protectant (fluazinam on left) and moderate-systemic (procymidone on right) on disease caused by *Sclerotinia sclerotiorum*. Results showed chemigation with lower water levels provided better disease control against in soybean. Reproduced from Miorini *et al.* 2017 *Crop Protection.*

Fungicide Efficacy – Complementary to knowledge of the epidemiology and evolution of *S. sclerotiorum* are studies aimed at providing more immediate deliverables for disease management by enhancing knowledge of fungicide efficacy, from application to resistance management. With no complete resistance to *S. sclerotiorum*, there is greater dependency on fungicides to prevent primary infection. Efficacy of fungicide applications for white mold control are dependent on application timing, ability to translocate within the plant, and residual activity.

Timing of fungicide applications is critical to prevent infection by *S. sclerotiorum*, yet few studies have evaluated the method of application or characterized the window of residual activity of fungicides to protect from infection. Using data from a field study in Brazil, my lab showed that chemigation with less water and overhead spray were best for slowing the loss of residual fungicide activity (**Fig. 4; Miorini *et al.* 2017**). We also showed that the systemic fungicide, procymidone, was better able to reduce *S. sclerotiorum* sclerotia formation, which may be an important consideration for long-term disease management.

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Following this study, we sought to evaluate the window of flower protection conferred by fungicides with different modes of action. Another collaborative study was initiated in my lab to evaluate the protective activity of different commonly applied fungicides in Nebraska and assess rate of disease development after inoculation of flowers with ascospores of *S. sclerotiorum* in the lab. Our results thus far showed that the systemic fungicide offered the greatest window of protection (**Fig. 5; Miorini *et al. In preparation***). These collaborative studies provide new information about methods for preventing and/or limiting disease progression.

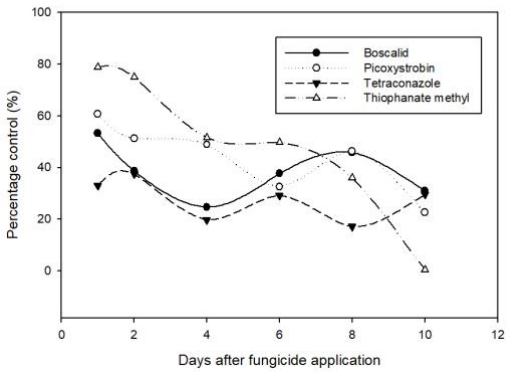

Figure 5. Decrease in percent disease control after inoculation of soybean flowers with ascospores of *S. sclerotiorum* from 1 to 10 days after fungicide application, which shows change in disease control decreased most for Thiophanate methyl over time, which is not unexpected given the protectant nature of this fungicide. Reproduced from Miorini *et al.* In preparation.

***Fungicide Sensitivity of* S. sclerotiorum –** Fungicide resistance in soybean production is recognized as a nation-wide problem, as demonstrated by creation of the Soybean Fungicide Resistance Hub on the Plant Management Network in 2014. This network was established to survey and report discovery of fungicide resistant pathogens throughout the U.S. soybean production area. A major problem is that by the time fungicide resistance is detected by growers, it may be too late to prevent spread of fungicide resistance. This problem is compounded by a lack of knowledge of the structure of pathogen populations within fields, which directly limits our ability to design targeted and effective disease management strategies. Large-scale fungicide sensitivity studies first require identification of a method that is both reliable and less time consuming than traditional approaches.

Traditional methods using serial dilution were not practical for assessing sensitivity for more than 1,000 isolates to multiple fungicides. More rapid methods, such as using a spiral gradient and a discriminatory concentration have been validated and applied with other fungi. However, these methods have not been validated for *S. sclerotiorum*. My lab conducted a methods comparison study to determine whether these rapid methods were congruent with the traditional method. Our results showed that reliability of the results from the spiral gradient method is affected by the fungicide's mode of action and that more reliable methods employ single concentrations, such as discriminatory dose and serial dilution methods (**Miorini *et al.* In review at *Pest Management Science***).

This was a collaborative project within my lab group, which is co-authored by one postdoc, two graduate students, and one undergraduate student from my lab. We used a Google Document to co-write the paper, which was a great way for new scientists to learn about the scientific writing method. This manuscript is now in review at *Pest Management Science*

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In 2016, my lab initiated a survey of *S. sclerotiorum* from soybean fields to evaluate sensitivity of isolates to commercial fungicides with different modes of action and to characterize the structure of pathogen populations within and between fields. This 3-year survey yielded 1,269 *S. sclerotiorum* isolates from Nebraska, Iowa, Wisconsin, and Michigan. We have also obtained more than 100 isolates from Brazil, where fungicide resistance has already been reported for *S. sclerotiorum*. Fungicide sensitivity assessments are currently in progress, and have established a baseline sensitivity for *S. sclerotiorum* to three commercial fungicides (Boscalid, Tetraconazole, and Picoxystrobin) using a discriminatory dose method to estimate EC_{50} for *S. sclerotiorum* (**Fig. 6; Nieto-Lopez *et al.* In preparation**). Complementary population genetic analysis will be performed to assess structure of *S. sclerotiorum* populations and compare them to populations from dry bean evaluated previously.

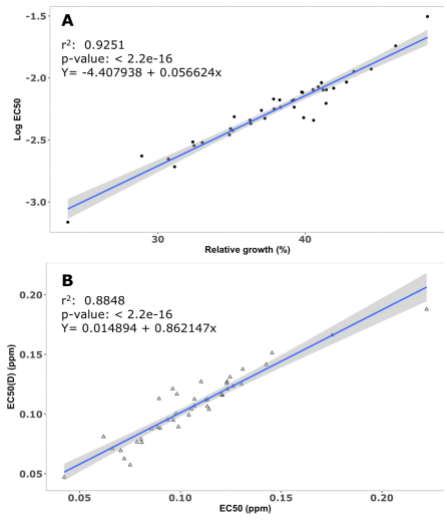

Figure 6. Identification of a discriminatory dose (DD) for *S. sclerotiorum* to Boscalid fungicide. Linear relationships between: A) relative growth at 0.2 ppm Boscalid to the $LocEC_{50}$ and B) the observed EC_{50} to the EC_{50} estimated by growth on the discriminatory dose ($EC_{50(D)}$). Reproduced from Nieto-Lopez *et al.* In preparation.

The above project was funded by the North Central Soybean Research Program and conducted by Ph.D. student, Edgar Nieto Lopez, who received a fellowship from Mexico's CONNACyT. Edgar was competitively selected to give an oral presentation on this work at the APS North Central Division Meeting in Fargo, ND in 2018.

Collective Impact of Research on Sclerotinia sclerotiorum

The impact of my research on *S. sclerotiorum* is multidimensional. Knowledge gained in three areas are the foci of my research (**Fig. 7**), which interact and drive new hypotheses that are the subject of subsequent research. Collectively, knowledge generated by this body of research enables more sustainable management of disease caused by *S. sclerotiorum.* Products of my research on *S. sclerotiorum* have led to 19 talks, 15 posters, three research reports, and six manuscripts. As described above, this research has garnered national and international recognitions, best exemplified by the double-invitation to present at the International Sclerotinia Workshop in Uberlandia, Brazil, and funding from multiple sources including the North Central Soybean Research Program and the USDA National Sclerotinia Initiative.

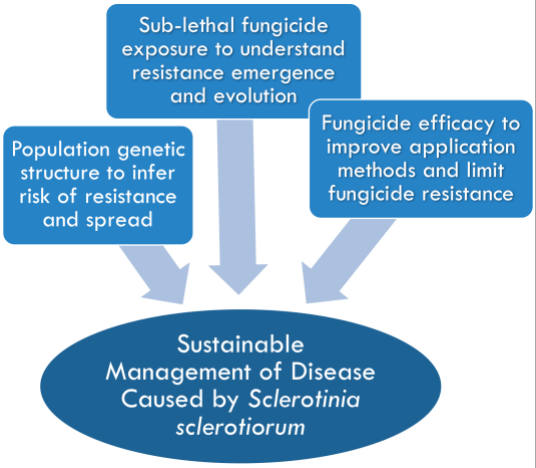

Figure 7. Conceptual diagram of my three research foci that aim to provide sustainable management of disease caused by *Sclerotinia sclerotiorum*.

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OTHER AREAS OF RESEARCH

Parallel Research on Rhizoctonia, *a Lesser Known Seedling Pathogen*

Long-term sustainability of soybean production in Nebraska requires minimizing disease losses and maintaining effective chemical control strategies. For farmers, high soybean yields are critical to profit margins, yet yields are reduced each year due to diseases. Among all types of diseases in Nebraska, yield loss due to seedling diseases ranked third in 2011, causing an estimated loss of 1.35 million bushels[3]. *Rhizoctonia solani* is one of three pathogens most commonly associated with seedling disease, where fungicidal seed treatments are a recommended line of defense. However, fungicide resistance may threaten soybean production because in 2012, fungicide resistance was reported for *R. solani* to azoxystrobin[4]. Unfortunately, there is a lack of knowledge of *Rhizoctonia* from soybean in Nebraska and little to no information on the population biology of any *Rhizoctonia*. To fill this gap, I initiated a collaborative study with Dr. Tony Adesemoye to survey soybean fields in Nebraska for *Rhizoctonia*, which would allow my lab group to evaluate fungicide sensitivity to commercial fungicides and to characterize the structure of pathogen populations within and between fields.

This survey has provided novel information, showing that *Rhizoctonia zeae* (*Waitea circinata* var. *zeae*) is an important pathogen of soybean, which has not been well-studied. Assessment of fungicide sensitivity shows that *R. zeae* has a broad range of fungicide sensitivity to prothioconazole, sedaxane, and fludioxonil. However, results of our research to date suggest that *R. zeae* is completely insensitive to azoxystrobin fungicide, which is a common used fungicide. We recently obtained whole-genome sequence data to develop molecular markers that, when applied, will provide deeper insight into the biology and spread of this pathogen. Presentations of this research by myself or a member of my lab were made at regional and national meetings, including three oral and two poster presentations, with two recent articles published in *SoyNebraska* (**Gambhir *et al.* 2018**; **Kodati *et al.* 2018**).

This project required collaboration between graduate students, Nikita Gambhir and Srikanth Kodati, to accumulate a large collection of isolates. Isolations were not trivial and these students processed more than 650 soil samples for *Rhizoctonia* during the three year study. Notably, both students were invited to present their research at the International Rhizoctonia Workshop held concurrently with the ICPP in 2018. Funding for this project is provided by the Nebraska Soybean Board and the North Central Soybean Research Program.

Community Sequencing to Identify Drivers of Disease

For diseases caused by unidentified agents and emerging pathogens, other approaches must be used before population genetic tools can be developed. In Nebraska, re-planting corn after a cover crop rotation is causing poor germination and reduced yields, possibly due to allelopathic or pest and pathogen carryover, which are poorly understood. Several pathogens that cause yield loss to field crops in Nebraska

[3] Bradley, C., and S. Koenning. 2012. Soybean Disease Loss Estimates – 2011. United Soybean Board. *Online.*
[4] Olaya, G., C. Buitrago, D. Pearsaul, H. Sierotzki, A. Tally. 2012. Detection of resistance to QoI fungicides in *Rhizoctonia solani* isolates from rice. APS Meeting, Providence, RI.

are caused by pathogens that dwell in soil (*Pythium*, *Phytophthora*, *Fusarium*, *Rhizoctonia*, *Diaporthe*, and *Macrophomina*). These pathogens are extremely challenging to study because they reside in the soil until the plant is under stress. Thus, methods that employ genetic sequencing technologies can be a better measure of microbial communities. To address this, my lab used metabarcode sequencing to characterize the effects of these practices on fungal and bacterial soil microbial communities. Multivariate methods, such as network analysis, multidimensional scaling, and indicator species analysis, will enable us to synthesize information and identify positive and negative drivers of yield, which will be valuable for management recommendations.

This is funded in 2017 by the USDA Foundational Program, with metabarcoding underway by the postdoc in my lab, Dr. Margarita Marroquin-Guzman. This line of research adds a new dimension to our existing and well-established research in the areas of molecular epidemiology and fungicide sensitivity.

Future Research and Vision

My future research interests are to continue to address challenging disease problems, using quantitative and multivariate approaches that combine population genetics and applied epidemiology. I will continue to establish collaborations within and outside the department to address research needs at the regional, national, and international level. Funding will continue to be sought from commodity groups, federal programs, and private foundations, and specifically from the USDA-National Sclerotinia Initiative. In addition to existing sources, new funding sources are being continuously sought, as evidenced by a pending proposal to the Bill & Melinda Gates Foundation (Co-PI with Tom Powers) to develop a partnership with the MatMaCorp, Inc. company that has a high-sensitivity molecular diagnostic tool that we proposed to apply for detection of soilborne yield-reducing nematodes and fungal pathogens in regions of Africa, facilitated by a partnership with the UNL Rwanda program and recent graduates of our program. Complementary funding will be sought to study soilborne pathogens of legumes in Africa from the “Feed the Future Legume Systems Research Innovation Lab” that recently received $13.6M from USAID and has not yet released a public call for proposals.

See Pending Proposals in Appendix 3, p. 40 [Link]

I am passionate about the application of quantitative methods for better understanding patterns and processes underlying disease epidemics, which I hope is demonstrated by the selected examples given above. Now and throughout my career, I will continue to integrate the latest technology, tools, and data analysis methods. Ultimately, however, my career goal is to establish an internationally recognized lab that produces high-impact publications that push the boundaries of our knowledge of plant disease epidemiology and decrease diseases caused by fungal plant pathogens that continuously threaten agricultural production.

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STATEMENT

Teaching

I have also achieved, in a short time, excellence in teaching that has received local and national attention. I have done this through revision of an existing course, in creating new courses, and by creating non-credit workshops taught to more than 250 attendees across the U.S. in the last two years. I have also made significant contributions in graduate student professional development and mentoring, within my department, university, and profession, in addition to co-developing an outreach program for high school students considering agSTEM careers. Below I have outlined the most significant impacts in teaching, with links to the appendix of course descriptions and student evaluations, and my vision for teaching in the future.

Classroom Teaching

Teaching Philosophy – Today's students are increasingly diverse with different learning styles and expectations. Most also need professional skills training to be competitive in the workforce. My strategy is to integrate the latest teaching approaches and technology to ensure learning is accessible. I also create in-class exercises with professional development in mind. Below are selected examples of these efforts.

PLPT802: Ecology and Management of Plant Pathogens – I currently lead and co-teach one of the two required graduate courses, PLPT802: *Ecology and Management of Plant Pathogens*. In 2015, I was a co-instructor and in 2016, became the lead instructor. As the lead instructor, I revised the course using backward design to achieve specific learning outcomes and integrated active learning techniques to increase engagement. This course now has six modules with specific learning outcomes that go from *Pathogen Groups* to *Management Applications* (**Fig. 8**). Each module has explicit learning outcomes and assessments designed to evaluate those outcomes.

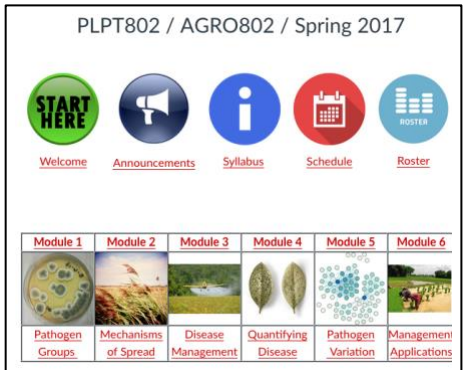

Figure 8. Layout of course instruction in the online Canvas environment for PLPT 802.

In the classroom, I have developed several new exercises to stimulate active learning and help students tackle difficult topics. For example, to help students better understand complex disease models or forecasting methods, I implemented the Jigsaw Strategy as a manuscript discussion exercise and asked students to create a visual representation of each paper as their group product. The Jigsaw Strategy divides a task so that students must work together to complete the exercise. In this case, I assigned one scientific manuscript to each group of five to six students. Each student within the group was required to read a different part of the manuscript and since no one person in a group had read the entire paper, this

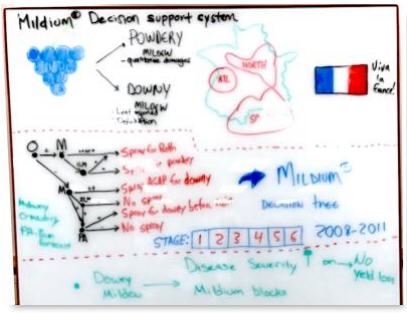

Figure 9. Infographic created during class to describe a grape downy and powdery mildew decision support tool in Delière *et al.* 2015 *Pest Management Science*.

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meant that students were required to cooperate and communicate to complete the exercise. At the end of the exercise, each group had created an infographic that described the manuscript (**Fig. 9**) and then each group presented this infographic to the class. By working in groups, students were better able to break down complex research papers to understand the topic. They also gained experience in communication and teamwork skills. I believe my students also appreciated this format, with one commenting, "[This was] probably the first course where everything was applicable to the course and was actually necessary and built upon and implemented… I found myself retaining much more information from these types of tests and assignments. Thank you!" In addition to significantly increasing the CIEQ student evaluations of the course, my efforts in teaching were further recognized by the graduate students in our department, who indicated that I was one of two faculty that were most deserving of recognition in the department (**Fig. A5**, pg. 47).

See course description, CIEQ scores, and additional student comments for PLPT802 in Appendix 6, pg. 42 [Link]

Student evaluations (CIEQ) showed a significant improvement in the course after revision in 2016. Average scores increased from 2.89 in 2015 to 3.51 in 2016 and 3.35 in 2017 (ANOVA p = <0.0001). Relative to other instructors in the department, evaluation scores moved from the bottom 10th percentile to the 60th and 70th percentile in 2016 and 2017, respectively.

PLPT892–401: Success in the Sciences – Professional skill development is currently a hot topic within graduate student education in the sciences. Job opportunities in academia are increasingly scarce, which means a greater number of our students will be pursuing careers in industry, government, and non-governmental organizations after graduation. Skills sought by prospective employers are increasingly focused on "soft skills" development. Recent studies have identified professional skills as an area in high demand by employers in plant pathology and related disciplines[5,6]. Although professional development is one of the most frequent course topics requested by graduate students, training in this area is traditionally accomplished through mentoring provided by the student's major advisor. Yet heterogeneity in mentoring styles, students' differing needs, and lack of incentive are major hurdles that hinder this type of one-on-one training. *Success in the Sciences* was created to fill this gap.

Design of this course was a synergistic collaboration with two graduate students, Ashley Stengel and Kimberly Stanke, with guidance solicited from Dr. Sydney Brown, UNL Assistant Director for the Center for Transformative Teaching and Instructional Design. Graduate students co-designing this course enrolled for two credit hours of PLPT 892–402 *Instructional Design*. Phases in the design process included identification and prioritization of learning outcomes, creating the syllabus and schedule of topics, and development of classroom activities / assessments. We are currently performing a self-assessment of the course and creating a benchmark portfolio to document the course. We also plan to present one or more posters on activities in this course at the 2019 North American Colleges and Teachers of Agriculture meeting.

This course provided a roadmap for graduate students to the resources, training, and opportunities that are necessary to attain success in their graduate programs and a successful career in the sciences. Specific skills taught and topics covered include: resources for research, critical evaluation of the primary literature, project management, optimizing your time, mentoring and being mentored, publishing protocols and pitfalls, presenting your science, the art of communicating your work, tips for communicating with colleagues, networking to get a job, and the job interview. Topics were engaged using several

[5] Beckerman, J., W. Schneider. 2016. Mining the gap: Assessing leadership needs to improve 21st Century plant pathology. *Plant Disease* 100:2349-2356.
[6] Richter, B.S., A. Poleatewich, M. Hayslett, K. Stofer. 2018. Finding the gaps: An assessment of concepts, skills, and employer expectations for plant pathology foundational courses. *Plant Disease* 102:1883-1898.

active learning techniques, including: peer instruction, minute papers, gallery walks, think-pair-share, jigsaw strategy, and role playing.

Perhaps the most valuable outcome of this course was that the content featured in this course was student-driven. This meant that the topics we covered were those most relevant to our current graduate students and not based only on my own experiences. For students, knowledge gained in the course will differ from the knowledge gained from their major advisor, providing a complementary perspective and information that they can build upon in the future. By covering a broad array of topics in professional skills important in the sciences, questions were answered, doubts were discussed, and life-long skills were imparted.

Non-Credit Instruction: Intro to R for Plant Pathologists

For data analysis, I primarily work in the R programming language, which is notorious for having a steep learning curve and lacking in tutorials using plant disease data. To address this, I developed several workshops, such as *Intro to R for Plant Pathologists* (everhartlab.github.io/IntroR-at-OSU). I developed this introductory R workshop because of my previous experiences co-developing and teaching advanced workshops in R for population genetics. A persistent observation was that students in this workshop lacked even the most basic skills in R and did not know where to start, with most having little to no background in programming. To bridge this large gap in knowledge, my idea was to develop an R workshop explicitly for students with no exposure to programming by using a pedagogical approach called *scaffolding.* Using this method, exercises were designed to directly connect new information in R programming to existing knowledge of plant disease data, thus increasing retention and comprehension. This led to development of "Intro to R for Plant Pathologists". This workshop was first offered in 2017 at UNL and was very popular. It was subsequently offered at the APS North Central Division meeting (**Fig. 10**) and I was invited to give this workshop at Ohio State University. By popular demand, the course was offered again in 2018 at UNL and taught at the APS / ICPP meeting in Boston. I was also invited by the graduate students at Penn State University to give a seminar and this workshop in 2018.

Figure 10. Dr. Everhart teaching *Intro to R for Plant Pathologists* at the APS North Central Division meeting in 2017.

In just over one year, this workshop has now been taught to more than 250 attendees, including faculty, postdocs, and staff. I have also used this as a professional training opportunity for postdocs and students by co-teaching the workshop with a postdoc (Z. Kamvar, 2017) or graduate student (N. Gambhir, 2018), and including others as assistants during the workshop (N. Gambhir, 2017, E.N. Lopez 2018). Additionally, I assisted Dr. Amanda Geven's graduate student, Katie Gold, at the University of Wisconsin to offer this workshop in her department. This workshop will be offered at UNL on March 12th, 2019 and will be offered as a workshop at the 2019 APS National meeting in Cleveland, OH.

Mentoring Postdocs and Students

During my time in rank, I have served as a mentor/supervisor to a total of 22 people. This includes four postdoctoral scholars, four graduate students, one Doctor of Plant Health student, one rotation graduate student from the Complex Biosystems program, twelve undergraduate students, one research technologist, and one departmental staff person. To efficiently and effectively manage my lab group, I hold regular lab meetings, manage ordering supplies using an online request form via Google Spreadsheets (see: goo.gl/sxYG1R), created an online guide for required lab safety training and annual refresher training (see: everhart.unl.edu/training.html), and also created an online guide on *Good Lab Stewardship* (see: everhart.unl.edu/stewardship.html). Creating these online tools has allowed me to single-handedly manage an active molecular genetics laboratory without support from a research technician for the vast majority of my time in rank at UNL.

Mentoring graduate students is perhaps the most challenging and time consuming aspect of my role. Particularly important for new graduate students is communication and understanding expectations. To facilitate this, I require new graduate students in my lab to enroll in a Special Topics course entitled *Proposal Development* (PLPT 892–003). We meet weekly and by the end of the first semester, the student has written a mini research proposal on their thesis or dissertation topic. This helps to establish a good working relationship and enables the student to understand what their project will entail. I also provide detailed advice for students (see: everhart.unl.edu/welcome.html), outline expectations for students supported by a graduate research assistantship (see: everhart.unl.edu/expectations.html) and outline an explicit step-by-step approach to effective time management (see: everhart.unl.edu/time-management.html). Most students, however, still require one-on-one training in the lab and at the command line for data analysis. For this, I maintain an 'open door' policy and enjoy the opportunity to work alongside students, including collaborative coding and data analysis (see: github.com/everhartlab/), which has also led to the development of a "Computing Café" (**Fig. 11**). The Computing Café is a group of individuals that meets up to four times per week (depending on interests/needs) for 3 to 4 hours to work on computational projects in a common workspace. Sharing my knowledge and seeing each student develop confidence and attain success is perhaps one of the most rewarding aspects of my career.

Figure 11. Postdoc, graduate student, and faculty, participating in the Computing Café in the spring of 2018.

Scholarship of Teaching and Learning

Beyond research, I have also been successful in obtaining federal funding for teaching and outreach. This includes a USDA National Needs Fellowship grant, which is focused on supporting students in the Doctor of Plant Health program to study resistance management, and funding from the USDA Women and Minorities in

Science, Technology, Engineering and Mathematics (STEM) Fields Program. The latter project came from an idea I had after learning about the website called MentorNet, which is an online platform to provide mentoring to youth considering a STEM career. The idea behind MentorNet and our own program is that a student's interest in a career field is influenced by the kind of people that they see in that field. A student who has a role model who looks like themselves is more likely to successfully complete their degree. So, for example, a young girl may not consider becoming a scientist if she only sees and knows men who are scientists. If you pair her with an established female scientist, the likelihood of successful completion of a science degree increases. To put this idea into action, I connected with faculty across campus and we co-wrote this proposal, which is a formalized mentoring program for underrepresented groups to consider agricultural STEM careers. This program is called "*Cultivate ACCESS"*, which is shorthand for "Cultivating Agricultural Career Communities to Empower Students in STEM". To accomplish this, our program connects high school youth in rural Nebraska communities (Scholars) with an established agSTEM professional (Mentors), using undergraduate UNL students to bridge the two groups (Ambassadors). My role is design and development of the website that we call the ACCESS Portal, located at cultivate.unl.edu. In the 2018-2019 academic year, we currently have 22 Scholars, four UNL undergraduates as Ambassadors, and six mentors that are agricultural career professionals.

Future Teaching Vision

My vision for teaching is to continue to revise and improve the PLPT802 Ecology & Management of Plant Diseases, specifically with the idea that it may eventually become an online-only course. I would also like to formalize the course *Success in the Sciences* because it is of broad interest and would dovetail nicely into several graduate programs on campus. For graduate students in plant pathology, however, we currently need a rigorous course in epidemiology. To accomplish this, I plan to collaborate with Dr. Lucky Mehra at Kansas State University to co-develop a course that combines epidemiology and population genetics. Workshops that I have developed in R will be used as the basis for lab exercises in this course. Overall, these formal and informal teaching experiences are a valuable component of my work.

STATEMENT

Service

In professional service, I am actively engaged in my department, society, and profession. Below are selected examples of the most significant contributions and impacts that I have made in professional service, along with my future vision for service in these types of roles.

Service to the Department

See *Service in CV*, pg.16 [Link]

In our department, the most significant contribution that I have made is in leading a team of faculty to write a proposal to establish a new graduate program, creating M.S. and Ph.D. degrees in Plant Pathology. For nearly 100 years our department has routed graduate students through other departments and currently has about 28 students enrolled. As one of 13 remaining Departments of Plant Pathology and being the only one that does not offer graduate degrees in Plant Pathology, establishing this new program was essential and will transform the future of our department. As co-chair for the committee of five faculty, I organized the materials, assembled/led our meetings, and coordinated our writing efforts. Being the lead member of this group also meant that I spoke on behalf of our Department to obtain support from the chairs and heads of both the Department of Agronomy & Horticulture and the School of Biological Sciences. We submitted our proposal to the CASNR Curriculum Committee on November 1, 2018, and I have continued to represent our department at relevant meetings when the proposal is discussed. I anticipate establishing a standalone graduate program in plant pathology will give our department greater unity and allow us to create a more student-centric curriculum and administration process, and improve our recruitment of the top graduate students in the nation. Because this effort led to a lasting change for the department, I consider this the most significant contribution that I have made in service.

The second greatest impact I made in service to the Department was during my three-year appointment as Chair of the Website Committee. Initially, my purpose was to re-design, develop content for, and migrate the existing website to the new Drupal framework, incorporating design elements suggested by committee members. To accomplish this, I worked closely with UNL Web Designer, Aaron Coleman, to create a framework for our new website. In total, the website update required migrating or creating a total of 145 pages of news, history, jobs, and faculty, staff, and student profiles, of which 70% were pages that I created or updated. After I hired, trained, and supervised a content editor (Ms. Jimin Kamvar) in the fall of 2017, this website gained an additional 95 pages. During this time, I also expanded our Department's communications delivery tools to include use of the UNL Events Calendar (events.unl.edu/plantpath), broadcasting of our departmental seminars online via Adobe Connect / Zoom, and, most recently, creating a Twitter account (@UNL_PlantPath) that was established in January 2018, which currently has 218 followers and 114 Tweets, most of which were posted by me. I can say with confidence that our department website now serves as a reliable source of current news and

events (plantpathology.unl.edu). Because this effort required sustained and continuous activity for three years, I consider it a close second for the most significant impact that I have made in service to our department.

The two examples above are what I consider my most significant service to the department, however my efforts were not limited to those activities. For example, I have held the following roles in our department: member of the Curriculum Committee (2017-present); secondary faculty representative for the Plant Pathology Graduate Student Club (2016-2017); serving on the Vision Committee that established a collective vision for the department (2017-present); obtaining bids, purchasing, and installing more than $20,000 of shared equipment for the department (2015); and managing my lab during two major renovations (2016 and 2017) to accommodate lab space needs of a neighboring lab.

As one of only three women hired as faculty in the ~100-year history of our department, I also make a point to informally engage our female graduate students and staff daily to ensure that the needs and interests of this subgroup are met. This type of engagement has led to several serendipitous events, such as hiring of Dr. Margarita Marroquin-Guzman as a postdoc in my lab, hiring Ms. Rebecca Higgins as current half-time research technologist in my lab, and collaborations with graduate students, such as, Ms. Julianne Matczyszyn, who has recently joined my lab to complete her Ph.D.

Service to the University

Within the Institute of Agriculture and Natural Resources (IANR), I have served as a faculty representative for the Department of Entomology 5-year Review (Fall 2016) and was nominated to co-lead a team Hatch Project on the topic of stress biology (Fall 2015-present), which includes four faculty from Plant Pathology and three faculty from Entomology. Among the 10 graduate student committees that I have or currently serve on, three were graduate students in the Department of Entomology. I have also recently become a member of the Dermott Coyne Foundational Awards Committee, which serves to support lectureships in plant breeding and emergency funding to graduate students in the plant sciences.

[1]See Service in CV, p.16 [Link]

Service to the Profession

Beyond UNL, I have been an active member of my scientific society, the American Phytopathological Society (APS). I joined APS as a member in 2001 and have attended the national meetings for the past 10 years in a row, and regional meetings for the past three years. During this time, I have been active in several committees, including the Epidemiology (current Vice Chair), Mycology, and Diversity & Equality Committees. From 2013 to 2016, I served on the Mycology Committee as Vice Chair, Chair, and Past-Chair. During that time, I worked with Dr. Frank Dugan to develop a proposal for a special session on cryptic species and important examples for plant pathology. We worked together to identify significant cases to highlight in the session. Although our special session was not selected, we ultimately converted our efforts into a review paper (**Dugan & Everhart 2016**) that was published in *Plant Health Progress* in 2016 and received distinction as the “Editor’s Pick” in 2017.

In 2016, I was invited to serve a three-year term on the APS Annual Meeting Board, which is an advisory panel that organizes and plans the annual meeting. On an annual basis, I am responsible for critical review of more than 60 submitted abstracts and 10 special sessions, which comprise only a small portion of the total abstracts submitted. I have also been involved with the development of new activities featured at our annual national meetings, such as the *One-to-One: Conversations with an Expert* activity that I co-developed with Dr. J.P. Dundore-Arias (Univ. Minnesota) and was a featured activity at the 2017 and 2018 APS National Meetings.

Beyond my contributions to my scientific society, other ways that I support my profession are by serving as an Associate Editor (*Ciencias Rural* 2014-2015), Section Editor (*Tropical Plant Pathology* 2018-present), and *ad hoc* reviewer for more than 11 journals within my discipline. I also served as an external reviewer of USDA-ARS Research Plans (2017) and on the review panel for the USDA-NIFA Foundational Program for Pests and Beneficial Species (2017). All of these have been valuable experiences as an early career scientist.

Future Role

My vision is to continue to serve the department in ways that enable us to best meet the research and teaching missions of the institution and to serve the profession in a way that continues to engage new and diverse scientists in plant pathology. Specifically, within the department, I am currently making plans with the chair of the curriculum committee, Dr. Gary Yuen, to perform a systematic curriculum assessment to identify how we can better meet our learning outcomes. In my professional service, I plan to seek a second term on the APS Annual Meeting Board to be able to continue to contribute to the success and inclusiveness of our annual meeting. To further develop my leadership skills in the future, I will seek out opportunities to participate in formal leadership programs, such as LEAD21, and opportunities to fill leadership needs in the department and institution. Overall, these types of activities give me a sense of ownership in my professional society and institution.

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III. APPENDICES

Appendix 1. Publication Metrics

Map of Readership

Figure A1. Readership of my publications available on the UNL Libraries Digital Commons from 6/3/2016 to 11/7/2018. There was a total of 3,595 downloads and 837 page hits, which originated from 547 institutions in 120 countries. Shown on the map are circles with the number of article downloads aggregated by geographic region.

Number and Type of Publications During Time in Rank

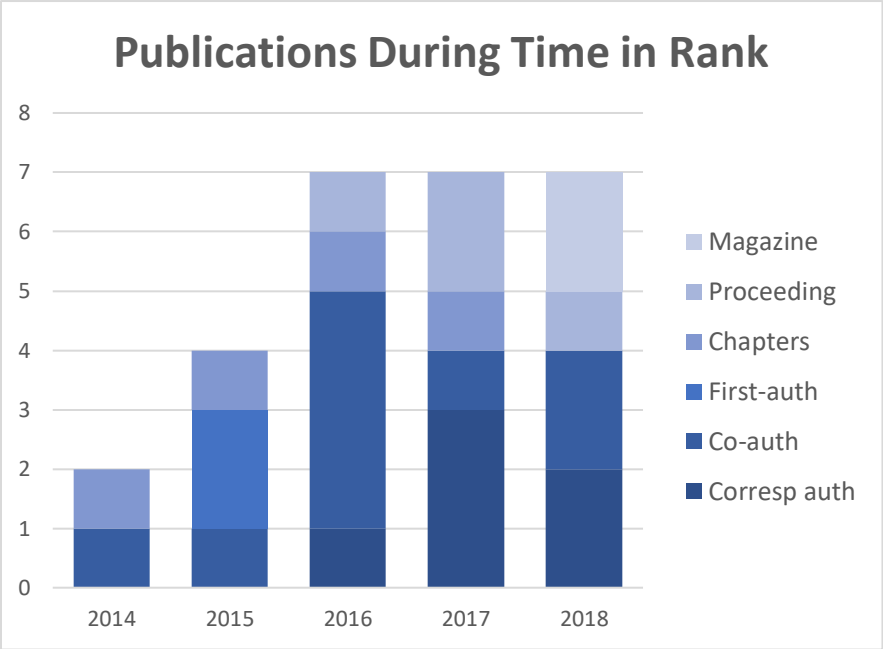

Figure A2. Composition of publications during the last five years in rank, which includes peer-reviewed articles and non-peer-reviewed magazine articles

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Number of Citations Over Time

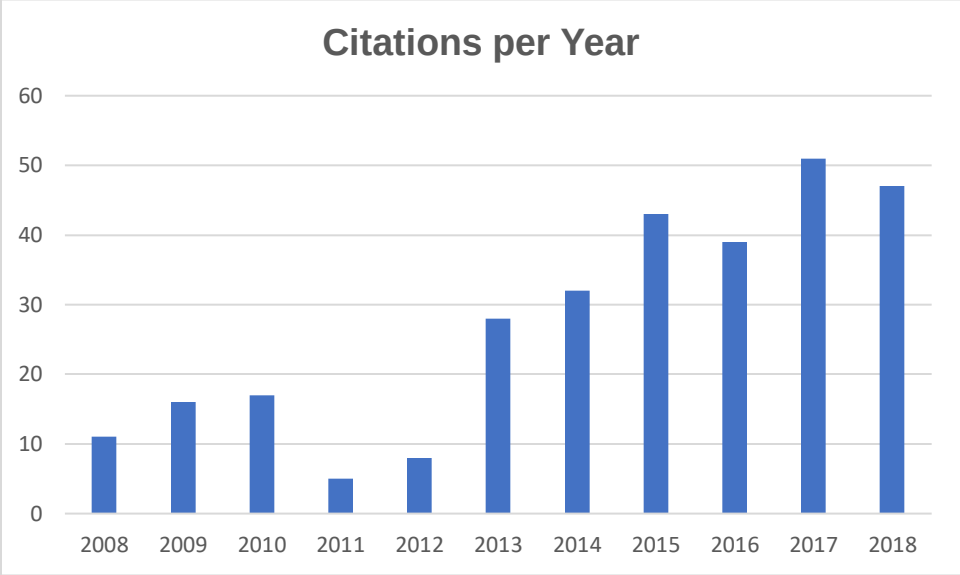

Figure A3. Number of citations per year after first publication in 2008, with numbers obtained from my Google Scholar profile at: scholar.google.com/citations?user=cRTlOIAAAAAJ&hl=en

Subject Area Composition of Publications During Time in Rank

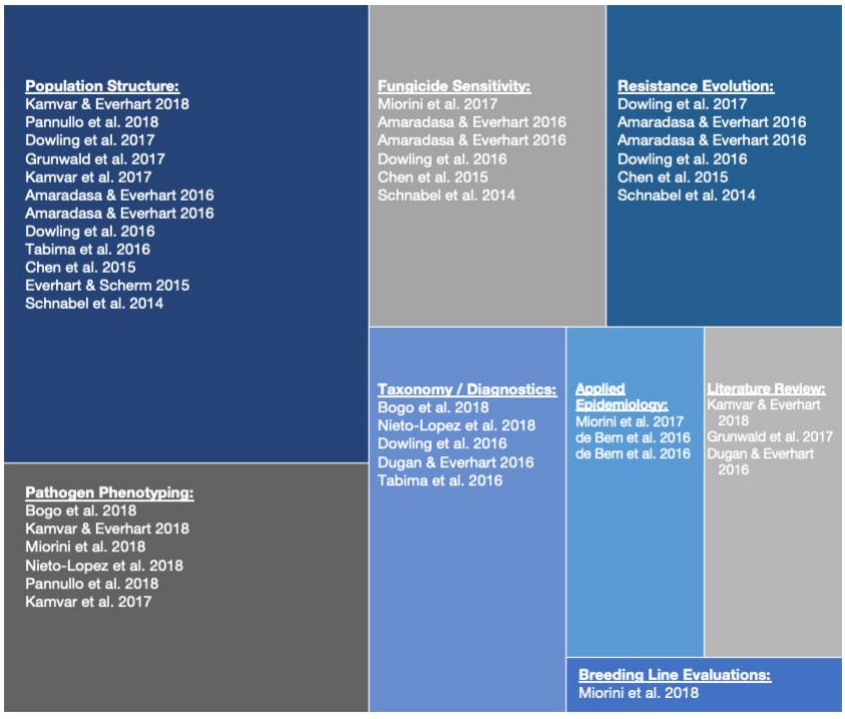

Figure A4. Manuscripts published during time in rank organized according to eight subject areas, where the size of the rectangle is scaled to the number of manuscripts addressing that subject area, which shows that studies of "Population Structure" are most abundant, followed by three areas equally represented: "Fungicide Sensitivity", "Resistance Evolution" and "Pathogen Phenotyping". Representation of manuscripts in each subject area is not mutually exclusive, thus a single manuscript may address more than one subject area.

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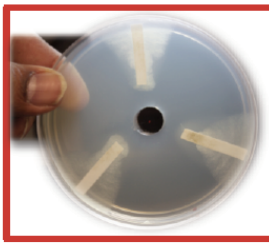
Appendix 2. Tear Sheets of Research



Are fungicides to blame for resistance emergence?

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Problem Statement

- Little is known about mechanisms of resistance emergence; most studies focus on fungicides as selection pressure (**Fig. 1**)
- Sub-lethal exposure to fungicides may be stressful and cause an increase in mutation rates, which is known to occur in bacteria
- Resistance emergence may be expedited by increased mutation rates from non-lethal fungicide stress

Project Goal

- Determine if sub-lethal fungicide exposure causes an increase in mutation rates and subsequent resistance emergence

Research Components

- *Sclerotinia sclerotiorum* used as model because of genetic stability and fully annotated / optically mapped genome
- 10 isolates will be exposed over 12 generations to fungicides with different modes of action (**Fig. 2**)
- Preliminary screening to detect mutations at SSR loci and indels with AFLP
- Whole-genome sequencing will be used to characterize genome-wide mutation pattern

Expected Outcomes

- Determine if long-term, sub-lethal fungicide exposure increases mutation rates
- Determine if mutational response is different based on fungicide mode of action
- Results may affect recommendation of lower dose rates to reduce selection pressure

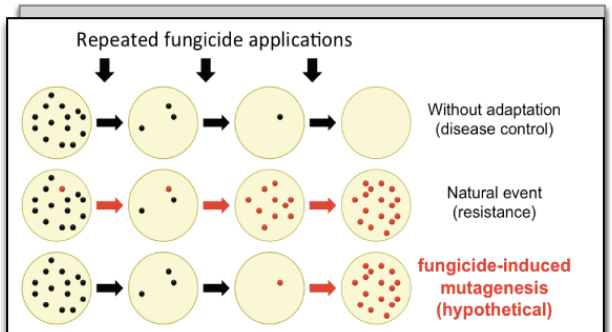
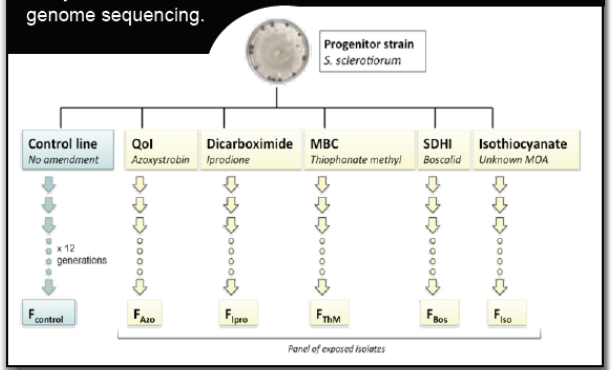


Figure 1. Three scenarios depicting the essential role of an advantageous allele (red) in emergence of fungicide resistance in a pathogen population: **top** is without resistance emergence; **middle** has pre-existing advantageous allele in the population that is selected for during fungicide application; **bottom** is hypothetical mechanism of fungicide-induced mutagenesis in the emergence of an advantageous allele, leading to a fungicide resistant population.

Figure 2. Experimental design showing independent exposure of progenitor isolate to five different fungicides (**yellow**) or no fungicide (blue); resultant isolates are candidates for mutational analysis and / or genome sequencing.



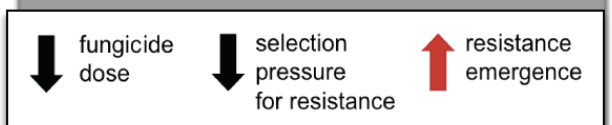


Figure 3. Current recommendations (black arrows) are to apply a lower fungicide dose in order to reduce selection for resistance, however an inadvertent consequence may be that lower dose increases resistance emergence (red arrow), but this hypothesis has not been tested.

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Exploring the root microbiome for big solutions to small-farm holders problems with soilborne pathogens

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Problem Statement

- Diseases caused by soilborne pathogens, such as *Rhizoctonia solani*, cause economic losses worldwide in >500 crops, including cassava, groundnut, banana, and millet
- Variation in disease incidence and severity on the same host is common from field-to-field (**Fig. 1**)
- Genomic resources for *R. solani* on different hosts and interaction of root microbiome to modulate disease development are lacking

Figure 1. Variation in disease severity among seedlings inoculated with the same strain of *Rhizoctonia solani* and grown close together.

Project Goal

- Our goal is to disentangle the complex relationship between soilborne pathogen virulence and host plant rhizosphere community using *R. solani* as a model system (**Fig. 2**)

Research Components

- Metagenomics of the root microbiome will be used to characterize the root microbial community and identify functions of novel PGPR strains
- Whole-genome sequencing and comparative genomics will be used used to identify pathogen virulence genes

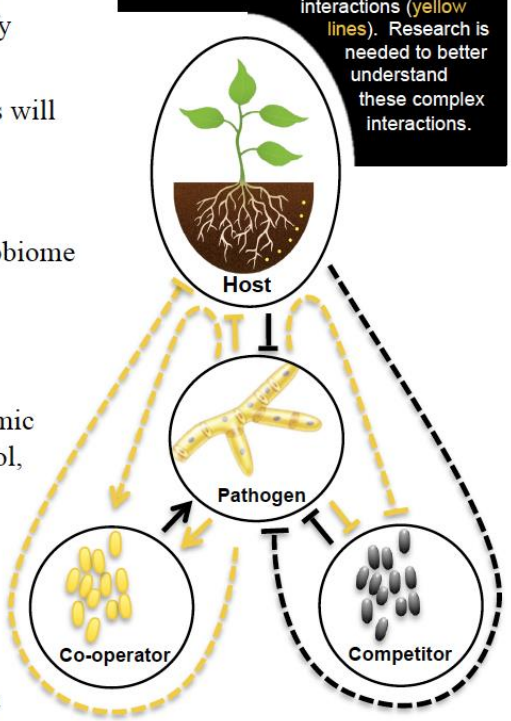
Expected Outcomes

- Elucidation of the relationship of beneficial root microbiome and pathogen virulence in this study will be novel
- This information will enable improved management of *R. solani* diseases
- Long-term goal is to provide morphological and genomic resources relevant for plant breeding, biological control, and improved integrated disease management

Collaborative Team

- Harikishan Sudini, ICRISAT, India
- Tim Adejumo, Adekunle Ajasin University, Nigeria
- Camilo Ramirez, Universidad de Antioquia, Colombia

Figure 2. Conceptual model of tripartite interaction between host, pathogen, and local bacterial community, where direct interactions are solid lines and indirect interactions are dotted; pathogen secreted effector proteins affect these interactions (yellow lines). Research is needed to better understand these complex interactions.



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Plant Host Defenses as Drivers of Fungal Pathogen Genomic Modification and Evolution

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Problem Statement

- Models of pathogen emergence assume mutation rates are fixed (**Fig. 1**)
- Oxidative stress from partially-adapted growth in host plant may be mechanism of rapid genomic modification and pathogen adaptation not previously quantified

Project Goal

- Assess genomic modification of partially-adapted growth inside host plant cell
- Quantify change in mutation rate compared to fully adapted growth and exposure to hydrogen peroxide *in vitro*

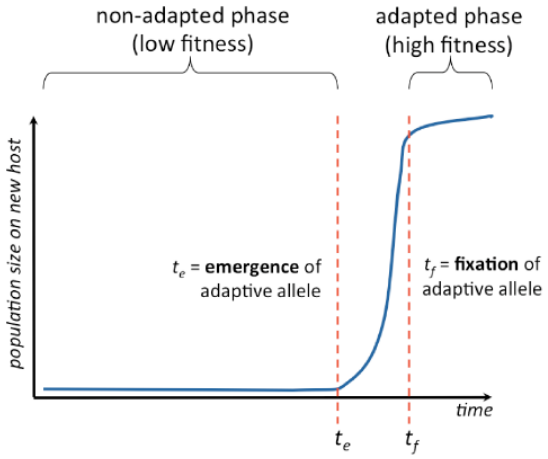
Research Components

- Antioxidation mutant of *Magnaporthe oryzae* will be used to simulate non-adapted growth in rice host cell (**Fig. 2**)
- Wildtype strain of *M. oryzae* will be grown *in planta* for comparison to mutant
- Growth of wildtype on hydrogen peroxide abiotic media will be used to dissect the role of other plant host effects on non-adapted pathogen modifications
- Whole-genome sequencing will be used to characterize genome-wide mutation rate
- Transcriptome analysis will be used to characterize epigenetic modifications

Expected Outcomes

- Quantify fungal genomic mutation rates during partially-adapted growth *in planta*
- Better understanding of adaptive evolutionary forces responsible for emergence of novel races of pathogen

Figure 1. Bi-phasic process of ecological adaptation on a new host, where non-adapted phase is longer and dependent on recombination rate and mutation rate; adaptation occurs once an adaptive allele emerges and proceeds to fixation.



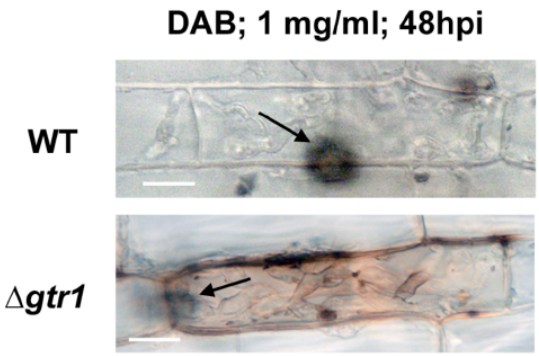


Figure 2. Detached rice leaf sheaths inoculated with *Magnaporthe oryzae* wildtype (WT) and Δgtr1 strain. DAB stain demonstrates reduced capacity of Δgtr1 to suppress plant ROS compared to WT (Fernandez & Wilson 2014 *PLoS ONE*)

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Appendix 3. Pending and Declined Funding

Pending

1. Powers, T., and **S.E. Everhart,** "Diagnosis of major soil-borne plant pathogens in sub-Saharan Africa for banana, beans, and maize, by a novel, ultra-high-sensitivity DNA-based assay system.", Gates Foundation, **$100,000**, (2019 to 2020). *Pending.*
2. **Everhart, S.E.** (PI), J.R. Steadman, and 7 others as cooperators, "Improved white mold resistance in dry and snap beans through multi-site screening and pathogen characterization throughout major production regions". USDA National Sclerotinia Initiative, $75,000, (2019 to 2020). *Pending.*
3. Krueger-Hadfield, S.A. (PI), M.E. Orive, and **S.E. Everhart**, "The clonal lexicon: synthesizing empirical, theoretical, and applied research across the eukaryotic tree in order to understand the evolution of reproductive mode". Progress Meeting in Evolutionary Biology, European Society of Evolutionary Biology, $10,000, (to host a meeting in 2019). *Pending.*

Declined

17 proposals submitted and declined from 2015 to 2018, which were submitted to 12 funding agencies, including:

- Biofungicide Evaluation Contract with Professor Hara & Associates
- European Society of Evolutionary Biology, Progress Meeting in Evolutionary Biology
- Johnson & Johnson Foundation WiSTEM2D Program
- Nebraska Corn Board
- Nebraska Soybean Board
- North Central Soybean Research Program
- UNL Enhancing Hatch
- UNL IANR Bridge Funding
- USDA Forest Service
- USDA-ARS National Sclerotinia Initiative
- USDA-NIFA Foundational Program for Foundational Knowledge in Agricultural Production Systems
- USDA-NIFA Foundational Program for Pests and Beneficial Species in Agricultural Production Systems

5 graduate student / postdoc fellowships with research proposals were also submitted and declined

Appendix 5. Annual CASNR-Calculated FTE

Courses Taught ***3-year average CASNR-Calculated FTE: 28.52%***

2018: Instruction **24.18%** Advising **8.27%** Total: **32.55%**

- **Ecology and Management of Plant Pathogens (PLPT 802)** lead instructor (60% credit), Spring 2018, 3 credit hours, 15 graduate students
- **Success in the Sciences (PLPT 896 *Special Topics*)** lead instructor (100% credit), Summer 2018, 2 credit hours, 7 graduate students (+1 audit)
- **Hands-On Instructional Design (PLPT 896 *Special Topics*)** lead instructor (100% credit), Summer 2018, 2 credit hours, 2 graduate students enrolled
- **Advising:** 3 Ph.D. Students; 5 Undergraduate students (1 is UCARE Research student)

2017 Instruction**: 11.53%** Advising**: 6.24%** Total: **17.77%**

- **Ecology and Management of Plant Pathogens (PLPT 802)** lead instructor (40% credit), spring 2017, 3 credit hours, 17 graduate students
- **Field Disease Tour (PLPT 891)** co-instructor (50% credit), fall 2017, 1 credit hour, 14 graduate students
- **Advising:** 2 Ph.D. Students; 5 Undergraduate students (1 is Honors / IANR Research student)

2016 Instruction: **30.06%** Advising**: 5.29%** Total: **35.29%**

- **Advanced Epidemiology and Population Genetics in R (PLPT 892)** taught in summer 2016, 1 credit hour, 2 graduate students (28 others in attendance)
- **Disease Dynamics and Evolution (PLPT 892/496)** taught spring 2016, 3 credit hours, 2 graduate students and 4 undergraduates
- **Ecology and Management of Plant Pathogens (PLPT 802)** co-taught (30% credit) in spring 2016, 3 credit hours, 14 graduate students
- **Research Proposal Development (PLPT 892)** 1 credit hour, taught fall 2016 to my first-year graduate student (1 in 2016)
- **Field Disease Tour** (PLPT 891) co-instructor (50% credit) in fall 2016, 1 credit hour, 14 graduate students
- **Advising:** 2 Ph.D. Students; 4 Undergraduate students (1 is Honors / IANR Research student); Committee member for 8 students (3 Ph.D.; 5 M.S.) in three departments (1 at Clemson)

2015 Instruction: **5.63%** Advising: **2.86%** Total: **8.49%**

- **Research Proposal Development (PLPT 892)** 1 credit hour, taught fall 2015 and to first-year graduate student (1 in 2015)
- **Independent Research (PLPT 892)** taught fall 2015 for student on rotation (1) at 2 credit hours
- **Advising: 1 Ph.D. Student; 1 Ph.D. rotation, 4 Undergraduate students (1 is summer intern)**

2014

- **Advising:** 2 Undergraduate students

Appendix 6. Course Descriptions & Student Evaluations

The following Course Instructor Evaluation Questionnaire (CIEQ) responses are summarized by the candidate to provide an overall view of teaching effectiveness. Actual reports from which these data were obtained are available here: https://unl.box.com/v/CIEQ

PLPT 802–001: Ecology and Management of Plant Pathogens, every Spring semester, Co-instruction with Dr. Gerard Adams (2016–2018) and Dr. Tamra Jackson-Ziems (2016–2017)

This is a graduate level course offered every spring on the biology, development, spread, and management of plant diseases, their causal agents and how environmental factors interact with diseases. The course is 3 credit hours and is a required course for students in the Plant Pathology Specialization and the Doctor of Plant Health. Course format is a mixture of lectures, discussions, and student presentations. The 2018 syllabus for this course is available here: https://unl.box.com/v/PLPT802

Table A1. CIEQ Course Evaluation Scores for PLPT 802 Ecology & Management of Plant Pathogens

Eco&Man			
Year	2016	2017	2018
PLPT #	802	802	802
Section	1	1	1
Enrollment	14	17	15
Respondents	13	14	7
Average CIEQ Scores:			
Attitude	2.92	3.77	3.71
Method	2.5	3.38	2.89
Content	3.02	3.43	3.36
Interest	2.46	3.27	3.18
Instructor	3.46	3.69	3.54
Total	2.89	3.51	3.35

Comments from students:

- "Sydney is very well organized. All classes and assignments were very well prepared and very helpful. She has excellent teaching skills and I loved her classes."
- "Excellent instructor is interested in students as individuals"
- "Plenty of knowledge about the subject matter that she taught. Effectively presented this information during the lectures and enjoyed the discussions that were done in this class."
- "We had a lot of assignments for this course, but it was worth it. The discussions were very helpful to be prepared for the final exam."
- "The examinations were really good. Sydney gave us valuable feedbacks and that was awesome."
- "It was a good course. One of the better team teaching courses I have taken because there was a good plan and one instructor took the lead and made sure that information was not missed or repeated."
- "I was very satisfied with course and it provided valuable experience that I have not been well exposed to."

PLPT 496/892–006: Disease Dynamics & Evolution, Spring 2016

This course was designed to cover core concepts of disease ecology and pathogen emergence and evolution for undergraduates in the Microbiology program. Concepts were organism-agnostic and important for understanding infectious diseases of humans, animals, and plants. The goal of this course is to use interesting and intriguing case studies of infectious diseases to develop critical thinking as scientists. The course was designed to be appropriate for a wide variety of biology students, with interests in ecology, environmental biology, animal, plant, and human biology to microbiology, pre-vet and pre-med. During the 2015-2016 academic year, I comprehensively reviewed this course while participating in the UNL Peer Review of Teaching program and used that information to develop a Benchmark Teaching Portfolio. This portfolio is published online on the UNL Digital Commons.

Table A2. CIEQ Course Evaluation Scores for PLPT 496/892 Disease Dynamics & Evolution

Disease Dynamics & Evolution		
Year	2016	2016
PLPT #	496	892
Section	6	6
Enrollment	4	2
Respondents	4	2
Average CIEQ Scores:		
Attitude	3.88	3.75
Method	3.56	3.75
Content	3.44	3.5
Interest	3.31	3.63
Instructor	4	4
Total	3.65	3.74

PLPT 892–008: Advanced Population Genentics and Epidemiology, Summer 2016

This course introduces students to the R programming language, with applications in population genetics and epidemiology. This course was offered in the summer of 2016 as a blended workshop / short-course. Students were taught basic skills in R syntax, data types (logical, character, numeric, etc.), data structures, sub-scripting, plotting, and packages. The goal of this course was to give students, faculty, staff, and postdocs, enough skills in R that they can access packages and resources of interest to each of them for their own research.

Table A3. CIEQ Course Evaluation Scores for PLPT 892 Adv. Pop. Gen & Epidemiology

	PopGen	
Year	2016	2017
PLPT #	892	892
Section	8	8
Enrollment	7	1
Respondents	0	1
Average CIEQ Scores:		
Attitude	-	4
Method	-	4
Content	-	4
Interest	-	4
Instructor	-	4
Total	-	3

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PLPT 892–401: Success in the Sciences, Summer 2018

PLPT 892–402: Instructional Design, Summer 2018

The course *Success in the Sciences* was co-developed with two graduate students in Complex Biosystems who were enrolled in *Instructional Design*. This was a professional development course for students pursuing graduate degrees in the sciences and targeted enrollment by Complex Biosystems students in the first summer. Content and activities in the course were developed by working collaboratively with two graduate students. Various topics were covered using active learning techniques in the classroom. Upon completion of this course students acquired skills and confidence to navigate a path to success in graduate school and feel more prepared to take the next step after graduation. Specific skills taught and topics covered include: using your resources (brains not brawn), critical evaluation of the primary literature, project management, optimizing your time, mentoring and being mentored, the protocols and pitfalls of publishing, presenting your science, the art of communicating your work, tips for communicating with colleagues, networking to get a job, and the job interview. Course format includes lectures, various out-of-class assignments, group discussion, peer evaluations, presentations, and reading the primary literature. Student comment: "I have a lot better handle as to what I need to be doing as a grad student." A syllabus for this course is available here: https://unl.box.com/v/SIS

Table A4. CIEQ Course Evaluation Scores for PLPT 892 Success in the Sciences and PLPT 892 Instructional Design

	SIS	InsDes
Year	2018	2018
PLPT #	892	892
Section	401	402
Enrollment	7	2
Respondents	1	0
Average CIEQ Scores:		
Attitude	4	-
Method	3.5	-
Content	3.75	-
Interest	3.25	-
Instructor	3.6	-
Total	3.62	-

PLPT 891–601 and –001: Disease Tour Across Nebraska, Summer 2016, 2017

This course is taught by Dr. Tamra Jackson-Ziems and is designed to introduce students to various agricultural practices in Nebraska, highlighting disease management. I was a co-instructor in 2016 and 2017. Below are our group photos from the 2016 trip across Nebraska.

Table A5. CIEQ Course Evaluation Scores for PLPT 891 Disease Tour Across Nebraska (Sum. & Fall)

	Disease Tour	
Year	2017	2017
PLPT #	891	891
Section	601	1
Enrollment	4	11
Respondents	0	4
Average CIEQ Scores:		
Attitude	-	4
Method	-	3.81
Content	-	4
Interest	-	4
Instructor	-	3.85
Total	-	3.85

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PLPT 892–003: Proposal Development, Fall 2015, 2016

I require new graduate students in my lab to enroll in a special topics course entitled *Proposal Development* (PLPT 892–003). We meet weekly and by the end of the first semester, the student has written a mini research proposal on their thesis or dissertation topic. This helps to establish a good working relationship and enables the student to understand what their project will entail. I also provide detailed advice for students (see: everhart.unl.edu/welcome.html, outline expectations for students supported by a graduate research assistantship (see: everhart.unl.edu/expectations.html, and outline an explicit step-by-step approach to effective time management (see: everhart.unl.edu/time-management.html.

Table A6. CIEQ Course Evaluation Scores for PLPT 892 Proposal Development

	PropDev	
Year	2015	2016
PLPT #	892	892
Section	3	3
Enrollment	1	1
Respondents	1	0
Average CIEQ Scores:		
Attitude	4	-
Method	4	-
Content	4	-
Interest	4	-
Instructor	4	-
Total	4	-

PLPT 892–003: Independent Study, Fall 2015

The topic of this independent study was to identify SNP variants from Illumina sequence data for the ancient clonal plant pathogen, *Phytophthora ramorum* (see project flyer on next page). Our goal was to use a highly sensitive population genetic marker to understand the dynamics and spread of this pathogen. This type of genetic information may allow us to determine if multiple introductions have occurred, the size of long-range dispersal zones, and if the pathogen shows signs of rapid evolution or adaptation during the past 12 years since the first introduction. Due to the clonal nature of this pathogen, existing genetic markers were not useful. Consequently, we performed reduced-representation whole-genome sequencing, called Genotyping-by-Sequencing (GBS), in order to identify new variants in the genomes. We obtained GBS data for a selection of 84 isolates but found few high quality variants from this analysis. We obtained additional sequence data using the Illumina HiSeq 3000 for the same amplicon library sequenced previously. The selected student will develop scripts to bin and combine reads from both sequence runs, perform alignments and call variants. Subsequently, the student will analyze this data in R to identify variable sites and, if needed, design primers for these sites. This student also wrote and submitted an NSF Proposal for support on this project, although it was not selected for funding.

Table A7. CIEQ Course Evaluation Scores for PLPT 892 Independent Study

	Rotation
Year	2015
PLPT #	892
Section	8
Enrollment	1
Respondents	1
Average CIEQ Scores:	
Attitude	4
Method	3.5
Content	3.75
Interest	4
Instructor	4
Total	3.86

Complex Biosystems Student Rotation Project for PLPT892–003

Complex Biosystems Rotation Proposed Project
Rotation Mentor: Sydney Everhart, Plant Pathology
Contact Information: everhart@unl.edu
Office Phone: 402-472-2879

Finding a Needle in the Haystack:

Identifying SNP variants from Illumina sequence data for the ancient clonal plant pathogen, *Phytophthora ramorum*

Background

Phytophthora ramorum is a recently introduced, emerging plant pathogen that has a wide host range and been repeatedly sent across the U.S. in plant shipments over the past 20 years. *P. ramorum*, it is also an ancient clonal organism that shows low variation from one individual to the next. More than 4,000 *P. ramorum* isolations of the pathogen have been obtained from the disease outbreak in native Oregon forests since 2001 (**Fig. 1**). Our goal was to use a highly sensitive population genetic marker to understand the dynamics and spread of this pathogen. This type of genetic information may allow us to determine if multiple introductions have occurred, the size of long-range dispersal zones, and if the pathogen shows signs of rapid evolution or adaptation during the past 12 years since the first introduction.

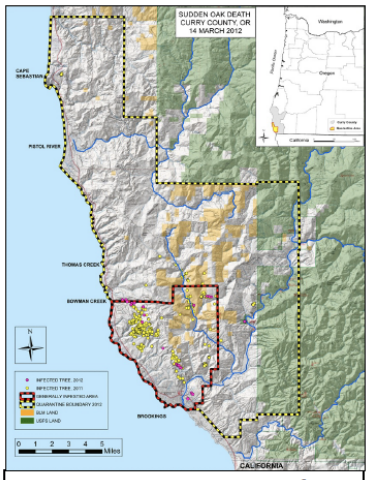

Figure 1. Current quarantine zone for Sudden Oak Death in Oregon, where red line is the generally infested area and yellow line is the quarantine zone. The pathogen, *P. ramorum* is collected from affected trees within these zones for subsequent genetic analysis.

Due to the clonal nature of this pathogen, existing genetic markers were not useful. Consequently, we performed reduced-representation whole-genome sequencing, called Genotyping-by-Sequencing (GBS), in order to identify new variants in the genomes. We obtained GBS data for a selection of 84 isolates but found few high quality variants from this analysis (**Fig. 2**).

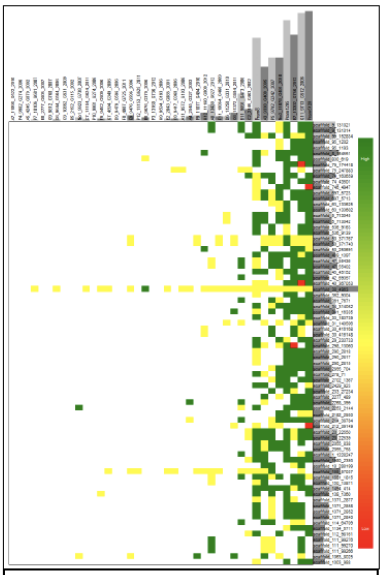

Figure 2. Total of 78 SNP variants (horizontal axis) obtained from genome-wide GBS analysis of 84 *P. ramorum* isolates (top; sequence depth) from the disease outbreak in Oregon

Proposed Project

We obtained additional sequence data using the Illumina HiSeq 3000 for the same amplicon library sequenced previously. The selected student will develop scripts to bin and combine reads from both sequence runs, perform alignments and call variants. Subsequently, the student will analyze this data in R to identify variable sites and, if needed, design primers for these sites.

Qualifications

This project requires that the student have the ability to write scripts (perl, python, etc). Experience in R is preferred, but not required.

Student Evaluations in the Department

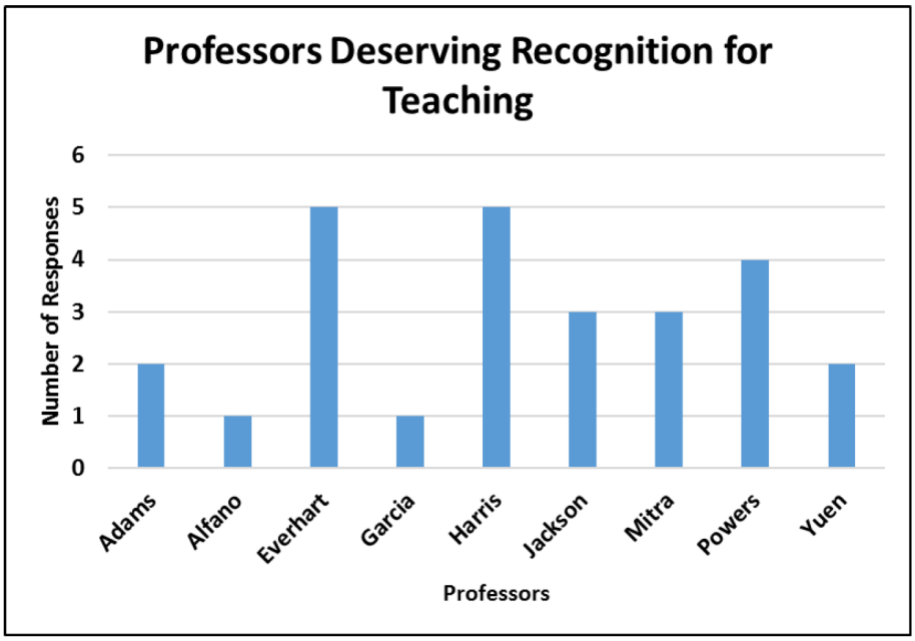

Figure A5. In the fall of 2016, graduate students in the Department of Plant Pathology conducted a self-survey on curriculum and instruction. This figure is excerpted from their report, which shows the number of votes for faculty they felt were deserving of recognition for teaching. The full report is available here: unl.box.com/v/GradStudentSurvey2016