

Exponent®
Engineering & Scientific Consulting

Sean Ryan, Ph.D.

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Professional Profile

Dr. Ryan is a broadly trained biologist with nearly 20 years of experience evaluating ecological and environmental impacts of human activities and emerging technologies. His expertise spans risk assessment of advanced biotechnologies—including genetically engineered organisms and RNA interference (RNAi) products—as well as ecological damage assessments following environmental disasters such as oil spills, chemical releases, and wildfires. He also develops and applies interactive data analytics and decision-support tools for regulatory compliance and infrastructure management.

Dr. Ryan applies a diverse suite of analytical tools, including molecular genetics, bioinformatics (e.g., *in silico* analyses), simulation modeling, and quantitative statistical methods, to evaluate past and predict future genetic and ecological changes across landscapes over time. He has also served as a testifying expert in litigation involving entomological issues.

Risk Assessment of Biotechnologies

Dr. Ryan specializes in helping clients assess potential risks of various products as part of the regulatory compliance processes (FDA/CVM, USDA/BRS, EPA) for products such as biopesticides and genetically engineered organisms. His work includes:

- **FDA Environmental Assessment for Gene-Edited Pigs**

Led development of the first FDA-approved Environmental Assessment for PIC's gene-edited pigs containing an Intentional Genomic Alteration (IGA) conferring resistance to Porcine Reproductive and Respiratory Syndrome (PRRS). Conducted individual-based simulation modeling to predict environmental fate and effects.

- **AquaBounty's AquaAdvantage Salmon**

Contributed to the Environmental Assessment for the first transgenic salmon approved by FDA for human consumption.

- **RNAi Biopesticide Risk Assessments**

Supported risk evaluations for multiple RNAi-based products (dsRNA, shRNA), including exposure likelihood for non-target organisms (NTOs) and bioinformatics (*in silico*) analyses to assess potential off-target effects.

- **Microbial Risk Evaluation**

Assessed risks posed by genetically engineered and non-engineered microbes using bioinformatics for strain delineation and pathogenicity potential.

Molecular Forensics for Environmental and Product Investigations

Dr. Ryan specializes in identifying and attributing sources of contamination in natural and manufactured systems using advanced molecular and genomic techniques.

- **Genome and Transcriptomic Analyses**

Used genomic data in litigation context to support clients' claims of product identity.

- **Environmental DNA (eDNA) and Molecular Source Tracking**

Leveraged eDNA and molecular methods for microbial source tracking (e.g., coliform bacteria) and for identifying contamination sources in environmental and product matrices, including determination of contaminant provenance (organisms' identity and origin).

Assessment of Natural Resource Damages and Environmental Impacts

Dr. Ryan has extensive experience evaluating species responses to environmental change—from climate impacts to catastrophic disturbances—and quantifying ecological injuries in terrestrial and aquatic systems. His work includes:

- **Natural Resource Damage Assessments (NRDA)**

Investigated ecological damages from chemical releases, wildfires, heavy metals, and climate-related stressors using causal analysis and other quantitative methods.

- **Complex Litigation Support**

Managed and supported large-scale litigation cases involving alleged ecological impacts from contaminants (e.g., PCBs, PFAS) and various anthropogenic disturbances (e.g., climate change, wildfires).

Interactive Data Analytics and Decision-Support Tools

Dr. Ryan develops and applies interactive analytical platforms to support regulatory decision-making, internal scientific workflows, and client communication, with an emphasis on reproducibility, transparency, and alignment with regulatory expectations (e.g., GLP). His work includes:

- **Interactive Dashboards (R Shiny)**

Designed and implemented custom R Shiny applications for client-facing and internal use to explore data, standardize analyses, and generate reproducible, audit-ready outputs.

- **Dose–Response Modeling and Reporting**

Developed interactive analytical tools to support statistical evaluation and visualization of dose–response relationships, including model selection and derivation of NOEC and ECx estimates, in GLP-compliant reports for regulatory submissions.

- **Pesticide Exposure and Drift Modeling**

Developed an open-source interactive dashboard for evaluating pesticide drift, integrating formulation-specific and environmental data to support assessment of deposition patterns by industry and regulatory stakeholders.

- **Infrastructure and Utilities Impact Evaluation**

Developed interactive dashboards for utilities companies to enable routine evaluation and decision-support for infrastructure management.

Entomology, Ecology, and Pest Management

- **Urban Pest Management and Litigation** Retained as a testifying expert in litigation involving urban pest-management and entomological issues, applying expertise in insect biology, ecology, and behavior to evaluate pest-related claims.

- **Pesticide and Biopesticide Risk Assessment** Evaluated ecological risks associated with conventional pesticides and novel pest-control technologies, including RNA interference (RNAi)-based biopesticides. His work has included assessment of potential effects on non-target organisms, bioinformatics analyses of potential off-target effects, dose-response analysis, and development of quantitative tools for evaluating pesticide exposure and drift.

Academic Credentials & Professional Honors

Ph.D., Biological Sciences, University of Notre Dame, 2016

M.S., Biological Sciences, Bowling Green State University, 2010

B.S., Organismal and Conservation Biology, San Jose State University, 2007

Academic Appointments

University of Tennessee, Knoxville, Department of Entomology and Plant Pathology, Assistant Professor (Adjunct)

Prior Experience

USDA-NIFA Postdoctoral fellow, University of Tennessee, Knoxville, TN, 2017-2019

Citizen Science fellow, North Carolina State University, NC, 2017-2019

Research Geneticist, USDA-ARS, Gainesville, FL, 2015-2017

Professional Affiliations

Entomological Society of America

Crop Life America

Citizen Science Association

Ecological Society of America

Publications

Ryan, K.P., Ryan, S.F., Heide-Jørgensen, M.P., Ferguson, S.H., Dall, S.R.X., Roth, J.D., Watt, C.A. 2026. Decadal migration timing and temporal variation in dive behavior of an endangered beluga whale population. Frontiers in Marine Science, 13:1727387. DOI: 10.3389/fmars.2026.1727387

Driscol, S.K., Ryan S., Small, A, Dombrowski, F. 2025. Employing site-specific sediment toxicity tests to develop remediation goals for polycyclic aromatic hydrocarbons at a manufactured gas plant site. Environmental Toxicology and Chemistry; vgaf186, https://doi.org/10.1093/etojnl/vgaf186

Menzie, C.A., Horr, T., Kashuba, R., Kierski, M.W., Kulacki, K.J., McArdle, M. E., Ryan, S.R., Taylor, A.A. 2024. Emerging Frameworks and Tools for Environmental Risk Assessment. In D. J. Paustenbach & K. Feinberg (Eds.), Human and Ecological Risk Assessment: Theory and Practice, Third Edition (pp. 26). https://doi.org/10.1002/9781119742975.ch26

Dekovich, A., Ryan, S., Bouwma, A., Calcaterra, L., Silvestre, R., Staton, M., Shoemaker, D. 2023. Population genetic analyses reveal host association and genetically distinct populations of social parasite Solenopsis daguerrei. Frontiers in Ecology and Evolution. 11; https://doi.org/10.3389/fevo.2023.1227847

Wenning, R.J., Gard, N.W., Ryan, S.F., White, C. 2022. The challenges for determining environmental footprints in the food sector. Integrated Environmental Assessment and Management, 18(3):836-838

Ryan, S.F., Lombaert, E., Espeset, A., Vila, R., Talavera, G., Dinca, V., Doellman, M.M., Renshaw, M.A., Eng, M.W., Hornett, E.A., Li, Y., Pfrender, M.E., Shoemaker, D.W. 2019. Global invasion history of the agricultural pest butterfly Pieris rapae revealed with genomics and citizen science. Proceedings of the National Academy of Science. DOI: 10.1073/pnas.1907492116

Ryan, S.F., Adamson, N.L., Aktipis, A., Anderson, L.K., Austin, R., Barnes, L., Beasley, M.R., Bedell, K.D., Bedell, K.D., Briggs, S., Chapman, B., Cooper, C.B., Corn, J.O., Creamer, N.G., Delborne, J.A., Domenico, P., Driscoll, E., Goodwin, J., Hijarding, A., Hulbert., J.M., Isard, S., Just, M.G., Kar Gupta, K., Lopez-Uribe, M.M., O'Sullivan, J., Landis, E.A., Madden, A.A., McKenney, E.A., Nichols, L.M., Reading, B.J., Russell, S., Sengupta, N., Shapiro, L.R., Shell, L.K., Sheard, J.K., Shoemaker, D.D., Sorger, D.M., Starling, C., Thakur, S., Vatsavai, R.R., Weinstein, M., Winfrey, P., Dunn, R.R. 2018. The role of citizen science in addressing grand challenges in food and agriculture research. Proceedings of the Royal Society B; DOI:10.1098/rspb.2018.1977

Ryan, S.F., Deines, J.M., Scriber, J.M., Pfrender, M.E., Jones, S.E., Emrich, S.J., Hellmann, J.J. 2018. Climate-mediated hybrid zone movement revealed with genomics, museum collection, and simulation modeling. Proceedings of the National Academy of Science, 201714950; DOI: 10.1073/pnas.1714950115

McKinley, D.C., A.J. Miller-Rushing, H.L. Ballard, R.E. Bonney, H. Brown, D.M. Evans, R.A. French, J.K. Parrish, T.B. Philips, S.F. Ryan, L.A. Shanley, J.L. Shirk, K.F. Stepenuck, J.F. Weltzin, A. Wiggins, O.D. Boyle, R.D. Briggs, S.F. Chapin III, D.A. Hewitt, P.W. Preuss, and M.A. Soukup. 2017. Citizen Science Can Improve Conservation Science, Natural Resource Management, and Environmental Protection. Biological Conservation, 208:15–28

Ryan, S.F., Fontaine, M.C., Scriber, J.M., Pfrender, M.E., O'Neil, S.T., Hellmann, J.J. 2017. Patterns of divergence across the geographic and genomic landscape of a butterfly hybrid zone associated with a climatic gradient. Molecular Ecology, 26(18): 4725-4742

Ryan, S.F., Scriber, J.M., Valella, P., Thivierge, G. Aardema, M.L. 2017. The role of latitudinal, genetic and temperature variation in the induction of diapause of Papilio glaucus (Lepidoptera: Papilionidae). Insect Science, 00: 1-9

McKinley, D.C., Miller-Rushing, A.J., Ballard, H.L., Bonney, R.E., Brown, H., Evans, D.M., French, R.A., Parrish, J.K., Philips, T.B., Ryan, S.F., Shanley, L.A., Shirk, J.L., Stepenuck, K.F., Weltzin, J.F., Wiggins, A., Boyle, O.D., Briggs, R.D., Chapin III, S.F., Hewitt, D.A., Preuss, P.W., Soukup, M.A. 2015. Can investing in citizen science improve natural resource management and environmental protection? Issues in Ecology, 19:1-28

Ryan, S.F., Bidart-Bouzat, G. 2014. Natal insect experience with Arabidopsis thaliana plant genotypes influences plasticity in oviposition behavior. Entomologia Experimentalis et Applicata, 152(3):216-227

Fontaine, M., Roland, K., Calves, I., Austerlitz, F., Palstra, F., Tolley, K., Ryan, S., Ferreira, M., Jauniaux, T., Llavona, A., Ozturk, B., Ozturk, A., Ridoux, V., Rogan, E., Sequeira, M., Siebert, U., Vikingsson, G., Borrell, A., Michaux, J., Aguilar, A. 2014. Postglacial climate changes and rise of three ecotypes of harbor porpoises, Phocoena phocoena, in western Palearctic Waters. Molecular Ecology, 23:3306-3321

Sharma, A., Bouchard, F., Ryan, S.F., Parker, D., Hellmann, J. 2013. Species are the Building Blocks of Ecosystem Services and Environmental Sustainability. Ethics, Policy & Environment, 16:1

Ryan, S.*, & Lambrecht, S. 2011. Seed soaking and age play a factor in heat-stimulated germination of two maritime chaparral Ceanothus (Rhamnaceae) species. Proceedings of the California Native Plant Society, 290:298

Presentations

Select Presentations

Ryan, S. 2024. Opportunities at the interface of citizen science, genomics, and agriculture: a case study of a collections-based project. Plant Animal Genome Conference. (Invited Talk)

Ryan, S. F. 2023. Assessing the Potential Environmental Risks of GE Animals for Regulatory Approval: Case Studies and Considerations. Plant Animal Genome Conference. San Diego, California. (Poster Presentation)

Ryan, S. F. 2023. Consideration of benchmarks for assessing environmental risks of genetically engineered animals. Transgenic Animal Research Conference. Lake Tahoe, California. (Poster Presentation)

Menzie, C., Morrison, AM., Kleven, M., Deines, A., Yu, Q., Duncan, B., Ryan, S. 2023. Holistic multiple stressor impact assessment methodology for application to vulnerable and disadvantaged communities. SETAC. (Talk)

Ryan, S. F. 2022. Navigating the Regulatory Landscape of Bringing Genetically Engineered Animals to Market. Plant Animal Genome Conference. San Diego, California. (Poster Presentation)

Ryan, S. F. 2022.Citizen Science as a Powerful Tool for Expanding Lepidoptera Research in a Rapidly Changing World. McGuire Center for Lepidoptera and Biodiversity, Florida Museum, University of Florida, Gainesville, Florida. (Invited talk)

Ryan, S. F. 2021. Citizen Science as a Powerful Tool for Transforming Evolutionary Biology and Our

Ability to Assess Species Responses to a Rapidly Changing World. Department of Biological Sciences, University of Denver, Denver, Colorado. (Invited talk)

Ryan, S. F. 2020. Combining Citizen Science and Population Genomics to Reveal Global Invasion Routes. Plant Animal Genome Conference. San Diego, California. (Poster Presentation)

McArdle, M., Ryan, S., Menzie, C., Taylor, A., Kulacki, K., Kierski, M., Kashuba, R., Goodfellow, W. Emerging Frameworks and Tools for Environmental Risk Assessment. 2020. 41st Annual Society of Environmental Toxicology and Chemistry (SETAC) SciCon2 North America. (Talk)

Ryan, S. F. 2020. How genetics and citizen science can help us understand insect ecology and evolution in a changing world. Washington Butterfly Association. (Invited talk)

Ryan, S. F., et al. 2018. The role of citizen science in the history and future of agriculture and food science. Program Symposium: Citizen Science in a Changing World: Successes and Challenges Across Projects and Institutions. Entomological Society of America Annual meeting in Vancouver, British Columbia. (Co-organized Symposia)

Ryan. S. F. 2018. Using genomics and citizen science to assess and monitor genetic variation in a globally invasive agricultural pest and associated pathogen (baculovirus). FY2018 NIFA Fellows PD Meeting. Washington, D.C. (Talk)

Ryan, S. F. 2017. Combining Big Data and Public Engagement to Understand Insect Ecology and Evolution in a Changing Environment. Department of Bioagricultural Sciences & Pest Management, Colorado State University, Fort Collins, Colorado. (Invited talk)

Ryan, S. F., et al. 2017. Invasion biology meets the 21st century: Harnessing the power of citizen science, in the genomics era. Symposium: Applying Emerging Genomic Techniques to Control Invasive Species. Entomological Society of America Annual meeting in Denver, Colorado. (Invited talk)

Ryan, S. F., Hellmann, J. J. 2016. Hybridization in the context of a changing climate. Symposium: Climate Change Impacts and Insect Population Dynamics. International Congress of Entomology in Orlando, Florida. (Invited talk)

Ryan, S.F., Shoemaker, D.D. 2016. Reconstructing the global invasion routes of the cabbage white butterfly using citizen science assisted genomics. Symposium: How Human Activities Shape the Global Distribution of Insects. International Congress of Entomology in Orlando, Florida. (Invited talk)

Ryan. S. F., Wade, E. J., Bouwman, A. M., Calcaterra, L., Shoemaker, D. D. 2016. Genetic variation in the ant social parasite Solenopsis daguerrei predicts host specificity at a micro-geographic scale. Evolution. Austin, Texas. (Talk)

Ryan, S. F., et al. 2014. Evaluating the efficacy of the RADseq method for use with historic specimen to explore long-term changes in the population genomics of a butterfly hybrid zone. Ecological Genomics as an Emerging Field: Opportunities for Non-Model Organisms. Ecological Society of America annual meeting in Sacramento, California. (Invited talk)

Ryan, S. F. 2013. How citizen science is revolutionizing science and why you should be a part of that revolution. Public lecture at Ideas on Tap. Goshen, Indiana. (Invited talk)

Ryan, S. F. 2012. Plant chemistry and insect choices: how experience may alter an ‘herbivore's dilemma. Public lecture for Potawatomi Conservatories, Mishawaka Indiana. (Invited talk)

Research Grants

Agriculture and Food Research Initiative | National Institute of Food and Agriculture Postdoctoral Fellowship

Peer Reviews

Proceedings of the National Academy of Science

Nature Scientific Reports

Molecular Ecology

Ecological Applications

Agronomy for Sustainable Development

Proceedings of the Royal Society B

Pest Management Science

Sustainability

Air Soil and Water Research

Citizen Science Theory and Practice

Philosophical Transactions of the Royal Society B

Journal of Biogeography

Sensors

Insect Conservation and Diversity