

# Nicholas A. Friedenber

## Curriculum Vitae

Applied Biomathematics, Inc.  
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### EDUCATION

Ph.D., Ecology and Evolution, Dartmouth College, NH, 2002.

B.A., Biology, Carleton College, MN, 1996.

### SUMMARY

Trained as an evolutionary ecologist with a focus on theory, I have progressively moved toward more applied questions about conservation, insect pests, and human health. I study methods for the simulation of population growth and evolution in complex landscapes and develop commercial software packages that make these methods broadly accessible. I regularly work with scientists from industry, academia, and government while maintaining an externally-funded research and development program in addition to contract work and business development.

### PROFESSIONAL EXPERIENCE

Vice President at Applied Biomathematics, Setauket, NY. 2015 to present.

Senior scientist at Applied Biomathematics, Setauket, NY. 2009 to present  
Methods and software for ecological and evolutionary risk analysis. I lead project development and execution and maintain an externally-funded research program.

Research scientist at Applied Biomathematics, Setauket, NY. 2007-2009  
Fish interactions with electric power plants. Forest insect pest outbreak risk.

Research scientist at Stony Brook University, NY, Evolution and Ecology. 2007-2009  
Experimental evolution of microbial resource specialization in chemostats.

Postdoctoral researcher at Dartmouth College, NH, Department of Biology. 2005 to 2007  
Population dynamics of southern pine beetle. Activities included statistical analysis of field-collected data, experimental design, and time series analysis of a long-term dataset.

Independent statistical consultant. 2003 to 2005.  
Supported proposal writing, experimental design, and data analysis for clients in biology and engineering.

Postdoctoral researcher at the University of Florida, Department of Biology. 2003  
Models of source-sink evolution and the evolution of dispersal rate. Performed mathematical modeling, analyzed experimental data, developed an individual-based simulation of multi-trait evolution.

## PROFESSIONAL ACTIVITIES

Co-organizer, Member Symposium: Density dependence, community genetics, and resistance evolution. 2018 Annual Entomology Conference, 2018, *proposed*.

Mentor and judge, Student Conference for Conservation Science, American Museum of Natural History. 2010, 2014, 2016, 2017.

Organizer, Pesticide Resistance Integrative Workshop, National Institute for Mathematical and Biological Synthesis, 2013.

Reviewer for: American Naturalist, Ecology, Ecological Applications, Ecology Letters, Ecological Modeling, Journal of Economic Entomology, Journal of Animal Ecology, Functional Ecology, Biology Letters, Nature Reviews Microbiology, Conservation Biology, Journal of Mathematical Biology

Society memberships: Entomological Society of America, American Society of Naturalists, American Fisheries Society

## RECENT GRANTS

Reducing data demands and improving accuracy of collision prediction for birds and bats at wind energy facilities. 2018. PI. Electric Power Research Institute Technology Innovation Grant. \$70,000.

Bt resistance management: software for research, education, and outreach. 2016. PI. USDA-NIFA SBIR Phase II. \$600,000

Reducing avian and bat collisions at wind energy facilities. 2016. PI. Electric Power Research Institute Technology Innovation Grant. \$70,000.

Bt resistance management: software for research, education, and outreach. 2015. PI. USDA-NIFA SBIR Phase I. \$100,000

Estimating dispersal and modeling its impact on resistance remediation in western corn rootworm. 2014-2018. Co-investigator. Monsanto Knowledge Grant subaward. \$215,000

Forest pest risk analysis in dynamic landscapes. 2009-2013. PI. USDA-CSREES SBIR Phase II. \$350,000

Risk models for rare events. 2009. Co-investigator. DHS SBIR Phase I. \$100,000

Forest pest risk analysis in dynamic landscapes. 2008. PI. USDA-CSREES SBIR Phase I. \$100,000

## SELECTED NON-REFEREED PUBLICATIONS

E.J. Rollinson, C.M. Foley, **N.A. Friedenber**g. 2018. Conservation plans for similar species: strategies, methods, and case studies. Electric Power Research Institute, Palo Alto, CA.

- Friedenberg, N.A.** and C. Foley. 2016. Multispecies conservation: policy, practice, and quantitative methods. Electric Power Research Institute, Palo Alto, CA.
- Rollinson, E.J., **Friedenberg, N.A.**, Ferson, S., and Ginzburg, L.R. 2015. Critical habitat: a review of policy, practice, and scientific approaches. Electric Power Research Institute, Palo Alto, CA.
- Friedenberg, N.A.** and C.M. Foley. 2015. Rapid assessment of species conservation status. Electric Power Research Institute, Palo Alto, CA.
- Rollinson, E., S. Ferson, **N.A. Friedenberg**, L.R. Ginzburg, K.T. Shoemaker. 2015. Voluntary conservation plans: approaches to cost-effectively protect multiple candidate species and to avoid listing. Electric Power Research Institute, Palo Alto, CA.
- Friedenberg, N.A.**, K. Shoemaker, and B. Root. 2015. RAMAS<sup>®</sup> IRM version 2.3: Software for risk-based durability assessment. Applied Biomathematics, Setauket, NY.  
[www.ramas.com/IRM](http://www.ramas.com/IRM)
- Friedenberg, N.A.** and K.T. Shoemaker. 2014. Population-level impacts of wind energy development on golden eagles (*Aquila chrysaetos*): a framework for quantitative risk assessment. Electric Power Research Institute, Palo Alto, CA.
- Friedenberg, N.A.** and K.T. Shoemaker. 2013. Golden eagle nesting habitat suitability in the contiguous western United States. Electric Power Research Institute, Palo Alto, CA.
- Friedenberg, N.A.**, J.J. Hoover, K.A. Boysen, and K.J. Killgore. 2013. Water diversions and pallid sturgeon population viability in the lower Mississippi River: uncertainties and priorities for ecological risk assessment. In ERDC Environmental Laboratory, editor. Entrainment Studies of Pallid Sturgeon Associated with Water Diversions in the Lower Mississippi River DRAFT. Army Corps of Engineers, New Orleans, LA.
- Shoemaker, K., J. Ray, **N.A. Friedenberg**. 2012. Assessing population-level risks of wind power development for the Indiana bat (*Myotis sodalis*). Electric Power Research Institute, Palo Alto, CA.
- Friedenberg, N.A.** and K. Shoemaker. 2011. Wildlife risks of wind and solar energy. Electric Power Research Institute, Palo Alto, CA.

#### RECENT CONFERENCE PAPERS

- Martinez, J.C., M.A. Caprio, and **N.A. Friedenberg**. 2017. An ecological perspective on dose. Annual Conference of the Entomological Society of America, Denver, CO.
- Caprio, M.A. and **N.A. Friedenberg**. 2017. Modeling resistance hotspots in western corn rootworm. Monsanto Knowledge Grant Academic Summit. St. Louis, MO.
- Friedenberg, N.A.** 2016. Toward greater genetic complexity in IRM modeling. International Congress of Entomology, Orlando, FL.

- Caprio, M.A. and **N.A. Friedenberg**. Toward understanding western corn rootworm dispersal and its importance to resistance remediation. Monsanto Knowledge Grant Academic Summit. St. Louis, MO.
- Martinez, J.C., M.A. Caprio, and **N.A. Friedenberg**. 2015. Mitigation of hotspot resistance. Annual Conference of the Entomological Society of America, Denver, Minneapolis, MN.
- Friedenberg, N.A.** and K.T. Shoemaker. 2014. Resistance evolution in irregular landscapes. Annual Conference of the Entomological Society of America, Portland, OR.

#### PEER REVIEWED PUBLICATIONS

- Friedenberg, N.A.**, J.J. Hoover, K. Boysen, and K.J. Killgore. 2018. Estimating abundance without recaptures of marked pallid sturgeon in the Mississippi River. *Conservation Biology* *In press*. doi:10.1111/cobi.12972.
- Martinez, J.C., **N.A. Friedenberg**, and M.A. Caprio. 2018. Density dependence and growth rate: evolutionary effects on resistance development to Bt (*Bacillus thuringiensis*). *Journal of Economic Entomology* 111:382-390.
- Monzón, J. and **N.A. Friedenberg**. 2018. Metrics of population status for long-lived territorial birds: a case study of golden eagle demography. *Biological Conservation* 220:280-289.
- Powell, J.A., M.J. Garlick, B.J. Bentz, **N.A. Friedenberg**. 2018. Differential dispersal and the Allee effect create power-law behavior: distribution of spot infestations during mountain pine beetle outbreaks. *Journal of Animal Ecology* 87:73-86.
- Thomas, M.J., M.L. Peterson, **N. Friedenberg**, J.P. Van Eenennaam, J.R. Johnson, J.J. Hoover, A.P. Klimley. 2013. Stranding of spawning run green sturgeon in the Sacramento River: post rescue movements and potential population-level effects. *North American Journal of Fisheries Management* 33(2): 287-297.
- Dennehy, J.J., **N.A. Friedenberg**, R. McBride, R.D. Holt, P.E. Turner. 2010. Experimental evidence that source genetic variation drives pathogen emergence. *Proceedings of the Royal Society of London, Series B* 277: 3113-3121.
- Friedenberg, N.A.**, N. Kouchoukos, S. Sarkar, R.F. Billings, M.P. Ayres. 2008. Temperature extremes and density dependent dynamics of southern pine beetles in east Texas. *Environmental Entomology* 37: 650-659.
- Friedenberg, N.A.**, B.M. Whited, D.H. Slone, S.J. Martinson, M.P. Ayres. 2007. Differential impacts of the southern pine beetle, *Dendroctonus frontalis*, on *Pinus palustris* and *P. taeda*. *Canadian Journal of Forest Science* 37: 1427-1437.
- Friedenberg, N.A.**, J.A. Powell, M.P. Ayres. 2007. Synchrony's double edge: transient dynamics and the Allee effect in stage structured populations. *Ecology Letters* 10: 564-573.

- Dennehy, J.J., **N.A. Friedenberg**, Y. Yang, P.E. Turner. 2007. Viral extinction via ecological traps. *Ecology Letters* 10: 230-340.
- Dennehy, J.J., **N.A. Friedenberg**, Y. Yang, and P.E. Turner. 2006. Bacteriophage migration via nematode vectors: host-parasite-consumer interactions in laboratory microcosms. *Applied Environmental Microbiology* 72: 1974-1979.
- Dennehy, J.J., **N.A. Friedenberg**, R.D. Holt, P.E. Turner. 2006. Viral ecology and the maintenance of novel host use. *American Naturalist* 167(3): 429-439.
- Friedenberg, N.A.** 2003. Determinism in a transient assemblage: the roles of dispersal and local competition. *American Naturalist* 162(5):586-596.
- Friedenberg, N.A.** 2003. Experimental evolution of dispersal in spatiotemporally variable microcosms. *Ecology Letters* 6:937.
- Hampton, S.E., and **N.A. Friedenberg**. 2002. Nocturnal increases in the use of near-surface water by pond animals. *Hydrobiologia* 477:171-179.