ELIZABETH E. CRONE – Department of Biology, Tufts University, 163 Packard Avenue, Medford MA 02115, phone: (406) 531-3498, email: Elizabeth.Crone@tufts.edu

Education:
B.S., *Summa cum laude*, College of William and Mary, 1991 (Biology Department)
Ph.D. Duke University, 1995 (Botany Department & University Program in Genetics)

Employment history:
Associate Professor, Department of Biology, Tufts University, 9/2013 – present
Senior Ecologist, Harvard Forest, Harvard University, Petersham MA (2010-2013)
Associate Professor, Wildlife Biology Program, College of Forestry and Conservation, University of Montana, Missoula MT (2001-2010, promoted to Assoc. Prof. with tenure in 2006)
Fulbright Fellow, Metapopulation Research Group, Department of Biological and Environmental Sciences, University of Helsinki, Finland (2007-2008)
Assistant Professor, Ecology Division, Department of Biological Sciences, University of Calgary, Calgary AB Canada, (1998-2001)
Instructor, Rocky Mountain Biological Laboratory (1997)
Postdoctoral Fellow, Department of Zoology, University of Washington, Seattle WA (1996-1997)
Graduate Fellow, Department of Botany, Duke University, Durham NC (1991-1995)
Research Assistant, Biology Department Herbarium, College of William and Mary, Williamsburg VA (1988-1991)

Fellowships, Honors and Awards:
Vice Chair / Chair, Theoretical Ecology Section, Ecological Society of America, 2010-2012
Fulbright Fellowship, 2007-2008
National Science Foundation (NSF) Postdoctoral Fellowship in Biosciences Related to the Environment (1996-1997)
US Department of Energy Graduate Fellowship for Global Change (1991-1995)
Baldwin Speece Award (College of William and Mary, for scholarship/service in ecology, 1991)

Research program overview *(extended credentials on pages 2-6)*
My research focuses on population ecology, especially of plants and insects, and plant-animal interactions. Specifically, I am interested in how environmental changes translate to changes in population dynamics: For example is there a simple, linear matching of changes in resources to abundance of consumers, or do interactions among individuals and species moderate these responses? Much of my research also involves developing novel quantitative approaches to predict long-term dynamics from small scale observations and experiments. Current projects include studies of butterflies, bees, perennial wildflowers, sugar maples, and acorn-granivore interactions. Past projects include some of the best documented examples of cyclical dynamics in plant populations and spatial metapopulation dynamics in animal populations. I was also one of the first ecologists to adapt generalized linear mixed models to estimate variance terms for stochastic population models.

Teaching program overview *(extended credentials on pages 7-10)*
I am interested in introducing people to general principles of ecological theory, as a guide to interpreting data and understanding the potential implications of environmental change. Making this link requires training students to understand basic biology and natural history, while knowing how to approach problems like a mathematician. I have a strong track record of training graduate students who have gone on to work in quantitative ecology, and in teaching lecture courses that introduce biology students to modeling and statistics. In biology classes, students expect to understand material as it is presented in class, and use time outside class to explore these ideas further, or memorize facts. In math classes, students do <u>not</u> expect to understand the material as it is presented; many of the best math majors come to understand the ideas later by working through problem sets. This difference means that biology students find math classes intimidating and tend to underestimate their own math skills. My approach is to start with tractable problems, and introduce students to the approach of learning by doing problem sets, in the context of ecologically-motivated problems.

Research Activities

Current Research Funding

Endangered butterflies as a model system for managing source-sink dynamics on Department of Defense lands (PI, with co-PIs Nick Haddad, Bill Morris, Cheryl Schultz, Brian Hudgens & Christine Damiani), Strategic Environmental Research and Development Program; March 2011 – February 2016; $2,440,000

How important is "colored" stochasticity for plant population dynamics? (PI) National Science Foundation; September 2010 – August 2014; $510,102

Response of Fender's blue butterfly to large scale habitat restoration in critical habitat (co-PI, with PI Cheryl Schultz), BLM Challenge Cost Share Program; May 2008 – August 2013; $82,000 ($40,000 subcontract to E. Crone, 2008-2013)

Interspecific interactions in changing environments: how do community context and abiotic conditions shape the outcome of plant-granivore association? (co-PI, with PI's R. Zwolak and L. Rychlik), Polish Research Council "Harmonia" grant for international collaboration; 2012- 2015

Population fluctuations: mechanisms, models and management (co-PI, with PI Y. Buckley, and co-PI's S. Blomberg, J. Ehrlen, and G. Wardle), Australian Research Council, 2012- 2014

FSML: Walk-up towers for research, education, communication, and outreach at the Harvard Forest, August 2012 – July 2014, $347,764 (Co-PI, with PI Aaron Ellison and co PI's David Foster, Bill Munger, and Andrew Richardson)

Pending Research Funding:

Effects of pulsed floral resources on pollinator population dynamics (pre-proposal submitted to NSF, January 2013; full proposal submitted August 2013), coPI, with PI Neal Williams

Past Research Funding:

National Center for Ecological Analysis and Synthesis working group ($121,210 9/08-11/10), When are matrix models useful for management? An empirical test across plant populations (PI, with co-PIs E. Menges and M. Ellis)

USFWS, Quantifying Fender's blue dispersal behavior in a wooded landscape to develop a conservation plan, 2008-2010, $196,960 (co-PI, with PI C. Schultz and co-PI E. McIntire)

National Science Foundation (NSF) Population and Evolutionary Processes Program (DEB 05-15756, 9/05 – 8/11, $511,000) – "Mast-seeding in perennial plants: A test of the pollen coupling hypothesis" (PI, with co-PI A. Sala)

(Polish) Ministry of Science and Higher Education Grant: "The influence of rodents on tree demography: how does seed and seedling consumption change the process of forest regeneration?" (01/01/2010-12/31/2012, ~$77,000). Co-PI, with PI R. Zwolak and co-PI L. Rychlik).

NSF Biological Research Collections grant (NSF DBI 04-47391, 02/05-02/09, $334,360) "Montana Flora online: constructing a web-searchable database of the vascular plant collections of the University of Montana Herbarium (MONTU)" (co-PI with PI L. Fishman)

National Science Foundation Long-term Research in Environmental Biology (4/03 – 4/08) – "Synchronous flowering and dormancy in iteroparous perennial plants" (~$80,000)

The Nature Conservancy (01/2007 – 12/2007, $40,000) – "Conservation decision support analysis" (co-PI, with PI L.S. Mills)

McIntire-Stennis Competitive Research Grant (1/04-6/07, $69,909) – "Landscape heterogeneity and invasion dynamics of tansy ragwort in NW Montana" [for Ph.D. student K. Crider]

McIntire-Stennis Competitive Research Grant (4/07-12/08, $19,000) – "Twice the mice: indirect effects of fire on forest dynamics" [for Ph.D. student R. Zwolak]

National Science Foundation Population Biology Research (8/03-8/04) – "Linking life history, behavior, and plant population dynamics" ($40,000)

U.S. Department of Agriculture Managed Ecosystems Program (8/03 – 07/05) – "Distribution of pests in agricultural-natural landscape mosaics: Are restored forests good for farmers?" (~$80,000)

NSF/EPSCoR State Competitive Grant (5/02-12/03) – "Population dynamics of sage grouse: Analysis and synthesis of available data" ($25,000)

National Science Foundation Biocomplexity Incubation Research (9/00-1/02) – "Linking hydrological and biological processes in riparian forest restoration"(co-PI with K. Holl, University of California – Santa Cruz; M. Kondolf, University of California – Berkeley; N. Nur, Point Reyes Bird Observatory) (~$100,000)

Natural Sciences and Engineering Research Council (Canada) operating grant (5/99-12/01) – "Life history, behaviour, and population dynamics in plants and animals" (~$80,000 CAD)

National Center for Ecological Analysis and Synthesis working group (9/99-12/02) – "Incorporating landscape processes in ecological restoration" (with K. Holl and C. Schultz) (~$125,000)

National Sciences and Engineering Research Council (Canada) major equipment grant (5/00) – 10 growth chambers (co-PI with D. Muench and 6 others, University of Calgary) (~$600,000 CAD)

National Science Foundation dissertation improvement grant (1994-96) - "Causes of complex dynamics in Cardamine pensylvanica" (~$10,000)

Minor (< $15,000) grants & contracts from: US Forest Service Rocky Mountain Research Station; Montana Fish, Wildlife and Parks; The Nature Conservancy; World Wildlife Fund (Canada), Calgary Parks and Recreation, University of Calgary, University of Montana, Bureau of Land Management, Bonneville Power Administration, Institute of Applied Ecology

Publications

Peer-reviewed research articles:

Bolker, B. M., B. Gardner, M. Maunder, C. W. Berg, M. Brooks, L. Comita, **E. Crone,** S. Cubaynes, , T. Davies, P. de Valpine, J. Ford, O. Gimenez, M. Kery, E. J. Kim, C. Lennert-Cody, A. Magnusson, S. Martell, J. Nash, A. Nielsen, J. Regetz, H. Skaug, and E. Zipkin, 2013. Strategies for fitting nonlinear ecological models in R, AD Model Builder, and BUGS. *Methods in Ecology and Evolution* 4:501-512.

Breed, G. A., S. Stichter, and **E. E. Crone**. 2013. Climate-driven changes in Northeastern US butterfly communities. *Nature Climate Change* 3:142-145

Crone, E. E. 2013. Responses of social and solitary bees to pulsed floral resources. *American Naturalist* 182:465-473

Crone, E. E. 2013. Desynchronization and re-synchronization of reproduction by *Astragalus scaphoides*, a plant that flowers in alternate years. *Ecological Research* 28:133-142.

Crone, E. E, M. M. Ellis, W. F. Morris, A. Stanley, T. Bell, P. Bierzychudek, J. Ehrlén, T. N. Kaye, T. M. Knight, P. Lesica, G. Oostermeijer, P. F. Quintana-Ascencio, T. Ticktin, T. Valverde, J. L. Williams, D. F. Doak, R. Ganesan, K. McEachern, A. S. Thorpe, and E. S. Menges 2013 Ability of matrix models to explain the past and predict the future of plant populations. *Conservation Biology* (in press)

Ellis, M. M. and **E. E. Crone** 2013. The role of transient dynamics in stochastic population growth of nine perennial plant species. *Ecology* (in press)

Molofsky, J., C. M. Danforth, and **E. E. Crone** 2013. Nutrient enrichment alters dynamics in experimental plant populations. *Population Ecology* (in press)

Rapp, J. M., E. J. B. McIntire, and **E. E. Crone** 2013. Sex allocation, pollen limitation, and masting in whitebark pine. *Journal of Ecology* 101:1345-1352

Tuomi, J., **E. E. Crone**, J. R. Gremer, A. Jäkäläniemi, P. Lesica, B. Pedersen, and S. Ramula. 2013. Prolonged dormancy interacts with senescence for two perennial herbs. *Journal of Ecology* 101:566-576.

Ellis, M. M., J. L. Williams, P. Lesica, T. J. Bell, P. Bierzychudek, M. Bowles, **E. E. Crone**, D. F. Doak, J. Ehrlén, A. Ellis-Adam, K. McEachern, R. Ganesan, P. Latham, S. Luijten, T. N. Kaye, T. M. Knight, E. S. Menges, W. F. Morris, H. den Nijs, G. Oostermeijer, P. F. Quintana-Ascencio, J. Stephen Shelly, A. Stanley, A. Thorpe, T. Ticktin, T. Valverde, C. Weekley. 2012. Data Paper: Matrix population models from 20 studies of perennial plant populations. *Ecology* 93:951

Gremer, J.R., **E. E. Crone**, and P. Lesica. 2012. Are dormant plants hedging their bets? Demographic consequences of prolonged dormancy in variable environments. *American Naturalist* 179:315-327

McCaffery, R., A. Solonen, and **E. E. Crone** 2012. Frog population viability under present and future climate conditions: a Bayesian state-space approach. *Journal of Animal Ecology* 81:978-985

Nowak, J and **E. E. Crone**. 2012. It is good to be eaten by a bear: Effects of ingestion on seed germination. *American Midland Naturalist* 167:205-209

Sala, A., K. Hopping, E. J. B. McIntire, S. Delzon and **E. E. Crone** 2012 Masting in whitebark pine (*Pinus albicaulis*) depletes stored resources. *New Phytologist* 196:189-199

Schultz, C. B., A. M. A. Franco, and **E. E. Crone**. 2012. Response of butterflies to structural and resource boundaries. *Journal of Animal Ecology* 81:724-34.

Zwolak, R. and **E. E. Crone**. 2012. Quanitfying the outcome of plant-granivore interactions. *Oikos* 121:20-27.

Zwolak, R., D. E. Pearson, Y.K. Ortega, and **E. E. Crone**. 2012. Mechanisms driving post-fire increase of a generalist mammal. *Canadian Journal of Zoology* 90:51-60

Crone, E. E., E. J. B. McIntire, and J. Brodie. 2011. What defines mast seeding? Spatio-temporal patterns of cone production by whitebark pine. *Journal of Ecology* 99:438-444

Crone, E. E., E. S. Menges, M. M. Ellis, T. Bell, P. Bierzychudek, J. Ehrlén, T. N. Kaye, T. M. Knight, P. Lesica, W. F. Morris, G. Oostermeijer, P. F. Quintana-Ascensio, A. Stanley, T. Ticktin, T. Valverde, and J. L. Williams. 2011. How do plant ecologists use matrix population models? *Ecology Letters* 14:1-8.

Hodgson, J. A., C. D. Thomas, T. H. Oliver, B. J. Anderson, T. M. Brereton, and **E. E. Crone.** 2011. Predicting insect phenology across space and time. *Global Change Biology* 17:1289-1300.

Jäkäläniemi, A., **E. E. Crone**, P. Närhi, and J. Tuomi. 2011. Orchids do not pay costs at emergence for prolonged dormancy. *Ecology* 92:1538-1543.

Buckley,Y. M., S. Ramula, S. P. Blomberg, J. H. Burns, **E. E. Crone**, J. Ehrlén, T. M. Knight, J.B. Pichancourt, H. Quested and G. M. Ward1e. 2010. Causes and consequences of variation in plantpopulation growth rate: a synthesis of matrix population models in a phylogenetic context. *Ecology Letters* 13:1182-1197.

Burns, J. H., S. P. Blomberg, **E. E. Crone**, J. Ehrlén, T. M. Knight, J. B. Pinchancourt, S. Ramula, G. M. Wardle, and Y. M. Buckley. 2010. Evidence consistent with life history tradeoffs in a phylogenetic analysis of terrestrial plant demography. Journal of Ecology 98: 334-344.

Gremer, J. R., A. Sala, and **E. E. Crone**. 2010. Disappearing plants: why they hide and how they return. *Ecology* 91:3407-3413.

Ranta, E., J. Lindström, V. Kaitala, **E. Crone**, P. Lundberg, T. Hokkanen, and E. Kubin, E. 2010. Life-history mediated responses to weather, phenology and large-scale population patterns. A contributed chapter to: *Phenology* (eds., Hudson, I., Keatley, M.), Springer Verlag.

Williams, N. M., **E. E. Crone**, T. H. Roulston, R. L. Minckley, L. Packer, and S. G. Potts 2010. Ecological and life history traits predict bee species responses to environmental disturbances. *Biological Conservation* 143:2280-2291

Zwolak, R., D. E. Pearson, Y.K. Ortega, and **E. E. Crone**. 2010. Fire and mice: Seed predation moderates fire's influence on conifer recruitment. *Ecology* 91: 1124-1131.

Crone, E. E., E. Miller, and A. Sala. 2009. How do plants know when other plants are flowering? Resource depletion, pollen limitation, and mast-seeding in a perennial wildflower. *Ecology Letters* 12:1119-1126.

Crone, E. E., M. Marler, and D. Pearson. 2009. Non-target effects of broadleaf herbicide on a native perennial forb: A demographic framework for assessing and minimizing impacts *Journal of Applied Ecology* 46:673-682.

Ovaskainen, O. and **E. E. Crone**. Modeling animal movement with diffusion. 2009. Contributed chapter to: Spatial Ecology (eds. S. Cantrell, C. Cosner, S. Ruan) Chapman and Hall/CRC Press.

Crone, E. E. and C. B. Schultz. 2008. Old models explain new observations of butterfly movement at patch edges. *Ecology* 89: 2061-2067.

Buckley, M. and **E. E. Crone**, 2008. Negative offsite impacts of ecological restoration: Understanding and addressing the conflict. *Conservation Biology* 22:118-124.

Schultz, C. B. and E. E. **Crone**. 2008. Using ecological theory to advance butterfly conservation. *Israel Journal of Ecology and Evolution* 54: 63 - 68

Kremen, C., N. M. Williams, M. A. Aizen, B. Gemmill-Herrenn, G. LeBuhn, R. Minckley, L. Packer, S. G. Potts, T. Roulston, I. Steffan-Dewenter, D. P. Vázquez, R. Winfree, L. Adams, **E. E. Crone**, S. S. Greenleaf, T. H. Keitt, A. M. Klein, J. Regetz, and T. H. Ricketts. 2007. Pollination and other ecosystem services produced by mobile organisms: a conceptual framework for the effects of land-use change. *Ecology Letters* 10:299-314

Crone, E. E., D. Pickering and C. B. Schultz. 2007. Can captive rearing promote recovery of endangered butterflies? An assessment in the face of uncertainty. *Biological Conservation* 139:103-112

Lesica, P. and **E. E. Crone**. 2007. Causes and consequences of prolonged dormancy for an iteroparous geophyte, *Silene spaldingii*. *Journal of Ecology* 95: 1360 – 1369.

McIntire, E. J., C. B. Schultz, and **E. E. Crone**. 2007. Designing a network for butterfly habitat restoration: where individuals, populations and landscapes interact. *Journal of Applied Ecology* 44: 725-736.

Williams, J. L. and **E. E. Crone**. 2007. The impact of invasive grasses on the population growth of *Anemone patens*, a long-lived native forb. *Ecology* 87:3200-3208.

Crone, E. E. and P. Lesica. 2006. Pollen and water limitation in *Astragalus scaphoides*, a plant that flowers in alternate years. *Oecologia* 150:40-49.

Maron, J. L. and **E. E. Crone**. 2006. Herbivory: effects on plant abundance, distribution and population growth. *Proceedings of the Royal Society B* 273:2575-2584

Lesica, P., R. Yurkewycz and **E. E. Crone**. 2006. Rare plants are common where you find them. *American Journal of Botany* 93:454-459.

Crone, E. E., L. Polansky and P. Lesica. 2005. Empirical models of pollen limitation, resource acquisition, and mast seeding by a bee-pollinated wildflower. *American Naturalist* 166:396-408.

Moffatt, K. C., **E. E. Crone**, K. D. Holl, R. W. Schlorff, and B. A. Garrison. 2005. Comparing strategies to restore *Riparia riparia* (Bank Swallow) colonies along the Sacramento River, California. *Restoration Ecology* 3:391-402.

Schultz, C. B. and **E. E. Crone**. 2005. Patch size and connectivity thresholds for butterfly habitat restoration. *Conservation Biology* 19:887-896

Crone, E. E. and P. Lesica, 2004. Causes of synchronous flowering in *Astragalus scaphoides*, an iteroparous perennial plant. *Ecology* 85:1944-1954.

Holl, K. D. and **E. E. Crone**. 2004. Applicability of landscape and island biogeography theory to restoration of riparian understorey plants. *Journal of Applied Ecology* 41:922-933

Irvine, R. L., **E. E. Crone**, L. J. Jackson, and E. A. MacIsaac, 2004. Does scale affect ecological model predictions? A test with lake responses to fertilization. *Ecological Applications* 14:1178-1188.

Winfree,R., J. Dushoff, **E. E. Crone**, C. B. Schultz, R. V. Budny, N. M. Williams and C. Kremen. 2004. Testing simple indices of habitat proximity. *American Naturalist* 165: 707-717.

Crone, E. E. and C. B. Schultz. 2003. Minimum patch size for butterfly population persistence. in: C. Boggs, W. Watt, and P. Ehrlich (eds) Ecology and Evolution Taking Flight: Butterflies as Model Study Systems. University of Chicago Press.

Holl, K. D., **E. E. Crone** and C. B. Schultz. 2003. Landscape restoration: Moving from generalities to methodologies. *BioScience* 53:491-502.

LaMontagne, J., R. L. Irvine and **E. E. Crone**. 2002. Spatial patterns of population regulation in sage grouse (*Centrocercus* spp.) population viability analysis. *Journal of Animal Ecology* 71:672-682.

Crone, E. E. 2001. Is survivorship a better fitness surrogate than fecundity? *Evolution* 55:2611-2614.

Crone, E. E., D. Doak and J. Pokki. 2001. Ecological influences on the dynamics of a field vole metapopulation. *Ecology* 82:831-843.

Schultz, C. B. and **E. E. Crone**. 2001. Edge-mediated dispersal behavior in a prairie butterfly. *Ecology* 82:1879-1892.

Harding, E. K., **E. E. Crone**, B. D. Elderd, J. Hoekstra, A. J. McKerrow, J. D. Perrine, L. J. Rissler, A.G. Stanley, E. L. Walters and NCEAS HCP Working Group. 2001. Use of Science in Habitat Conservation Plans. *Conservation Biology* 15:488-500.

Molofsky, J., J. Lanza, and **E. E. Crone**. 2000. Effects of plant litter feedback on density dependent population dynamics. *Oecologia* 124:522-528.

Crone, E. E., and C. G. Jones. 1999. The dynamics of carbon-nutrient balance: effects of cottonwood acclimation to short- and long-term shade on beetle feeding preference. *Journal of Chemical Ecology* 25:636-656.

Crone, E. E. and J. L. Gehring. 1998. Population viability of *Rorippa columbiae*: multiple models for spatial trend data. *Conservation Biology* 12:1054-1055.

Crone, E. E. and J. Molofsky. 1998. Message in a bottle? Utility and limitations of recent ecological "bottle experiments". *Integrative Biology* 1:209-214.

Schultz, C. B. and **E. E. Crone**. 1998. Fire to restore butterfly habitat? A modeling approach to management tradeoffs for the Fender's blue. *Restoration Ecology* 6:244-252.

Crone, E. E., 1997. Delayed density dependence and the stability of interacting populations and subpopulations. *Theoretical Population Biology* 51:67-76.

Crone, E. E. 1997. Parental environmental effects and cyclical dynamics in plant populations. *The American Naturalist* 150: 708-729.

Crone, E. E., and D. R. Taylor. 1996. Complex dynamics in experimental populations of an annual plant, *Cardamine pensylvanica*. *Ecology* 77:289-299

Other professional writing articles (Notes, Reviews, etc):

Buckley, M. and **E.E. Crone**. 2009. Leading by Example (response to Golet et al.) *Conservation Biology* 23:1638.

Jones, A., and **E. E. Crone**. 2009 Effect of disturbance history on *Hieracium aurantiacum* (orange hawkweed) invasion. *Ecological Restoration* 27:139-141

Callaway, R. M., A. Sala, **E. Crone**, and J. Maron. 2003. Plant ecology textbooks: a new contender (Book Review) *American Journal of Botany* 90: 960-964.

Golet, G.H., D.L. Brown, **E.E. Crone**, G.R. Geupel, S.E. Greco, K.D. Holl, K.A. Hoover, D.E. Jukkola, G.M. Kondolf, E.W. Larsen, F.K. Ligon, R.A. Luster, M.P. Marchetti, N. Nur, B.K. Orr, D.R. Peterson, M.E. Power, W.E. Rainey, M.D. Roberts, J.G. Silveira, S.L. Small, J.C. Vick, D.S. Wilson, and D.M. Wood. 2003. Using science to evaluate restoration efforts and ecosystem health on the Sacramento River Project, California. In PM Faber (editor), Proceedings of the Riparian Habitat and Floodplains Conference, March 12-25, 2001, Sacramento, CA. University of California Press.

Crone, E. E. 2000. Restoration Ecology. *McGraw-Hill 2000 Yearbook of Science and Technology*. McGraw-Hill, Inc., New York, NY USA.

Nelson, W. A. and **E. E. Crone**, 1999. Genetics and Analysis of Quantitative Traits (book review). *Quarterly Review of Biology* 74:225.

Buck. W. R., R. C. Harris, A. J. Shaw, M. D. Piercey-Normore, A. Tabaee, J. Antonovics and **E. E. Crone**. 1998. Unusual lichens under electricity pylons on zinc-enriched soil. *The Bryologist* 102: 130-132

Workshop and scientific panel participation

2012, 2008, 2006: panelist, NSF Population and Community Ecology program (previously Population and Evolutionary Processes)

2011: NCEAS "Nonlinear modeling" working group (led by Ben Bolker and Mark Mauder)

2010: panelist, panel discussion on oil sands restoration: Cumulative Environmental Management Association, Edmonton AB Canada

2008-2010: Australian Research Council Vegetative Function Network, "Comparative Plant Life Histories" (led by Yvonne Buckley)

2008-2010: UK PopNet working group on butterfly species distributions and climate change (led by Barb Anderson and Chris Thomas)

2005: NSF/USDA joint conference on invasive species research

2005-2007: NCEAS "Restoring Pollination Services" working group (led by Claire Kremen & Neal Williams)

2005: University of Melbourne / ARC Centre of Excellence for Mathematics and Statistics of Complex Systems (MASCOS), "Decision making for complex problems in conservation" working group (led by Mark Burgman and Hugh Possingham).

2005: Workshop on Spatial Ecology: The Interplay between Theory and Data, University of Miami

2004, 2005: panelist, USDA Managed Ecosystems program

Education & Outreach Activities

Undergraduate and Graduate Courses:

University of Montana (2002-2010):

WBIO/BIO 240: *Introduction to Biostatistics* – Basic principles of probability, classical statistics, and some problems unique to wildlife/ecology, such interpreting results with low statistical power. Students wrote proposals for monitoring programs with a limited budget, and peer-reviewed them in the form of a grant panel.

WBIO 470: *Conservation of Wildlife Populations* – Wildlife population ecology courses have a strong emphasis on quantitative tools. This course included techniques for parameterizing, working with, and interpreting ecological models, as well as principles of population ecology. It also included an introduction to decision analysis, an emerging field in wildlife biology.

WBIO 572: *Model Selection & Inference* – Introduction to likelihood-based statistics, including extensions such as AIC and Bayesian approaches. Generalized linear models and finite mixture /mixed/hierarchical models, in a likelihood context. Model selection writ large in the sense of evaluating different ecological hypotheses with data, as well as the specific case of multiple regression problems.

WBIO 580: *Topics in Population Ecology* – Weekly discussion group, at times focused on general topics and students' research, but at times focused on particular issues, including working with animal movement data, and the role of ecological theory in restoration ecology.

University of Calgary courses (1998-2001):

BIOL 451: *Conservation Biology* – Large (75-100 students) lecture course covering applied population ecology, conservation genetics, and community/ecosystem/economic issues related to conservation.

ECOL 439: *Population Ecology* – Principles of population dynamics, including species interactions, and spatially structured populations. Students worked together on a semester-long experiment, using a model system (e.g., *Daphnia*) to observe and interpret dynamics over multiple generations. Co-taught with Ed McCauley

ECOL 677: *Advanced Population Ecology* – Small discussion group for graduate students. Topics rotated, and included dynamic programming and time series analysis

Rocky Mountain Biological Laboratory (1997): *Applied Ecology and Conservation Biology*

Doctoral students (with current positions)

Robyn Irvine (Ph.D. 2004) *Detecting ecosystem level disturbances*, co-founder/owner Poisson Consulting, Ltd. (http://poissonconsulting.ca/)

Rafał Zwolak (Ph.D. 2008) *Causes and consequences of the postfire increase in deer mouse (Peromyscus maniculatus) abundance*, Assistant Professor, Adam Mickiewiscz University

Kimberly Crider (Ph.D. 2009) *Biological control: Effects of Tyria jacobaeae on the population dynamics of Senecio jacobaea in northwest Montana*, Resource Manager, Klamath National Forest

Rebecca McCaffery (Ph.D. 2010) *Population dynamics of the Columbia spotted frog (Rana luteiventris): Inference from long-term demography*, stay-at-home mother, part-time consultant for The Nature Conservancy and Bureau of Land Management (population viability of rare species)

Jennifer Gremer (Ph.D., 2010) *Causes and consequences of prolonged dormancy: Why stay below ground?*, postdoctoral researcher, University of Arizona

Julie Beston (Ph.D., 2010) *Are black bears declining in Montana? Inference from multiple data sources in the face of uncertainty*, postdoctoral researcher, University of Delaware

Martha Ellis (Ph.D. defense passed 3/12/2013) *Transient dynamics in plant population models*, Wildlife Biometrician for the State of Alaska starting May 2013

External examiner/opponent for Ph.D. dissertations at the University of Alberta (2007), University of Oslo (2009), and University of Queensland (2009), University of Bergen (2012)

Past committee member for ~25 graduate students in four programs at the University of Montana (Wildlife Biology, Organismal Biology and Ecology, Forestry, and Mathematics). I currently serve on Ph.D. committees at the University of Montana, Harvard University, University of Massachusetts, University of Pittsburgh, and Rutgers University

Postdoctoral Scholars (with current positions)

Eliot McIntire, 2004-2006, Research Scientist, Canadian Forest Service
Mark Buckley, 2005-2006, Senior Economist, ECONorthwest
Jennifer Williams, 2008, Assistant Professor, University of British Columbia
Jedediah Brodie, 2009-2010, Assistant Professor, University of British Columbia
Greg Breed, 2011-2012, Banting Fellow, University of Alberta
Rui Zhang, 2011-2012, stay-at-home mother (looking for work in the San Francisco Bay area)
Norah Warchola, 2011-present
Joshua Rapp, 2011-present
Leone Brown, 2013-present

M.S. students

Norah Saona, M.S. 2002, Foraging ecology of *Rhinanthus minor* (a hemiparasitic plant)
Kerry Moffatt, M.Sc. 2003, Metapopulation dynamics of bank swallows
Tonya Chilton, M.Sc., 2006, Spatial and Temporal Relationships of Adult Male Black Bears to Roads in Northwest Montana

Undergraduate Honors thesis students:

Josh Nowak, B.S. (Wildlife Biology, University of Montana), 2007
Alexis Jones, B.S. (Botany, University of Montana), 2007
Brian Laub, B.S. (Wildlife Biology, University of Montana), 2004
Karilynn Sweet, B.Sc. (Ecology, University of Calgary), 2001
Claire Solohub, B.Sc. (Ecology, University of Calgary), 2001
Janet Summerscales, B.Sc. (Ecology, University of Calgary), 2000
Hajnalka Pinter, B.Sc. (Ecology, University of Calgary), 1999
Sheri Bouchard, B.Sc. (Ecology, University of Calgary), 1999

REU students (if not mentioned as honors students, above):

Lydia Molina (Education, Northwestern University), 2003
Felix Nez (Biology, Salish-Kootenay College), 2003
Ray Yurkewiscz (Wildlife Biology, University of Montana), 2004
Glendaly Torres (Environmental Studies, University of Puerto Rico), 2005
Elizabeth Miller (Mathematics, Carleton College), 2006
Desiree Oyola (Biology, University of Puerto Rico), 2010
Dash Donnelly (Wildlife Biology, Montana State University), 2011
Aubrie James (Ecology, University of Iowa), 2012 (with postdoc Greg Breed)
Casey Mangnall (English, Oregon State University, 2012 (with postdoc Josh Rapp)
Kelsey McKenna (Physics, Harvard University), 2012 (with Ph.D. student James Crall)

Training workshops:

2011-ongoing: Mixed Models in Ecology - Ecological statistics are changing rapidly, and there are few opportunities for mid-career ecologists to stay current. I run a one-week workshop at Harvard Forest which is targeted at mid-career faculty from undergraduate-oriented institutions and biologists from conservation and management agencies. Each workshop to date was attended by ~12-15 participants, about half of whom were faculty and half Ph.D. students or postdocs. See (http://harvardforest.fas.harvard.edu/news/2nd-annual-mixed-models-workshop).

2009-2011: National Center for Ecological Analysis and Synthesis, leader of "Testing matrix models" working group (with co-leaders Eric Menges & Martha Ellis) – About half of the participants in this workshop were employed by conservation NGO's or undergraduate-oriented universities. In addition to writing scientific papers, we used the workshop as an opportunity to train all participants to analyze their own data in R, and to introduce them to statistical approaches for analyzing demographic data (such as integral projection models based on generalized linear mixed models).

1999-2001: National Center for Ecological Analysis and Synthesis, co-leader of "Landscape Restoration" working group (with leader Karen Holl)

Representative synergistic activities:

- I collaborate regularly with resource managers and agency biologists. Past activities include serving as an advisor to the Oregon silverspot and Northwest Prairie Endangered Species Recovery Teams, and working with the City of Missoula and Montana State Co-Op unit. Current activities include working with the Massachusetts State Co-op Unit, the Finnish Forest and Parks Service, and with resource managers at Ft. Lewis, Ft. Bragg, and USACE lands in western Oregon. These activities typically involve working with field biologists to develop population models to evaluate recovery goals or restoration plans.
- I give about one invited lecture per month, including a mixture of academic seminars and public lectures. Of these, the most notable are an annual public lecture about theoretical ecology as part of the Cambridge Science Festival (http://news.harvard.edu/gazette/story/2012/04/sharing-a-passion-for-science/) and an outreach video about butterfly conservation, produced by Roberto Mighty, 2011-2012 artist-in residence at Harvard Forest (http://harvardforest.fas.harvard.edu/videos/video-butterfly-habitat-massachusetts). As part of my Fulbright fellowship (2007-2008), I kept a blog about science and culture in Finland (http://croneinhelsinki.blogspot.com/)
- In 2010, I initiated a collaboration with a citizen scientist group, the Massachusetts Butterfly Club. Working with citizen scientists is an important way to obtain spatially and temporally extensive data sets in a short amount of time. Because these data have various constraints, however, it is an especially interesting area for outreach by quantitative ecologists; the challenge to us is to adapt models to the data volunteers want to collect, rather than expecting volunteers to behave like professional researchers.
- ~80% of the doctoral and postdoctoral researchers in my group have been women, which is especially high for mathematically-oriented sciences. Most of these scholars are well-trained in ecology and come to my group for training in quantitative sciences. I do not go out of my way to recruit women, but I do believe that, especially in mathematics and statistics, it is important to have more women with quantitative skills, to serve as mentors and role models for other women.

Selected university, professional and community service:

Vice Chair / Chair, Theoretical Ecology Section, Ecological Society of America, 2010-2012: The Vice Chair (incoming chair) and Chair of the Theoretical Ecology section are responsible for running three annual competitions, including selecting the best student oral and poster presentations at the ESA annual meeting, and one for an outstanding paper in theoretical ecology, published by a researcher at any level. We also organize the annual section meeting and participate in society-wide activities as appropriate.

Associate editor, Ecology, September 2008-ongoing

Board of Directors, Friends of the University of Montana Herbarium, 2007-2010. The University of Montana does not employ a plant systematist. This is a group composed primarily of botanists from agencies and NGOs who oversee the herbarium operations and track herbarium use to encourage the university to maintain this facility.

Consultant for the USFWS Recovery Plan for Prairie Species of Western Oregon and Southwest Washington (2006-ongoing) and the Oregon Silverspot Butterfly Recovery Team (2004).

Ecology seminar series coordinator, 2002-2007, University of Montana (jointly sponsored by the graduate programs in Fish & Wildlife Biology and Organismal Biology & Ecology)

Chair, Wildlife Biology Graduate Committee, 2004-2005, University of Montana

Coordinated Forestry Greenhouse renovations, 2002-2004

Contributor, 2002-2004, Montana Native Plant Society "Wildflower of the Week" column in *The Missoulian*

Other University of Montana commities: College of Forestry Research committee (2004-2005,2006-2007, 2009-2010), committee to explore Computational Sciences Ph.D. Program, 2006-2007, Wildlife Biology Program Graduate Committee (2003-2004), College of Forestry Scholarship committee (2003-2004), search committees: Soils (Chair, College of Forestry, 2006-2007), Restoration Ecology (College of Forestry, 2005-2006), Wildlife Disease (Wildlife Biology Program/Organismal Biology & Ecology, 2002-2003), Forest Operations (College of Forestry, 2001-2002), Plant Evolutionary Genetics (Organismal Biology & Ecology, 2001-2002); NSF EPSCoR Summer Diversity Program Advisory Committee (2003-2005); NSF EPSCoR State Competitive Grant Panel (2003)

Alberta Prairie Research Committee, 1999-2001. This was a committee organized by the provincial government to review research and restoration priorities in light of ongoing oil and gas development.

University of Calgary service: advisory committee for the Alberta high school mathematics curriculum (2001), Biology Department greenhouse management committee (1998-2001), Ecology Division graduate student seminar organizer (1998-2001), Ecology Division undergraduate open house organizer (1999-2000), Ecology Division fall retreat co-organizer (1999).

IUCN Northern Rockies Grizzly Bear PHVA, 1999 (statistical advising)