

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:

Professor, Department of Biology, Tufts University, 9/2013 – present (hired as an Assoc. Prof with tenure; promoted to Professor in 2016)
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)
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 Herbarium, College of William and Mary, Williamsburg VA (1988-91)

Fellowships, Honors and Awards:

Project of the Year Award, SERDP Resource Conservation Program, 2018
Foreign Member, Finnish Academy of Science and Letters (elected 2017)
Vice Chair / Chair, Theoretical Ecology Section, Ecological Society of America, 2010-2012
Ecological Research Award, Ecological Society of Japan 2014
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 2-9*)

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 11-16*)

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 not 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

- Western monarch breeding phenology (coPI, with PI Cheryl Schultz and coPI Sarina Jepsen), DOD Legacy Program, May 2017 – June 2020, ~ \$125,000 to Tufts (~\$40K/year, with potential for annual renewal).
- RAPID: Population viability below the quasi-extinction threshold (PI, with coPI's Cheryl Schultz, Sarina Jepsen and Marm Kilpatrick), National Science Foundation, February 2019-February 2020, \$194,867
- Will climate-mediated phenological shifts affect population viability? A test with butterflies on Department of Defense lands (PI, with co-PIs Cheryl Schultz, Diane Debinksi, and Sonia Altizer) Strategic Environmental Research and Development Program; May 2017-February 2022, \$2,136,946
- Effects of pulsed floral resources on pollinator population dynamics (coPI, with PI Neal Williams), National Science Foundation, August 2014 – December 2018, \$668,768 award (\$231,522 to Tufts)

Past Research Funding:

- Threats Analysis for Western Monarch butterflies (coPI, with PI Cheryl Schultz), US Fish and Wildlife Service, 2017-18, ~\$18,000 to Tufts
- Population Viability Analysis of Western Monarchs (coPI, with PI Cheryl Schutz and coPI Leone Brown), US Fish and Wildlife Service, December 2016 – November 2017, \$18,825 to Tufts
- 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 2017; \$2,440,000
- Support for Species Recently Listed under the Endangered Species Act (coPI, with PI Cara Nelson), Center for Integrated Research on the Environment (USACE), February 2016-September 2017, ~\$97,800 to Tufts
- 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)
- 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)
- Natural 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:

- Bogdziewicz, M., **Crone, E.E.** and Zwolak, R., 2020. Do benefits of seed dispersal and caching by scatterhoarders outweigh the costs of predation? An example with oaks and yellow-necked mice. *Journal of Ecology* (in press)
- Kerr, N.Z., Wepprich, T., Grevstad, F.S., Dopman, E.B., Chew, F.S. and **Crone, E.E.**, 2020. Developmental trap or demographic bonanza? Opposing consequences of earlier phenology in a changing climate for a multivoltine butterfly. *Global Change Biology* 26:2014-2027 (DOI: 10.1111/gcb.14959).
- Kerr, N.Z., **E. E. Crone**, and F.S. Chew. 2020. Life history trade-offs are more pronounced for a non-invasive, native butterfly compared to its invasive, exotic congener, *Population Ecology* 62:119-133
- Ramula S., N.Z. Kerr, **E.E. Crone**. 2020. Using statistics to design and estimate vital rates in matrix population models for a perennial herb. *Population Ecology* 62:53-63.
- Smith, A.L, T.R. Hodkinson, J. Vilellas, J.A. Catford, A.M. Csergő, S.P. Blomberg, **E.E. Crone**, J. Ehrlén, M.B. Garcia, A.L. Laine, D.A. Roach, R. Salguero-Gómez, G.M. Wardle, D.Z. Childs, B.D. Elderd, A. Finn, S. Munné-Bosch, M.E.A. Baudraz, J. Bódis, F.Q. Brearley, A. Bucharova, C.M. Caruso, R.P. Duncan, J.M. Dwyer, B. Gooden, R. Groenteman, L.N. Hamre, A. Helm, R.

- Kelly, L. Laanisto, M. Lonati, J.L. Moore, M. Morales, S.L. Olsen, M. Pärtel, W.K. Petry, S. Ramula, P.U. Rasmussen, S.R. Enri, A. Roeder, C. Roscher, M. Saastamoinen, A.J.M. Tack, J.P. Töpper, G.E. Vose, E.M. Wandrag, A. Wingler, Y.M. Buckley. 2020. Global gene flow releases invasive plants from environmental constraints on genetic diversity. *Proceedings of the National Academy of Sciences* 117:4218-4227; DOI: 10.1073/pnas.1915848117
- Bogdziewicz, M., M. Żywic, J.M. Espelta, M. Fernández- Martinez, R. Calama, M. Ledwoń, E. McIntire, and **E. E. Crone**. 2019. Environmental veto synchronizes mast seeding in four contrasting tree species. *American Naturalist* 194:246-259
- Crone, E.E.**, L. M. Brown, J. A. Hodgson, F. Lutscher, C. B. Schultz, 2019. Faster movement in non-habitat matrix promotes range shifts in heterogeneous landscapes. *Ecology*: e02701
- Crone, E. E.**, E. M. Pelton, L. M. Brown, C. C. Thomas and C. B. Schultz. 2019. Why are monarch butterflies declining in the West? Understanding the importance of multiple correlated drivers. *Ecological Applications*: e0175
- Iles, D. T., G. Pugsek, N. Z. Kerr, N. N. Dorian and **E. E. Crone**. 2019. Accounting for imperfect detection in species with sessile life cycle stages: a case study of bumble bee nests, *Journal of Insect Conservation* 23:945-55
- Malfi, R. L., **E. E. Crone** and N. M. Williams. 2019. Demographic benefits of early-season resources for bumble bee (*Bombus vosnesenskii*) colonies. *Oecologia* 191:377-88.
- Pelton, E. M., C. B. Schultz, S. J. Jepsen, S. H. Black and **E. E. Crone**. 2019. Western monarch population plummets: Status, probable causes, and recommended conservation actions. *Frontiers in Ecology and Evolution* 7:258
- Schultz, C.B., Haddad, N.M., Henry, E.H., **Crone, E.E.** 2019. Movement and Demography of At-Risk Butterflies: Building Blocks for Conservation. *Annual Review of Entomology* 64:167-184.
- Wrobel, A., **E. E. Crone**, and R. Zwolak. 2019. Differential impacts of soil microbes on native and co-occurring invasive tree species. *Ecosphere* 10:e02802.
- Bogdziewicz, M., Steele, M.A., Marino, S. and **Crone, E.E.**, 2018. Correlated seed failure as an environmental veto to synchronize reproduction of masting plants. *New Phytologist*, 219(1), pp.98-108.
- Himes Boor G.K., Schultz C.B., **Crone E.E.**, Morris W.F. 2018. Mechanism matters: the cause of fluctuations in boom-bust populations governs optimal habitat restoration strategy. *Ecological Applications* 28: 356-372.
- Iles, D.T., Williams, N.M. and **Crone, E.E.**, 2018. Source-sink dynamics of bumble bees in rapidly changing landscapes. *J. Appl. Ecol.* 55:2802-2811 DOI: 10.1111/1365-2664.13175
- Tenhumberg, B., **E. E. Crone**, S. Ramula, and A. J. Tyre, A.J., 2018. Time-lagged effects of weather on plant demography: drought and *Astragalus scaphoides*. *Ecology*, 99:915-925
- Warchola, N., Crone, E.E. and Schultz, C.B., 2018. Balancing ecological costs and benefits of fire for population viability of disturbance-dependent butterflies. *Journal of Applied Ecology* 55:800-809.
- Gremer, J., S. Ramula, B. Pedersen, **E. E. Crone**, P. Lesica, A. Jäkäläniemi and J. Tuomi. 2017 Complex life histories and senescence in plants: Avenues to escape age-related decline? Contributed chapter to: *The Evolution of Senescence in the Tree of Life* (eds. R. Salguero-Gomez, R. Shefferson & O. Jones)
- Bogdziewicz, M., **E. E. Crone**, M. A. Steele, and R. Zwolak. 2017. Effects of nitrogen deposition on reproduction in a masting tree: benefits of higher seed production are trumped by negative biotic interactions. *Journal of Ecology* 105:310-320
- Brown, L. M., G. A. Breed, P. M. Severns, and **E. E. Crone**. 2017 Losing a battle but winning the war: moving past preference–performance to understand native herbivore–novel host plant interactions. *Oecologia* 183:441-453
- Brown, L.M., Fuda, R.K., Schtickzelle, N., Coffman, H., Jost, A., Kazberouk, A., Kemper, E., Sass, E. and **Crone, E.E.**, 2017. Using animal movement behavior to categorize land cover and predict consequences for connectivity and patch residence times. *Landscape Ecology*, 32: 1657-1670.
- Lesica, P., and **E. E. Crone**. 2017 Arctic and boreal plant species decline at their southern range limits in the Rocky Mountains. *Ecology Letters* 20:166-174

- Schultz, C.B., Brown, L.M., Pelton, E. and **Crone, E.E.**, 2017. Citizen science monitoring demonstrates dramatic declines of monarch butterflies in western North America. *Biological Conservation* 214: 343-346.
- Schultz, C. B., B. G. Pe'er, C. Damiani, L. Brown, and **E. E. Crone**. 2017. Does movement behaviour predict population densities? A test with 25 butterfly species. *Journal of Animal Ecology* 86:384-393.
- Bogdziewicz, M., R. Zwolak, L. Redosh, L. Rychlik, and **E. E. Crone**. 2016. Negative effects of density on space use of small mammals differ with the phase of the masting-induced population cycle. *Ecology and Evolution* 6: 8423-8430.
- Brown, L. M., and **E. E. Crone**. 2016. Minimum area requirements for an at-risk butterfly based on movement and demography. *Conservation Biology* 30: 103-112.
- Brown, L. M., and **E. E. Crone**. 2016. Individual variation changes dispersal distance and area requirements of a checkerspot butterfly. *Ecology* 97: 106-115.
- Bruninga-Socolar, B., **E. E. Crone**, and R. Winfree. 2016. The Role of Floral Density in Determining Bee Foraging Behavior: A Natural Experiment. *Natural Areas Journal* 36: 392-399.
- Crone, E. E.** 2016 Contrasting effects of spatial heterogeneity and environmental stochasticity on population dynamics of a perennial wildflower. *Journal of Ecology* 104: 281-291.
- Crone, E. E.**, and N. M. Williams. 2016. Bumble bee colony dynamics: quantifying the importance of land use and floral resources for colony growth and queen production. *Ecology Letters* 19:460-468.
- Schultz, C. B., J. L. Zemaitis, C. C. Thomas, M. D. Bowers, and **E. E. Crone**. 2016. Non-target effects of grass-specific herbicides differ among species, chemicals and host plants in Euphydryas butterflies. *Journal of Insect Conservation* 20: 867-877.
- Zwolak, R., M Bogdziewicz, A. Wróbel, and **E. E. Crone**. 2016. Advantages of masting in European beech: timing of granivore satiation and benefits of seed caching support the predator dispersal hypothesis." *Oecologia* 18: 749-758.
- Bogdziewicz, M., R. Zwolak, and **E. E. Crone**. 2016. How do vertebrates respond to mast seeding? *Oikos* 125:300-307.
- Schultz C. B. and **E. E. Crone**. 2015. Using ecological theory to develop recovery criteria for an endangered butterfly. *Journal of Applied Ecology* 111-115.
- Rapp, J. M., and **E. E. Crone**. 2015. Maple syrup production declines following masting. *Forest Ecology and Management*, 335, 249-254.
- Warchola N, C. Bastianelli, C. B. Schultz and **E. E. Crone**. 2015. Fire increases ant-tending and survival of the Fender's blue butterfly larvae. *Journal of Insect Conservation*. 19:1063-73.
- Crone, E. E.** and J. M. Rapp. 2014. Resource depletion, pollen coupling and the ecology of mast-seeding. *Annals of the New York Academy of Sciences* 1322:21-34
- Molofsky, J., C. M. Danforth, and **E. E. Crone** 2014. Nutrient enrichment alters dynamics in experimental plant populations. *Population Ecology* 56:97-107.
- 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* 27:968-978.

- Ellis, M. M. and **E. E. Crone** 2013. The role of transient dynamics in stochastic population growth of nine perennial plant species. *Ecology* 94:1681-1686
- 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.
- Zwolak, R., S. Meagher, J. W. Vaughn, S. Dzieman, and **E. E. Crone**. 2013. Reduced ectoparasite loads of deer mice in burned forest: From fleas to trees? *Ecosphere* 14: article 32
- 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. Quantifying 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-Ascencio, 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. Wardle. 2010. Causes and consequences of variation in plant population 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. Pichancourt, 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

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- 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.
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Other professional writing (Notes, Reviews, Opinion pieces etc):

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- 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. Tabaei, 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

- 2018 - ongoing: advisor, Western Association of Fish and Wildlife Administrators planning meeting for western monarch butterflies
- 2017-ongoing: Science Advisory Board, COMPADRE/COMADRE (international databasing project for demographic data from plant and animal populations)
- 2014-ongoing: Steering Committee, PlantPopNet (International Plant Demography Network based at Trinity University in Dublin)
- 2018: Santa Fe Institute workshop on Spatiotemporal Population Dynamics (led by Alan Hastings & Jon Machta)
- 2016: BIRS (Banff International Research Station) Workshop on Integro-difference Equations in Ecology
- 2015, 2012, 2008, 2006: panelist, NSF Population and Community Ecology program (previously Population and Evolutionary Processes)
- 2015-17: NIMBIOS “Dispersal Biogeography” working group (led by Britta Teller)
- 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

Department seminar and conference presentations

(presentations led by me during the 2018-2019 and 2019-2020 academic years; a list of presentations given by students & collaborators is available on request)

2018-2019

Why are monarch butterflies declining in Western North America? Ecological Society of America Annual Meeting, New Orleans LA, August 2018

- Faster movement in non-habitat matrix promotes range shifts in heterogeneous landscapes*, Ecology & Evolution Days, Fribourg University, Switzerland, September 2018
- Breeding phenology of monarch butterflies in North America* Entomological Society of America Annual Meeting, Vancouver BC, November 2018
- Endangered butterflies as a model system for managing source-sink dynamics on Department of Defense lands*, featured “Project of the Year” poster at SERDP/ESTCP Symposium, November 2018
- Why are monarch butterflies declining in the West?* Wildlife & Conservation Biology seminar, University of California Berkeley, January 2019
- Why are monarch butterflies declining in the West?* Committee on Environmental Cooperation Monarch Butterfly Conservation Meeting, Mexico City Mexico, February 2019
- Bumble bee population dynamics in changing environments* Kellogg Biological Station seminar series (Michigan State University), March 2019
- Why are monarch butterflies declining in the West?* Ecology Colloquium, University of Nevada Reno, April 2019
- Will climate-mediated phenological shifts affect population viability? A test with butterflies on Department of Defense lands* Annual In-Progress Report presentation for SERDP advisory board (April 2019, Arlington VA)
- Bumble bee population dynamics in changing environments* Ecology & Evolutionary Biology seminar, University of California, Santa Cruz, May 2019
- 2019-2020
- Why are western monarchs declining?* Western Association of Fish & Wildlife Administrators Western Monarch Population Summit., Reno NV, June 2019
- Population dynamics of monarch butterflies in highly fragmented landscapes* Society for Mathematical Biology annual meeting, Montreal Canada, July 2019
- Transient responses of bumble bee populations to spatial and temporal variation in food resources* Ecological Society of America annual meeting, Louisville KY, August 2019
- Bumble bee population dynamics* (Introductory talk, and leader of organized discussion) BOMBUSS 2.0 conference, Toronto ON Canada, October 2019
- Why are monarch butterflies declining in the West?* Mini-symposium in association with Ph.D. defense, University of Helsinki, December 2019
- Population dynamics of insect herbivores in highly fragmented landscapes* American Society of Naturalists meeting, Asilomar CA, January 2020
- Why are monarch butterflies declining in the West?* Department of Entomology, University of California Davis, January 2020
- Transient dynamics in bumble bee colony growth* American Mathematical Society Eastern Sectional Meeting, March 2020 (meeting was to take place at Tufts, but symposium was held online, after Tufts closed for covid19 concerns)
- Will climate-mediated phenological shifts affect population viability? A test with butterflies on Department of Defense lands* Annual In-Progress Report presentation for SERDP advisory board (April 2020, meeting was to take place in Texas, but will be held online, due to covid19 concerns)
- Predicting insect phenology in space and time* Graduate Group in Population Biology, University of California Davis (April 2020, to be given online, due to covid19 concerns)

Education & Outreach Activities

Undergraduate and Graduate Courses:

Tufts University

- BIO 133: *Ecological Statistics & Data* – Introduction to likelihood-based statistics and related techniques such as Bayesian and information-theoretic approaches. Emphasis on analysis of discrete count data with extension to mixed and mixture models. Includes programming in R.
- BIO 196.07: *Advanced Biostatistics* – Advanced techniques that are often encountered in biological research. Topics vary, but often include multivariate data analysis, generalized additive models, and implementing Bayesian models using WinBUGs.
- BIO 51: *Experiments in Ecology* – Introduction to ecological inference (study design, interpretation of data) in an experiential setting. Modules on three different topics led by different instructors. Mine features species interactions, using squirrels, oak trees, and predators such as red-tailed hawks as a model system. Involves 8 contact hours / week, with 2 afternoons/week of outdoor labs on Tufts campus.

Teaching recognition: in 2016, two graduating seniors selected me as their most influential instructor (based on teaching in Bio 133); in 2018, one graduating senior selected me as their most influential instructor (based on teaching in Bio 51)

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 as 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 Mickiewicz 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*, Research Associate, USGS Biological Survey
- Jennifer Gremer (Ph.D., 2010) *Causes and consequences of prolonged dormancy: Why stay below ground?*, Assistant Professor, University of California (Davis)
- Julie Beston (Ph.D., 2010) *Are black bears declining in Montana? Inference from multiple data sources in the face of uncertainty*, Assistant Professor, University of Wisconsin (Stout)
- Martha Ellis (Ph.D. 2013) *Transient dynamics in plant population models*, Research Scientist, Montana State University
- Natalie Kerr (January 2014 – present; defense scheduled for May 1, 2019) *Insect life history strategies in a changing world: the importance of integrating vital rates across the life cycle when evaluating life history phenomenon*, postdoctoral researcher, Duke University
- Genevieve Pugsek (September 2015 – present)
- Nick Dorian (September 2017 – present)
- Atticus Murphy (September 2018 – present)
- Brendan Carson (September 2018 – present)
- 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), Swedish Agricultural University (SLU Uppsala) (2013), University of Helsinki (2019)*
- Past committee member for ~25 graduate students in four programs at the University of Montana (Wildlife Biology, Organismal Biology and Ecology, Forestry, and Mathematics), and current committee member for ~10 Ph.D. students at Tufts University (in addition to my 4 students). I serve or have recently served on Ph.D. committees at the University of Oulu, University of Montana, Harvard University, University of Pittsburgh, and Rutgers University. In 2019-2020, I assisted in Ph.D. qualifying examinations for 2 Ph.D. students at University of California Davis.*

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, Professor, University of Montana
- Greg Breed, 2011-2012, Assistant Professor, University of Alaska (Fairbanks)
- Rui Zhang, 2011-2012, Business Analyst, Google
- Norah Warchola, 2011-2017, Lecturer, Tufts University
- Joshua Rapp, 2011-2014, Regional Scientist, Mass Audubon
- Leone Brown, 2013-15, 2017-present, Research Associate, Tufts University
- Ailene Ettinger, 2014-2018, Quantitative Ecologist, The Nature Conservancy
- David Iles, 2016-17, Quantitative Wildlife Biologist, Canadian Wildlife Service
- Rachael Bonoan, 2018-present
- Collin Edwards, 2019-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:

Hajnalka Pinter, B.Sc. (Ecology, University of Calgary), 1999
Sheri Bouchard, B.Sc. (Ecology, University of Calgary), 1999
Janet Summerscales, B.Sc. (Ecology, University of Calgary), 2000
Karilynn Sweet, B.Sc. (Ecology, University of Calgary), 2001
Claire Solohub, B.Sc. (Ecology, University of Calgary), 2001
Brian Laub, B.S. (Wildlife Biology, University of Montana), 2004
Josh Nowak, B.S. (Wildlife Biology, University of Montana), 2007
Alexis Jones, B.S. (Botany, University of Montana), 2007
Nick Dorian, B.S. (Biology, Tufts University), 2016
Lauren Redosh, B.S. (Biology, Tufts University), 2016
James Michielini (Biology, Tufts University), 2019
Max McCarthy (current, Tufts University), class of 2020
Emma Maria Ostapovich (current, Tufts University), class of 2020

REU & Tufts Summer Scholars students (if not mentioned as honors students, above):

Lydia Molina (Education, Northwestern University), 2003
Felix Nez (Biology, Salish-Kootenay College), 2003
Ray Yurkewicz (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)
Hailley Coffman (summer 2014, with postdoc Leone Brown)
Michelle Santana (summer 2015, with postdoc Norah Warchola)
Eliot Kemper (summer 2015)
Alice Kazberouk (summer 2016)
Annkia Greenleaf (summer 2017, with Ph.D. student Genevieve Pugesek)
Janelle Bouman (summer 2018, with postdoc Leone Brown)
Carolyn Burt (summer 2018, with Ph.D. student Genevieve Pugesek)
Cassandra Carroll (summer 2018, with postdoc Leone Brown)
Shan Ming Gao (summer 2018, with postdoc Leone Brown)
Siobhan Pascal (summer 2019, with postdoc Leone Brown)
Alexandra Wolf (summer 2020)

Visiting scholars

Kirsi Alahuhta (Fulbright scholar, Ph.D. student, University of Oulu, Finland, Fall/Winter 2014/15, Fall 2016)
Michal Bogdziewicz (visiting Ph.D. student, Adam Mickiewicz University, Poland) Fall 2013, 2014, 2015)
Aleksandra Wrobel (visiting Ph.D. student, Adam Mickiewicz University, Poland) Fall 2013, 2014)
Iris LeRonce (visiting M.S. student, University of Lyons, France, Spring 2014)
Audrey Jost (visiting M.S. student, Catholique University de Louvain, Belgium, Summer 2015)
Bethanne Bruninga-Socolar (Ph.D. student, University of Rutgers USA, research assistant on “colored stochasticity” project)
Xianfeng Yi, professor Jiangxi Normal University, China (2017-18 academic year)

Training workshops:

2011-2013: 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)

Informal education

I work to create opportunities for graduate and undergraduate students to learn outside of formal classroom, lab, and conference settings. Examples from the past year include:

- 2018 Entomological Society of America annual meeting (November 2018): Our lab group organized a group of Tufts graduate students from insect ecology labs to attend the conference and network with students from my collaborators’ labs at University of California and Washington State University. Networking activities included a joint dinner for the three lab groups, and a Facebook group where students could share ideas and impressions about the talks.
- annual SERDP working group meeting at Tufts University (September, 2017, December 2018, December 2019): This included students and PIs from the three collaborating institutions (Montana State University, University of Georgia, Tufts University). Activities included two days of academic presentations, informal meals, and a bowling/pizza party for all involved.
- Tufts Pollinator Initiative (Spring 2019 – ongoing): Students from my lab (in collaboration with students from the Starks’ lab) organized and obtained funding from the Tufts Green Initiative to enhance pollinator habitat on campus. I was not involved in planning this initiative, but I am proud to have created a work environment where students and postdocs feel encouraged to initiate their own community outreach initiatives, as well as academic activities,

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:

- Department of Biology Graduate Admissions Committee*, 2014, 2015, 2016, Tufts University
Biology Seminar Series coordinator (2014-15, 2015-16, 2016-2017, 2017-2018, 2018-2019), Tufts University
Insect Ecology Search Committee member, 2014-15 academic year, Swedish Agricultural University (Uppsala)
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 committees: 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)