University of Northern British Columbia
POPULATION AND COMMUNITY ECOLOGY (BIOL 410) – FALL 2012
Course Syllabus

Instructor: **Dr. Chris Johnson**
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Office hours: Wednesday 2:45-3:45

Class Meeting Rooms and Timing
Lecture room: 10-4588
Lecture time: Monday & Wednesday 1:00-2:20
Tutorial room: 10-4588
Tutorial time: Tuesday 8:30-9:20

Course Description
This course is designed to provide students with an understanding of the fundamental concepts underlying the interrelated disciplines of population and community ecology. Successful completion of this course will provide the theoretical foundation necessary to tackle applied problems in other upper division courses including animal and plant ecology, conservation biology, and wildlife management. The scope of learning is incremental starting from sample design and assessing population parameters, to building simple population models and progressing to system dynamics that generally characterise the interactions of plants and animals within communities. Thus, we will examine increasingly more complex ecological processes and successful completion of the course will require the integration of ideas and concepts presented throughout the semester. Topics include understanding and quantifying spatiotemporal scale, generating an estimate or census of population numbers, exponential and logistic population growth, predator-prey systems, competition, the spatial elements of populations and communities, Lotka-Volterra equations, and community structure and dynamics. Population and community ecology is an inherently mathematical discipline; students should expect some exposure to quantitative principles and techniques. As this is not a course in quantitative ecology, the focus is on qualitative principles and supporting calculations not mathematical derivation.

The learning objectives for the course are:

- understand the fundamental principles and theory that describe population change and community dynamics;
- develop comfort and ability to work with and interpret data used to describe changes in the distribution, abundance, and interactions of plants and animals;
- recognise and appreciate the assumptions and limitations of our understanding of population and community ecology;
- awareness of the science and leading edge thinking in the discipline; and
- exercise critical thinking that will allow you to challenge the current paradigms (and simplifications!) that are the foundation for population and community ecology.

Tutorial
This course has a scheduled tutorial. The tutorial is designed to provide students with additional opportunities to ask questions and further explore lecture material and assignments. When time permits, we will use computer models and simulation tools to investigate concepts presented in class.

Text Book
There is no required text for this class; however, for supplemental reading I recommend: Gotelli, N.J. 2008. A Primer of Ecology (4rd Edition). Sinauer Associates, Inc. This book can be purchased online (at discount used prices) or through the bookstore. For those of you on a budget the 3rd edition published in 2004 will provide nearly all the content you will require for the course. Also, several copies are on reserve in the library.

Evaluation
The grade for this course will be based on exams, individual practice exercises, and a conceptual population model:

- one midterm worth 20% (see schedule below); the midterm will test lecture material presented over the examination period;
- final exam worth 35% scheduled by the Registrars Office; the final exam will focus on material presented following the midterm, but will also challenge a comprehensive understanding of the course material;
- hypothetical population model worth 20%; this model represents a species of your choice and should capture the major processes that influence the distribution or abundance of a 'sample' population; and
- 5 problem sets allow a hands-on examination of material offered during lecture; each problem set is worth 5% for a total of 25%; the problem set is due one week after it is assigned.

Assignment	Grade	Due Date
Midterm exams	20%	October 24
Problem sets	25% (5×5%)	One week after assigned
Population model	20%	November 28
Final Exam	35%	TBA

Dishonesty and Professional Conduct
Purposeful dishonesty and plagiarism is a series offence. If you are unsure of what constitutes ***Plagiarism*** or ***Cheating*** please consult the calendar (2012-2013, P.61) or see your instructor for definitions, explanation, and potential consequences. Ignorance is not a valid excuse.

Other Details

- The schedule of topics and assignments, as currently outlined in the syllabus, are subject to change with notification.
- Persons with disabilities requiring special learning approaches should contact the instructor and Disability Services early in the semester (http://www.unbc.ca/disabilities/index.html).

Schedule of Lecture Topics

Date	Topic	Text	Supporting Paper
	Sampling and Assessing Populations and Communities		
Sep 5	Introduction to course; defining population and community ecology	NA	Vonesh et al. 2009
Sep 10	Spatiotemporal distribution of organisms – concepts	NA	Moore & Elmendorf 2006
Sep 12	Spatiotemporal distribution of organisms – methods	NA	Nams & Bourgeois 2004
Sep 17	Study design and population sampling	NA	
Sep 19	Population estimation – concepts and methods	NA	Frantz et al. 2004
	Simple and Complex Models for Population Change		
Sep 24	Population change – density independent (exponential) model	Ch1	
Sep 26	***NO CLASS***		
Oct 1	Density dependence and independence		Nowicki et al. 2009
Oct 3	Population change – density dependent (logistic) model	Ch2	Krebs 2002
Oct 8	Population regulation and limiting factors	NA	Oedekoven & Joern 2000
Oct 10	*Thanksgiving* – no class		
Oct 15	Calculating vital rates – natality and survival	Ch3	Johnson et al. 2004
Oct 17	Age structured population growth	Ch3	Garcia et al. 1999
Oct 22	Stochastic population models and PVA	Ch1 P13-19; Ch2 P38	Slotta-Bachmayr et al. 2004
Oct 24	***Midterm exam***		
Oct 29	Guest Lecture – Doug Heard MoE	NA	Mowat et al. 2005
Oct 31	Population cycles and nonlinear dynamics	NA	Zalatan et al. 2006
	Concepts for Understanding and Predicting Community Dynamics		
Nov 5	Introducing communities and relating communities to populations	Ch5	Boyce & McDonald 1999
Nov 7	Metapopulations – the spatial dynamics of communities and populations	Ch4	Marsh & Trenham 2001; Caudill 2005
Nov 12	*Remembrance Day* – no class		
Nov 14	Interspecific interactions – mechanisms of predation, functional and numerical responses	NA	Berryman 1992; Messier 1994
Nov 19	Predation – Lotka-Volterra equations	Ch6	Roemer et al. 2002
Nov 21	Competition – mechanisms and models	Ch5	Bonesi et al. 2004
Nov 26	Community structure – guilds, niches, webs and cascades	NA	Silvertown 2004; Hebblewhite et al. 2005
Nov 28	Community change – succession and Markov chains	Ch8	Forrest et al. 2004; Schmitz et al. 2006
Dec 3	Last class – piecing it together and review	NA	

Course Readings

Berryman, A.A. 1992. The origins and evolution of predator-prey theory. Ecology 73:1530-1535.

Bonesi, L., P. Chanin, and D.W. Macdonald. 2004. Competition between Eurasion otter *Lutra lutra* and American mink *Mustela vison* probed by niche shift. Oikos 106:19-26.

Boyce, M.S. and L.L. McDonald. 1999. Relating populations to habitats using resource selection functions. Trends in Ecology and Evolution 14:268-272.

Caudill, C.C. 2005. Trout predators and demographic sources and sinks in a mayfly metapopulation. Ecology 86:935-946.

Cook, W.M., K.L. Lane, B.L. Foster, and R.D. Holt. 2002. Island theory, matrix effects and species richness patterns in habitat fragments. Ecology Letters 5:619-623.

Forrest, H.M., J.D. Witman, and H. Caswell. 2004. Markov chain analysis of succession in a rocky subtidal community. American Naturalist 164:E46-E61.

Frantz, A.C., M. Schaul, L.C. Pope, F. Fack, L. Schley, C.P. Muller, and T.J. Roper 2004. Estimating population size by genotyping remotely plucked hair: the Eurasian badger. Journal of Applied Ecology 41:985-995.

García**,** D., R. Zamora, J.A. Hódar and J.M. Gómez. 1999. Age structure of *Juniperus communis* L. in the Iberian peninsula: Conservation of remnant populations in Mediterranean mountains. Biological Conservation 87:215-220.

Hebblewhite, M., C.A. White, C.G. Nietvelt, J.A. McKenzie, T.E. Hurd, J.M. Fryxell, S.E. Bayley, and P.C. Paquet. 2005. Human activity mediates a trophic cascade caused by wolves. Ecology 86:2135-2144.

Johnson, C.J., M.S. Boyce, C.C. Schwartz, and M.A. Haroldson. 2004. Modelling survival: application of the Anderson-Gill model to Yellowstone grizzly bear. Journal of Wildlife Management 68:966-978.

Krebs, C.J. 2002. Two complementary paradigms for analyzing population dynamics. Transactions of the Royal Society of London B 357:1211-1219.

Marsh, D.M., and P.C. Trenham. 2001. Metapopulation dynamics and amphibian conservation. Conservation Biology 15:40-49.

Messier, F. 1994. Ungulate population models with predation: a case study with the North American moose. Ecology 75:478-488.

Moore, K.A., and S.C. Elmendorf. 2006. Propagule vs. niche limitation: untangling the mechanisms behind plant species' distributions. Ecology Letters 9:797-804.

Nams, V.O. and M. Bourgeois. 2004. Using fractal analysis to measure habitat use at different spatial scales: an example with marten. Canadian Journal of Zoology 82:1738-1747.

Nowicki, P., S. Bonelli, F. Barbero, and E. Balletto. 2009. Relative importance of density-dependent regulation and environmental stochasticity for butterfly population dynamics. Oecologia 161:227-239.

Oedekoven, M.A., and A. Joern. 2000. Plant quality and spider predation affects grasshoppers (Acrididae): food-quality-dependent compensatory mortality. Ecology 81:66-77.

Roemer, G.C. C.J. Donlan, and F. Courchamp. 2002. Golden eagles, feral pigs, and insular carnivores: How exotic species turn native predators into prey. Proceedings of the National Academy of Sciences of the United States of America 99:791-796.

Schmitz, O.J., E.L. Kalies, and M.G. Booth. 2006. Alternative dynamic regimes and trophic control of plant succession. Ecosystems 9:659-672.

Silvertown, J. 2004. Plant coexistence and the niche. Trends in Ecology and Evolution 19:605-611.

Slotta-Bachmayr L, R. Boegel, P. Kaczensky, C. Stauffer, and C. Walzer. 2004. Use of population viability analysis to identify management priorities and success in

reintroducing Przewalski's horses to southwestern Mongolia. Journal of Wildlife Management 68:790-798.
Vonesh, J.R., J.M. Kraus, J.S. Rosenberg, and J.M. Chase. 2009. Predator effects on aquatic community assembly: disentangling the roles of habitat selection and post-colonization processes. Oikos 118:1219-1229.
Whittaker, R.J., Triantis, K.A., and Ladle, R.J. 2008. A general dynamic theory of oceanic island biogeography. Journal of Biogeography 35:977-994
Wowat, G., D.C. Heard, D.R. Seip, K.G. Poole, G. Stenhouse, and D.W. Paetkau. 2005. Grizzly *Ursus arctos* and black bear *U-americanus* densities in the interior mountains of North America. Wildlife Biology 11:31-48.
Zalatan, R., A. Gunn, and G.H.R. Henry. 2006. Long-term Abundance Patterns of Barren-ground Caribou Using Trampling Scars on Roots of *Picea mariana* in the Northwest Territories, Canada. Arctic, Antarctic, and Alpine Research 38: 624-630.