

# Community Ecology

Community ecology is the study of interactions between organisms and their environment in a given time and space. It has a rich theoretical basis, a tradition of experimentation and observation, and major applications in the world around us. In this class, we will integrate theory and evidence to see what it takes build and maintain communities from the ground up.

**Course Objectives:** This goal of this course is to broadly expose student to the principles, development and applications of community ecology. Specifically, student should expect to:

- Gain proficiency in the mathematical models of species interactions and community dynamics.
- Learn to recognize the patterns that structure communities across different scales and evaluate possible mechanisms for these patterns based in community ecology theory.
- Engage with applications of community ecology, with an understanding of the theory and evidence to contribute thoughtful to today's debates in the field.

**Required text:** Mittelbach, G. (2012) *Community Ecology*. Oxford University Press

**Course Structure:** This course will meet twice a week for a one hour lecture.

**Prerequisites:** A course in introductory biology or permission of instructor.

Topic	Reading(s)
1] What is Community Ecology anyway?	Mittelbach Ch. 1, <i>Velland 1999</i>
2] Patterns of Biodiversity	Mittelbach Ch. 2
3] Tradeoffs: Niche and Life History Theory	Argawal 2010, <i>Silverton 2004</i>
4] Basic Populations Models	Mittelbach Ch. 4
5] Age-structured populations	Gotelli p.50-62 (Canvas)
6] Population Genetics	Waits Ch. 3 (Canvas),
7] Models of Competition	Mittelbach Ch. 7
8] Competition in experiments and nature	Mittelbach Ch. 8, <i>Goldberg 1992</i>
9] Basic Models of Predation	Mittelbach Ch. 5
10] Selective and Responsive Predation	Mittelbach Ch. 6
11] Mutulism and Facilitation	Mittelbach Ch. 9, <i>Janzen 1966</i>
12] Eco-Evo	Mittelbach ch. 15, <i>Benton 2009</i>
13] Ecological Networks I	Mittelbach Ch.10
14] Food Chains and Webs	Mittelbach Ch.11, <i>Beschta 2003,2014</i>
15] Metapopulations and Patchy Environments	Ch. 12
16] Metacommunities and Assemby Theory	Mittelbach Ch.13 Mittelbach, <i>Leibold 2004</i>
17] Variable Environments and Species Coexistence	Mittelbach p. 291-303, <i>Fox 2013</i>
18] Historical Contingencies	Fukami 2015
19] Alternate stable states and Regime shifts	Mittelbach p. 304-313, <i>Folke 2004</i>
20] Compexity, stability and function	Mittelbach Ch. 3, <i>Tilman 1999</i>
21] Quaternary Biogeography	Gavin 2014
22] Invasion biology	Sax 2007, Richarson 2006
21] Invasion Debate	Gould 1998
24] Rewilding and Restoration	McLachlan 2007, Donlon 2005

## References

- Agrawal, A., Conner, J. & Rasmann, S. (2010) *Tradeoffs and adaptive negative correlations in Evolutionary ecology*. Sinauer Associates, evolution after darwin: the first 150 years edn.
- Benton, M.J. (2009) The Red Queen and the Court Jester: Species Diversity and the Role of Biotic and Abiotic Factors Through Time. *Science* **323**, 728–732.
- Beschta, R.L. & Ripple, W.J. (2016) Riparian vegetation recovery in Yellowstone: The first two decades after wolf reintroduction. *Biological Conservation* **198**, 93–103.
- Bestcha, R. (2003) Cottonwoods, elk, and wolves in the lamar valley of yellowstone national park. *Ecological Applications* **13**, 1295–1309.
- Donlan, J., Berger, J., Bock, C., Bock, J., Burney, D., Estes, J., Foreman, D., Martin, P., Roemer, G., Smith, F., Soule, M. & Greene, H. (2005) Re-wilding North America. *Nature* **436**, 913–914.
- Folke, C., Carpenter, S., Walker, B., Scheffer, M., Elmqvist, T., Gunderson, L. & Holling, C. (2004) Regime shifts, resilience, and biodiversity in ecosystem management. *Annual Review of Ecology, Evolution, and Systematics* **35**, 557–581.
- Fox, J.W. (2013) The intermediate disturbance hypothesis should be abandoned. *Trends in Ecology Evolution* **28**, 86–92.
- Fukami, T. (2015) Historical contingency in community assembly: Integrating niches, species pools, and priority effects. *Annual Review of Ecology, Evolution, and Systematics* **46**, 1–23.
- Gavin, D.G., Fitzpatrick, M.C., Gugger, P.F., Heath, K.D., Rodríguez-Sánchez, F., Dobrowski, S.Z., Hampe, A., Hu, F.S., Ashcroft, M.B., Bartlein, P.J. & et al. (2014) Climate refugia: joint inference from fossil records, species distribution models and phylogeography. *New Phytologist* **204**, 37–54.

- Goldberg, D. & Barton, A. (1992) Patterns and consequences of interspecific competition in natural communities- a review of field experiments with plants. *American Naturalist* **139**, 771–801.
- Gotelli, N. (2008) *A Primer of Ecology*. Sinauer Associates, fourth edn.
- Gould, S. (1998) An evolutionary perspective on strengths, fallacies, and confusions in the concept of native plants. *Arnoldia* **44**.
- Janzen, D. (1966) Coevolution of mutualism between ants and acacias in central america. *Evolution* **20**, 249–275.
- Leibold, M.A., Holyoak, M., Mouquet, N., Amarasekare, P., Chase, J.M., Hoopes, M.F., Holt, R.D., Shurin, J.B., Law, R., Tilman, D. & et al. (2004) The metacommunity concept: a framework for multi-scale community ecology. *Ecology Letters* **7**, 601–613.
- McLachlan, J.S., Hellman, J.J. & Schwartz, M.W. (2007) A framework for debate of assisted migration in an era of climate change. *Conservation Biology* **21**, 297–302.
- Richardson, D. & Pysek, P. (2006) Plant invasions: merging the concepts of species invasiveness and community invasibility. *Progress in Physical Geography* **30**, 409–431.
- Sax, D., Stachowicz, J., Brown, J., Bruno, J., M, D., Gaines, S., Grosberg, R., Hastings, A., Holt, R. & Mayfield, M. (2007) Ecological and evolutionary insights from species invasions. *Trends in Ecology Evolution* **22**, 465–471.
- Silvertown, J. (2004) Plant coexistence and the niche. *Trends in Ecology Evolution* **19**, 605–611.
- Tilman, D. (1999) The ecological consequences of changes in biodiversity: A search for general principles. *Ecology* **80**, 1455–1474.

Vellend, M. (2010) Conceptual synthesis in community ecology. *Quarterly Review of Biology* **85**, 183–206.

Waits, L. & Storfer, A. (2016) *Landscape Genetics: Concepts, Methods Applications*. John Wiley and Sons Ltd.