



Department of Natural Resources and Environmental Science

## The Unified Neutral Theory of Biodiversity and Biogeography

NRES 701A  
Spring 2010

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### Instructor information

Instructor: Dr. Elizabeth (Beth) Leger  
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 Discussion board: <http://groups.google.com/group/untb?hl=en>

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### Course information

Call number / code: 10923 / NRES 701A.004  
 Credits: 2  
 Title: The Unified Neutral Theory of Biodiversity and Biogeography  
 Meeting time / room: Fridays 10 AM to noon / Knudsen Resource Center (KRC) 103A  
 Description: Stephen Hubbell's unified neutral theory of biodiversity and biogeography has been one of the most controversial scientific ideas since its publication nearly one decade ago. Hubbell proposed that adding the process of speciation to MacArthur and Wilson's theory of island biogeography resulted in a unified theory explaining relative species abundance and diversity.  
 Objective: The aim of this seminar is to examine the philosophy, theoretical grounds, empirical evidence, and evolution of Hubbell's theory from its formulation until present.  
 Format: Weekly meetings will consist of group discussions.  
 Text: Recommended, but not required: **Hubbell, S. P. 2001. The unified neutral theory of biodiversity and biogeography. Princeton University Press, Princeton, New Jersey, U.S.** All other material will be available electronically on the course website.  
 Assessment: Participation is 100% of the grade.  
 Grading scale: A 98–99%  
 A- 96–97%  
 B+ 94–95%  
 B 92–93%  
 B- 90–91%  
 C < 90%

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### Schedule (by week)

#### INTRODUCTION

1. Organizational meeting
  - a. Forister, M. 2009. Re: Let's give them something to talk about: Choosing a discussion paper. *Frontiers in Ecology and the Environment* 7:501–502.
  - b. Stokstad, E. 2009. On the origin of ecological structure. *Science* 326:33–35.

#### PHILOSOPHY

2. Neutrality and null models
  - a. Caswell, H. 1976. Community structure: A neutral model analysis. *Ecological Monographs* 46:327–354.
  - b. Gotelli, N. J. and G. R. Graves. 1996. Null models in ecology. Smithsonian Institution Press, Washington D.C. Chapter 1, pages 1–20.
  - c. Gotelli, N. J. and B. J. McGill. 2006. Null versus neutral models: What's the difference? *Ecography* 29:793–800.
3. The foundations of the theory
  - a. MacArthur, R. H. and E. O. Wilson. 1963. An equilibrium theory of insular zoogeography. *Evolution* 17:373–387.
  - b. Hubbell, S. P. 2001. The unified neutral theory of biodiversity and biogeography. Princeton University Press, Princeton, New Jersey, U.S. Chapter 1, pages 3–29.
4. Niche-assembly perspectives
  - a. Diamond, J. M. 1975. Assembly of species communities. Pages 342–444 in M. L. Cody and J. M. Diamond, editors. *Ecology and evolution of communities*. Belknap Press of Harvard University Press. (Photocopied)
  - b. Connor, E. F. and D. Simberloff. 1979. The assembly of species communities: Chance or competition? *Ecology* 60:1132–1140.
  - c. Belyea, L. R. and J. Lancaster. 1999. Assembly rules within a contingent ecology. *Oikos* 86:402–416.
5. Other theories of relative species abundance
  - a. Hubbell, S. P. 2001. The unified neutral theory of biodiversity and biogeography. Princeton University Press, Princeton, New Jersey, U.S. Chapter 2, pages 30–47. (Photocopied)
  - b. MacArthur, R. H. 1957. On the relative abundance of bird species. *Proceedings of the National Academy of Sciences of the United States of America* 43:293–295.
  - c. MacArthur, R. 1960. On the relative abundance of species. *The American Naturalist* 94:25–36.
6. General reviews
  - a. Chave, J. 2004. Neutral theory and community ecology. *Ecology Letters* 7:241–253.
  - b. Alonso, D., R. S. Etienne, and A. J. McKane. 2006. The merits of neutral theory. *Trends in Ecology & Evolution* 21:451–457.
  - c. Hu, X. S., F. L. He, and S. P. Hubbell. 2006. Neutral theory in macroecology and population genetics. *Oikos* 113:548–556.

**THEORY**

7. On sampling
  - a. Alonso, D. and A. J. McKane. 2004. Sampling Hubbell's neutral theory of biodiversity. *Ecology Letters* 7:901–910.
  - b. Etienne, R. S. and D. Alonso. 2005. A dispersal-limited sampling theory for species and alleles. *Ecology Letters* 8:1147–1156.
8. Spring break
9. On the species independence assumption
  - a. Pueyo, S., F. He, and T. Zillio. 2007. The maximum entropy formalism and the idiosyncratic theory of biodiversity. *Ecology Letters* 10:1017–1028.
  - b. Volkov, I., J. R. Banavar, S. P. Hubbell, and A. Maritan. 2009. Inferring species interactions in tropical forests. *Proceedings of the National Academy of Sciences* 106:13854–13859.
10. On the stochastic patch occupancy approach
  - a. Kadmon, R. and O. Allouche. 2007. Integrating the effects of area, isolation, and habitat heterogeneity on species diversity: A unification of island biogeography and niche theory. *The American Naturalist* 170:443–454.
  - b. Allouche, O. and R. Kadmon. 2009. Demographic analysis of Hubbell's neutral theory of biodiversity. *Journal of Theoretical Biology* 258:274–280.
11. On the spatially explicit approach
  - a. Rosindell, J. and S. J. Cornell. 2009. Species-area curves, neutral models, and long-distance dispersal. *Ecology* 90:1743–1750.
  - b. O'Dwyer, J. P. and J. L. Green. 2010. Field theory for biogeography: A spatially explicit model for predicting patterns of biodiversity. *Ecology Letters* 13:87–95.
12. On the size-structured approach
  - a. O'Dwyer, J. P., J. K. Lake, A. Ostling, V. M. Savage, and J. L. Green. 2009. An integrative framework for stochastic, size-structured community assembly. *Proceedings of the National Academy of Sciences* 106:6170–6175.
13. On speciation dynamics under neutrality
  - a. Etienne, R. S., M. E. F. Apol, H. Olf, and F. J. Weissing. 2007. Modes of speciation and the neutral theory of biodiversity. *Oikos* 116:241–258.
  - b. Hu, X.-S., F. He, and S. P. Hubbell. 2009. Community differentiation on landscapes: Drift, migration and speciation. *Oikos* 118:1515–1523.

**EVIDENCE**

14. Testing neutral theory
  - a. McGill, B. J., B. A. Maurer, and M. D. Weiser. 2006. Empirical evaluation of neutral theory. *Ecology* 87:1411–1423.
  - b. One or two additional paper(s) that we encounter during the semester that we wish to read.

**SUMMARY**

15. Recap and revisit basic assumptions, criticisms, and possibilities for further extensions. Can we write a paper?
  - a. Hubbell, S. P. 2001. *The unified neutral theory of biodiversity and biogeography*. Princeton University Press, Princeton, New Jersey, U.S. Chapter 10, pages 319–346. (Photocopied)
  - b. Kelly, C. K., M. G. Bowler, O. Pybus, and P. H. Harvey. 2008. Phylogeny, niches, and relative abundance in natural communities. *Ecology* 89:962–970.
  - c. Vergnon, R., N. K. Dulvy, and R. P. Freckleton. 2009. Niches versus neutrality: Uncovering the drivers of diversity in a species-rich community. *Ecology Letters* 12:1079–1090.

**Other information**

Disabilities: If you have a disability and will be requiring assistance, please contact me or the Disability Resource Center (Thompson Building Suite 101) as soon as possible to arrange for appropriate accommodations.

Academic dishonesty: Due to the nature of the course, academic dishonesty is implausible.

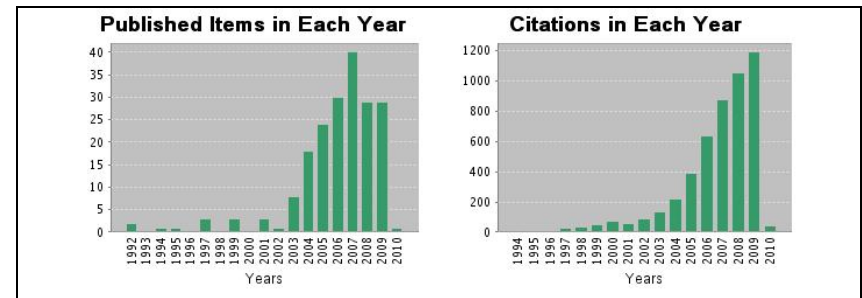


Figure 1. Web of Science® citation report for “neutral theory ecology.”