Instructor: Brad Butterfield  
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Office hours: By appointment

Coordinator: Neil Cobb  
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Room: Bio 146

Day and time: Fridays, 9-11AM

**Course Prerequisites**

There are no specific prerequisite courses, however a working knowledge of general linear models and basic ordination techniques is recommended.

**Course Description**

Class meetings will consist of discussion followed by a brief introductory lecture relevant to the following week’s topics, including R libraries and other statistical packages. A final presentation will be required at the end of the semester using at least one of the methods covered in the course on any appropriate biological dataset. This is a pass/fail course, with participation in discussions and final presentation each worth half of the grade.

**Schedule and Readings**

Sep. 2 Overview and introduction to data input and manipulation in R

* Introduction to Ecological Analysis in R (by Matt Lau; pdf on shared drive)

Sep. 9 Ordination methods – PCA, Gradient Analysis, NMDS

* Legendre, P. and Gallagher, E.D. (2001) Ecologically meaningful transformations for ordination of species data. *Oecologia*, 129:271-280.
* Anderson, M.J. and Willis, T.J. (2003) Canonical analysis of principal coordinates: a useful method of constrained ordination for ecology. *Ecology*, 84:511-525.
* Butterfield, B.J. and Briggs, J.M. (2011) Regeneration niche differentiates functional strategies of desert woody plant species. *Oecologia*, 165:477-487.

Sep. 16 Structural equation modeling – The basics

* Smith, F.A. et al. (1997) Path analysis: A critical evaluation using long-term experimental data. *American Naturalist*, 149:29-42.
* Wolkovich, E.M. (2010) Non-native grass litter enhances grazing arthropod assemblages by increasing native shrub growth. *Ecology*, 91:756-766.
* Johnson, J.B. and Omland, K.S. (2004) Model selection in ecology and evolution. *TREE*, 19:101-108.

Sep. 23 Structural equation modeling – Latent variables and more

* Clark, C.M. et al. (2007) Environmental and plant community determinants of species loss following nitrogen enrichment. *Ecology Letters*, 10:596-607.
* Grace, J.B. et al. (2010) On the specification of structural equation models for ecological systems. *Ecological Monographs*, 80:67-87.
* Harrison, S. and Grace, J.B. (2007) Biogeographic affinity helps explain productivity-richness relationships at regional and local scales. *American Naturalist*, 170:S5-S15.

Sep. 30 Null models

* Gotelli, N.J. (2000) Null model analysis of species co-occurrence patterns. *Ecology*, 81:2606-2621.
* Gotelli, N.J. and McGill, B.J. (2006) Null versus neutral models: what’s the difference? *Ecography*, 29:794:800.
* Peres-Neto, P.R. (2004) Patterns in the co-occurrence of fish species in streams: the role of site suitability, morphology and phylogeny versus species interactions. *Oecologia*, 140:352-360.

Oct. 7 Trait-based analyses – Community assembly and null models

* Cornwell, W.K. and Ackerly, D.D. (2009) Community assembly and shifts in plant trait distributions across an environmental gradient in coastal California. *Ecological Monographs*, 79:109-126.
* Ackerly, D.D. and Cornwell, W.K. (2007) A trait-based approach to community assembly: partitioning of species trait values into within- and among-community components. *Ecology Letters*, 10:135-145.
* Villeger, S. et al. (2011) The multidimensionality of the niche reveals functional diversity changes in benthic marine biotas across geological times. *Ecology Letters*, 14:561-568.

Oct. 14 Trait-based analyses – Diversity indices and ecosystem function

* Diaz, S. et al. (2007) Incorporating plant functional diversity effects in ecosystem service assessments. *PNAS*, 20684-20689.
* Villeger, S. et al. (2008) New multidimensional functional diversity indices for a multifaceted framework in functional ecology. *Ecology*, 89:2290-2301.
* Mouillot, D. et al. (2011) Functional structure of biological communities predicts ecosystem multifunctionality. *PLoS One*, 6.

Oct. 21 Phylogenetic analyses – Community assembly and null models

* Webb, C.O. et al. (2002) Phylogenies and community ecology. *Annual Review of Ecology and Systematics*, 33:475-505.
* Cavender-Bares, J. et al. (2004) Phylogenetic overdispersion in Floridian oak communities. *American Naturalist*, 163:823-843.
* Swenson, N.G. et al. (2006) The problem and promise of scale dependency in community phylogenetics. *Ecology*, 87:2418-2424.

Oct. 28 Phylogenetic analyses – Trait evolution

* Ackerly, D.D. et al. (2006) Niche evolution and adaptive radiation: Testing the order of trait divergence. *Ecology*, 87:S50-S61.
* PICs
* Cooper, N. et al. (2010) Phylogenetic comparative approaches for studying niche conservatism. *J. Evolutionary Biology*, 23:2529-2539.

Nov. 4 Network analysis

* Bascompte, J. et al. (2002) The nested assembly of plant-animal mutualistic networks. *PNAS*, 100:9383-9387.
* Dormann, C.F. et al. (2009) Indices, graphs and null models: analyzing bipartite ecological networks. *Open J. Ecology*, 2:7-24.
* Verdú, M. and Valiente-Banuet, A. (2011) The relative contribution of abundance and phylogeny to the structure of plant facilitation networks. *Oikos*, 000:001-006.

Nov. 14 (Monday) Synthesis

* Dray, S. and Legendre, P. (2008) Testing the species traits-environment relationships: the fourth-corner problem revisited. *Ecology*, 89:3400-3412.
* Leibold, M.A. et al. (2004) The metacommunity concept: a framework for multi-scale community ecology. *Ecology Letters*, 7:601-613.
* Leibold, M.A. et al. (2010) Metacommunity phylogenetics: separating the roles of environmental filters and historical biogeography. *Ecology Letters*, 13:1290-1299.

Hillary presentation

Nov. 18 Presentations

Rob, Silke, Julie, Kristin, Jeff, maybe

Nov. 25 Thanksgiving, no class

Dec. 2 Presentations