

BIOD66: Causes and Consequences of Diversity Winter 2020

Course information

Lecture times:

Thursdays 9-12am

Location:

AA 208

Textbook:

None

Exams:

Midterm & Final

Projects:

Final paper

Blog post

Professor:

Marc Cadotte

Office: SY362

Office hours: By appointment or with TA

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Teaching Assistants:

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Course description

This course will combine lecture and projects to explore the evolutionary and ecological processes that generate patterns of biological diversity as well as how species interactions and ecosystem function are affected by diversity. Of key interest will be how invasions, climate change, and habitat destruction affects diversity and function.

Course Resources

Course Website and Online Lectures: Lecture notes (PDF copies of the Powerpoint slides) will be posted on Quercus by noon the day before the lecture. You should familiarize yourself with Quercus and its contents, and check it regularly.

How to Get Help with the Course. First, check this syllabus; you will find the answer to almost all procedural questions here. If you have a question that cannot be answered by this syllabus, check the course website, which will be consistently updated with answers to many conceptual and procedural questions. If this does not answer your question, then decide if the question is conceptual or procedural. Conceptual questions are best answered by the TA or the professor's office hours. If you have other questions, feel free to email either TA or the professor.

The professor will return your email in a reasonably timely fashion Monday through Friday.

Course Requirements/Marking

Midterm exam (20): Short answer and multiple-choice exam will cover concepts from first half of course.

Blog post (10): All students will prepare a blog post on a topic about human impacts on ecosystems (Due date TBD).

Blog presentation (10): All students will give a short in-class presentation on their blog post.

Participation (20): All students will be expected to submit questions before each class and discuss readings in class.

Paper (20): All students will complete a final paper (Due last day of class).

Final exam (20): The long and short-answer exam will cover all material from the course.

Accessibility

Everyone is a welcome member of this class, and we strive to provide an equal playing field for students with diverse learning styles and needs. Please contact the AccessAbility office as soon as possible if you need any form of accommodation. They will provide confidential services that include flexible, personalized solutions for test-taking, note-taking, and the like. The AccessAbility office is located in SW302 and can be emailed at: ability@utsc.utoronto.ca

Academic Integrity

The learning environment is built on mutual trust, and we will assume that all students operate with honesty and integrity. However, in the rare cases of substantial evidence that the University of Toronto's Code of Behaviour on Academic Matters (Section B; <http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>) has been compromised, then I will enact the procedures outlined in the Code of Behaviour on Academic Matters. First, I will invite you to discuss the possible offence through an email invitation. If our discussion leads me to believe that you have not compromised the code, then the matter will be dropped. If either you fail to respond to two requests for this discussion or new evidence comes to light, then a formal investigation will be initiated.

Week	Lecture	Topic	Readings
Jan. 9	1	Intro to causes and consequences of diversity. Anthropocene and biodiversity and assembly mechanisms.	Sala et al. 2000
Jan. 16	2	The major stressors today and their effects on biodiversity via assembly -land use change, fragmentation.	Helmus et al. 2014; Frishkoff et al. 2014
Jan. 23	3	Biodiversity and ecosystem function/services.	Tilman et al. 2014; Srivastava & Vellend 2005
Jan. 30	4	Novel ecosystems	Hobbs et al. 2009; Murcia et al. 2014; Hobbs et al. 2014
Feb. 6	5	Urban ecology	Lepczyk et al. 2017; Dunn & Heneghan 2011
Feb. 13	NA	Test and work on blog post/paper	Lectures 1-4
Feb. 20	NA	Reading week	Reading week
Feb. 27	6	Invasive species: problems, benefits, future?	Simberloff 2011; Davis 2011; Good NYTimes; Ricciardi & Ryan 2018
Mar. 5	7	Agro-ecological systems: good or bad for biodiversity?	Landis 2017; Kremen et al. 2002
Mar. 12	NA	Blog post presentation/work on final paper	None
Mar. 19	9	Climate change and assisted migration	McLachlan et al. 2007; Bellard et al. 2012
Mar. 26	10	Restoration - baselines; objectives; use locally adapted genotypes?	Thorpe & Stanley 2011; Kettenring et al. 2014; Breed et al. 2013
Apr. 2	11	Emerging technologies. Crispr, gene drives, and genetic tools to manipulate species & towards an inclusive applied ecology	Reardon 2016; Webber 2015; Esvelt 2014; Nunez et al. 2019

Readings

Bellard, C., C. Bertelsmeier, P. Leadley, W. Thuiller, and F. Courchamp. 2012. Impacts of climate change on the future of biodiversity. *Ecology Letters* **15**:365-377.

Breed, M. F., M. G. Stead, K. M. Ottewell, M. G. Gardner, and A. J. Lowe. 2013. Which provenance and where? Seed sourcing strategies for revegetation in a changing environment. *Conservation Genetics* **14**:1-10.

Davis, M. A., M. K. Chew, R. J. Hobbs, A. E. Lugo, J. J. Ewel, G. J. Vermeij, J. H. Brown, M. L. Rosenzweig, M. R. Gardener, and S. P. Carroll. 2011. Don't judge species on their origins. *Nature* **474**:153-154.

Dunn, C., and L. Heneghan. 2011. Composition and diversity of urban vegetation. Pages 103-115 in J. Niemela, editor. *Urban Ecology: Patterns, Processes, Applications*. Oxford University Press, Oxford, UK.

Esvelt, K. M., A. L. Smidler, F. Catteruccia, and G. M. Church. 2014. Concerning RNA-guided gene drives for the alteration of wild populations. *eLife* **3**:e03401.

Goode, E. 2016. Invasive species aren't always unwanted. *New York Times* **29**.
<https://www.nytimes.com/2016/03/01/science/invasive-species.html>

Helmus, M. R., D. L. Mahler, and J. B. Losos. 2014. Island biogeography of the Anthropocene. *Nature* **513**:543-546.

Hobbs, R. J., E. Higgs, and J. A. Harris. 2009. Novel ecosystems: implications for conservation and restoration. *Trends in Ecology & Evolution* **24**:599-605.

Hobbs, R. J., E. S. Higgs, and J. A. Harris. 2014. Novel ecosystems: concept or inconvenient reality? A response to Murcia et al. *Trends in Ecology & Evolution* **29**:645-646.

Kettenring, K. M., K. L. Mercer, C. R. Adams, and J. Hines. 2014. EDITOR'S CHOICE: Application of genetic diversity–ecosystem function research to ecological restoration. *Journal of Applied Ecology* **51**:339-348.

Kremen, C., N. M. Williams, and R. W. Thorp. 2002. Crop pollination from native bees at risk from agricultural intensification. *Proceedings of the National Academy of Science, USA* **99**:16812-16816.

Landis, D. A. 2017. Designing agricultural landscapes for biodiversity-based ecosystem services. *Basic and Applied Ecology* **18**:1-12.

Lepczyk, C. A., M. F. Aronson, K. L. Evans, M. A. Goddard, S. B. Lerman, and J. S. MacIvor. 2017. Biodiversity in the city: fundamental questions for understanding the ecology of urban green spaces for biodiversity conservation. *Bioscience* **67**:799-807.

- Frishkoff, L. O., D. S. Karp, L. K. M'Gonigle, C. D. Mendenhall, J. Zook, C. Kremen, E. A. Hadly, and G. C. Daily. 2014. Loss of avian phylogenetic diversity in neotropical agricultural systems. *Science* **345**:1343-1346.
- McLachlan, J. S., J. J. Hellmann, and M. W. Schwartz. 2007. A framework for debate of assisted migration in an era of climate change. *Conservation Biology* **21**:297-302.
- Murcia, C., J. Aronson, G. H. Kattan, D. Moreno-Mateos, K. Dixon, and D. Simberloff. 2014. A critique of the 'novel ecosystem' concept. *Trends in Ecology & Evolution* **29**:548-553.
- Reardon, S. 2016. Welcome to the CRISPR zoo. *Nature* **531**:160.
- Ricciardi, A., and R. Ryan. 2018. The exponential growth of invasive species denialism. *Biological Invasions* **20**:549-553.
- Sala, O. E., F. S. Chapin, J. J. Armesto, E. Berlow, J. Bloomfield, R. Dirzo, E. Huber-Sanwald, L. F. Huenneke, R. B. Jackson, A. Kinzig, R. Leemans, D. M. Lodge, H. A. Mooney, M. Oesterheld, N. L. Poff, M. T. Sykes, B. H. Walker, M. Walker, and D. H. Wall. 2000. Biodiversity - Global biodiversity scenarios for the year 2100. *Science* **287**:1770-1774.
- Simberloff, D. 2011. Non-natives: 141 scientists object. *Nature* **475**:36-36.
- Srivastava, D. S., and M. Vellend. 2005. Biodiversity-ecosystem function research: Is it relevant to conservation? *Annual Review of Ecology Evolution and Systematics* **36**:267-294.
- Thorpe, A. S., and A. G. Stanley. 2011. Determining appropriate goals for restoration of imperilled communities and species. *Journal of Applied Ecology* **48**:275-279.
- Tilman, D., F. Isbell, and J. M. Cowles. 2014. Biodiversity and Ecosystem Functioning. *Annu. Rev. Ecol. Evol. Syst* **45**:471-493.
- Webber, B. L., S. Raghu, and O. R. Edwards. 2015. Opinion: is CRISPR-based gene drive a biocontrol silver bullet or global conservation threat? *Proceedings of the National Academy of Sciences* **112**:10565-10567.