###### Columbia University

###### EEEB 3087 – Conservation Biology

###### Spring 2020

Instructor: Dr. Alex Moore – acm2261@columbia.edu

Teaching Assistant: Isobel Mifsud – im2501@columbia.edu

Course Lectures: Mondays, 4:10–6:00pm, Schermerhorn Ext. 1015

Discussion Sections: Section 1: Wednesday, 6:10-7:00pm, Schermerhorn Ext. 1015

Section 2: Thursday, 6:10-7:00pm, 511 Kent

Office hours: Dr. Moore – By appointment only

TA – Dates and times TBD

**Introduction**

This course will introduce you to the applied science of maintaining the earth’s biological diversity. The course will focus on the biological principles relevant to the conservation of biodiversity at the genetic-, population-, community-, and landscape levels. We will emphasize problem solving and the translation of theory to practice through quantitative exercises, discussion of primary literature, and exploration of real-world case studies.

Because conservation biology is an interdisciplinary field, some of the social, philosophical, and economic dimensions of biological conservation will also be addressed. The course is intended to link perspectives gained from other biology courses under the common theme of how scientific principles can be applied to the conservation of the biosphere. In addition, the course is designed to help you sharpen several professional skills important to professional life: oral and written communication, data analysis, and especially, critical thinking.

**Learning Objectives**

After taking this course, you will be able to:

* Describe and explain what biodiversity is, why it is important, and the threats it is facing today.
* Describe and explain different conceptual and quantitative approaches used to mitigate those threats and address conservation problems.
* Analyze a variety of types of data relevant for conservation.
* Analyze conservation problems in a critical way: make judgments and reach a position on a conservation problem, drawing appropriate conclusions based on the available information, its implications and consequences.

**Prerequisites**

Science majors and E3B postbac students should have completed at least one introductory course that covers biology, ecology, evolution, or conservation prior to taking this course. Non-science majors should have some exposure to these same topics but are not required to have taken courses in advance of this class.

**Grading:** Grading is based on class attendance and participation, the completion of a series of weekly exercises, participation in the discussion section, and a final exam.

Each of these class requirements will contribute to your final grade as follows:

|  |  |
| --- | --- |
|  | Proportion of Grade |
| attendance + participation in lectures | 5% |
| exercises | 45% |
| final exam | 35% |
| discussion section | 15% |

**Readings**

*Recommended:* Peter Kareiva & Michelle Marvier. 2014. Conservation Science: Balancing the Needs of People and Nature. Roberts and Company Publishers.

Textbook is available on Course Reserves at Butler Library. It may be used to supplement course material but is not required.

Lectures will build on assigned readings in the primary literature and real-world case studies. All readings from the primary literature will be posted directly on CourseWorks.

**Discussion Section**

You **must** sign up for one of the two discussion sections. Each weekly discussion section will be devoted to discussion of a case study or other current topics in conservation biology through critical reading of the primary literature articles assigned for that week as well as reviewing the content of the weekly exercises.

**Assignments**

A particular emphasis of the course is toward applications and problem-solving in conservation biology. Each week we will present an overview of a topic, and then in most weeks introduce an exercise that students will be expected to complete before the next class meeting. Many of these exercises are demanding in terms of time and effort, making up a large part of the course’s learning experience.

All assignments must be submitted to CourseWorks by the beginning of the lecture session on the assignment’s due date. (Some exercises will require handing in hard copies of solutions as well.) Late work will not be accepted without permission for an extension. Extensions for legitimate medical and/or personal emergencies must be requested by email. ***Only Dr. Moore can give you an extension - the TA will not be able to approve any extensions.***

**Students with Disabilities**

Please let me know if you are registered with the Office of Disability Services and require special accommodations related to this class so that I can assist in this regard.   If you have a disability but have not yet contacted the Office of Disability Services, please do so as soon as possible.  For more information visit <http://health.columbia.edu/services/ods>.

**Statement on Academic Integrity**

At the request of the administration, I refer students to the Faculty Statement on Academic Integrity.  Any violation of the school honor code (e.g., cheating on either the midterm or final) will result both in a failing grade for this course and referral to CSA. <http://www.college.columbia.edu/faculty/resourcesforinstructors/academicintegrity/statement>.

**Class Reading and Assignment Schedule**

CLASS 1 – January 27: Overview of Conservation Biology

**Recommended Lecture Reading**:

* K&M: Chapter 1 (pp. 20-25), Chapter 2 (pp. 35-44, 56-61), Chapter 3 (all)

**Required Discussion Reading:**

* What is Conservation Science? Karieva P and Marvier M. 2012. Bioscience 62 (11): 962-969.
* The "New Conservation". Soule M. 2013. Conservation Biology 27(5):895-897.
* A Call for Inclusive Conservation. Tallis H and Lubchenco J. 2014. Nature 515: 27-28

**Assignments – Due February 3:** Address the following prompt in 300 words or less. What do you think conservation priorities should be? Provide justification for your answer.

**CLASS 2 – February 3: Threats to Biodiversity**

**Recommended Lecture Reading**:

* K&M: Chapter 1 (pp. 1-19), Chapter 2 (44-56), Chapter 9 (all)

**Required Discussion Reading:**

* Rockstrom et al 2009. A safe operating space for humanity. *Nature* 461, 472-475
* Fardila D et al. 2017. A systematic review reveals changes in where and how we have studied habitat loss and fragmentation over 20 years. *Biological Conservation* 212: 130-138.
* Colloca F et al. 2017. Recent Trends and Impacts of Fisheries Exploitation on Mediterranean Stocks and Ecosystems. *Frontiers in Marine Science*. https://doi.org/10.3389/fmars.2017.00244

**Assignment – Due February 10:** Fragmentation Exercise

#### CLASS 3 - February 10: Small Populations 1 – Conservation Genetics

**Recommended Lecture Reading:**

* K&M: Chapter 7 (pp. 192-202), Chapter 10 (298-306)

**Required Discussion Reading:**

* Allendorf F et al. 2010. Genomics and the future of conservation genetics. *Nature Reviews Genetics* 11(10): 697-709.

# Assignment – Due February 17: Captive Breeding and Asymmetry Exercise

#### CLASS 4 - February 17: Small Populations 2 – Conservation of Populations

**Recommended Lecture Reading**:

* K&M: Chapter 7 (pp. 183-192), Chapter 8 (all)

**Required Discussion Reading:**

* McCusker MR et al. 2017. Exploring uncertainty in population viability analysis and its implications for the conservation of a freshwater fish. *Aquatic Conservation* 27: 780-788.
* Kienberg O and Becker T. 2017. Differences in population structure require habitat-specific conservation strategies in the threatened steppe grassland plant *Astragalus exscapus*. *Biological Conservation* 211: 56-66.

**Assignment – Due Feb. 24:** Applied demography exercise

# CLASS 5 – February 24: Applied Systematics, Speciation, and Patterns of Diversity

# Recommended Lecture Reading:

* K&M: Chapter 2 (pp. 36-40)

**Required Discussion Reading:**

* Stigall A. 2017. How is biodiversity produced? Examining speciation processes during the GOBE. *Lethaia* 51: 165-172.
* Mora C et al. 2011. How Many Species Are There on Earth and in the Ocean? *PLoS Biology* 9(8): e1001127.doi:10.1371/journal.pbio.1001127.

**Assignment – Due March 2:** Taxonomy and Conservation Exercise

**CLASS 6 – March 2:** **Conservation of Endangered Taxa**

**Recommended Lecture Reading:**

* K&M: Chapter 4 (pp. 99-111), Chapter 11 (pp. 323-334)

**Required Discussion Reading:**

* Dolman P et al. 2015. Ark or park: The need to predict relative effectiveness of ex situ and in situ conservation before attempting captive breeding. *Journal of Applied Ecology* 52: 841-850

**Assignment – Due March 9:** Prioritizing conservation taxa exercise

CLASS 7 – March 9: Invasive Species and Conservation

Recommended Lecture Reading:

* K&M: Chapter 17 (all)
* K&M: Chapter 19 (all)

**Required Discussion Reading**:

* Schlaepfer MA, Sax DF, and Olden JD. 2011. The potential conservation value of non-native species. Conservation Biology 25(3): 428-437.
* Smith-Ramesh LM, Moore AC, and Schmitz OJ. 2016. Global synthesis suggests that food web connectance correlates to invasion resistance. Global Change Biology doi: 10.1111/gcb.13460.

***Mar 16 - Spring Break***

#### CLASS 8 – March 23: Conservation of Land and Seascapes

**Recommended Lecture Reading:**

* K&M: Chapter 10 (all)

**Required Discussion Reading:**

* Lindenmayer D et al. 2008. A checklist for ecological management of landscapes for conservation. Ecology Letters, 11: 78–91.
* Turner WR et al. 2012. Global Biodiversity Conservation and the Alleviation of Poverty. *BioScience* 62: 85-92.
* Ellis EC and Mehrabi Z. 2019. Half Earth: promises, pitfalls, and prospects of dedicating Half of Earth’s land to conservation. *Current Opinion in Environmental Sustainability* 38: 22-30.

**Assignment – Due March 30:** Conservation acquisitions exercise

#### CLASS 9 – March 30: Restoration Ecology

**Recommended Lecture Reading:**

* K&M: Chapter 11 (pp. 310-321, 334-336)
* SER Restoration Primer

**Required Discussion Reading:**

* Allison SK. 2007. You Can't Not Choose: Embracing the Role of Choice in Ecological Restoration. *Restoration Ecology* 15(4):601-605
* Jones HP et al. 2018. Restoration and repair of Earth’s damaged ecosystems. *Proc. R. Soc. B* 285: 20172577. http://dx.doi.org/10.1098/rspb.2017.2577

**Assignment – Due April 13:** Mannahatta 2409 Restoration Project (2 week project)

**CLASS 10 – April 6: Guest Lecture (Tentative)**

**Assignment:** Mannahatta 2409 Restoration Project (continued; due Apr 13)

**CLASS 11 – April 13: Field Trip to AMNH or Guest Lecture (Tentative)**

**Required Discussion Reading:**

* Willis KJ and Birks JB. 2006. What is Natural? The Need for a Long-term Perspective in Biodiversity Conservation. Science 314:1261-1265.
* Hobbs R et al. 2009. ﻿Novel ecosystems: implications for conservation and restoration. *Trends in Ecology and Evolution* 24: 599-605.

**CLASS 12 - April 20:** **Conservation in a Changing Climate**

**Recommended Lecture Reading**:

* K&M: Chapter 18 (all)
* Coenen et al. 2008. Future directions in conservation and development: Incorporating the reality of climate change. Biodiversity 9 (3&4): 106-113.

**Required Discussion Reading**:

* Hannah L. 2011. Climate Change, Connectivity, and Conservation Success. Conservation Biology, 25, No. 6, 1139–1142.
* Thomas. 2011. Translocations of species, climate change, and the end of trying to recreate past ecological communities. *Tree 26(5): 216-221.*

**Assignment – Due April 27:**

* Take the Ecological Footprint Self Audit and hand in your **answers and results** in writing. (See: <https://www.footprintcalculator.org/> to take the self-audit. Make sure to “Add Details to Improve Accuracy” for each applicable question.)
* Write a maximum 300-word summary of your carbon footprint by land-use type and consumption category. Why are these categories largest for you? Are there realistic areas where you can reduce your footprint? Why or why not?

**CLASS 13 – April 27: Ecosystem Conservation and Adaptive Management**

**Recommended Lecture Reading:**

* K&M: Chapter 12 (all)
* Meretzky et al. 2006. New Directions in Conservation for the National Wildlife Refuge System. Bioscience 56(2): 135-143.

**Required Discussion Reading:**

* Meretzky and Fischman. 2014. Learning from Conservation Planning for the U.S. National Wildlife Refuges. *Conservation Biology*, Volume 28, No. 5, 1415–1427
* Nie M and Schultz C. 2012. Decision-making triggers in adaptive management. *Conservation Biology* **26:**1137–1144.

**Assignment – Due May 4:** Adaptive ecosystem management exercise

#### CLASS 14 – May 4: Conservation Law and Policy

**Required Lecture Reading**:

* Rose DC et al. 2019. Calling for a new agenda for conservation science to create evidence-informed policy. *Biological Conservation* 238: 108222.

**Final exam essay questions distributed**

FINAL EXAM DUE – Monday May 13