

## BIOL 648

### INVASIVE SPECIES: EVOLUTION, ECOLOGY AND MANAGEMENT

**Time:** Thursday, 12:30-3:30 pm

**Room:** W-3-022

**Instructor:** Dr. Cascade Sorte, cjsorte@ucdavis.edu

**Office Hours:** Thursday, 10-noon in the EEOS main office (*and other times by appointment*)

Species invasions are considered one of the primary causes of global biodiversity loss, and invasive species have profound evolutionary and ecological effects on biological systems. Invasion biologists are still working to answer fundamental questions, such as:

- Which species are most likely to be transported and become invasive?
- Why do some species have large impacts while others can persist virtually unnoticed for decades?
- What management strategies are most effective at preserving native species and ecosystem function?

In this course, we will use readings, guest lectures, and field trips to explore the ecology, evolution, and management of invasive species across ecosystems.

#### Goals

1. Develop a strong understanding of the processes and implications of species invasions.
2. Be able to interpret, communicate, and critique primary research, both of invasions and in general.
3. Synthesize concepts in order to write an original paper.

#### Class participation

It's very important – to your individual and our group success – that everyone:

- (1) attends every class (contact me asap to talk about any required absences),
- (2) does all of the reading (keeping notes of questions and comments),
- (3) regularly contributes questions and ideas during class discussions, and
- (4) encourages and considers everyone else's questions and ideas.

#### Leading discussion

Suggested format for your week leading discussion:

- (1) a short (10-15 min.) introduction to the general topic with visuals (e.g. powerpoint, drawing on the board, or printouts),
- (2) a brief (~2-3 min.) summary of each paper, and
- (3) a list of questions, comments, critiques, etc. (and class exercises?) to keep the discussion going.

#### Grading

Class participation	50%
Final paper outline	10%
Peer review	10%
Term paper	30%

## Schedule

Date	Topics & Presenters	Readings	Assignments
Th, 1/27	<b>No class (made up during field trip on May 7)</b>		
Th, 2/3	Defining Invasive Species, the Stages of Invasion, & Current Questions in Invasion Biology (C. Sorte)	(1) Invasive Plant Pests Definitions and Criteria: <a href="http://sain.sunsite.utk.edu/invasives/inv_plant_pest_def.shtml">http://sain.sunsite.utk.edu/invasives/inv_plant_pest_def.shtml</a> (2) Theoharides KA, Dukes JS. 2007. Plant invasion across space and time: factors affecting nonindigenous species success during four stages of invasion. <i>New Phytologist</i> 176:256-73. (3) Carlton JT. 1996. Biological invasions and cryptogenic species. <i>Ecology</i> 77:1653-5.	
Th, 2/10	Invasion Vectors and Pathways	(1) Lowe S. 2000. 100 of the world's worst invasive alien species. <i>ISSG/SSC/IUCN</i> . (2) Lockwood JL. 2005. The role of propagule pressure in explaining species invasions. <i>TREE</i> 20:223-8. (3) Tatem AJ. 2006. Global traffic and disease vector dispersal. <i>PNAS</i> 102:6242-7. (4) Mack RN, Lonsdale WM. 2001. Humans as global plant dispersers: getting more than we bargained for. <i>BioScience</i> 51:95-102.	
Th, 2/17	Species Traits as Predictors of Invasion Success	(1) Kolar CS, Lodge DM. 2001. Progress in invasion biology: predicting invaders. <i>TREE</i> 16:199-204. (2) Van Kleunen M et al. 2010. A meta-analysis of trait differences between invasive and non-invasive plant species. <i>Ecol Lett</i> 13:235-45. (3) Bomford M et al. 2009. Predicting establishment success for alien reptiles and amphibians: a role for climate matching. <i>Biol Inv</i> 11:713-24.	Paper Topic Due (via email)
Th, 2/24	Community Determinants of Invasion Success: Enemy Release & Resource Availability	(1) Keane RM, Crawley MJ. 2002. Exotic plant invasions and the enemy release hypothesis. <i>TREE</i> 17:164-70. (2) Miller TE et al. 2002. Effect of community structure on invasion success and rate. <i>Ecology</i> 83:898-905. (3) Blumenthal DM. 2006. Interactions between resource availability and enemy release in plant invasion. <i>Ecol Lett</i> 9:887-95. (4) Blumenthal D. 2005. Interrelated causes of plant invasion. <i>Science</i> 310:243-4.	
Th, 3/3	Diversity & Invasibility: the Invasion Paradox	(1) Stachowicz JJ et al. 1999. Species diversity and invasion resistance in a marine ecosystem. <i>Science</i> 286:1577-9. (2) Fridley JD et al. The invasion paradox: reconciling pattern and process in species invasions. <i>Ecology</i> 88:3-17. (3) Davies KF et al. 2007. Productivity alters the scale dependence of the diversity-invasibility relationship. <i>Ecology</i> 88:1940-7.	
Th, 3/10	Genetic Revolutions and Invasions (Rick Kesseli)	To be determined...	Paper Outline Due (via email)
Th, 3/17	<b>SPRING BREAK - No class</b>		
Th, 3/24	(1-3 pm) Climate Change & Invasive Species (C. Sorte)	(1) Dukes JS, Mooney HA. 1999. Does global change increase the success of biological invaders? <i>TREE</i> 14:135-9. (2) Sorte CJB et al. 2010. Ocean warming increases threat of invasive species in a marine fouling community. <i>Ecology</i> 91:2198-204. (3) TBD	
F, 3/25	12-1 pm Biology Department Seminar: "Predicting the Impacts of Global Change" (Cascade Sorte)		
Th, 3/31	Ecological and Evolutionary Impacts of Invasive Species	(1) Phillips BL, Shine R. 2006. An invasive species induces rapid adaptive change in a native predator: cane toads and black snakes in Australia. <i>Proc Royal Soc</i> 273:1545-50. (2) Crooks JA. 2002. Characterizing ecosystem-level consequences of biological invasions: the role of ecosystem engineers. <i>OIKOS</i> 97:153-66. (3) Grosholz ED. 2005. Recent biological invasion may hasten invasional meltdown by accelerating historical introductions. <i>PNAS</i> 102:1088-91.	
Th, 4/7	Invasion Impacts from a Global Perspective	(1) Parker IM et al. 1999. Impact: toward a framework for understanding the ecological effects of invaders. <i>Biol Inv</i> 1:3-19. (2) Olden JD et al. 2004. Ecological and evolutionary consequences of biotic homogenization. <i>TREE</i> 19:18-24.	Rough Draft Due (in class; 2 copies)
Th, 4/14	Managing Marine Invaders: "The Rapid Assessment Survey of Marine Invasive Species from ME to RI" (Judy Pederson); Return Peer Reviews	None (Visit the marine community on the UMass docks; time- & weather-dependent)	Peer Review Due (in class; 2 copies)
Th, 4/21	Managing Terrestrial Invaders: "Dealing with Asian Longhorned Beetle in Mass." (Jenn Forman-Orth)	To be determined...	
Th, 4/28	Informal Presentations of Paper Topics; Synthesis Discussion	(1) Leung B. 2002. An ounce of prevention or a pound of cure: bioeconomic risk analysis of invasive species. <i>Proc Royal Soc</i> 269:2407-13. (2 - skim) Pimentel D et al. 2005. <i>Update on the environmental and economic costs associated with alien-invasive species</i>	
Th, 5/5	<b>No class (final class is field trip on May 7)</b>		
Sat, 5/7	<b>Saturday, Time TBD: Field trip (to Boston Harbor Islands?)</b>		
			Final Draft Due (by 11:59 pm)

## **Term paper**

This project will help you get to know the literature, synthesize topics discussed in class, and exercise your own creativity while yielding a final, tangible product. There are 4 options for the paper's format:

- (1) Review paper: choose a topic and write a paper summarizing and bringing together the primary questions, hypotheses, findings, and conclusions of researchers working in this area. *Example*: Mack RN, Lonsdale WM. 2001. Humans as global plant dispersers: getting more than we bargained for. *BioScience* 51:95-102.
- (2) Synthesis paper (aka Perspectives paper): develop a thesis (hypothesis or idea) and bring together references to support and address your idea. *Example*: Blumenthal DM. 2006. Interactions between resource availability and enemy release in plant invasion. *Ecol Lett* 9:887-95.
- (3) Data paper: this could use either field, lab, or meta-analytical data and should be organized in the typical data-paper format (Abstract, Intro, Methods, Results, Discussion). *Example*: (1) Van Kleunen M et al. 2010. A meta-analysis of trait differences between invasive and non-invasive plant species. *Ecol Lett* 13:235-45.
- (4) Research proposal: develop a proposal for a graduate fellowship to do research on invasive species; format will depend on the funding agency instructions. *Example*: check with me, and we'll try to find a proposal previously submitted for the same fellowship.

*Think about ways to make this project most useful, e.g.: thesis introduction, thesis chapter, publishable paper, writing sample for grad school applications, future fellowship or grant proposal.*

### Intermediate deadlines for parts of the paper:

Feb. 17 – Topic due (via email)

March 10 – Outline due (via email)

April 7 – Rough draft due (bring 2 hard copies to class)

April 14 – Peer review (of 1 classmate's paper) due (bring 2 hard copies to class)

May 5 – Final draft due (by 11:59 pm)

As far as length, between 10-20 pages, double-spaced is a flexible guideline. References should be cited using standard journal format.