

## Conservation Biology (WFC 198)

Fall 2017

Location and Time: Everson 176, MWF 8:00am-8:50am

---

**Instructor:** Daniel S. Karp

Office: 1071 Academic Surge

Email: [dkarp@ucdavis.edu](mailto:dkarp@ucdavis.edu)

**Include WFC 198 in subject line**

Hours: Tuesdays, 1:00-2:30pm; Thursdays, 2:00pm-3:30pm

**TAs:** Allie Essert and Kate Ingram

Office: Allie- 1059 Academic Surge; Kate- 1057 Academic Surge

Email: Allie- [amessert@ucdavis.edu](mailto:amessert@ucdavis.edu); Kate- [kpingram@ucdavis.edu](mailto:kpingram@ucdavis.edu)

Hours: Allie- Wednesdays, 9:00-10:00am; Kate: Mondays, 9:00-10:00am

### Materials:

1. **Conservation Science**, Kareiva and Marvier
2. **Conservation Biology for All**, Sodhi and Ehrlich (freely available at link below)

[https://conbio.org/images/content\\_publications/ConservationBiologyforAll\\_reducedsize.pdf](https://conbio.org/images/content_publications/ConservationBiologyforAll_reducedsize.pdf)

3. **Academic articles**, Available through the course website
- 

### Purpose:

Earth is experiencing more rapid change now than at any time in the past 10,000 years. Over the last century, intellectual and technological innovations have resulted in improvements in human livelihoods, even as human populations exponentially increased. Yet improved livelihoods were largely achieved through widespread degradation of natural systems, causing a global biodiversity crisis and severely impaired Earth's life-support systems. One of our greatest challenges will be continuing to sustain a growing population while simultaneously safeguarding Earth's biodiversity and the processes that enrich and sustain human life.

WFC 198 is intended to (1) introduce students to the major threats to Earth's ecosystems, (2) explore how the global human enterprise depends on natural systems, and (3) critically evaluate forward-thinking conservation strategies to manage nature in a changing world. WFC 198 will thus be grounded in ecology but also leverage key ideas and concepts from economics, psychology, philosophy, and other disciplines as they relate to conservation science.

WFC 198 will also help students understand and develop useful skills for the modern conservation scientist or practitioner. Students will learn basic science literacy (e.g., by reading scientific articles), how to communicate conservation (e.g., by participating in mock debates and a course blog), and how to advocate for conservation policy (e.g., by developing a policy brief).

---

### Learning Objectives:

1. Clearly communicate to policymakers and laypeople (both orally and in writing) how humans depend on ecosystems and the threats that those ecosystems now face.
2. Objectively weigh benefits and pitfalls associated with conservation interventions.
3. Advocate for management strategies that they believe show great promise at reconciling conservation and human welfare goals.
4. Read and review academic papers pertaining to conservation science.
5. Articulate how achieving conservation goals will depend on collaborating across cultures, disciplines, and career types.

## Assessment (Overview)

Assessment	Value	Date
Lecture/section participation	10%	Ongoing
Reading questions	5%	Prior to each lecture
Message box	5%	Developed in section 6 (week 6)
Online blog	15%	Due on Oct. 20
Policy brief	15%	Due on Nov. 22
Midterm Exam	20%	Friday, Oct. 27
Final Exam	30%	Wednesday, Dec. 13 10:30am-12:30pm

### Tentative Schedule (Readings, topics, and timings subject to change)

#### **Part I: Introduction to conservation science**

##### WEEK 1

#### **Lecture 1 (9/27/2017): Course introduction**

- Readings: Kareiva/Marvier- Ch. 1
- Learning Objectives: (I) gain a broad appreciation for how humans have influenced and are influenced by natural systems; (II) understand course structure and assignments

#### **Lecture 2 (9/29/2017): Biodiversity**

- Readings: Kareiva/Marvier- Ch. 2
- Learning Objectives: (I) be able to define biodiversity; (II) understand how biodiversity is measured; (III) characterize types of biodiversity loss

#### **Section 1: Developing familiarity with academic articles**

- Learning Objectives: (I) understand how academic articles are structured; (II) differentiate between academic literature and advocacy material; (III) learn to search for pertinent articles

##### WEEK 2

#### **Lecture 3 (10/2/2017): The extinction crisis**

- Readings: Sodhi/Ehrlich- Ch. 10; Ceballos et al. (2015) *Scientific Reports*; [http://www.huffingtonpost.com/leilani-munter/the-loneliest-frog-in-the\\_b\\_5940426.html](http://www.huffingtonpost.com/leilani-munter/the-loneliest-frog-in-the_b_5940426.html)
- Learning Objectives: (I) understand how extinction rates are measured; (II) argue whether or not we are experiencing a mass extinction; (III) identify attributes of at-risk species

#### **Lecture 4 (10/4/2017): What are ecosystem services?**

- Readings: Kareiva/Marvier- Ch. 3 (pp. 65-80); Cardinale et al (2012) *Nature*.
- Learning Objectives: (I) understand and communicate the concept of ecosystem services; (II) articulate connections between ecosystem services and biodiversity; (III) identify strategies for measuring and monitoring ecosystem services

#### **Lecture 5 (10/6/2017): Valuing and managing ecosystem services**

- Readings: Kareiva/Marvier- Ch. 3 (pp. 81-95); Tallis et al (2014) *Nature*.
- Learning Objectives: (I) articulate the philosophical underpinnings of modern conservation; (II) differentiate alternative strategies for valuing benefits from ecosystems; (III) evaluate pros and cons associated with current ecosystem service management strategies

#### **Section 2: Summarizing conservation for lay-audiences—online blogging**

- Learning Objectives: (I) distill the take-away messages from an academic article; (II) learn to effectively communicate the implications and limitations of a scientific study; (III) understand parameters for online blogging assignment. Due on Oct 20.

## **Part II: Threats to Earth's ecosystems**

### **WEEK 3**

#### **Lecture 6 (10/9/2017): Deforestation and fragmentation**

- Readings: Kareiva/Marvier- Ch. 13; Sodhi/Ehrlich- Ch. 5
- Learning Objectives: (I) understand the extent and drivers of deforestation and fragmentation; (II) evaluate and compare the relative impacts of habitat loss versus fragmentation on biodiversity; (III) enumerate multiple strategies for mitigating deforestation and articulate pros and cons associated with each approach

#### **Lecture 7 (10/11/2017): Overhunting (Kate Ingram Lecture)**

- Readings: Sodhi/Ehrlich- Ch. 6; Dirzo *et al.* (2014) *Science*.
- Learning Objectives: (I) understand why people hunt; (II) articulate the cascading impacts of overhunting on ecosystems; (III) learn management strategies

#### **Lecture 8 (10/13/2017): Climate change— evidence and solutions**

- Readings: Kareiva/Marvier- Ch. 18 pp. 507-519
- Learning Objectives: (I) understand why climate change is occurring; (II) articulate the scientific evidence for anthropogenic climate change; (III) be able to discuss strategies for both reducing the magnitude of climate change and mitigating its impact

#### **Section 3: Intrinsic and instrumental values and 'New Conservation' (Debate)**

- Readings (In Order): Soule (2013) *Con Bio*; Kareiva (2014) *Con Bio*; Soule (2014) *Con Bio*.
- Learning Objectives: (I) articulate arguments for why nature should be valued; (II) critically evaluate the concept of 'New Conservation'

### **WEEK 4**

#### **Lecture 9 (10/16/2017): Climate change— impacts**

- Readings: Kareiva/Marvier- Ch. 18 pp. 519-539; Urban (2015) *Science*.
- Learning Objectives: (I) articulate risks of climate change to people; (II) understand how species can respond to changing climates; (III) identify fingerprints of climate change in natural ecosystems

#### **Lecture 10 (10/18/2017): Fisheries and aquaculture**

- Readings: Kareiva/Marvier- Ch. 15
- Learning Objectives: (I) understand the causes and consequences of fisheries collapse; (II) differentiate alternative strategies for managing common pool resources; (III) compare relative benefits and costs of wild fisheries and aquaculture.

#### **Lecture 11 (10/20/2017): Invasive species**

- Readings: Kareiva/Marvier- Ch. 17; Listen to RadioLab 'Stranger in Paradise' at: <http://www.radiolab.org/story/stanger-paradise/>
- Learning Objectives: (I) understand how and why species invasions occur; (II) predict when species are likely to become invasive; (III) discuss potential impacts of species invasions; (IV) identify how management strategies for each stage of the invasion process

#### **Section 4: The climate wedge stabilization game (in class game)**

- Learning Objectives: (I) understand emissions-reduction strategies; (II) identify and argue for a preferred suite of strategies; <http://cmi.princeton.edu/wedges/game.php>

### **WEEK 5**

#### **Lecture 12 (10/23/2017): Rodd Kelsey Guest Lecture**

- Readings: Mokelumne Executive Summary (Report by The Nature Conservancy); Regional Prioritization of Forest Restoration (Report by The Nature Conservancy)

- Learning Objectives: (I) learn challenges associated with practicing conservation in California; (II) gain exposure to career options for conservation scientists

**Lecture 13 (10/25/2017): Pesticides and pollutants**

- Readings: Köhler and Triebkorn (2013) *Science*.
- Learning Objectives: (I) appreciate the importance of pesticides to global agriculture; (II) evaluate pros and cons associated with chemical pest control versus alternative methods

**Midterm 1 (10/27/2017): Covers all materials discussed in Parts I and II of the course.**

**Section 5: Sustainable fisheries (in class game)**

- Learning Objectives: (I) experience the tragedy of the commons; (II) learn how alternative regulatory strategies can solve common pool resource problems; (III) understand how species biology influences sustainable harvest

**Part III: How ecosystems support and enrich human life**

**WEEK 6**

**Lecture 14 (10/30/2017): Biological control**

- Readings: Letourneau *et al.* (2011) *Ecol. App.*; Karp *et al.* (2013) *Ecol. Lett.*
- Learning Objectives: (I) understand the basic process of integrated pest management; (II) compare classical versus conservation biological control; (III) identify some strategies for bolstering control of crop pests by their natural enemies

**Lecture 15 (11/1/2017): Pollination**

- Readings: Potts *et al.* (2010) *Trends in Ecology and Evolution*.
- Learning Objectives: (I) understand the reliance of our global food system on pollinators; (II) characterize the extent and drivers of pollinator decline; (III) weigh the evidence that conserving nature may bolster pollination and improve crop yields

**Lecture 16 (11/3/2017): Biodiversity and infectious diseases**

- Readings: Keesing *et al.* (2010) *Nature*; Wood *et al.* (2014) *Ecology*.
- Learning Objectives: (I) learn how zoonotic diseases are propagated; (II) understand contexts under which biodiversity would be expected to increase or decrease disease risk

**Section 6: Delivering an elevator pitch**

- Pre-section assignment: choose a conservation-relevant scientific finding, policy, or concept that you would like to communicate to a lay-audience
- Learning Objectives: (I) learn to communicate a scientific finding, policy, or concept to multiple audiences; (II) learn to use the message box to hone and deliver an argument; (III) message box completed in class as an assessment

**WEEK 7**

**Lecture 17 (11/6/2017): Cultural ecosystem services**

- Readings: Bratman *et al.* (2012) *Annals NY Acad. Sci.*; Chan *et al.* (2012) *BioScience*.
- Learning Objectives: (I) understand why cultural services are critical for motivating conservation but often overlooked; (II) appreciate the many ways in which ecosystems enrich human lives; (III) learn how qualitative analysis can help us assess cultural services

**Lecture 18 (11/8/2017): Water quality and quantity**

- Readings: Kareiva/Marvier- Ch. 16
- Learning Objectives: (I) articulate the current state of Earth's freshwater resources; (II) differentiate between core threats to global water quantity and quality; (III) learn promising solutions for increasing freshwater sustainability

**NO LECTURE (11/10/2018): VETERAN'S DAY HOLIDAY****Section 7: Policy briefs**

- Learning Objectives: (I) learn about the purpose and structure of an effective policy brief; (II) understand parameters for policy brief assignment (due on Nov 22).

**Part IV: Conservation strategies and opportunities****WEEK 8****Lecture 19 (11/13/2017): Protected areas**

- Readings: Kareiva/Marvier- Ch 5
- Learning Objectives: identify recent trends in global protected area coverage; (II) understand key challenges to effective protected area creation and implementation; (III) learn how protected areas could be managed to improve outcomes for wildlife and local people.

**Lecture 20 (11/15/2017): Reserve design and conservation planning**

- Readings: Kareiva/Marvier- Ch. 6
- Learning Objectives: (I) articulate basic principles of reserve design, (II) understand zoning strategies for reserves and multi-use areas, (III) learn about strategies for setting global conservation priorities.

**Lecture 21 (11/17/2017): Conservation in working landscapes**

- Readings: Sodhi/Ehrlich- Ch. 13
- Learning Objectives: (I) appreciate the challenges and opportunities for conserving wildlife in farming landscapes; (II) understand how alternative farming practices influence farmland biodiversity; (III) articulate how farming policy and certification programs can influence on-farm conservation practices

**Section 8: Land sparing versus land sharing (in class debate)**

- Reading: Kremen (2015) *Ann. NY Acad. Sci.*
- Learning Objectives: (I) articulate tradeoffs between conserving wildlife in farming landscapes versus sparing land for nature in protected areas; (II) identify contexts in which land sparing strategies would outperform land sharing strategies (and vice-versus); (III) articulate the debate's limitations and inadequacies

**WEEK 9****Lecture 22 (11/20/2017): Conservation policy: The Endangered Species Act**

- Readings: Kareiva/Marvier- Ch. 4 pp. 97-112; Sodhi/Ehrlich- Ch. 12
- Learning Objectives: (I) articulate key policies that have shaped conservation; (II) understand when and how species are listed, (III) learn how listed species are managed

**Lecture 23 (11/22/2017): International conservation policy**

- Readings: Kareiva/Marvier- Ch. 4 pp. 113-124.
- **Policy brief due.**
- Learning Objectives: (I) understand how biodiversity is protected in other countries; (II) articulate key conservation problems that span political borders; (III) understand why some international environmental treaties have succeeded while others have failed; (IV) discuss pros and cons associated with scientists engaging in advocacy

**NO LECTURE (11/24/2017): THANKSGIVING HOLIDAY****NO SECTION: THANKSGIVING HOLIDAY****WEEK 10**

**Lecture 24 (11/27/2017): Restoration and reintroduction**

- Readings: Kareiva/Marvier- Ch. 11
- Learning Objectives: (I) identify alternative strategies for defining restoration goals; (II) learn about tradeoffs involved with managing novel ecosystems; (III) understand advantages and limitations associated with reintroduction, rehabilitation, and captive breeding

**Part V: Conservation science****Lecture 25 (11/29/2017): Problems with small populations**

- Readings: Kareiva/Marvier- Ch. 7 183-192; 202-208
- Learning Objectives: (1) understand how stochasticity threatens small population, (2) define and explain the Allee effect, (3) articulate the concept of a minimum viable population

**Lecture 26 (12/1/2017): Conservation genetics (Guest Lecture: Rachael Bay)**

- Readings: Kareiva/Marvier- Ch. 7 pp. 192-202; Nair (2014) *PNAS*; Valentini *et al.* (2009) *Trends in Ecology and Evolution*.
- Learning Objectives: (I) differentiate between the causes and consequences of inbreeding depression, (II) understand how population genetics can be used to define and manage populations, (III) learn about DNA barcoding as a tool for conservation

**Section 9: Course review— threats and benefits**

- Learning Objectives: (I) solidify understanding of the major threats to Earth's ecosystems; (II) solidify understanding of the many ways that nature supports human wellbeing

**WEEK 11****Lecture 27 (12/4/2017): Quantifying population sizes and simple population trends**

- Readings: Kareiva/Marvier- Ch. 8 pp. 211-227
- Learning Objectives: (I) articulate alternative methods for conducting wildlife censuses, (II) use basic mark-recapture models to estimate population size, (III) implement a simple population model

**Lecture 28 (12/6/2017): Population viability analysis**

- Readings: Kareiva/Marvier- Ch. 8 pp. 228-243
- Learning Objectives: (I) implement a stage-structure population model, (II) articulate the components of population viability analysis and how it can be used in conservation management

**Lecture 29 (12/8/2017): Adaptive management and monitoring**

- Readings: Kareiva/Marvier- Ch. 12
- Learning Objectives: (I) understand basic principles of adaptive management, (II) articulate costs and benefits of monitoring

**Section 10: Course review— conservation science and strategies**

- Learning Objectives: (I) solidify understanding of the major strategies leveraged to practice modern conservation; (II) understand the conservation scientist's toolkit

**Assessment Description**

**Course participation:**

TAs will give credit to students that actively participate in the games, debates, and discussions that occur during course sections.

**Reading questions**

Students will be asked to post one question about course readings to canvas prior to each lecture. Questions can either be clarifying (if topics, methods, or ideas presented in the readings are unclear) or provocative (*e.g.*, research questions that follow from the proposed reading). Full credit will be given to all questions that logically follow from the assigned readings.

**Online blog**

One learning objective of this course is to teach students how to communicate with lay-audiences about conservation issues. Each student will be required to summarize the insights, implications, and limitations of a recent academic article (relevant to conservation) for an online course blog. Blog entries will be 750-1000 words, targeted for a lay-audience, and modeled after The Nature Conservancy's *Cool Green Science* (<http://blog.nature.org/science/>). Be sure to spice up your blog entry with some photos or figures. Course teaching assistants will grade the blog and provide feedback. Students can then decide whether they want to incorporate this feedback before posting the entry to the course website. Students that do not wish to make their blog entries public will not be required to do so or post anonymously. A full assignment description will be posted on canvas.

**Message box**

Students will learn how to use the message box to effectively communicate a conservation policy, a conservation issue in the news, or recent conservation-relevant research. Students will be tasked with choosing a conservation-relevant scientific finding, policy, or concept that they would like to communicate to a lay-audience before section 6. In section 6, students will be introduced to the concept of the message box and how it can be used to communicate with multiple target audiences. Students will then be asked to write a message box targeted to specific audience and then deliver it in <2min to another student. Students will then develop another message box on the same topic, targeted to a different audience, and deliver it to a different student. Grades will be assigned for both the written message boxes (graded by course instructors) and orally delivered message boxes (full credit for all participants).

**Policy brief**

Another course theme is the crucial need to transfer knowledge from experts to decision-makers. Academic papers are often hard to obtain, written in technical language, and difficult to relate to concrete policy recommendations. Translating academic writing to a format that could potentially influence policy requires: (I) grabbing and holding the attention of the target audience and (II) summarizing complex information into easily digestible, jargon-free language. Students will distill from a recent academic article or conservation topic in the news a 1 page policy brief. As policy briefs must be both informative and attention grabbing, figures and/or photos are required. A full assignment description will be posted on canvas.

**Midterm exam**

An in-class midterm exam will be administered Friday, 10/27/2017, in week 5. The midterm will cover all course lectures and assigned readings in the first two sections of the course (introduction to conservation science and threats to Earth's ecosystems).

**Final exam**

A final exam will cover all course lectures and readings on Wed. 12/13/17, from 10:30-12:30.