This course will provide an introduction to the discipline of conservation biology. The first half of the course will focus on the biological aspects of the discipline. Topics covered will include patterns of biodiversity and extinction, and causes of extinction and population declines. The second half will cover practical aspects of implementing conservation actions, techniques used to restore populations, landscape level conservation planning, and the role of conservation in protecting ecosystem services.

Instructor: Dr. Michael Reed   
TA: Jessica Rozek

Class hours: Anderson 212, Mon, Wed, 1:30-2:45

Office hours: Reed: Mon 3-4:30, or by appointment, Robinson 360 (go through Robinson 359), michael.reed@tufts.edu  
Rozek: Monday, Wednesday 12:30-1:30, Robinson 350, Jessica.rozek@tufts.edu

Your emails to us must contain the phrase “Bio 144” in the subject line; emails received without that phrase, and especially those with a blank subject line, may get treated as SPAM and be deleted without being read.

Text: ESSENTIALS OF CONSERVATION BIOLOGY, 6th ed., Primack

Reading assignments: Chapters from the text, plus readings from the primary literature (on Canvas), associated with each lecture are listed below.

Videos: There are some videos to watch as supplemental material that complement the lecture.

Optional reading that might be helpful: If you are really interested in this topic, then you will be well served if you check out recent issues of the journal Conservation Biology (note that to read articles you will need to be connected to the Tufts system).

Questions: Please ask lots of them! Class is much more interesting (for me and you) when people ask questions. If you send us questions over email, we might post them (anonymously) along with the answers on Canvas, so that everyone can read the responses.

Course objectives and expectations: My goal is to provide you with a basic understanding of the scientific field of conservation biology and the application of science to solving conservation problems. My primary goal is for you to learn and understand basic concepts and general ideas, although to get an A or a high B, you will need to know plenty of details too. I will expect you to know examples relating to each major concept, so that you can relate theory to practical, real-world situations. I won’t expect you to memorize all of the minutia in my notes; for example, I wouldn’t ask you exactly how many species have gone extinct in the last 500 years. But, I will expect you to have a solid understanding of the core information that would be required of you in a job in this field; for example, I would expect you to know whether the number of extinctions this decade is likely to be closer to 6 or 20,000. The text book readings are intended to complement the lectures. My lectures will not repeat verbatim what is in those readings, and I will often use different examples or cover somewhat different topics. Both the lecture material and the readings, however, are important and could appear on exams.
Specific things that I hope you will learn are:

- to understand the basic issues that define the field of conservation biology;
- specific factual information about major issues in conservation biology;
- specific examples of all important concepts, problems, and solutions;
- to use general principles to think about ways to solve specific conservation problems;
- to extrapolate from examples I provide in class to other cases with similar characteristics (e.g., that I may ask about in exams!);
- to acknowledge scientific uncertainty when it exists, and to recognize when it hampers understanding and when it does not;
- to read scientific papers and understand the main points that they make;
- to interpret graphs, tables, and simple statistics presented in the scientific literature;
- to present scientific information to your peers in a format commonly used by scientists;
- to think about the work of others and provide constructive feedback.

If you are just taking this course out of general interest, then hopefully it will provide you with a sense of how the biological sciences can be applied to protection of the natural world, and will give you a better understanding of the main issues in conservation biology. For those of you wishing to pursue a career in conservation biology, I hope that this course will give you a solid foundation on which to build with future courses.
Grading

1) Two mid-term exams (total 50% of final grade) [there is no final exam]

2) Management Plan poster and associated materials (30% of final grade)
   - Topic approved & 5 citations found by October 22; first come, first choice
   - About 30% of your poster grade will be determined by peer evaluation (your fellow students)

3) Evaluation of other students’ Management Plan posters (5% of final grade) – your evaluations will be confidential to the students being evaluated – you will evaluate 3 plans.

4) Reading and Excel exercise assignments (15% of final grade). For excel assignments, dates they are handed out are below – work is due by the next class.
   For the reading assignments – due dates are on the syllabus. For the readings, I have posted papers from the primary literature to read before a particular lecture. Before the start of class, post document on Canvas – of one thing that surprised you about the paper – with regards to the Methods, Analysis, Results, or Interpretation of the results – and why you were surprised. It helps a lot if you have in your statement sentences that includes the phrase “I was surprised by”, and another that includes “I was surprised because” (or something else this obvious).

Notes about grading

- Grades tend to be straight percentages (e.g., 80-83% B-, 83-88% B, 88-89% B+) unless I see a need to curve.
- Exams are not cumulative, except when material is repeated in the new examination period.
- Make up exam policy: NO make-up exams (except for your own documented medical problem, or extraordinary circumstance)
- Late assignments will be penalized
- You must be present for both days of poster presentations.
- NO, there is no extra credit – please don’t ask.
- If you have a question regarding how an exam question was graded, after reviewing the exam key please submit in writing why you think your answer might be correct, along with your exam. This must be done within 7 days of our returning the exam to the class. Exam key will be posted on Canvas.
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Text Chapter</th>
<th>Primary Literature</th>
<th>Supplemental videos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 5</td>
<td>What is Conservation Biology?</td>
<td>1; 6</td>
<td>Summary of what the course is about</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Types of biodiversity</td>
<td>2</td>
<td>International year of Biodiversity;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ecosystem services, new species</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Patterns of biodiversity</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Extinction rates</td>
<td>7</td>
<td>Ceballos et al. 2015</td>
<td>Thylacine video</td>
</tr>
<tr>
<td>19</td>
<td>Vulnerability to extinction</td>
<td>8</td>
<td>Woinarski et al. 2015</td>
<td>short extinction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>overview</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Habitat loss &amp; degradation</td>
<td>9</td>
<td>Mineau &amp; Whiteside 2013</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Overexploitation Excel assignment given</td>
<td>10</td>
<td></td>
<td>bushmeat; wildlife</td>
</tr>
<tr>
<td>Oct. 1</td>
<td>Exotic, invasive species, &amp; disease</td>
<td>10</td>
<td></td>
<td>trade</td>
</tr>
<tr>
<td>3</td>
<td>Climate change</td>
<td>pp. 205-214</td>
<td>Martin &amp; Maron 2012</td>
<td>IPANE</td>
</tr>
<tr>
<td>9</td>
<td>Problems of small populations, &amp; role of</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Conservation genetics</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>EXAM I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Population viability analysis Excel assignment given</td>
<td>12</td>
<td>Neff &amp; Larson 2014</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Establishing new populations Management plan topic + 5 citations due</td>
<td>13</td>
<td></td>
<td>Frozen Ark Project</td>
</tr>
<tr>
<td>24</td>
<td>Surveying &amp; monitoring</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Ex situ approaches</td>
<td>14</td>
<td>Seddon et al. 2014</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Protected areas &amp; protected areas networks</td>
<td>15; 16</td>
<td>Ramirez-Villegas et al. 2014</td>
<td></td>
</tr>
<tr>
<td>Nov. 5</td>
<td>Managing protected areas</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Habitat restoration</td>
<td>19</td>
<td>Craig et al.</td>
<td></td>
</tr>
<tr>
<td>Week</td>
<td>Topic</td>
<td>Pages</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------</td>
<td>-------</td>
<td>--------------------</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Managing the matrix</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Economics of conservation</td>
<td>4; 5</td>
<td>Coniff 2014</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Ecosystem services</td>
<td>20</td>
<td>Silvertown 2015</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Sustainability</td>
<td>20; 21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dec. 3 **EXAM 2**

5 & 10 **Poster presentation & evaluation (all posters due Dec 5 at start of class)**
Excel exercises

There are 2 homework assignments where you use Excel spreadsheets – assignments are due by the start of the next class. The spreadsheets can be downloaded from Canvas, and your assignment will be to use the spreadsheet to answer some questions. If you want a brief introduction to using excel beyond what I talk about in class or have in the assignment handout, there are introductory videos on YouTube, and/or you can see me or the TA. If you do not have Excel on your computer, you can get it for free – all students have access to Microsoft Office 365 for PC or Mac, which includes Excel: https://it.tufts.edu/sw-office365-pp. If you have questions about this download, contact the TTS help desk (617-627-3376 or it@tufts.edu).

Management Plan Poster

Students will work in teams of 2 to prepare a management plan, and present it as a poster. Posters are one of the primary methods people in the scientific community communicate research results at conferences. The management plan can be to solve any particular species or ecosystem-oriented problem: recovery of a threatened or endangered species or ecosystem, control an exotic invasive species or emerging disease whose invasion is causing biodiversity problems, reducing human-wildlife conflicts, adaptive management for climate change, etc. Treat the management action as a hypothesis to test, and your plan as an experiment.

Each team will prepare a poster, and turn in a separate bibliography (electronic copy) of materials used in developing your management plan. Citations in the bibliography should be mostly from the primary scientific literature, and must include at least 5 sources from the primary literature. The bibliography should be typed in the form of the journal Conservation Biology. If you do not know what constitutes primary literature, see me, the TA, or Nicole Nawalaniec (your science librarian).

Your proposed Management Plan topic must be cleared with me or the TA before you start work, and the latest you can clear a topic is October 22. By this date, you also must provide at least 5 citations from the primary literature (= scientific journal articles). Submit topics and citations and/or come talk to us about possible topics AS EARLY AS POSSIBLE to avoid being scooped – only one group per species / problem, so first come first served. Before you select a species/ecosystem you should do a literature search to make sure there is sufficient information to tackle the project. Do not cite articles that you did not read (we have a great interlibrary loan service).

Management plans already exist for many species or ecosystems – your selected project may not be a repeat of an already proposed or completed project. If you select a species or ecosystem with an existing management plan, you need to (1) propose something that goes beyond the existing plan, (2) make it clear in your poster what is new to you and what is not, and (3) include as one of your references the existing plan.

Posters will be on display on the dates listed in the syllabus; half the class will present and answer questions one day and evaluate the posters the other; the next day, roles will switch. All posters must be completed and brought in by the first presentation date. Both members of each team will be expected to answer questions regarding management plans when people come to view the posters. Each student will formally evaluate 3 other groups’ posters in order to
practice thinking critically and assessing others’ work and your evaluation will be graded. Your grade will be based on your doing a careful, constructive job of reviewing posters – if you say a poster is great when it is not, your evaluation grade will go down. Also, students will assign a grade to each poster they evaluate, and their grading will affect the poster’s final grade.

**Selecting a Topic**

The scientific literature, popular literature, news, personal experience, and the Internet are filled with examples of endangered or threatened species and ecosystems, and conflicts between environmental and other concerns. Talk with me or with your TA for ideas. You can use any of these sources for an initial selection of a problem to be addressed. Your next step is to search the **scientific literature** to see what information exists that could be used to develop a management plan for a specific area. Please come discuss ideas with me. Web of Science or Scopus are the best places for searches of primary literature, but Google Scholar is not bad.

**Some scientific journals that focus on Conservation Biology:**

- Animal Conservation
- Biodiversity & Conservation
- Biological Conservation
- Bird Conservation & Ecology
- Conservation Biology
- Conservation Ecology (on line)
- Conservation Letters
- Ecological Applications
- Invasion Biology
- Journal of Applied Ecology
- Journal of Wildlife Management
- Restoration Ecology

**Some potentially useful web sites for getting ideas:** (There are tons of them of varying quality. These sites are NOT scientific literature, but they might lead you to some.)

- The International Union on Conservation of Nature (IUCN) [www.iucn.org](http://www.iucn.org)
- The Society for Conservation Biology [http://conbio](http://conbio)
Lazy team member: If you believe your partner is not being productive, and you cannot get that person to be productive, come talk to me.

**Poster format** [note: example posters from past classes are on Canvas]

**Title & presenter names**

**Abstract:** In 350 words or less, summarize your management plan. State the problem, why it is a problem, where it is a problem, and the major findings and recommendations of your management plan. No citations appear in the abstract.

**Introduction:** Introduce the general conservation/management problem, then narrow the focus of the introduction to your specific management problem. Give the location, interested parties (for many projects this will include who is in conflict), and state your specific goals for the project. By the end of the section a reader should know what you are doing and why.

**Background:** A brief review of the location and species involved. If your management plan focuses on a single species, give me a summary of its pertinent natural history, ecology, and behavior. If it is an ecosystem, tell me about the ecosystem (biome, primary species, etc).

**Proposed management plan:** This is the bulk of your project. What do you propose to do? What is your reasoning? Design your management plan as an experiment (= adaptive management). That is, you plan to do “x”, and you expect “y” to occur. This means you should state your plan as a hypothesis, or set of hypotheses, or predictions. Include predictions – what specifically should result from your management plan?

**Quantifying success:** How does your management plan address and solve the problem? What were you not able to deal with? Define “success” for your management plan, and provide criteria for assessing success (or failure).

**Literature Cited:** To be handed in separately when you turn in your poster. All ideas, data, information not your own must be cited, unless they are ideas common in the literature (e.g., that plants photosynthesize). All citations must come from the scientific literature. This includes scientific journals, symposia, and some government reports (but not all). When in doubt, ask me. The literature cited section should contain all citations used, and no extras. **Format** for the literature cited section must follow format of the journal Conservation Biology. It might help to view [http://researchguides.library.tufts.edu/biology](http://researchguides.library.tufts.edu/biology)

**Citing Web pages:** **DO NOT**, unless it is an on-line journal; then cite web page, journal number, and page numbers. The only acceptable use of other Web citations is if you want to document a popular interest in the topic.

**PROOFREAD YOUR POSTER.** I guarantee that if you wait to the last minute to do this project it will show in the quality of your work.
**Poster tips:** [see also ‘How to make a Good Poster’: Canvas, Files, Poster resources]

Your goal for a poster is to distill the information for your management plan into short, clear paragraphs, illustrations, and/or tables in a space not exceeding 36 inches tall by 48 inches wide.

1. Everything should be easily readable from at least 2 meters away. Recommendations: Arial font is easy to read. Abstract & headings: 36 pt; text 32 pt; title: 72-80 pt.

2. If you are having trouble making everything fit, look to see if you have included irrelevant information or too many pictures (especially large ones).

3. Graphs, figures, and tables can be pre-mounted on colored paper or poster board for ease in setting up your poster and to highlight the material. Each figure or table should be numbered and referred to in the text of the poster. Each should have a heading of one or more lines that provides a brief (one or two lines) “take home” message.

4. Choose fonts that are easy to read, don’t overuse bold or italics. Background colors should draw attention to material, but not detract from presentation – avoid fluorescent colors. Backgrounds to text that are pictures make the text difficult to read.

5. Some relevant pictures can make a presentation more aesthetically presentable, and easier to read.

6. Avoid unnecessary details in preparing figures, drawings or illustrations. Try to keep everything straight forward. If you are copying a figure and the font is too small, rewrite it!

7. Ideally, your poster should be self-explanatory so that you are free to supplement and discuss particular points raised by visitors.

8. If you use a picture or diagram from the Web or other sources, be sure to attribute it.

9. Arrange material in columns rather than in rows. It is easier for viewers to scan a poster by moving systematically down then across rather than zigzagging back and forth. Figures should be numbered, with matching reference in text. An abstract should be placed at the upper left or center. Make sure your names appear on the poster under the title.